

The Zero-Carbon Competition Brief; a rational approach

NBT Consult:

Nick Grant; Elemental Solutions

Neil May; Natural Building Technologies

Peter Warm; Environment Conscious Building Services

AECB Annual Conference Durham

June 2007

nbt consult

”... what I have sought to do throughout the text is to start from first principles, to believe nothing until it is demonstrated, to junk any technology, however pleasing it may be, which does not work. What I am attempting to do is to find the least painful means of making real cuts, rather than the least painful means of being seen to do something”

George Monbiot

Heat

“Science is the belief in the ignorance of experts”

Richard Feynman



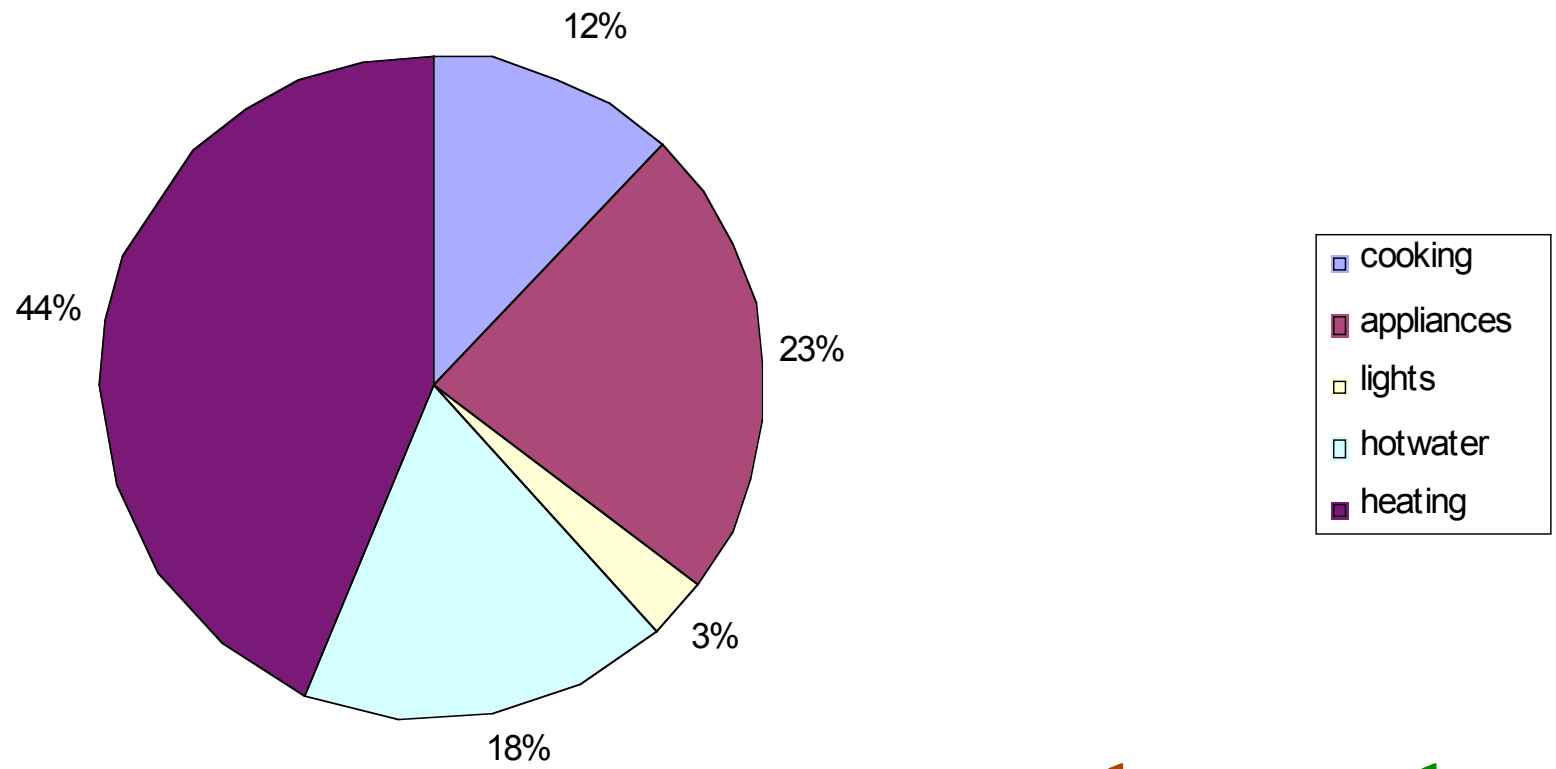
Restormel Urban Village, St Austell (20 units)
Swan Country Homes
Jewell & Co Architects Ltd
NBT Consult

