Measuring the Environmental Sustainability of the Bristol City-Region:

Current and Potential Scenarios

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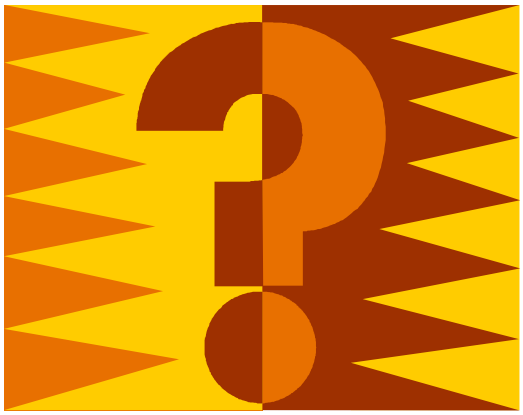
View of Bristol City from Arnos Street, Totterdown, evening of 13th January 2010
(Photo credit: Matthew Taylor)

2010: The orange streetlit glow of the City of Bristol, viewed from the suburb of Totterdown on a cold and wintry January evening. The lighting, courtesy of electricity mass-generated from the combustion of coal, nuclear fission of uranium and combustion of natural gas (methane), is helping to prevent crime and accidents on the streets. The inhabitants are kept warm predominantly from on-site combustion of natural gas. Their food, water, medicine, cosmetics, clothes, furnishings and consumer goods have been produced, processed and/or transported through the use of various products of crude oil, an energy source also primarily responsible for powering their journeys around and beyond the city come the morning.



2050: This scene could look fairly similar or vastly different – the reality depends on a range of physical and political factors, the most compelling of which are likely to centre around the availability of crude oil fuel products[1]. Holmgren[2] has suggested several future energy scenarios, the best cases being that either technological innovation has provided sufficiently abundant alternatives to oil and other fossil fuels to enable a continued global socio-economic existence, or that no convenient oil equivalent has been found but society has had enough time to adapt to a more localised, energy efficient way of life before oil is completely depleted. The worst case scenario on the other hand is that the oil decline is swift, climate change is increasingly destructive, planning has been inadequate, the market economy has effectively collapsed and no usable infrastructure exists to meet basic human needs.

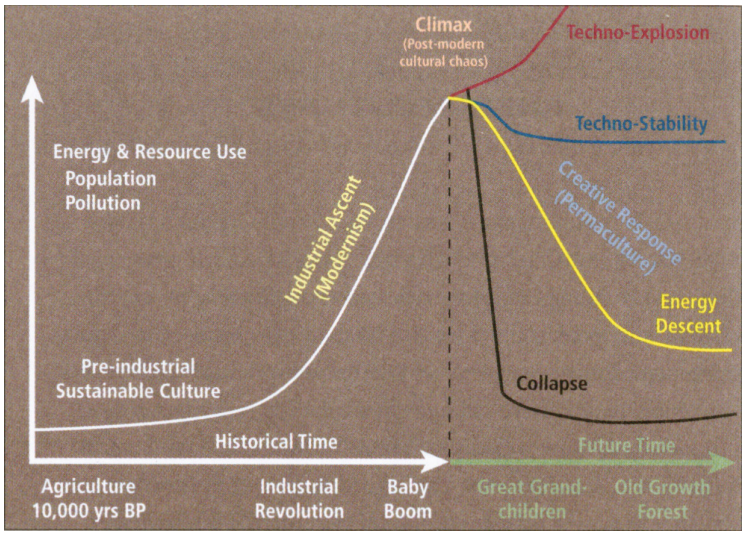


Figure 1: Future Energy Scenarios (Source: Holmgren, 2009)

The best case scenarios for 2050 might bear a resemblance to the 2010 night scene above, be it with some very different technologies or lifestyles within. The pessimistic worst case scenario however, of blackout, cold, starvation and anarchy, constitutes a stark warning against an apathetic approach to future energy and food security.

It is within this context that the concept of environmental sustainability is being approached in this research. Food and warmth along with clean water and sanitation are essential for basic human needs. If technological innovation is unable to provide a suitable clean, abundant, mobile energy source capable of replacing liquid fossil fuels, then it is highly likely that food, fuel and products formerly imported using such energy will need to be produced locally[3]. Therefore the local land surrounding Bristol City – that constituting the city-region county formerly known as Avon, would need to be relied upon to sustain the population with food, fuel, timber and minerals indefinitely[4]. Environmental sustainability would be as crucial as it was before the industrial revolution.

