



This is the third in a series of quarterly updates for the stakeholders to summarise the progress and direction of the Tyndall Cities Programme.

Tyndall Cities Programme: progress

Significant progress has been made in the Cities Programme since the last stakeholder meeting. With many components of the work due to be completed over the next couple of months, we hope to be able to present and demonstrate the following at the next stakeholder meeting in July:

- Completed socio-Economic scenarios to 2100 for London;
- Land use model extended to households and socio-economic sectors; generalised travel costs work completed and tools available for demonstration;
- Analysis of the climate change action plan using the emissions accounting tool;
- Results from the analysis of personal transport emissions;
- Update on the analysis of emissions from freight transport;
- Flooding impact module will be completed and we will report on progress on the heat water resources modules;
- The Integrated assessment tool will be available to demonstrate

This bulletin reports in more detail on recent progress made in the economics work, the land use transport model and the personal transport component of the programme.

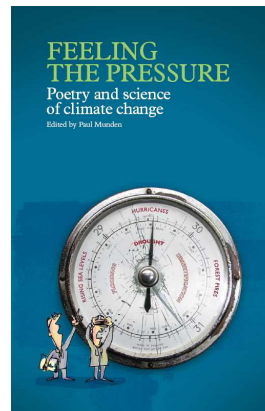
Cities Programme: News

Young Researcher Award



Helen Harwatt of ITS Leeds has just won the Leipzig young researcher award from a paper based on her PhD study. The jury had a difficult task in selecting the best paper among 14, all of a very high research level, but they particularly appreciated the consistency of the paper with the theme of the Forum “Transport and Energy: the Challenge of Climate Change” and the political dimension of the research. Helen is presenting the paper at the Leipzig transport forum at the end of May.

Poetry Book



Richard Dawson has contributed to a poetry and science anthology on climate change that includes poems by Andrew Motion and Roger McGough. The anthology is published by British Council Switzerland. If you would like a hard copy of the

book please contact: Richard.dawson@ncl.ac.uk; alternatively it is also available on the British Council's

website:

<http://www.britishcouncil.org/anthology.pdf>

ESRI International User Conference

Stuart Barr and Alistair Ford will attend the ESRI International User Conference in San Diego California during August. They will present work been undertaken in the Cities Programme to model travel costs across London under various scenarios up to 2100, and describe the changes in transport accessibility which may occur.

Visitors from Durban

Following Richard Dawson's visit to Durban, Rob Hounsome from the Council for Scientific and Industrial Research (CSIR) and Debra Roberts and Penny Croucamp from the Durban Municipal Authority in South Africa completed the exchange visit by spending time at Newcastle University, Tyndall Headquarters at the University of East Anglia and the GLA.

Recent Publications

Crooks, A., Castle, C., and Batty, M. (2008) Key Challenges in Agent-Based Modelling for Geo-Spatial Simulation, Computers, Environment, and Urban Systems, forthcoming.

Zanni A.M. and Bristow A.L. (2008) Freight transport in London: climate change challenges and issues, Paper to the 40th Annual Universities Transport Studies Group Conference, 3rd to 5th January 2008, Portsmouth.

Socio-Economic scenarios to 2100 for London

The economics for avoiding dangerous climate change requires analysis from many disciplines. The multi-disciplinary risk analysis carried out by the Stern Review team (Stern 2006) and the IPCC 4th Assessment Report (IPCC AR4 2007) has revealed critical weaknesses of the traditional, neoclassical approach to economics, especially in the treatment of uncertainty and risks. Equilibrium-based models alone are not considered appropriate for providing an adequate understanding of the climate change problem. Considering that the first step in integrated assessment modelling is the derivation of assumptions about population, employment and economic activity (GDP growth), which will feed then the different submodels, it is crucial to have ranges of these assumptions prepared in a credible and scientific way so that the assessment can explore feasible solutions of the climate-change problems (Barker 2008). For this reason a model incorporating the approach of this new ‘complexity’ economics (Beinhocker 2006) has been selected.

The Cambridge Centre for Climate Change Mitigation Research (4CMR) has extended the MDM-E3 model (Multisectoral Dynamic Model of the UK Economy, including energy-environment-economy (E3) interactions) up to 2100 with an overall objective to provide output tables of economic activity with regional and industrial disaggregation (measured in terms of economic value added at constant prices), of employment with regional and industrial disaggregation (measured in terms of full-time-equivalent – FTE- employees) and of energy demand (in terms of thousands tonnes of oil equivalent (toe) consumed by different fuel type) at national level with industrial disaggregation as input to the land use and population distribution model, the transport emissions accounting model and the energy use emissions accounting model.