nbt consult

Site Carbon Emissions

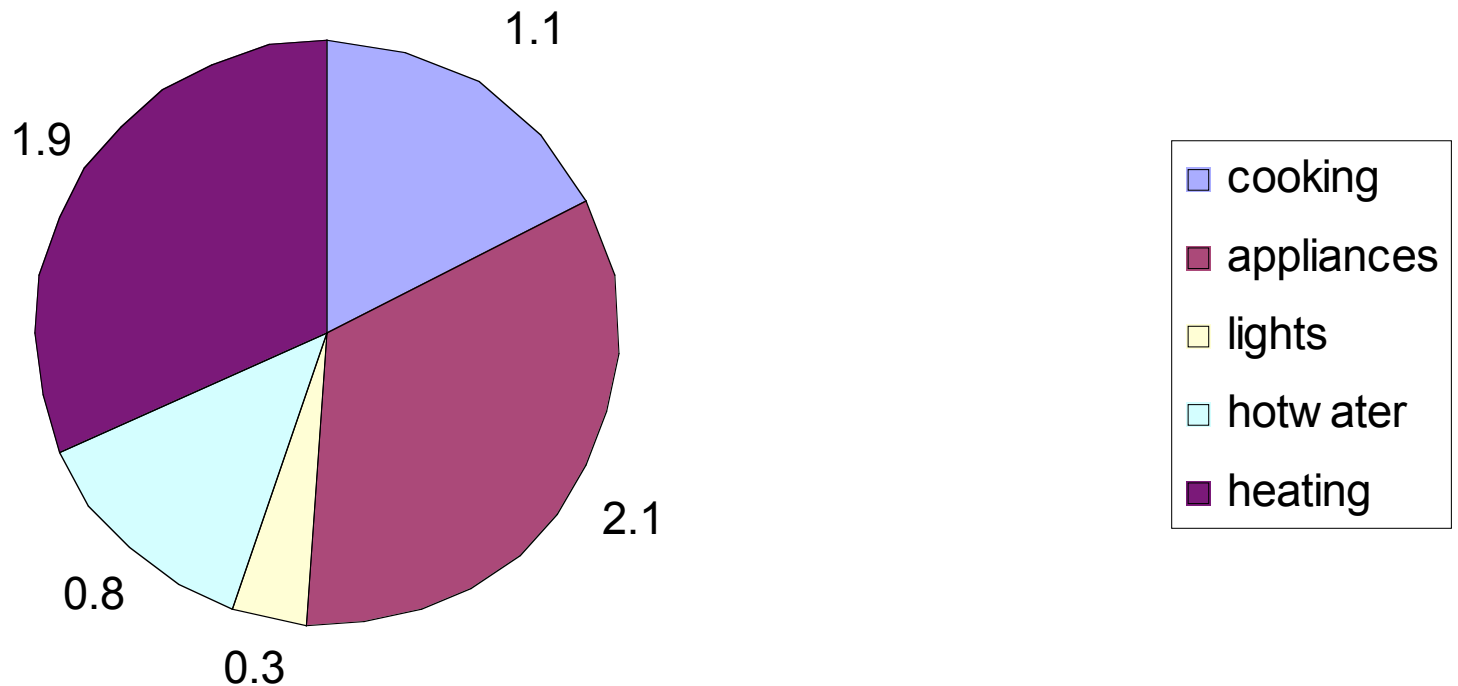
– Building Regs case for 20 units

Building Regulations CO2: 53 tonnes pa



Annual Energy Costs – BRegs case 20 units

Building Regulations Energy Costs £6.1k pa



List Technical Options

- Reduce Fabric and Ventilation Heat loss
- Low energy appliances and usage
- Site Biomass boiler to supply heat
- Solar Panels to preheat hot water
- Small and Large Scale windpower to provide electricity
- Solar Photovoltaic to provide electricity
- Ground source heat pumps to provide heat

