# Carbon Footprint –A Model Structure for our Future

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**Introduction**

Michael Dan Archer, British Sculptor and Senior Lecturer in Fine Art at Loughborough University School of the Arts in the UK is currently working on a project with Ray Leslie, Professor of Chemistry at Nottingham University, James Davis, Nottingham Trent University, Simon Austin, Professor of Structural Engineering at Loughborough University, Tony Thorpe, Civil and Building Engineering, Loughborough University on a project to illustrate the volume of the Carbon Footprint of an average British family through a large sculptural tower partly based on the form of a carbon nanotube and partly on the shape of a power station cooling tower.

## Background

The ever increasing impact of climate change on the environment is a well established topic within the scientific community and there is now increasing haste in both government and industrial effort to attempt to curtail emissions. The dangers are all too real but, to the general public, the concept remains fuzzy especially given the potential scale of the problem and the apathy associated with what an individual can achieve. Carbon footprint is one of the more common terms that the government and the media have fixed on as an attempt to personalise the issue but the lasting impression is on the need for energy efficient light bulbs, lower central heating temperatures and wash cycles. The underlying principles and the sustained actions which need to be taken in the future are lost and therein the true nature of the impending crisis. There are regular pronouncements that individuals need to reduce their carbon footprint but few people will have any idea of what their contribution currently is let alone how they can reduce it in a meaningful way nor what science is trying to do to help the process. The project outlined herein seeks to provide a highly visual example of what the average carbon footprint equates to, how it much it must be reduced and highlight the processes through which this can be achieved at both the domestic and industrial scale.

The main concept is to construct an engaging and interactive sculpture whose overall volume would be representative of the carbon dioxide output produced by the average person in a single month. The latter aspect provides the spectator with a more immediate visual assessment of their contribution. The real strength of the design process however will be the tangible nature of the “footprint” information that would be inherent to the design – both external and internal. The core rationale is to have a multidimensional interactive structure that can be entered and the contextual background to the climate problem and how it can be solved presented as the visitor progresses through the sculpture. The core aim is to provide an experience and educational resource that easily contextualises the issue but which informs in an engaging manner whose message would be retained much more strongly than through conventional publicity drives.

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## Project Vision

The Carbon Trust puts the average carbon footprint of the UK citizen at 10.92 tons per annum. While the overall weight can be rationalized in terms of everyday objects – few people would be able to visualize the gaseous volume representative of annual emission. A simple estimate (using the van der Waals equation[1i]) gives an output volume of some 6044 $m^3$ for annual $CO_2$ production. Spatial estimations on this scale are clearly difficult but it can be more easily pictured when considering one months' output (504 $m^3$) and shrouding the volume in a structure as indicated in Figure 1. The latter makes the volume much more realisable – in terms of construction yet it retains an impressive degree of awe which would be necessary for the spectator to associate as "their monthly footprint" and impregnate memory. The artistic nature of the sculpture should drive curiosity to approach and hence forth engage with the more subtle aspects of the resource.

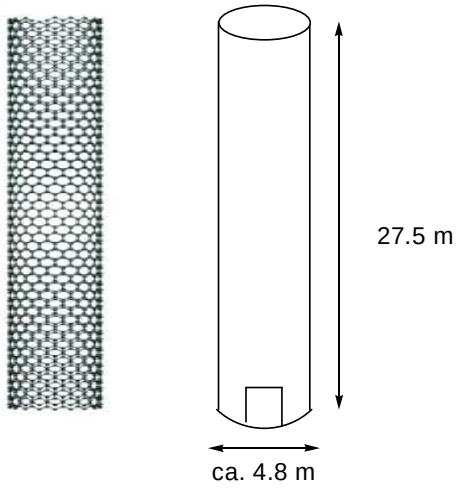



**Figure 1**

The design will play to the recent material and technological advances in molecular architecture and it is anticipated that it would encompass components of nanotube/graphene sheet geometry integrated within a circular tower format. Rather than being a passive sculpture, the intention would be to have a design that allows movement up through the tower whereupon the visitor would be presented with a sequential "carbon story" on forward travel and the methods being developed to reduce the output on their downward exit. The aim is to have a design that stands as a focal point that stimulates debate - notable enough to drive interest in visiting but provide a more interactive event for those willing to participate in the "event" that the whole structure represents.

