

What does sustainable living look like?

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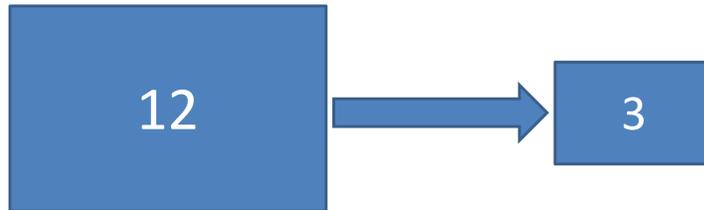
Presentation at the SGR conference on 'Living within environmental limits', Halton Mill, 4 October 2014

We will cover...

- Tackling carbon emissions in daily life
- How much do we need to reduce?
- Focus on four key areas
 - Home energy, transport, food, indirect
- Some of the latest evidence
 - Assessments of real-life projects
 - Other scientific research
- Quality of life issues

- Providing an assessment of what a 'sustainable lifestyle' might look like will help both individuals in making choices in their own lives and, arguably more importantly, help policy-makers design policies, economic incentives, regulations etc that will support society in moving to much more sustainable living
- Carbon emissions make up the largest share of the ecological footprint – so useful indicator
- All figures are averages, and there are significant uncertainties

How much do we need to reduce?



UK average emissions per person per year in tonnes of carbon dioxide equivalent: some indirect emissions included

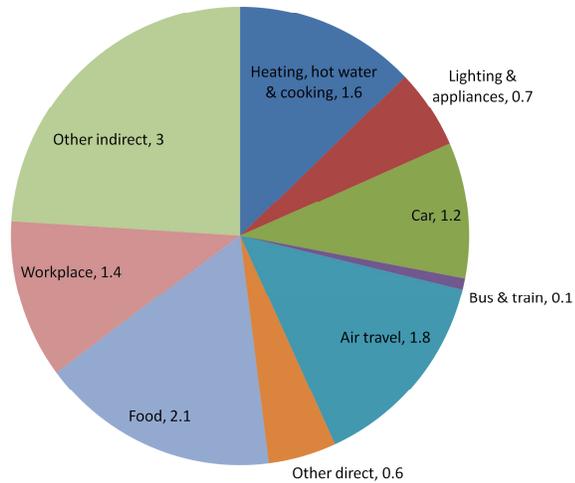
- 12 tonnes estimated by Goodall (2007) – includes some indirect emissions; some UK emissions have fallen since then (e.g. due to falls in domestic energy use), but indirect emissions arguably higher (see later)
- 3 tonnes is average level for 2010 to 2050 for UK – which gives 80% chance of keeping below 2C global temp change (assuming population of 70 million): calculated from CAT (2013) – p26
- This is a minimum reduction

Sustainable living: 4 key areas

- Home energy
 - Transport
 - Food
 - Other/ indirect emissions
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- How much through technology choice?
 - How much through behaviour choice?

- For technology choice, the focus will be on wider deployment of current technologies
- Some expensive current technologies will get cheaper in the future
- Some new technologies are likely to provide greater emissions reductions in the future (but we will not consider those here)

Average annual greenhouse gas emissions per person in UK



Source: Goodall (2007)

Total: 12.5 tonnes of carbon dioxide (equiv)

- Source: Goodall (2007), pp73-74 & 233 & 249
- Since 2007
 - Heating etc consumption fallen 20% (DECC, 2014; chap 3)
 - Electricity consumption fallen 10% (DECC, 2014; chap 3)
 - Emissions from flying revised down by 30% due to newer scientific understanding of 'uplift' factor (Berners-Lee, 2010; p136)
 - More indirect emissions due to UK consumption are happening overseas – with the UK's 'carbon footprint' increasing by about 10% in the last 20y (CCC, 2013)

Home energy

Leading home energy options - 1

- New very low carbon house
 - e.g. Passive House at Lancaster Cohousing
 - Heating and hot water energy use ~85% less than average UK home
 - Heat energy supplied from sustainable biomass + solar hot water panels
 - Electricity from solar photovoltaics (+ soon from hydro)
 - Direct carbon savings near 100%

- Reduction in energy use at Lancaster Cohousing based on sample of 6 homes (1 year's data) compared with average UK figures from DECC (2014)
- More info: Lancaster Cohousing (2014)
- Sustainable biomass – wood chips from regional sustainably-managed forests and saw mill waste (Irving and Sons, 2014)

Leading home energy options - 2

- Retrofit
 - e.g. SuperHomes programme
 - Wall/ loft/ floor insulation; double/ triple glazing; solar hot water panels + efficient gas boiler
 - Solar photo voltaic panels; efficient lighting + appliances
 - Typical carbon savings: 70%

