UNIVERSITY OF LEEDS

Mobility & Energy Futures Series

CAN WE ACHIEVE LOW-CARBON FREIGHT?

Energy Leeds

The context - growing amounts of freight, largely by road transport

Freight transport constitutes a very significant but under-researched part of total transport demand, and one in which the prospects for lower energy use and associated lower carbon emissions may prove particularly elusive. Reducing energy use and carbon emission whilst maintaining the freight transport services that the modern global economy requires will hinge on many recent and current trends being changed.

Whilst there is a broadly positive relationship between economic growth and increasing freight demand, this relationship is not straightforward, with a number of factors leading to greater demand for freight movement in recent times;

- A growing retail sector has reconfigured its logistics networks around consolidated stockholding at larger depots, and uses road freight transport intensively both to pull in goods from suppliers and to replenish shop shelves
- In many developing economies, deindustrialisation has led to a shift away from denser heavier materials towards lighter, highly packaged consumer goods which are volume-hungry
- For these and many other reasons, sustained attempts to promote non-road lower carbon modes of freight transport such as rail have achieved only marginal success
- A sustained and ongoing trend towards globalisation and offshore low-cost manufacturing has promoted massive growth in long-distance freight movements
- Increased movement of higher value goods as well as material and product movements associated with 'just in time' (low inventory) business processes has led to reduced attention to vehicle utilisation and greater use of air freight
- Rapidly growing levels of online shopping and demands for home delivery are adding to the proliferation of light commercial vehicle movements and freight deliveries in urban areas.

These and other factors have led to a predominant use of road freight for land-based freight transport movements, in many cases at less than optimal levels of utilisation and efficiency.

A potential trajectory towards low carbon freight and logistics

It has long been recognised (for example by the UK's former 'Freight Best Practice' programme) that there are plenty of relatively easy wins, many of which will reduce business costs as well as energy use, mainly through efficiency-enhancing initiatives such as eco-driving and effective use of ICT for optimal loading, routing and scheduling.

Beyond such measures, further energy saving will need to come from changes such as modal shift, possibly at higher business cost. Energy reduction beyond that is contingent on major changes in business practices, to facilitate much greater co-operative use of capacity sharing, before in the longer term much more energy efficient and greener technologies come to the fore.

Can freight transport achieve the carbon reductions required to meet agreed targets?

In the UK case, 'achieving carbon reduction targets' has been translated into targets such as an 80% reduction in CO_2e by 2050, compared to 1990 levels. For freight transport, EU strategy documents[1] set out a vision of more than half of medium and long distance freight using low-carbon modes and of urban freight and logistics becoming carbon free. Change to this extent will be very difficult to achieve. Mode shift for trunk haul movements, for example, may well be challenged by the platooning of autonomous trucks on the roads. A recent report for the Committee for Climate Change suggests,[2] in line with previous exploratory research, that whilst achievement of UK targets is not impossible, very significant business and logistics changes would need to take place, such as greatly increased levels of logistics co-operation between organisations to ensure maximum vehicle utilisation and changes to business models used for city logistics to ensure high levels of load consolidation coupled with the use of zero carbon delivery vehicles. A major contributory factor is that – unlike for personal travel for which major electrification is envisaged – widespread adoption of any radical new technology to replace diesel engines in heavy commercial vehicles is not expected within the required timeframe.

Internet shopping and home delivery - good or bad for the environment?

The development of online retail can be hypothesised as positive or negative from an energy or environmental viewpoint. On the one hand, car trips to the shops might be replaced by more consolidated freight deliveries to homes, whilst on the other hand such deliveries might replace walking or cycling shopping expeditions. In fact various studies[3] have suggested that on a range of assumptions regarding issues such as mode choice for traditional shopping behaviour, fill levels for delivery van operations and likelihoods of failure to deliver first time, home delivery offers a net advantage over traditional forms of retailing. This advantage can be expected to increase over time as online volumes continue to grow. Online retailers may well share their use of parcels networks, such that growth may take up slack volume in such networks. Growth will also allow online retailers to optimise their logistics networks, for instance through the establishment of regional depot operations that may reduce transport distances.

Potential for disruptive technologies

Recent work by McKinnon et al (2015) considers potential for disruptive change to supply chains through various emerging technologies. The 'Internet of Things' may result in further dematerialisation, reducing the need for physical goods movement. If 3D printing can achieve mass market penetration, significant amounts of production could become much more local than at present. Concepts such as the 'Physical Internet' (a highly standardised and co-ordinated network for intermodal freight movements powered by low carbon fuels) might allow for substantial carbon reduction. Unmanned aerial vehicles ('drones') could replace vans as a means of delivering parcels to businesses and homes. McKinnon et al note major technical, operational, cost-effectiveness and legal obstacles to all such developments, suggesting that at best they will only start to make any meaningful contributions towards the end of the carbon target timeframe.

The need for further research

Given the importance of achieving energy and carbon reduction in freight transport and logistics, the major risks of missing established targets and the relatively low level of awareness and knowledge in the field, we can only conclude that this is a sector in need of significantly more research. Such research needs to not only continue to push forward on the technical fronts, but importantly needs to focus much more on the business practices and business models that will be required if the businesses of the future are to be able to take full advantage of new low energy, low carbon opportunities that may become available.

Anthony Whiteing
Institute for Transport Studies

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[1] E.g. European Commission (2011). White Paper: Roadmap to a Single European Transport Area — Towards a competitive and resource efficient transport system, Brussels: COM(2011) 144 final.

[2] Greening, P., Piecyk, M., Palmer, A. and McKinnon, A.C. (2015), An assessment of the potential for demand-side fuel savings in the Heavy Goods Vehicle (HGV) sector. Report prepared for the Committee for Climate Change by the Centre for Sustainable Road Freight.

[3] See for example BESTUFS. (2001). Best Practice Handbook Year 2. E-commerce and urban freight distribution (home shopping). Germany: PTV.

[4] See the Postscripts in the 3rd edition of the 'Green Logistics' book; McKinnon, A.C, Piecyk, M., Browne, M. and Whiteing, A.E, (2015), Green Logistics. London; Kogan Page.

Mobility & Energy Futures Series

Transport consumes a fifth of global energy and has a near-exclusive reliance on petroleum. As such it has an important role to play in the Energy Trilemma of reducing energy consumption and associated greenhouse gas emission, creating an energy system built on secure supplies and developing the system in ways which are affordable.

Addressing the Energy Trilemma in the transport and mobility sector is especially challenging due to the continued growth in demand for the movement of goods and people, the technical, regulatory and social challenges of moving away from an oil based system of mobility and a complex and fragmented set of stakeholders required to work together to deliver change.

Drawing on the expertise and opinions of the University of Leeds academics from different disciplines, this series will highlight the drivers, gaps and opportunities in reducing the energy consumption and carbon emissions from the transport sector in future. This is the third briefing in the series.

Other issues in the series are available online at www.its.leeds.ac.uk/research/mobility-energy-futures-series

Editors:

Zia Wadud
Centre for Integrated Energy Research
Email: **Z.Wadud@leeds.ac.uk**
Tel: **+44 (0)113 343 7733**

Greg Marsden
Institute for Transport Studies
Email: **G.R.Marsden@its.leeds.ac.uk**

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Energy Leeds
University of Leeds
Leeds, LS2 9JT
Tel: +44(0) 113 343 4609
Email: energy@leeds.ac.uk
www.energy.leeds.ac.uk

UNIVERSITY OF LEEDS
University ofLeeds
Leeds, United Kingdom
LS2 9JT
Tel. 0113 243 1751
www.leeds.ac.uk