Analysis method

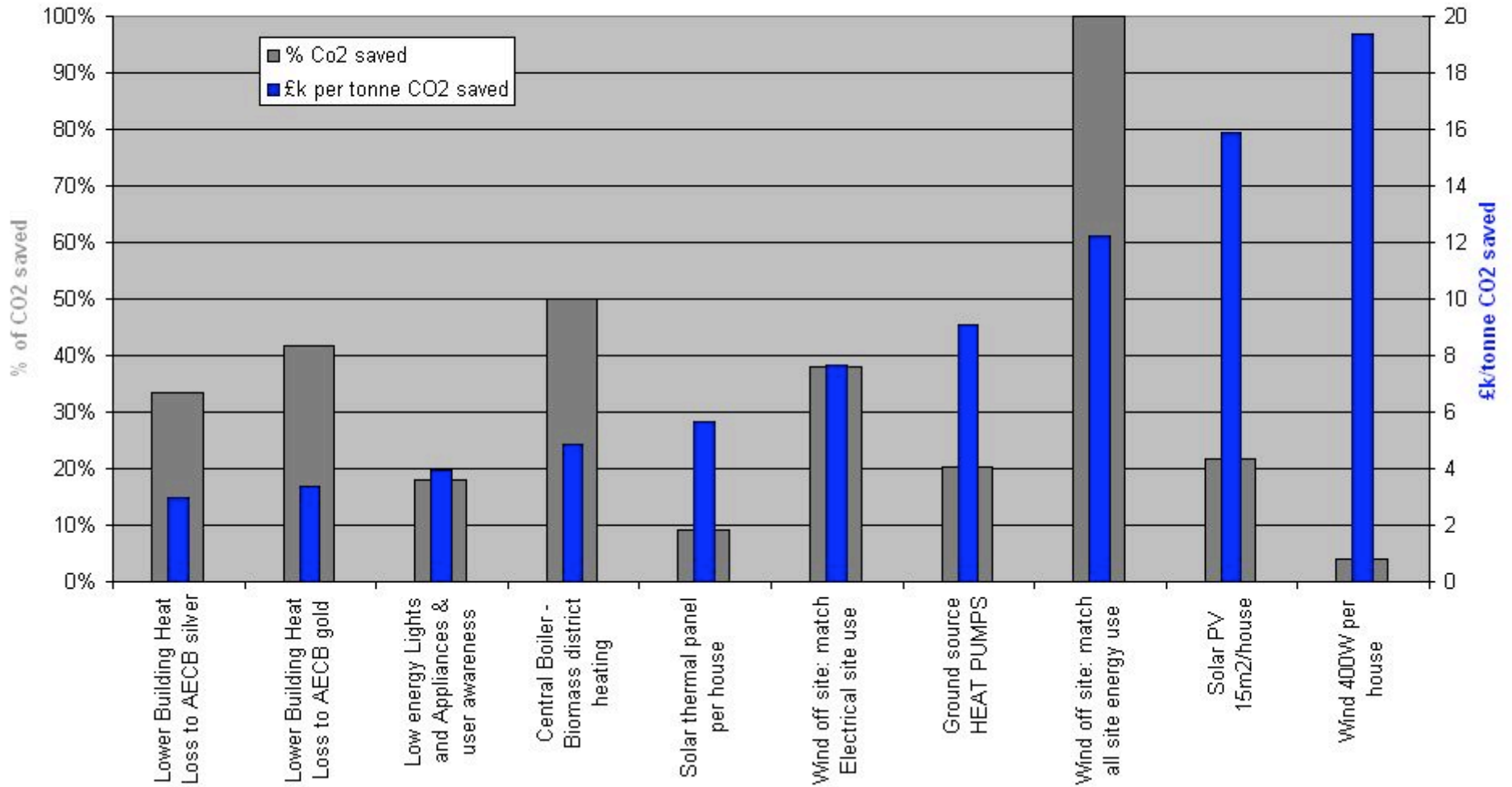
- Estimate for each option:
 - Annual Carbon dioxide emissions saved - tonnes per year
 - Costs over 60 year lifetime
 - Using Net Present Cost of measure (Discounted future costs)
 - Subject to discount rate and fuel cost inflation
 - hence Tonnes of CO₂ saved annually per £ Lifetime cost
- Combine measures in a technically sensible way to reach carbon neutrality

