

WYG Engineering



Challenges Facing Low and Zero Carbon Strategies in Sustainable Urban Extensions

Ashton Green, Leicester

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Key Drivers and Challenges



- **Making new housing stock more efficient and less carbon intensive now takes a central role in policies to reduce UK carbon emissions.**
- Recent history of carbon reduction policy in housing is constantly changing
- The government is committed that new homes be Zero Carbon by 2016.
- 3 million new homes forecast by 2020 means this is a major challenge
- large-scale Zero Carbon delivery in Britain is unproven
- The Zero Carbon commitment raises a multitude of questions, regarding the priorities of social, economic and environmental objectives



- **Ashton Green is a 130ha Greenfield site near Beaumont Leys**
- Proposed to deliver 3,000 new homes, employment and community land
- Phased build programme is estimated at 20 years
- Delivery via multiple development partners and house builders
- Outline Planning Application to be submitted this year
- Sustainable energy has been at the heart of aspirations for the site
- The One Leicester vision aims for Zero Carbon homes and buildings
- Development Faces challenging economic climate and needs to balance social, environmental and economic concerns to deliver sustainable development

Approaches to Sustainable Housing

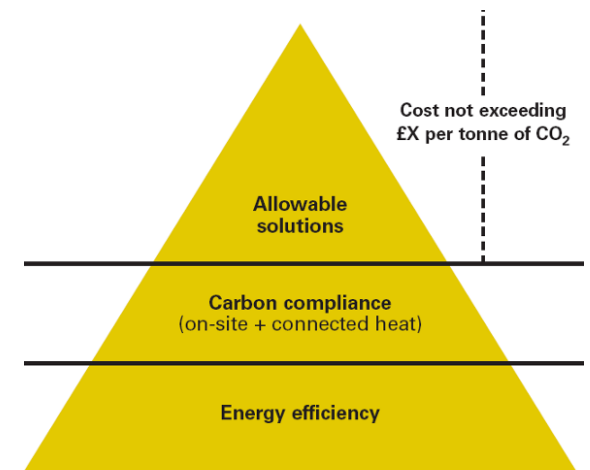


- **Delivery of Low and Zero Carbon housing is now a key aspect of the future regulation of house building.**
- The Zero Carbon standard is incorporated into the Code for Sustainable Homes (The Code) which is the national standard for sustainable new homes
- The Code measures the sustainability of a new home against nine categories summarised in a rating system that goes from 1 to 6 stars
- Minimum standards for energy use is set in relation to carbon emissions at each level along with a wide range of other sustainability criteria
- **Since 2008 new homes have to be rated against The Code, but this does not involve as yet any mandatory compliance standard.**
- 2010 building regulations require compliance with the energy criteria of Code Level 3 – a 25% reduction in CO₂

The Zero Carbon Goal



- **What is a Zero Carbon home?**
- The Government's definition of a Zero Carbon home remains:
- **"Net annual carbon dioxide emissions, taking account of emissions associated with all energy use in the home, is zero"**
- The accepted methods for achieving this standard have recently changed
- Zero Carbon homes must achieve minimum standards of thermal energy efficiency set at 46kWh/m²
- Onsite emissions reduction must meet a minimum 'Carbon Compliance' reduction standard of 70%
- A selection of 'Allowable Solutions' can be adopted to mitigate residual emissions



Zero Carbon at Ashton Green



- **70% reduction in regulated carbon emissions at Ashton Green is estimated as equal to a 6,671tonnesCO₂/yr reduction**
- Minimum performance specification for all space heating and dedicated energy efficient lighting estimated as saving **3,245tonnesCO₂/yr (33%)**
- Low or Zero Carbon (LZC) technologies must deliver further **3,677tonnesCO₂/yr (38%)** reduction
- Allowable solutions must offset further **5,512tonnesCO₂/yr**

Ashton Green Energy Demand and Carbon Emissions Summary		
No of Dwellings	3,000	Dwellings
Non-Residential	63,900	m ²
Total Energy	36,111	MWh/yr
Regulated CO ₂	6,286	TonnesCO ₂ /yr
Total CO ₂	9,912	TonnesCO ₂ /yr

Role of Low and Zero Carbon Technologies



- **LZC technologies are an essential part of any low and zero carbon energy strategy**
- An estimated 38% reduction in CO2 will need to be achieved at Ashton Green by LZC technologies
- Challenge of balancing the carbon benefit of technologies against the environmental, economic and operational impact of different LZCs to ensure a sustainable solution is achieved.