## Methodology

The project would require a site within Nottingham that can offer a reasonable level of footfall to ensure that the display captures the general public and yet be accessible for more organized outings. In the first instance, it would be envisaged that the sculpture would be fixed but it is possible that transfer to different locations may be possible (subject to planning and engineering considerations). The assembly of the structure represents a multi-disciplinary collaboration in which the design would be directed

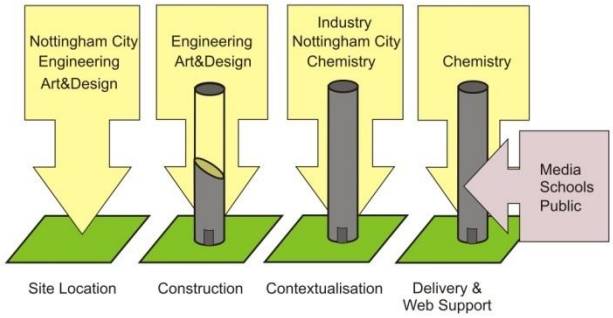
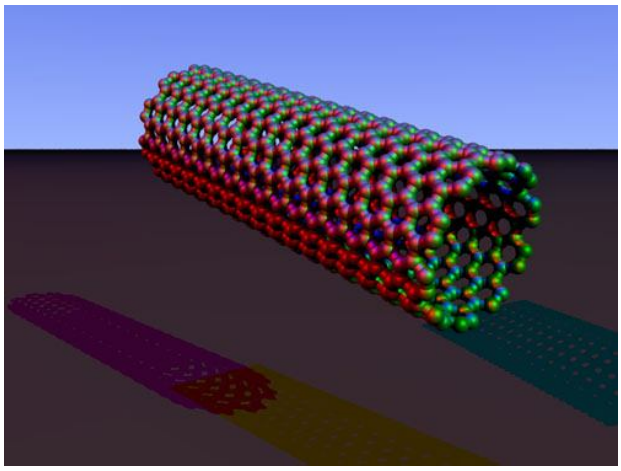


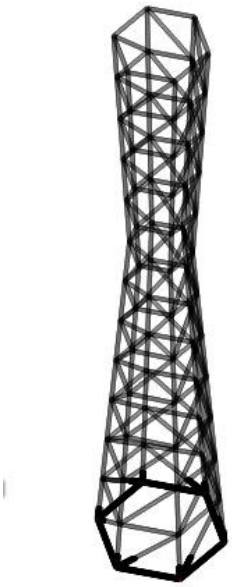

**Figure 2**

by artistic consideration to ensure a visually attractive and stimulating structure such that it is capable of capturing interest of the passerby. The integrity of the structure would be guided by structural engineering expertise and the contextual content of the carbon story and resource development by chemists to emphasize the science behind the problem and solutions. The interplay of the various groups, external bodies and the intended audience is highlighted in Figure 2.

**Resources**



The carbon story will provide a general overview to the main factors affecting climate change and sources. It will provide a statistical breakdown of relative contributions but in everyday, recognizable terms rather than scientific units. It will contextualize the data recognizable to Nottingham residents and their individual contributions and then highlight how they can actively manage the reduction of their footprint. The resources will emphasize the steps being taken at local council, central and international government level. A proportion of the displays held within the tower will be updatable such that they can reflect topical issues that arise during the lifetime of the tower – as such the infoboards will evolve rather than being a static display. A web resource will be developed in conjunction with the sculpture with the aim of providing a multi-level stage through which further information can be obtained and educational projects initiated. The web resource-sculpture will be synergistic – each promoting the other.



The educational benefits are twofold – the sculpture would serve to highlight the issue to the general public and promote the initiatives being sponsored by Nottingham City. It would also serve as a focal point for schools to create, develop and implement creative projects based on carbon emissions, climate change, alternative energy, green chemical processes, recycling, conservation and sustainable production. Most of these areas are components, in one form or another, in the National Curriculum and form core components of A level studies. At present, most displays on such subjects are held with museums or distributed through leaflets. The key

attributes of the proposed sculpture are the novelty of the approach, physicality of the resulting sculpture, community contextual support. It would provide a source of discussion and in doing so will immediately reserve a place in the consciousness – much more so than a leaflet.