This extreme re-localisation scenario could be viewed as one side of a future socio-economic scenario polemic relating to human scale. At the other end of this polemic is the technological innovation scenario, whereby a combination of efficiency measures and new technologies (such as nuclear fusion) has enabled the global economic system to continue. For this latter scenario still to be sustainable 'indefinitely', limits on consumption and high standards of environmental management would be required to ensure ecosystems globally are able to cope with resource demand and waste assimilation (pollution) and that non-renewable resources are not wasted, are recycled and are used sparingly[5]. At this spatial scale of human activity the impact on the environments of other regions, countries and continents and the management of the global stock of non-renewable resources for future generations becomes more prominent.

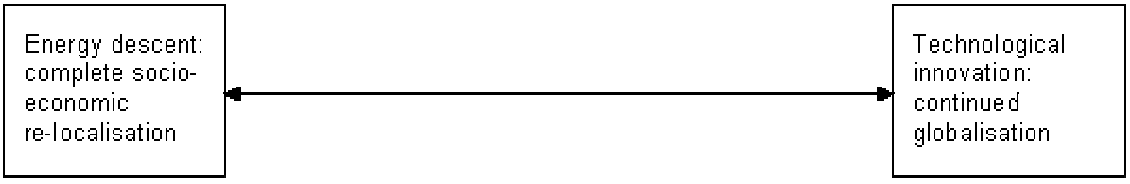


Figure 2: The sustainable future scenarios polemic of the scale of human economic activity

Between these two poles lies a continuum of potential socio-economic sustainable lifestyles. As these two poles represent two very spatially different economic modes of activity, a study of the environmental sustainability of the Bristol city-region requires examination of both spatial scales in its methodology – the local and the global.

The design for this research has therefore been modelled to assess the quality and quantity of local natural resources to capture the local spatial scale of environmental sustainability from a

'bioregional' carrying capacity perspective, as well as to examine the flows of materials and energy into and out of the city-region to assess whether its 'industrial metabolism' is environmentally sustainable in a global context. This will enable a set of baseline indicators of the current environmental sustainability of the Bristol city-region to be established, including a set of pressure-state-impact indicators of local natural capital and an ecological footprint of the current level of consumption. The extent to which the city-region could be self-sustainable at defined levels of resource consumption and population can then be calculated, pressures causing negative impacts locally and globally examined, and future trends based on a 'business as usual' scenario predicted.

The second half of the research will be to examine several future scenarios in more detail. Much future scenarios visioning has been undertaken already for the Bristol City-Region[6], which will be drawn upon with reference to the human scale scenario model. An examination of how these visions can be achieved and at what pace would then be examined using backcasting from the year 2050, whilst at the same time factoring in natural resource depletion rates, rate of climate change and socio-political factors. Figure 3 shows a model of how these scenario factors will be related to one another, the NW to SE axis being interchangeable for different physical earth systems constraints such as oil depletion rate or climate stability deterioration rate.

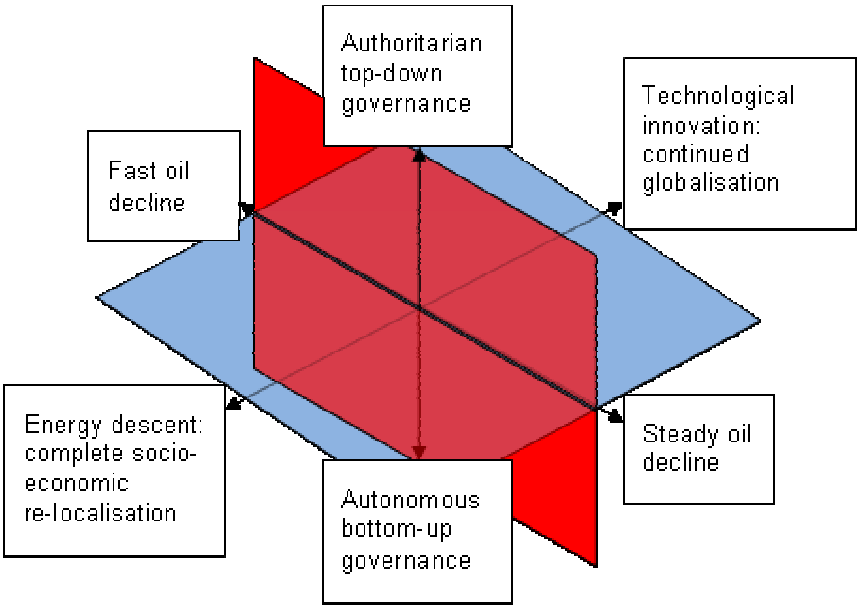


Figure 3: A 3d depiction of factors determining future environmental sustainability scenarios.
(NE to SW: human activity scale. NW to SE: natural resource decline rate or climate stability depletion rate. Elevation: level of governance.)