The energy-environment-economy (E3) model of the UK, MDM-E3, includes a detailed treatment of the labour market with stochastic

equations for employment (as a head count) (Lee et al. 1990), average wages (Lee and Pesaran 1993), hours worked (Poncet 2006) all by industrial sector and region, and labour market participation by gender and regions. This treatment plays an important role in analysis involving tax switches or inflation, particularly in cases where tax revenues are recycled through reductions in taxes on labour.

Unemployment is calculated as the difference between employment and the active labour force and is a key explanatory variable in the equations for wages, labour market participation and trade. Unlike equilibrium models, MDM-E3 does not assume full employment, even in the long run.

A number of scenarios have been designed in order to represent different views of the future, trying to examine the influence of some critical parameters on the future socio-economic profile of London and neighbouring regions. Figure 1 shows employment in 5 general sectors for the baseline scenario in London.

References

- 4CMR, Cambridge Centre for Climate Change Mitigation Research, Dept. of Land Economy, University of Cambridge, <http://4cmr.org>
 Barker, T. (2008) ‘The economics of avoiding dangerous climate change’. Climatic Change (forthcoming).
 Beinhocker, Eric (2006) *The Origin of Wealth: Evolution, Complexity and the Radical Remaking of Economics*. Random House Business Books.
 IPCC, (2007) IPCC Fourth Assessment Report. <http://www.ipcc.ch/>
 Lee, K. C. & Pesaran, M. H. R. (1993) “The role of sectoral interactions in wage determination in the UK economy”, *Economic Journal* 103: 21-55.
 Lee, K. C., Pesaran, M. H. & Smith, R. (1990) “Aggregation bias and labour demand equations for the UK economy”, in T.S. Barker & M.H. Pesaran (eds) *Disaggregation in Economic Modelling*, Routledge.
 Poncet, S. (2006) “The Long Term Growth Prospects of the World Economy: horizon 2050”, CEPII, No 2006-16
 Stern Review on the Economics of Climate Change (2006) HM Treasury

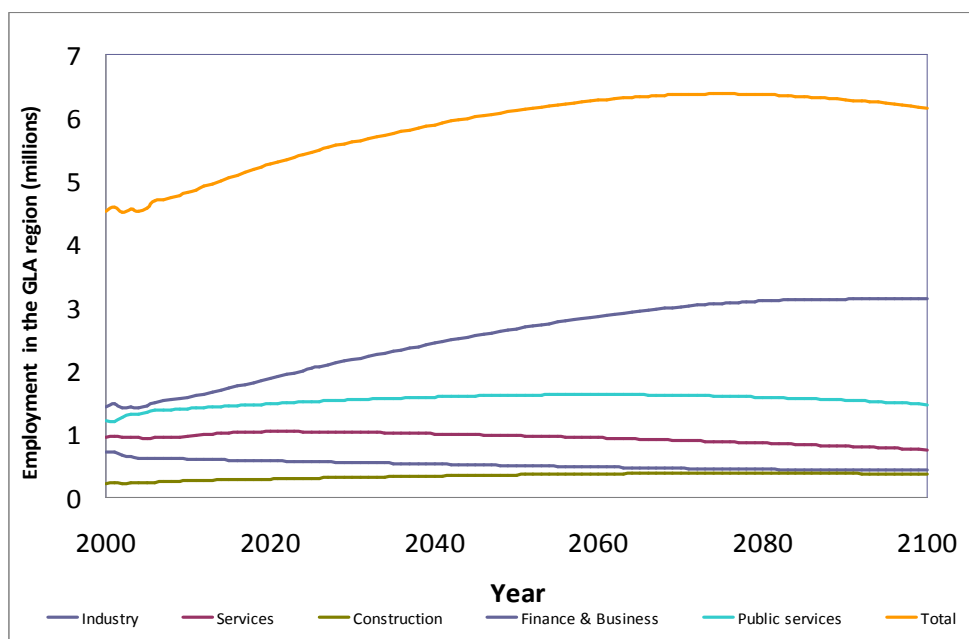


Figure 1: London employment for different sectors in the period 2000-2100 for the baseline scenario