Example – Increase insulation

- Base case Building Regulations
 - 53 tonnes per year (3.3 tonnes pre unit)
 - Fuel costs of k£6.1 per annum (£380 per unit)
- Upgrade insulation
 - 13 tonnes per year saving
 - k£1.1 per annum saving
- Estimate Additional costs
 - Envelope £20/m² external area = k£58 capital cost
- Estimate future savings
 - Assuming 60 year project Life, 8% Discount Rate, 3.5% fuel price inflation
 - k£1.1 per year saving = Net Present Sum of k£22

Hence net present cost of measure = k£58 - k£22 = k£36
- Emissions saved = $13/53 = 25\%$
 - Lifetime cost of each annual tonne of carbon saved = $k£36 / 13 \text{ t}$
 - = k£ 2.7 per tonne (saved per year)

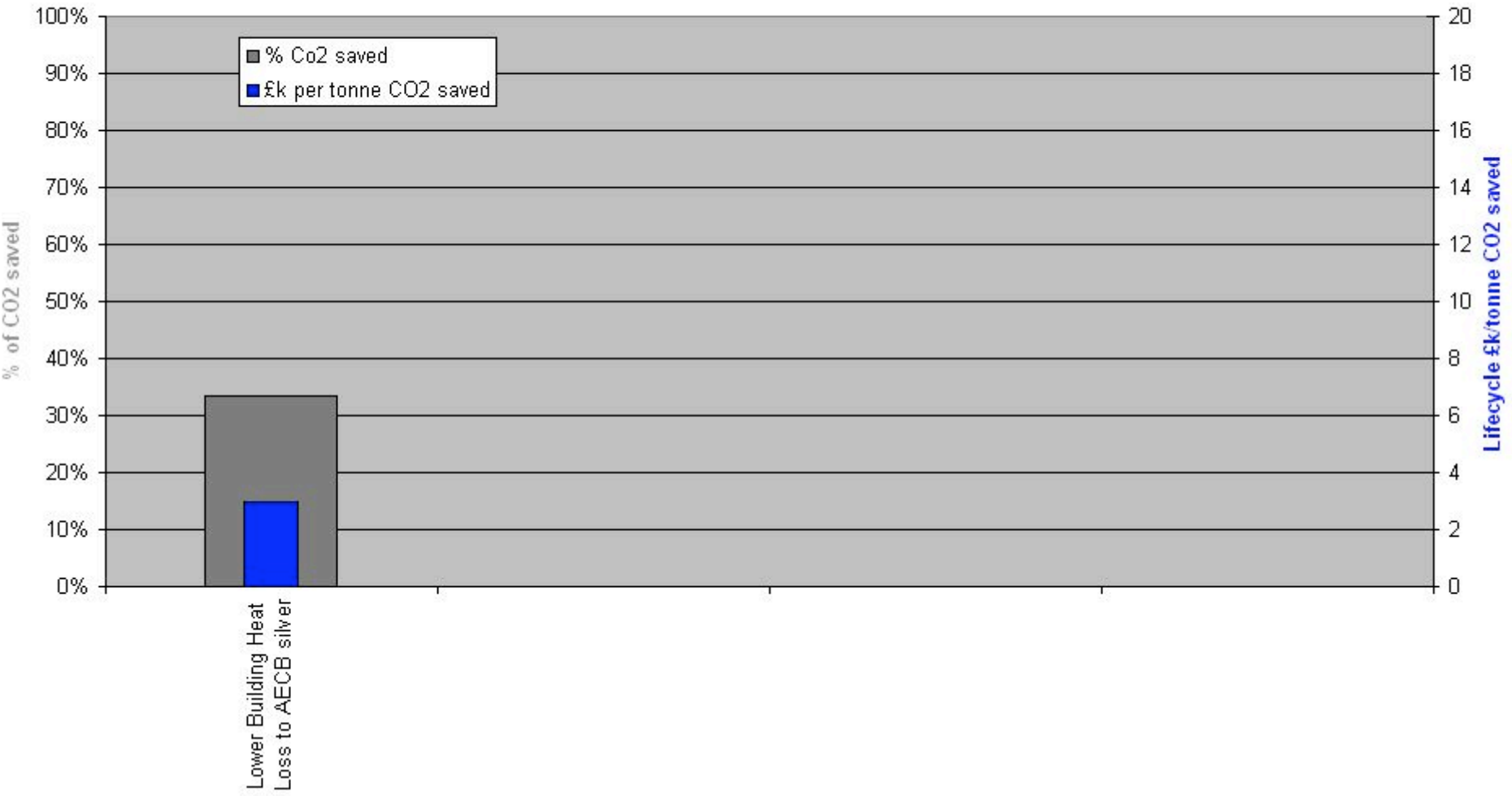
St Austell Energy Analysis



Combinations that are technically possible; What combination is optimum?

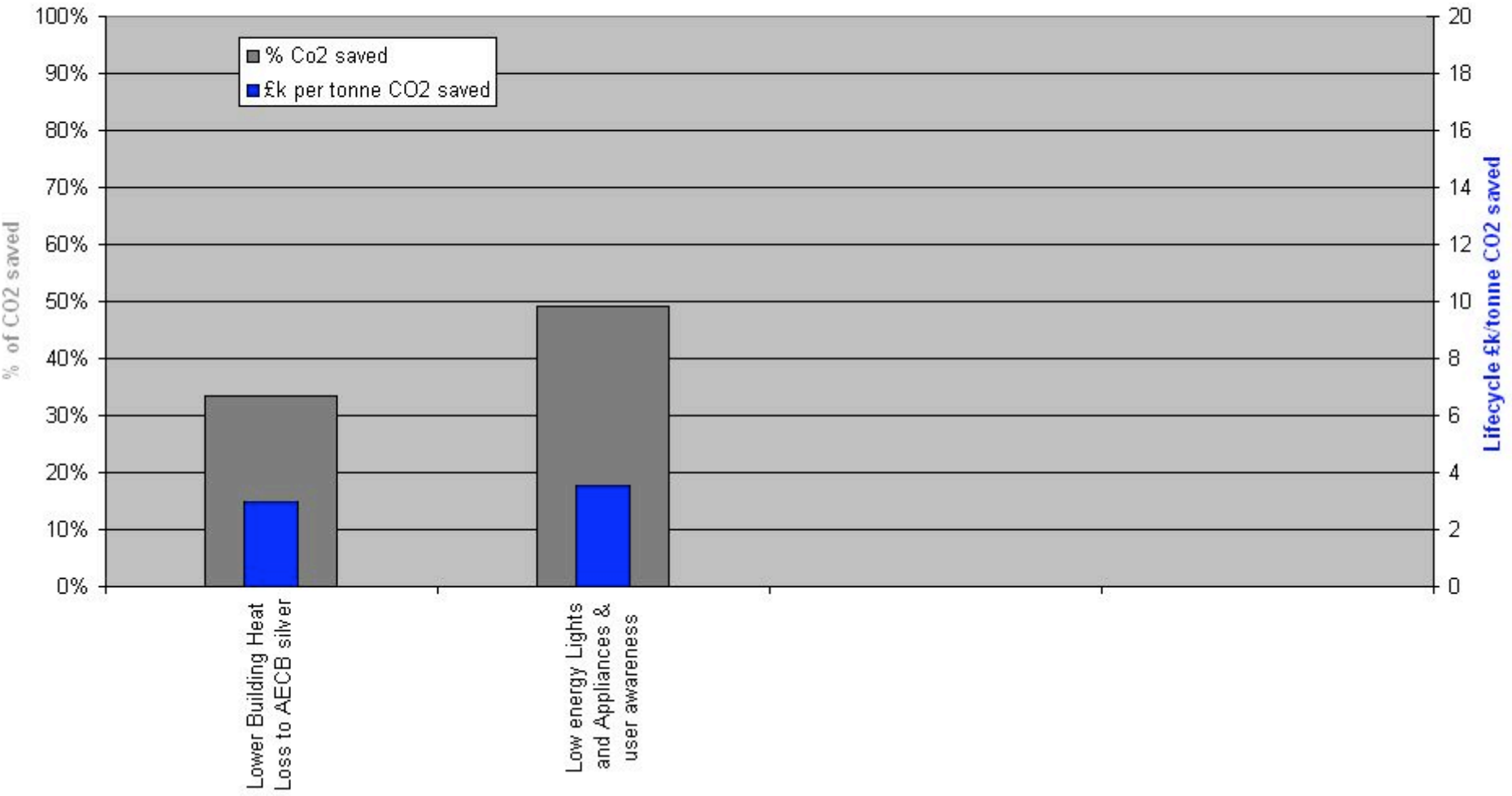
- Adoption of one measure affects another:
 - More efficient boiler means insulation takes longer to payback costs
 - Can't generally save more than 100 % – Biomass and solar thermal
- Crucial to consider issues such as
 - Buildability
 - Simplicity
 - Risk - how low dare we go? Passiv Haus?
 - Other benefits, e.g. MVHR for air quality rather than carbon saving
 - Long term robustness/maintenanceto make sure future costs estimated correctly