Figure 4 shows a conceptual model of a scenario located more or less in between the two poles of local versus global.

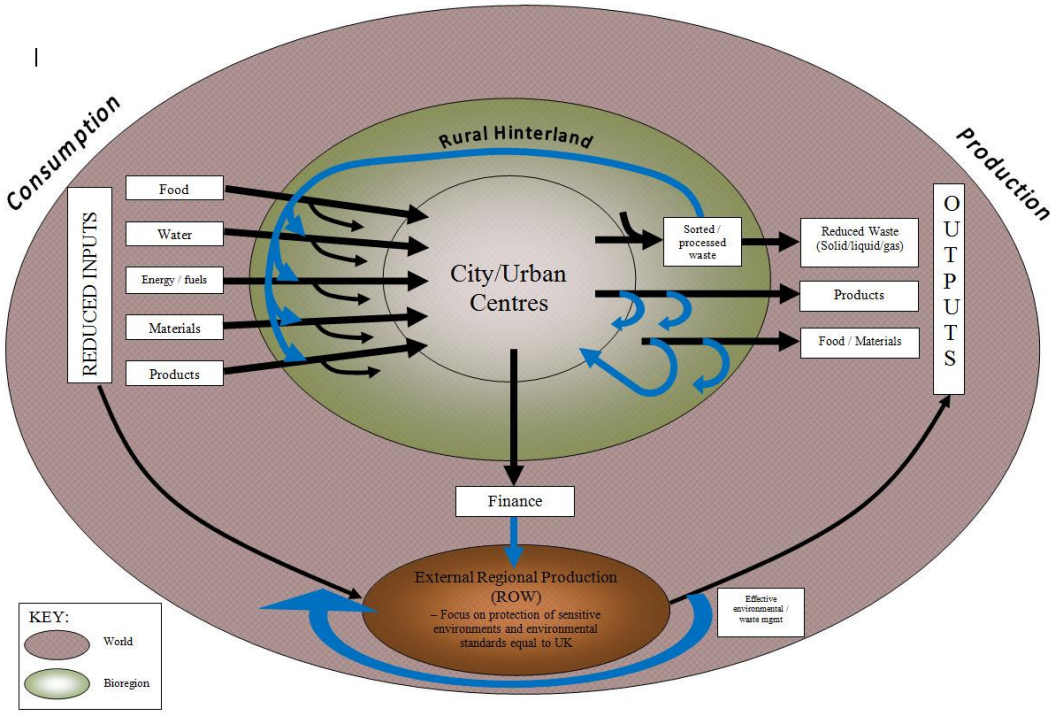


Figure 4: A model of an environmentally sustainable city region scenario, improving local resilience and resource efficiency within a globalised economy.

The significance of the research will be to have undertaken the first holistic assessment of the environmental sustainability of the Bristol city-region, incorporating both the local and global spatial scales of the city-region's economic activity in order to cover two main extremes of future sustainable scenario. The research's methodology for the baseline assessment could also be extrapolated to other city-regions in the developed world. The baseline assessment, future visions and examination of the steps required to achieve such visions should prove useful to those stakeholders within the city-region who are working towards making it a more sustainable habitation. It should also be of help to those who are making valuable steps towards planning for a very different energy future than we have known over the last century.

Endnotes:

1 A growing body of evidence suggests that the peak of crude oil production is imminent or has already passed (see for example the website of the Association for the Study of Peak Oil at http://www.peakoil.net/). The "Hirsch report" of 2005, commissioned by the US Department of Energy, warns of the grave implications of failing to plan for the energy descent from liquid fossil fuels, claiming it is likely to occur "within twenty years". The Bristol Partnership and Bristol Green Capital (2009) have also recently produced a report on the challenges peak oil presents for the city.

2 Holmgren, David. *Future Scenarios – How communities can adapt to peak oil and climate change.* Totnes: Green Books, 2009.

3 If a reduction in greenhouse gas emissions is also to be taken seriously, a reliance on coal liquification as a main source of liquid fuels would be untenable without a considerable breakthrough in carbon capture technology.

4 The idea of returning to a more localised way of life drawing on the unique physical and ecological resources and people of a region belongs to the philosophy of bioregionalism. See for example Sale, Kirkpatrick. *Dwellers in the Land: The Bioregional Vision.* San Francisco: Sierra Club Books, 1985.

5 A broad overview of the literature on principles of environmental sustainability can be found in Heinberg, Richard. *Peak Everything – Waking Up to the Century of Decline in Earth's Resources.* Forest Row, East Sussex: Clairview Books, 2007, p.85.

6 Such work has been undertaken by Forum for the Future (2008) in the Climate Futures report, GWE Business West and Bristol City Council.