Land use transport model

The land use transport model sits halfway down the chain of integrated assessment, sandwiched between the more aggregate economic predictions of employment totals which are formed from the various long terms scenarios relating to environment and economy and the more detailed predictions generated by the climate impacts models which are in turn a function of various long terms scenarios relating the sea level rise and related climate change. The aggregate economic forecasts for Greater London are produced by the regional input-output model and these predictions are then factored into small area estimates of future employment at the scale at which the land use transport model currently works, which is based on the 633 wards within Greater London at 2001. These estimates are used to drive the land use transport model which at present consists of allocating employment by these sectors to the zones of the city using a mode split constrained interaction model in which generalised travels costs on four modes – road, heavy rail light rail (tube) and bus – affect the extent to which workers commute to their place of residence.

This is a standard spatial interaction model, tying employment locations to population locations through trips on each of the four modes, the total volume of which are fixed in advance for the whole city. The generalised cost matrices are produced using the transport network analysis module developed by Newcastle which is based on full statements of costs incurred for each trip which consists of out of pocket costs (parking, fuel, fare) as well as loss of time. The generalised cost module will be reported in a future newsletter. The model has currently been calibrated to these four modes by ensuring that the mean travel costs for each of the modal networks re reproduced by the model although as yet the model has not been extended to deal with the five employment and five population types. The next stage will involve this extension. The link from the model to the finer scale is also being handled

using land for development which is coded at a fine raster level, thus constraining the model in terms of land available for development. This hooks the model downstream to the next stage where the Newcastle group are developing a detailed land allocation procedure taking account of various physical constraints. The land use transport model estimates the totals that are then factored to 50 metre grid square level at the next stage.

Currently the model is being tested in terms of its ability to predict long term scenarios which consist of changes to the transport system, constraints on where population is likely to be located and changes to the pattern and type of employment. We also envisage that the model can be used to test the impact of systematic changes in generalised travel cost, as for example in terms of the changes in the price of fuel and we would expect the model to show considerable mode shifting between networks. However major shifts between modes in a total sense, that is trip-makers shifting in total between models with some modes declining, other growing overall, cannot be predicted by the model and these need to be input as scenarios for testing.

After the model has been extended to different employment types, it will be spatially extended to the rest of the Thames Gateway. Currently as the figure 2 shows, the model has been developed just for Greater London. Figure 2 shows the extent of the area, accessibility in 2001 by light rail/tube, and the tool bar used to control the operation of the model.

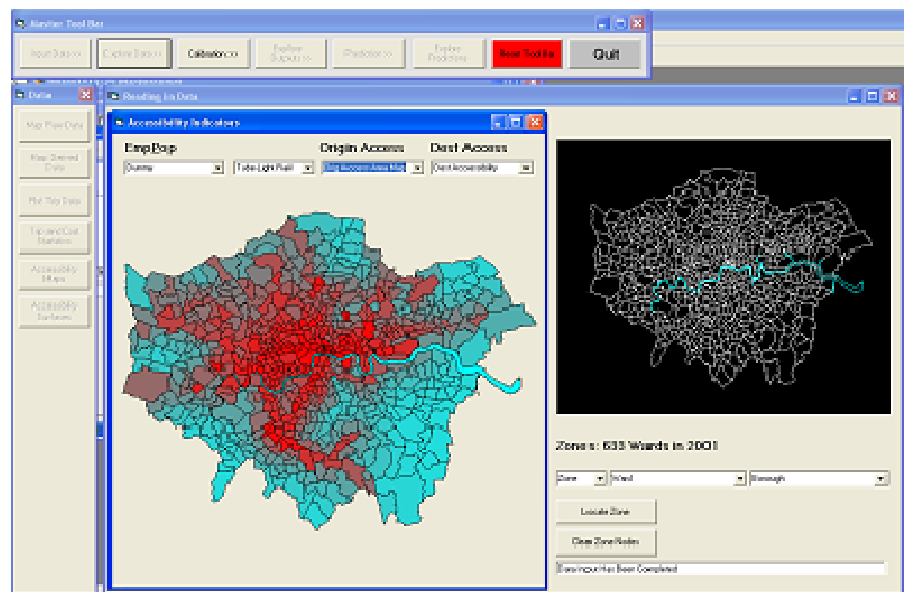


Figure 2: A Typical Output from the Land Use Transport Model

Personal transport carbon emissions

Using data from the National Travel Survey and the 2001 Census, a baseline of carbon emissions from personal transport within London was created. The data can be broken down by travel mode, Government Office Region (GOR) (according to the travellers' area of residence), and National Statistics Socio-economic Classification (NS-SEC).