Ashton Green Building Integrated Technologies



Technology	Technical and Site Suitability for Residential	Occupant Practicality	Developer Affordability
Solar Water Heating	High	High	High
PV	High	High	Low
Ground and Air Source Heat Pumps	Maybe	High	Medium
Solar Air Heating	Low	Low	Low
Individual Dwelling Biomass Heating	Medium	Low	Low
Domestic Gas CHP	Low	Medium	Medium
Micro Wind	Low	Low	Low

Ashton Green Site Wide Technologies



Technology	Technical and On-Site Suitability	Practicality	Developer Affordability
Biomass Heating	High	Medium	Medium
Large Gas CHP	High	High	Medium
Biomass CHP	Medium	Medium	Low
Offsite Heat Recovery	High	Low	Medium
Medium Wind	Medium	Low	High
Large Wind	Medium	Low	High
Micro-Hydro	Low	Medium	Low
EfW	Medium	Low	Low

Constraints to Low and Zero-Carbon Technologies



- **The sheer pace of change in technologies is a significant challenge.**
- Attempts to promote immature technologies could cause future problems
- Decentralised Energy market is changing rapidly regulation and consumer protection must be considered
- With the possible exception of solar hot-water roof panels, no renewable energy technology has achieved significant unassisted penetration of the new build housing market in the UK
- Each technology currently has benefits and disadvantages e.g. small output (micro-wind turbines) or high capital costs (photovoltaic cells)
- **Any energy supply strategy for 3,000 homes to be built over 20 years must be flexible and adaptive**

Ashton Green Carbon Compliance Energy Scenario 1



Energy Scenario 1

Primary Technology

- Solar photovoltaic's
- Solar thermal collectors
- Heat pump systems

Alternative Generation

- Domestic biomass boilers
- Micro gas CHP
- Micro wind turbines

Location

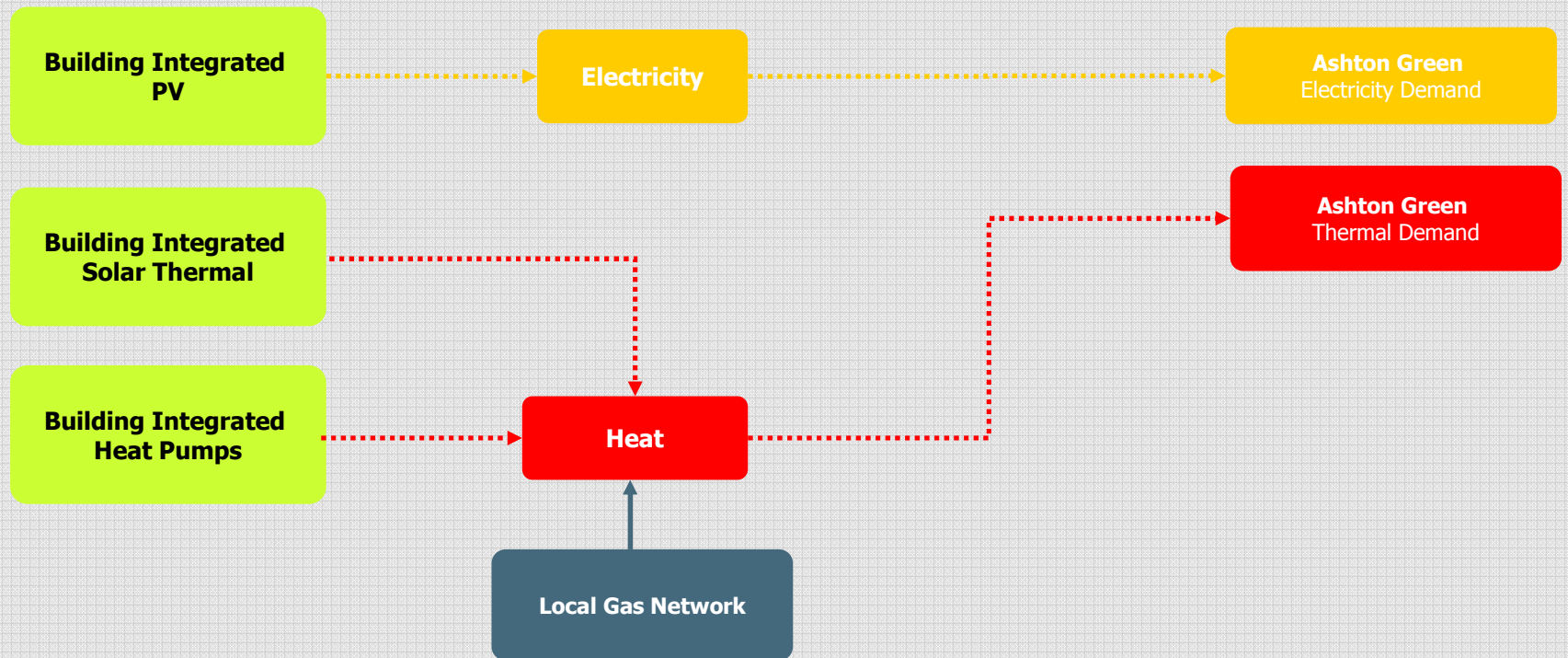
Individual building and dwelling solutions