- SuperHomes (2014)

Leading home energy options - 3

- Behaviour choice
 - Smaller home
 - Sharing

Key home energy options

Area	Behaviour choice	Technology choice	Average carbon saving (tCO ₂ e)
Heating + hot water		Passive House run from sustainable biomass/ solar	1.3
	Turn down thermostat	Whole house insulation package Solar hot water panels	1.0
	Smaller house 2+ occupants		0.5[?]
Electricity		LED + CFL lighting A-rated appliances Renewable electricity	0.6
	Small numbers of (smaller) appliances		0.3

- Figures calculated/estimated based on Goodall (2007) and DECC (2014) – reductions for ‘Smaller house’ etc. especially uncertain
- NB actual reductions may be much higher if household is currently a high consumer

Transport

Leading transport options

- Avoid flying
 - Average annual UK flying: 1 return flight to Rome
 - 1 return flight to Washington DC = all home energy use for 1 year
 - More holidays by rail/ cycle etc
- Car use
 - Use of a small/ energy efficient car (<100g/km) travelling up to 10km per day carrying 2 people can save 80%

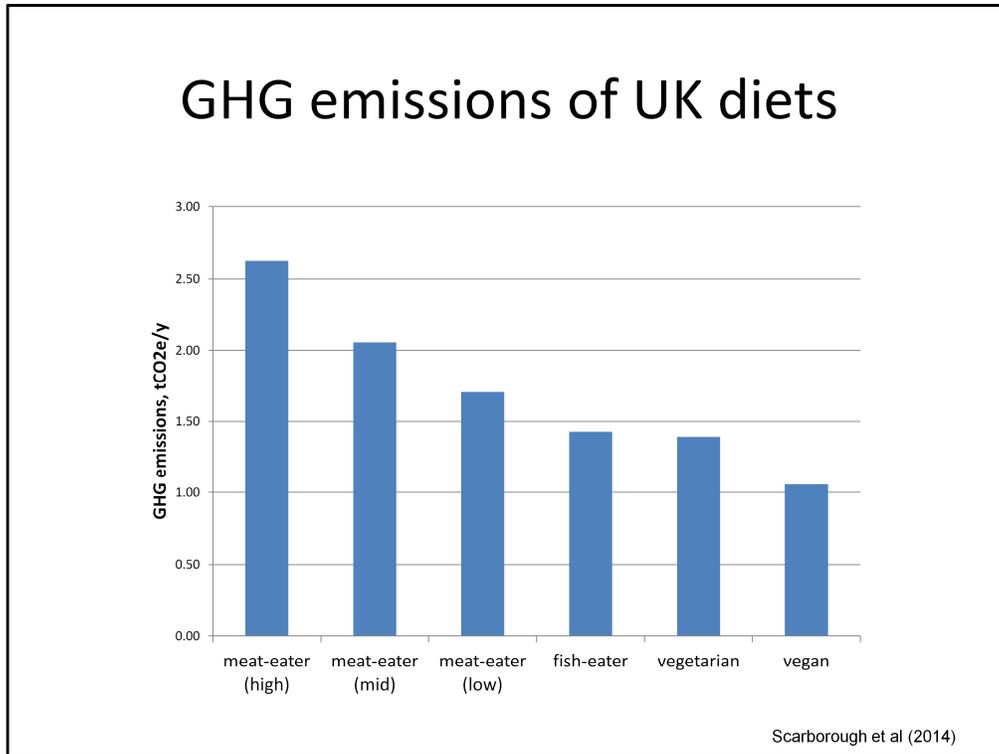
- Average annual UK flying from Goodall (2007)
- London to Washington return flight is nearly 12,000km: hence emissions are 2.3tCO₂e (including uplift factor of 1.9 due to indirect warming effects in stratosphere) – equivalent to more than one year's home energy use (see slide 5)

Key transport options

Area	Behaviour choice	Technology choice	Average carbon saving (tCO ₂ e)
Air travel	Avoid flying		1.2
Cars	70% fewer kms Average 2 per journey	Small / efficient conventional car	1.0
	Fewer kms	Electric car, run on renewable electricity	1.2
Bus/ train	5x more travel allowed		-0.3

- Using figures from Goodall (2007) and others in slide 5
- NB actual reductions may be much higher if household is currently a high consumer

Food



- Assessment by researchers at Oxford University (Scarborough et al, 2014)
- Most comprehensive assessment to date – based on dietary surveys of 55,000 people in the UK and disaggregation of food into 94 categories

