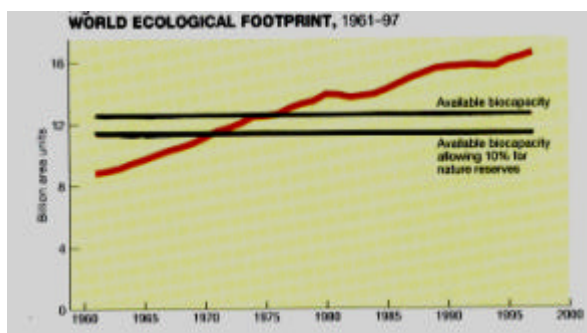


## Creating low carbon communities – taking a lifestyles and infrastructure led approach.

We can gain a deeper understanding of how to create an environmentally secure future by considering the ecological footprint and carbon impact of our lifestyles. Relying on direct UK carbon dioxide emissions is misleading. Rather we should use carbon impacts, including the carbon emissions we in effect export when we import manufactured goods and food from overseas. Learning from the BedZED eco-village in Sutton, our work suggests that in order to create low carbon communities we need to take a lifestyles and infrastructure approach, where food and waste are as important as energy efficient buildings and transport in reducing our carbon impact.

Ecological footprinting is a rapidly emerging methodology which allows us to relate our consumption of natural resources to the Earth's biological capacity<sup>1</sup> - i.e. its ability to replenish resources and to absorb greenhouse gases such as carbon dioxide. We can estimate the Earth's biological capacity from the total areas of productive cropland, pasture, fishing grounds and forests on the planet, some 12.6 billion hectares. On the consumption side, we can aggregate the net consumption of each country in the world to produce a World Ecological Footprint. Comparing the planet's biological capacity to the World Ecological Footprint suggests that we, as a global society, are currently consuming 20% more per annum than the planet can sustain into the long term. We are fuelling this excess consumption by eating into the natural capital of the planet resulting in forest loss, soil degradation, depletion of fishing grounds and global warming.



Different countries are consuming at different rates. As is now widely being quoted, if everyone on Earth consumed as much as the average person in the UK, we would need three planets to support us. If we consumed as much as the average American, we'd need six planets.



<sup>1</sup> Global Footprint Network; [www.footprintnetwork.org](http://www.footprintnetwork.org)

The 100 unit Beddington Zero fossil Energy Development (BedZED) eco-village in the London Borough of Sutton was initiated by BioRegional Development Group and developed by The Peabody Trust in partnership with BioRegional. Started in 1998, the project required a large number of partners to be brought together and support of Sutton's planning authorities to allow for strategies which were innovative at the time, such as reduced parking provision. As well as energy efficient buildings by Bill Dunster Architects and Arup, various service providers were involved to create a more sustainable lifestyle. For example, we worked with car club provider Smartmoves to introduce the first car club to London, LB Croydon to develop woodchip supply from tree surgery waste as a renewable energy source, organic box scheme providers for local food and waste collectors and residents to provide for greater domestic and commercial recycling. Since BedZED was completed in 2002, BioRegional has led on monitoring and analysing the benefits.

Various ecological footprint studies for the UK have been carried out<sup>2</sup>. Part of our ecological footprint is attributable to carbon dioxide. Pulling together data from various sources, the average person in the UK has a carbon footprint in the region of 12 tonnes of carbon dioxide per annum. This carbon footprint is made up from a combination of fossil fuels burned in the UK (8 tonnes) and, because we are a net importer of food and manufactured goods, from carbon dioxide released in other countries (4 tonnes). Although Defra state that we are on course to meet our Kyoto targets, in reality our carbon impact has been increasing as we have exported food production and manufacturing – it just appears on another country's direct emissions figures. This clearly emerges for example in our report for WWF, "One Planet Living in the Thames Gateway"<sup>3</sup>. Building on this research, we have estimated where carbon impacts arise from an average UK lifestyle for a person living in a home built to 2002 Building Regulations (Table 1).