Delivery mechanism

Integrated building design by architect and developers

Energy Scenario 1	CO ₂ Saving	Total CO ₂	CO ₂ Reduction (%)
Baseline Total Carbon Emissions		13,156	
Baseline Regulated Carbon Emissions		9,531	
Improved fabric performance and energy efficiency	3,245	6,286	34%
Solar Thermal Hot Water	843	5,443	9%
PV	2,575	2,868	27%
Zero Carbon Compliance onsite CO ₂ Reduction			70%
Residual emissions mitigated via allowable solutions		6,493	

Energy Scenario 2 – Building Integrated



Building driven energy strategy using micro generation systems to achieve targets can enable easy adaptation of emerging technologies

Ashton Green Carbon Compliance Energy Scenario 2



Energy Scenario 2

Primary Technology

Gas CHP

Biomass

Low temperature community heat and power infrastructure.

Alternative Generation

EfW

Bio-fuel CHP

Heat recovery

Location

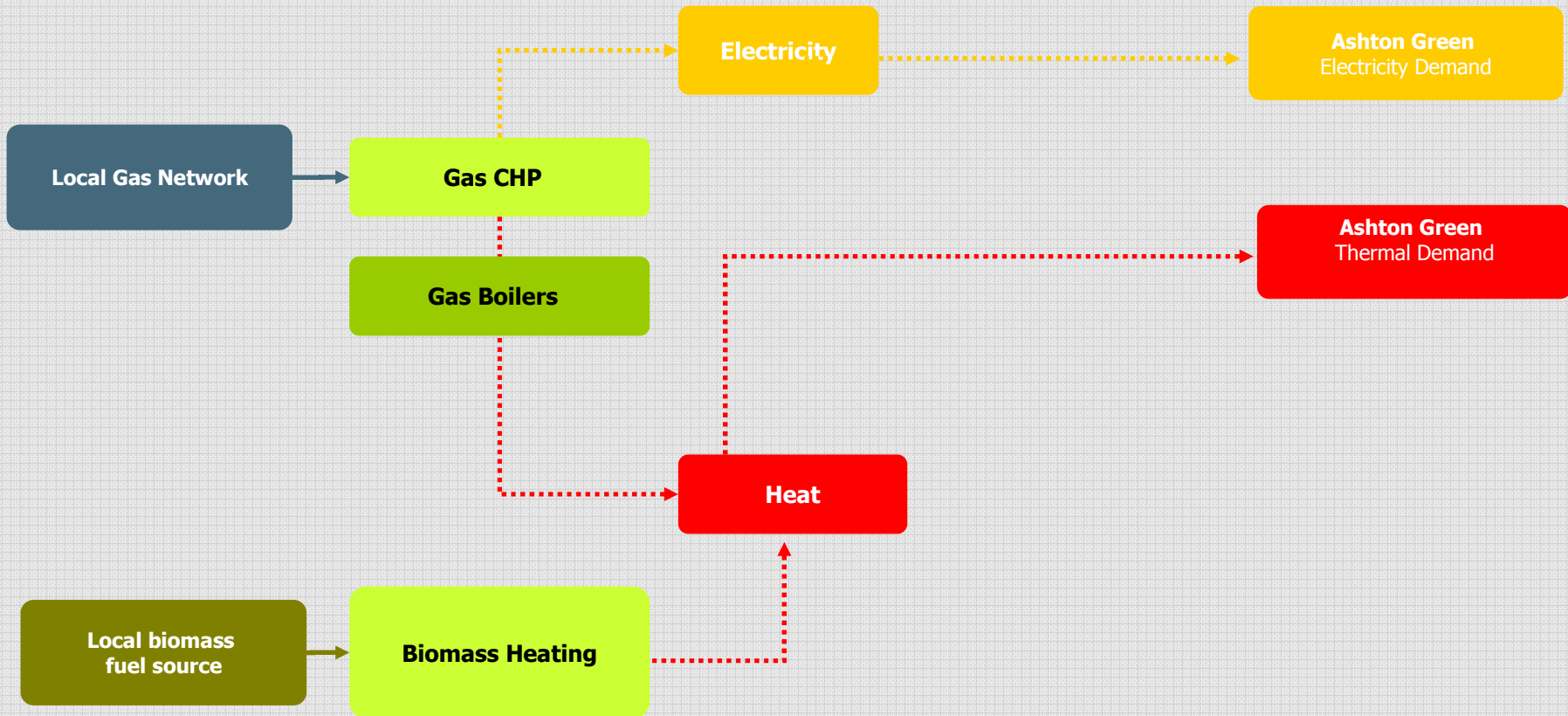
onsite energy centre, thermal storage and distribution network