St Austell Energy: Building a Strategy



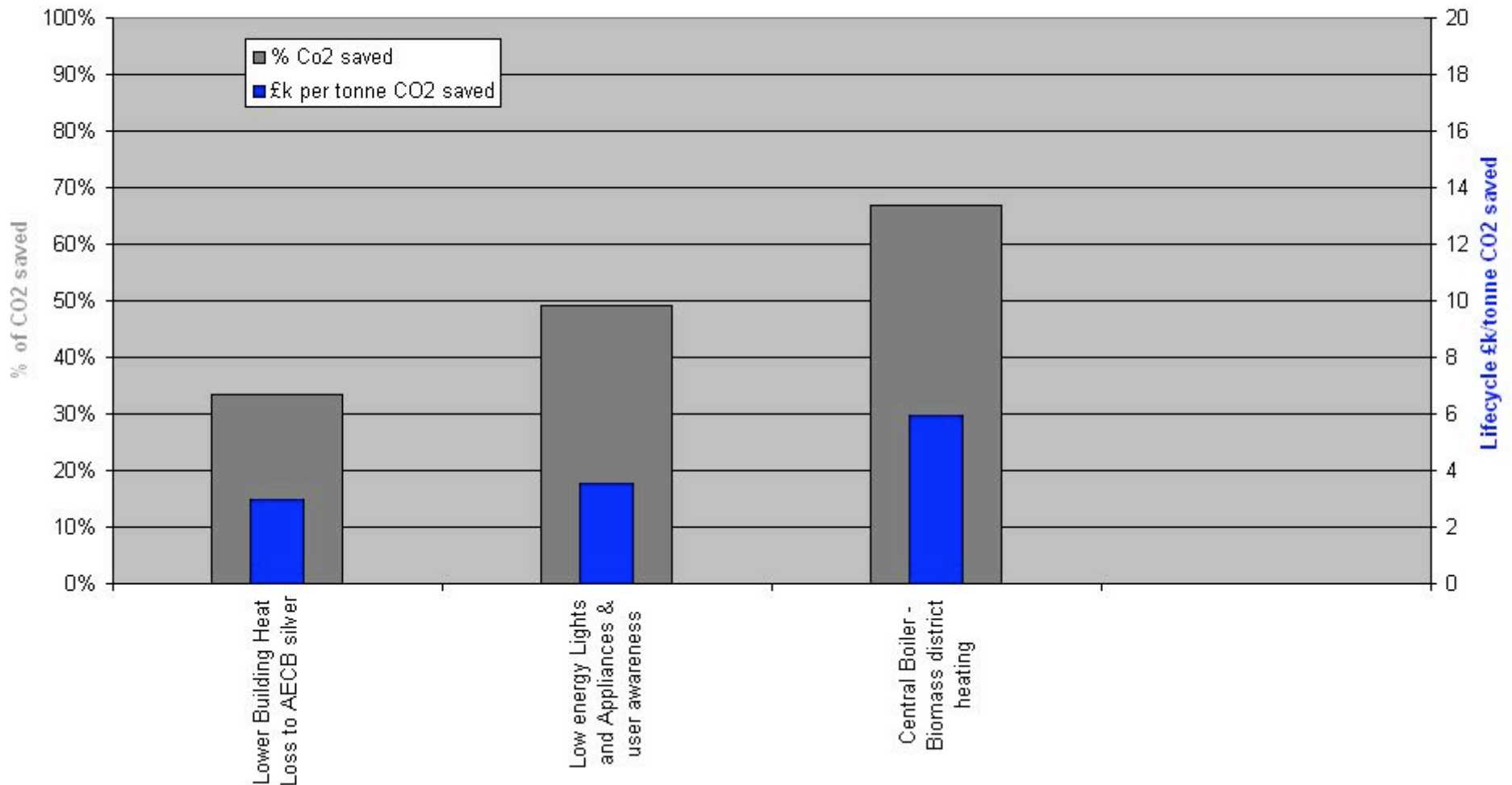
Lets start to build a package of measures that work together:
Insulation and airtightness/ventilation control has the best £ per lifetime tonne,
so let's start with that.