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<sup>2</sup> for example see [www.citylimits.com](http://www.citylimits.com) and [www.takingstock.com](http://www.takingstock.com)

<sup>3</sup> "One Planet Living in the Thames Gateway"; BioRegional report for WWF, 2003; [www.bioregional.com](http://www.bioregional.com)

Table 1 – Carbon impacts for average person in UK

	<b>UK Average % of total CO<sub>2</sub> impact</b>
Space heating in the home	4 %
Hot water	4 %
Appliances in the home	3 %
Personal transport	18 %
Embodied energy in home infrastructure	3 %
Waste and consumer items	13 %
Food	23 %
Shared services (total energy for running schools, hospitals, financial services, etc)	12 %
Shared infrastructure (embodied energy in constructing schools, hospitals, roads, airports, etc)	20 %
<b>Total</b>	<b>100%</b>

Perhaps surprisingly, space heating in the home makes up 4% of carbon dioxide emissions, while food makes up 23%. Of course, living in a poorly insulated Victorian home will change the profile considerably and space heating becomes a larger contributor. It can also be seen that the embodied energy in major infrastructure projects such as roads and airports adds considerably to our carbon impact when allocated on a per capita basis.

BioRegional have undertaken analysis of the carbon savings achieved by residents at BedZED (Table 2). The research is based on monitored energy consumption figures<sup>4</sup> and residents surveys. Over the coming months we will be monitoring this further, but we have started to get a good idea of the significance of lifestyle issues and where in future we should be looking to achieve our biggest savings.

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<sup>4</sup> "Carbon Neutral Toolkit" (parts 1 and 2) BioRegional, 2003; [www.bioregional.com](http://www.bioregional.com)

Table 2 – Estimates of carbon savings at BedZED

	Tonnes CO <sub>2</sub> saved per resident per year	% contribution to reducing CO <sub>2</sub> impact over UK average
Woodfired Combined Heat and Power, CHP (when operating)	1.94	16 %
Green Transport Plan/Car Club	1.30	11 %
Food (assuming increase in local seasonal and organic produce and 10% lower animal protein diet)	0.48	4 %
Waste and recycling (assuming 30% increase in recycling)	0.36	3 %
Super-insulation	0.32	3 %
Passive solar gain via south-facing conservatories	0.16	1 %
Water efficient appliances reducing hot water use	0.17	1 %
Energy efficient appliances	0.17	1 %
Photovoltaics	0.17	1 %
Low embodied energy materials	0	0 %
<b>Total Saving</b>		<b>41 %</b>

If we put aside carbon savings from wood-fired CHP (the particular installation at BedZED has been problematic), the largest savings are coming from the car club, with far lower contributions from strategies, for example, such as passive solar gain and photovoltaic panels. Although low embodied energy materials were used, a greater volume of material was needed to create the thermal mass for the particular energy efficient design taken at BedZED. It is interesting to note the carbon savings which can accrue from food and waste and the huge potential for improvement in these areas.

Although adherence to Building Regulations is an issue, with the 2005 revision of Building Regulations, space heating is likely to come down to around 3% of the average person's carbon impact. We can and should make our new homes more thermally efficient, but further savings will be relatively small and when considering strategies such as passive solar gain and very high levels of insulation, we must avoid the risk of overheating in future warmer summers. At the same time, we see that the UK's carbon impacts associated with food, transport, electrical appliances and waste are on the increase. Therefore we do need to think about our total carbon impacts and where they are heading. One return air flight to New York or driving a small saloon car 10,000km per year will release as much carbon dioxide as 5 years of heating a new home. Air freighting a punnet of strawberries will release as much carbon dioxide as providing our hot water needs for 3 days.

Carrying out research for the report "One Planet Living in the Thames Gateway" confirmed the need for an infrastructure and lifestyles led approach to creating low carbon communities. The report led to subsequent research on "Z-squared", a concept for a zero waste zero carbon community for the Thames Gateway<sup>5</sup>, working with

<sup>5</sup> "Z-squared – enabling one planet living in the Thames Gateway"; BioRegional 2004; www.bioregional.com

engineers Fulcrum Consulting and KBR, architects Foster and Partners and quantity surveyors Cyril Sweett.