Delivery mechanism

Specialist ESCO via private sector specialist or public/private joint venture

Energy Scenario 2	CO ₂ Saving	Total CO ₂	CO ₂ Reduction (%)
Baseline Total Carbon Emissions		13,156	
Baseline Regulated Carbon Emissions		9,531	
Improved fabric performance and energy efficiency	3,245	6,286	34%
Gas CHP	954	5,332	10%
Biomass	2,942	2,390	30%
Zero Carbon Compliance onsite CO ₂ Reduction			74%
Residual emissions mitigated via allowable solutions		6,015	

Energy Scenario 1 – Decentralised Strategy



Potential for long term fuel flexibility and integration of biomass CHP, EfW and heat recovery systems and onsite renewables such as PV

The Cost of Sustainable Energy



- Difficult to quantify the long term financial implications
- Different views as to how they are viewed e.g. capital only or whole life costing
- As technological and design solutions advance cost of solutions will reduce.
- Costs vary according to specific type, construction and location of every dwelling
- Latest published cost research :

Code Level 3: +3% on current build costs

Code Level 4: +11%- £3,000 to £5,500

Code Level 6: +37% - £24,000 to £40,000

- Cost implications could result in a significant impact on land value
- Developers elevated build costs could affect property prices and affordability
- **Building 3,000 Zero Carbon homes that are unaffordable and undesirable is not sustainable!**

Key Barriers



- **Many challenges to delivering Zero Carbon homes at Ashton Green**
- Uncertainty and conflicting agendas regarding carbon reduction
- Changing technological solutions
- Current economic uncertainty and adaptability of the development industry
- Few incentives to developers other than grant funding set against high capital costs of delivering Zero Carbon homes
- Currently little market premium attached to Low and Zero Carbon homes
- Planning framework uncertainty with LDF delays
- Struggling housing market in recession
- Lack of skills and technology

Key Decisions and Way Forward



- Decisions are needed regarding building integrated or community energy
- A combination of both district and building integrated solutions?
- A combination of Low and Zero Carbon homes prior to 2016?
- A phased approach to carbon reduction represents a lower financial impact in current challenging economic circumstances
- Further work should be undertaken by LCC to progress preliminary scenarios following the outline planning application
- Current Ashton Green Energy Working Group a potential future forum for developing the solutions, sharing knowledge and informing decision making
- Carbon Reduction Framework proposed in OPA a mechanism for delivery



Thanks for Listening

Any Questions?

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