All personal transport within London produced 1.15 million tonnes of carbon in the baseline year (2004). This includes all personal travel within London from all households in the UK. If travel began outside of London and ended in London, the estimated proportion of the travel within London was retained whilst the travel estimated to have occurred outside of London was removed. Figure 3 shows the proportion of carbon emitted in London by travellers' area of residence.

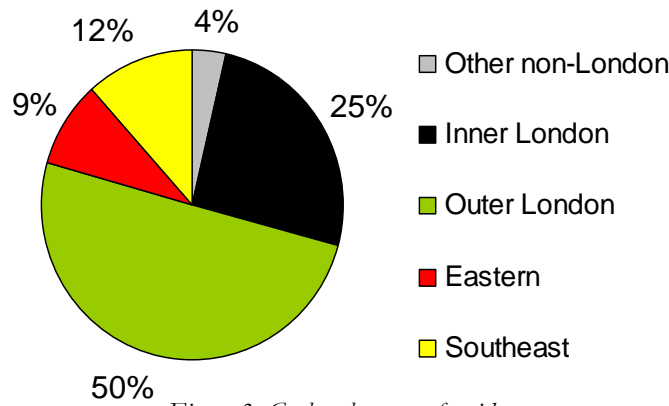


Figure 3: Carbon by area of residence

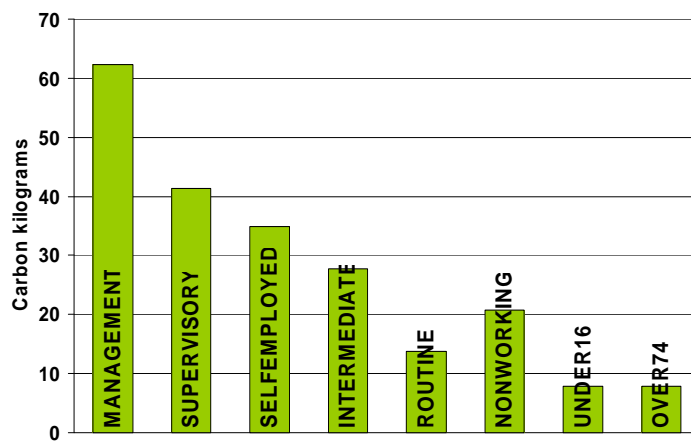


Figure 4: Carbon per person per year by NS-SEC

As shown in figure 3, outer London residents were responsible for half of all emissions produced in 2004, with inner London residents contributing the same amount as non-London residents who travel within London. Car use was responsible for the majority of carbon from all areas, with outer London having the largest proportion (74%) and inner London having the lowest proportion (55%). In terms of carbon from public transport, inner London has the highest proportion (41%) with other non-London areas having the lowest proportion (19%), followed closely by outer London (20%).

The NS-SEC population data from the 2001 census (correlated with the NTS data) was used to estimate the amount of carbon used by each group. Two

additional groups were added to represent the proportion of the population under the age of 16 years and over the age of 74 years (these groups are not covered by the NS-SEC but are included in the NTS data). Figure 4 shows the amount of carbon used within London per person for each NS-SEC.

Individuals within the management NS-SEC consume the most carbon whilst those under 16 years and over 74 years old consume the least. Further analysis reveals that the supervisory NS-SEC had the largest proportion of carbon from car use whilst the management NS-SEC had the largest proportion of carbon from rail and tube use in comparison to the other NS-SEC groups. The non-working NS-SEC had the largest proportion of carbon from bus use whilst the self-employed NS-SEC had the largest proportion of carbon resulting from van use.

Following the creation of the baseline, carbon emissions were forecast up to 2050 assuming that each person continues to consume the same amount of carbon each year per mode. The current stage of the study involves the manipulation of this forecast dataset to incorporate changes to vehicle carbon emissions over time (which could vary according to NS-SEC and GOR), changes in modal share, the impact of the full T2025 programme and additional policies including a fuel price increase. The resultant carbon emissions will be provided and presented in relation to the targets outlined in the climate change action plan and the wider UK policy goals for carbon emissions reductions.