St Austell Energy: Building a Strategy



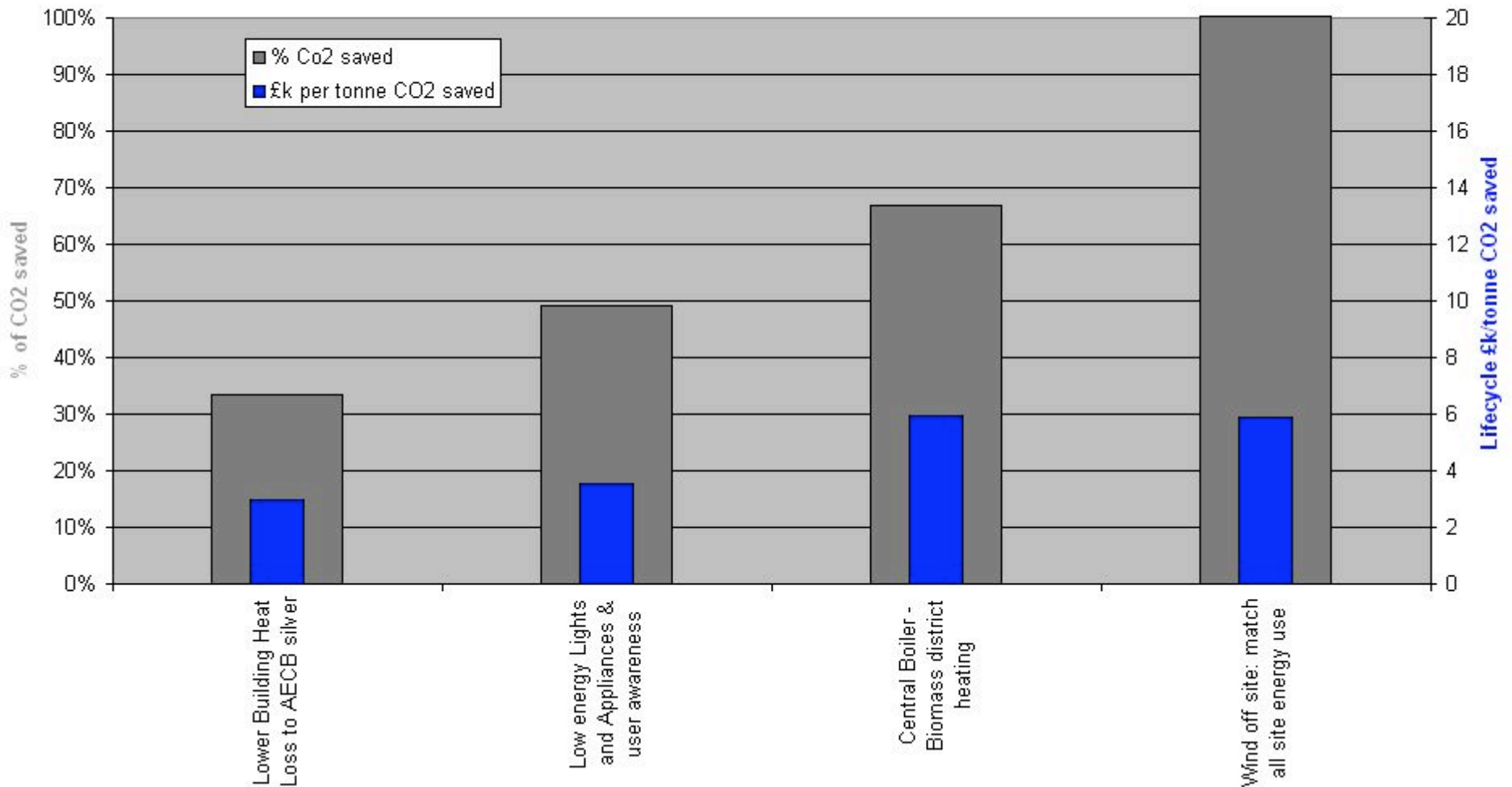
Now let's add the next best option, in terms of £/tonnes of CO2 saved: the low energy lights & appliances, with raising user awareness. There is an interaction between these two, as less appliance heat gains equals more heat requirement, but its small and overall we have a healthy increase in %Co2 saved on the site.