**Deliverables**

- Engaging sculpture which physically defines a "Carbon Footprint"
- Interactive resources that stimulates curiosity and debate
- Educate the public with respect to defining the carbon footprint and the factors that affect it
- Provide information relating to current research into alternative fuels
- Outline methods for reducing an individual carbon footprint by recycling, increasing energy efficiency and, where appropriate, utilizing renewable energy sources
- Display Nottinghamshire's performance with respect to recycling and use of renewable energy sources and therefore create a community project to lower the county's overall carbon footprint
- Provide educational resources to maximize the value of the display and aim to encourage pupil-parent pester power to be proactive in carbon reduction
- Highlight the role of local, central and international scientific research in developing technologies to counter a global threat

**Communication Strategies**

Carbon footprint is an ambitious project both in terms of the structural engineering involved in the sculpture and the goal of inspiring an entire community to participate in a scheme which could ultimately change the way we live. However we feel that the challenge presented by climate change requires a suitably bold answer and we can justify our choice by considering that:

- The structure will become synonymous with Nottingham in much the same way that Angel of the North is linked with Newcastle and the Millennium Bridge with Gateshead. The resulting publicity will generate far greater interest than would normally be associated with a passive sculpture.
- The sculpture will be the focal point which attracts people, who will then be more receptive to learning, from the associated informative displays, about climate change and the science concerned with both investigating and addressing the problem.
- Information relating to reducing an individual carbon footprint will generate; debate within households about the current scientific research; and action with respect to lifestyle changes.
- Associated with the exhibit will be a rolling 'performance update' which will outline the county's efforts to reduce the carbon footprint by recycling, use of

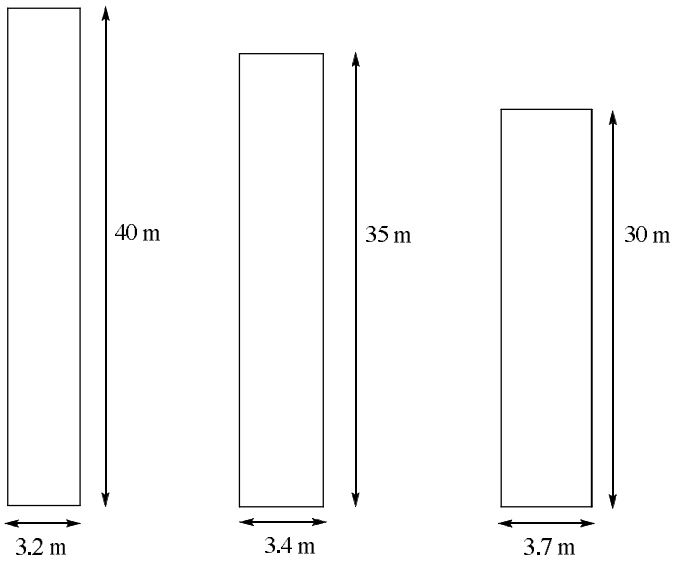
renewable energy sources, efficiency drives etc. This will generate a sense of competition, especially if the performance is rated against the national average and a strong sense of public engagement in the project will be manifest.

- The exhibit will not be a permanent fixture in Nottingham and although sourced from recycled and recyclable material we will have the option, depending on initial success, to move the project to other towns in the UK to stimulate further community schemes.

In order to gain public interest in the project we will work closely with Nottingham City Council's PR department to reach both local and national media and ensure maximum publicity for this work.

**Notes**

[i] Taking an arbitrary carbon footprint of 7 tonnes of $CO_2$ per annum this translates to 7 000 000 grams of $CO_2$ or 159090.9 moles. Calculating the volume of a gas is always a bit subjective but I've used the Van der Waals equation (calculating the volume at 25 $^{o}$C) to give a value of 3 873 863.6 litres which translates to 322.8 $m^3$ (per month).
The volume of a cylinder is $\pi r^2 h$ (where r = radius, h = height)




So there are three possible tower dimensions given above just to give an idea.

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www.archersculpture.co.uk