Other key food options

- Eat what you buy
 - 25% saving
- More local, seasonal produce
 - Reduces transport emissions
- Avoid air freight, veg from heated greenhouses
- Less processed food

- Other aspects – more complicated
- Sources: Berners-Lee (2010), p182; Goodall (2007), p229

Key food options

Area	Behaviour choice	Technology choice	Average carbon saving (tCO ₂ e)
Animal products	Go vegan/ near vegan		1.0
	Low animal products		0.8
Waste	Eat what you buy		Up to 0.5
Location	Eat seasonal, local		0.2

- Figures calculated from Scarborough et al (2014) and Berners-Lee (2010)
- Low animal products diet: 1 serving of milk + 1 serving of other animal products per day (CAT, 2013)

Other/ indirect emissions

- Over 5t (40%) of average carbon emissions is currently indirect – see slide 5
- Some of these emissions can be reduced by individuals' behaviour, but others can only be dealt with at a national or international level. Nevertheless, individual activity can affect these emissions.

Key indirect options - 1

- Renewable energy tariff
 - Extra payment to support RE supplies
- Buy less stuff!
 - Manufacturing a car: 6t to 35t
 - Electric car is 50% higher
 - Manufacturing a computer: 0.2t to 0.8t

Sources: Berners-Lee (2010); Hawkins et al (2012)

Key indirect options - 2

- Investment
 - Savings, pensions etc often used to fund carbon intensive projects
 - Invest in energy efficiency or community renewable energy projects – major carbon savings
- Population
 - Average no. of children per UK family: just over 2
 - Having one or zero children – major savings

- Investment examples: Ecology Building Society (energy efficient housing etc); local projects such as Halton Lune Hydro or MORE Community Renewables
- Population: to avoid misinterpretation, I am not advocating any sort of coercion here!
- Campaigning etc can obviously affect indirect (and direct) emissions, but its effect is extremely difficult to estimate on an individual basis

Key indirect options

Area	Behaviour choice	Technology choice	Average carbon saving (tCO ₂ e)
Renewable energy tariff	Sign-up!		0.3
Buy less stuff	Buy less Buy second hand Share with neighbours		1.0 [?]
Investment	Invest £10k in energy efficiency/ renewable energy		5.0
Population	Only one child		6.0

- Over 5t of average carbon emissions is currently indirect
- Investment emissions saving is based on a project with a cost of £100/tCO₂e
- Population emissions saving based on two biological parents being each responsible for half the emissions of their child – and assuming average individual emissions

Sustainable living examples

- These scenarios focus on carbon emissions under the control of the individual, noting that action on other emissions also needs to be taken either by policy-makers or by 'offsetting' by the individual (although the latter can only be a stop-gap option)

Sustainable lifestyle – option 1

	Action	Carbon emissions (tCO ₂ e)
Home energy: heating	'SuperHomes' retrofit; Solar hot water panel + gas 2 people sharing	0.4
Home energy: electricity	Energy efficient lighting + appliances; Solar pv panel	0.3
Car use	<4,000km of high efficiency car; 1+ passengers	0.2
Car ownership	Second-hand	0.2
Air travel	Avoid flying	0
Other travel	7,500km of bus/ train use	0.4
Food	Low animal products; Minimal food waste; Mainly local, few 'ready meals'	0.9
Other possessions	Embodied energy of (eg) solar panels; Small number of new goods per year	0.5
Total		2.9

- Figures based on calculations from the preceding analysis
- Obviously, there are many variations in the lifestyle options which could still yield less than 3t

Sustainable lifestyle – option 2

	Action	Carbon emissions (tCO ₂ e)
Home energy: heating	Passive House or similar; Solar/ biomass 2 people sharing	0
Home energy: electricity	Energy efficient lighting + appliances; Local renewable energy tech	0
Car use	Low use of electric car, run on renewable electricity	0
Car ownership	Car club	0
Air travel	Avoid flying	0
Other travel	7,500km of bus/ train use	0.4
Food	Vegan/ minimal animal products; Minimal food waste; Mainly local, few 'ready meals'	0.7
Other possessions	Embodied energy of (eg) solar panels; Small number of new goods per year	0.5
Total		1.6

- More radical changes
- Indirect emissions from all house building assumed to be spread evenly across the population

Quality of life benefits

Action	Benefits
Highly insulated house	More comfort; low energy bills
Less car travel	Less driving stress; traffic jams
Car club	No maintenance responsibilities; cheaper
Holidays by rail	See more of the countryside
Less animal food	Healthier diets; cheaper
Sharing stuff with neighbours	More socialising; cheaper
Ethical investment	Better returns?

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