St Austell Energy: Building a Strategy



Now the difficult bit: Solar thermal panels have a better cost effectiveness but they don't save much carbon. Site biomass costs more but makes a better total carbon saving, and its clearly not cost effective in carbon terms to do both. We opted for the Biomass for this site.

St Austell Energy: Building a Strategy



And finally we went for the off site windmill to reduce the carbon to zero, as required by the competition, as being a far better option than small scale windmills or solar photovoltaic panels in terms of Whole life cost per tonnes Co2 saved. In other projects with different constraints, we might choose solar thermal instead of biomass, but we can't see the sense in using the poorest performing option such as the small scale windmills, Solar PV, etc etc.

Is Zero Carbon the right target?

- 'Forced' us into biomass - sustainable?
- Opportunity cost
- Reproducibility/big picture
- Paradoxically, it may be better to heat with gas than renewable electricity!
- Should developers be responsible for UK renewables?
- Zero Carbon by 2016??

What is Cheat Offsetting?

When you cheat on your partner you add to the heartbreak, pain and jealousy in the atmosphere.

Cheatneutral offsets your cheating by funding someone else to be faithful and NOT cheat. This neutralises the pain and unhappy emotion and leaves you with a clear conscience.

Can I offset all my cheating?

First you should look at ways of reducing your cheating. Once you've done this you can use Cheatneutral to offset the remaining, unavoidable cheating



are you a cheater?

cheatneutral can help you
offset your indiscretions.

[offset now!](#)

loyal and faithful?

become an offset project and
get paid for not cheating

[find out more!](#)

Projects

Some of the people who are offsetting your cheating:



alex



chris



mim



rich

so far, **cheatneutral**
has offset **65,768**
cheats and has
9002 faithful people
ready to neutralise
your
misdemeanours.

Summary

- We chose Insulation, efficient appliances, biomass boiler and off-site renewable electricity.
- Identified the need to go off site for at least part of renewables.
- Biomass option could link into larger adjacent Leisure Centre District heat CHP unit.
- Acknowledgement of the need to walk before we can run, AECB Silver Standard chosen this time rather than Gold or Passivhaus.