Following on from this research, we advocate implementing 4 key areas of sustainable infrastructure to promote low carbon communities

1. local low carbon food infrastructure
2. local closed loop waste infrastructure for zero waste
3. renewable energy infrastructure as a combination of on and off-site generation
4. compact city design and sustainable transport infrastructure, reducing car dependence

If we underpin our communities with this infrastructure, we can have more freedom with urban design and architecture, and we can apply this same approach to retrofit existing communities. As we have moved to an infrastructure and lifestyles led approach, the financial viability increases. Extra capital expenditure is still required for investment in renewable energy and waste infrastructures but this is greatly offset by reductions in car based infrastructure provision (roads and parking) and also results in reduced household expenditure. Although it needs to be calculated on a site by site basis as part of a full development appraisal and involves some lifestyle changes by residents, for large schemes of say 2000 homes or more, we believe additional capital expenditure may be as low as 3% with household expenditure savings of 5% per annum.

## Costs - capex

	£	%
<b>Z-squared difference from base case</b>		
Site wide energy and other utility works	£38m	6%
Reduction in carparking and other support infrastructure	(£18m )	-3%
<b>Difference</b>	<b>£20m</b>	<b>3%</b>
Avoided infrastructure off-site energy gen, distrib, landfill, reservoir	?	?
Avoided climate change	?	?

## Household budget

Annual Costs	Base Option	Z-Squared	Difference	Difference
	£	£	£	
Utilities	1356	1052	-304	
Community facilities	4,130	4,160	30	
Consumer Goods etc.	8,500	7,050	-1450	
Transport	2,900	1,000	-1900	
Mortgage	7,360	7,360	0	
<b>Totals</b>	<b>24,246</b>	<b>20,622</b>	<b>-3,624</b>	<b>-15%</b>

**15% saving on household budget**



In terms of overseas trade and supporting developing economies. In our book, BioRegional Solutions, we have suggested a sustainable international trade index called “FEET” (Foreign Exchange Earned per Tonne of Transport CO2). We have for instance calculated that South Africa earns 20 times as much foreign exchange, for the same amount of carbon dioxide put into the atmosphere, from the sale of sea freighted wine compared to air-freighted grapes.

BioRegional has already started to engage with planners and developers to take these concepts further. In Portugal, we are working with a developer on a 6,000 home “One Planet Living”<sup>6</sup> community which is planned to start on site in 2006 and where development of the waste and food infrastructures have given as much importance as transport and buildings. In the UK, BioRegional used the 10 principles of “One Planet Living” to create the sustainability vision for the London 2012 Olympic Bid. More recently BioRegional has formed a joint venture company with London-based developer, Quintain Estates and Development PLC, which develops and invests across the UK in all property sectors. Quintain is well placed to take BioRegional’s ideas further, having developed specific expertise in delivering major regeneration projects, leading the £1.3 billion regeneration of Wembley, and with partners, Lendlease, the £5 billion regeneration of Greenwich Peninsula.

<sup>6</sup> “One Planet Living” is a registered trademark and the name of a joint international initiative of BioRegional and WWF; see [www.oneplanetliving.com](http://www.oneplanetliving.com)

**One Planet Living Principles**

<b>Zero Carbon</b>	<b>Sustainable Water</b>
<b>Zero Waste</b>	<b>Natural Habitats and Wildlife</b>
<b>Sustainable Transport</b>	<b>Culture and Heritage</b>
<b>Local &amp; Sustainable Materials</b>	<b>Equity and Fair Trade</b>
<b>Local and Sustainable Food</b>	<b>Health and Happiness</b>

To create the low carbon communities of the future, we will need to take a lifestyles and infrastructure approach. We might therefore be asking planners in London to think as much about food growing as energy efficient buildings.

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Notes: Various reports are available from BioRegional, as well as tours, courses and some consultancy services; bespoke courses are available on request – see [www.bioregional.com](http://www.bioregional.com)