

Decarbonising Freight Transport

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Freight transport accounts for around 8% of CO₂ emissions worldwide and is generally recognised to be one of the hardest economic activities to decarbonise. This is partly because of its very heavy reliance on fossil fuels, but also because the demand for freight transport is predicted to rise steeply by 2050, possibly as much as three-foldⁱ.

Data for the EU indicates the magnitude of the challenge. The EU committed in 2011 to cut transport-related CO₂ emissions by 60% between 1990 and 2050. For the freight sector to achieve this target while accommodating the predicted growth in freight demand, the amount of CO₂ emitted by each unit of freight movement will have to plunge to a sixth of its current level over the next thirty yearsⁱⁱ.

In fact the challenge is even more formidable than these figures suggest because it is no longer simply a matter of constraining annual CO₂ emissions to a particular level by a given year decades away. Account must also be taken of the accumulation of freight-related emission (GHG) in the atmosphere over the intervening period. To keep freight transport's share of 1.5°C or 2.0°C carbon budgets within an acceptable limit its emissions will have to peak as soon as possible and then drop steeply. How might this be achieved?

In my bookⁱⁱⁱ on this subject I examine a broad range of technological, managerial, operational and regulatory options for decarbonising logistics and conclude that, if they are effectively and collectively deployed, a dramatic reduction in emissions could be achieved over the next 10-20 years. The options can be classified into five categories.

Restrain the growth in demand for freight transport

The first set of options could moderate and possibly reverse the forecast growth in total demand for freight transport. This can be done, for example, by reconfiguring supply chains, routing vehicles more efficiently and 'relocalising' some production and distribution operations. New forms of additive manufacturing / 3D printing may streamline and shorten supply chains reducing the transport intensity of major industries^{iv}. Automation may also promote a 'reshoring' of manufacturing capacity from low-labour-cost countries. The move to a 'circular economy' could also dampen future demand for transport within 'closed loop supply chains', while the continuing digitisation of new media and entertainment products and downsizing of electronic equipment will reduce the amount of stuff that needs to be moved.

These freight-reducing trends will be partly offset by developments generating more freight traffic. For example the creation of a new renewable energy infrastructure is proving both material- and transport-intensive though in the longer term should eliminate the need to move fossil fuels. Adapting our built environment to the worsening effects of climate change will also entail the movement of large quantities of building material.

Make more use of lower carbon transport modes

The second category of options increases the proportion of freight carried by transport modes that emit less CO₂, like rail and waterborne services. In many countries this will entail reversing a long term erosion of freight traffic from these modes to the road network. Modal shift is by far the most commonly mentioned freight decarbonisation measure in the 'nationally determined contribution'

(NDC) statements submitted by signatories to the 2015 Paris Accord on climate change. Corridor-based intermodal systems^v, concepts such as synchronomodality^{vi} and greater internalisation of the environmental costs of freight transport in higher taxes should favour the greener modes, though the phasing out of fossil fuels will deprive them of a core traffic that will be difficult to replace.

Optimise vehicle loading

The third set of initiatives improves the utilisation of freight vehicles, cutting CO₂ emissions per unit of freight movement. Available data suggests, for example, that roughly one truck-km in every three or four is run empty and even laden vehicles have much under-used capacity. All freight transport modes could be better filled, yielding commercial as well as environmental benefits. Online platforms for the trading of freight capacity, greater willingness by companies to share their vehicle capacity and a relaxation of vehicle size and weight constraints can all help to raise utilization levels. In the longer term, the creation of a physical internet^{vii} could prove to be a decarbonising game-changer for the freight transport sector. This would replicate key characteristics of the digital internet, such as open systems, shared networking and modularisation, in the physical world of freight distribution.

Improve energy efficiency

In the fourth category are measures which cut the energy used by trucks, trains, ships and planes per kilometre travelled. To put this into perspective, the movement of freight consumes around 10% of global energy consumption, almost all of it from fossil sources. Although the energy efficiency of all freight modes has greatly improved in recent decades, the potential exists for further improvement through a combination of technical and operational measures. In the road freight and maritime sectors, legally-binding fuel economy standards are accelerating the uptake of fuel-saving technologies in new trucks, vans and ships. One recent report^{viii} suggested that energy efficiency improvements of 35-40% were possible in 'heavy duty' road transport '*without radical changes in technology and potentially more with technology breakthroughs*'. Technical enhancements to fuel efficiency can be supplemented by a host of operational and behavioural measures. In the trucking sector, these include eco-driver-training, the rescheduling of freight deliveries to off-peak periods when vehicles can run at more fuel efficient speeds and a lowering of speed limits. 'Slow steaming' is now fairly pervasive across the shipping industry. Although introduced primarily for commercial reasons, it has proved to be a very effective means of decarbonising the movement of freight by sea. More general deceleration of supply chains and relaxation of the just-in-time principle could significantly lower the carbon intensity of freight transport, though allowance would have to be made for wider, rebound effects^{ix}.

Foster renewable energy use

In addition to using less energy, the freight transport sector will have to switch its energy from fossil to renewable sources, though there is currently much uncertainty about the optimal mix of low carbon energy for particular freight modes. As the carbon intensity of grid electricity steadily drops, the challenge will be to get the low/zero carbon electricity into freight operations as quickly and cheaply as possible. For electrified rail networks and battery-powered vans this process is well underway in some countries. In the case of long haul road freight, it will probably involve a mix of batteries, hydrogen fuel cells and catenary systems, though in proportions that are difficult to predict. The catenary option involves highway electrification with overhead cables powering 'trolley trucks', a concept that was considered far-fetched ten years ago, but is today promoted in countries such as Sweden and Germany as the most cost-effective way of decarbonising long distance trucking. The

prospects of ships and aircraft being powered by low carbon electricity are slim, at least in the next 10-20 years, largely confining low carbon energy options for these modes to biofuels, if enough can be produced sustainably and at affordable prices.

Conclusions

It is very encouraging that there are many ways of decarbonising freight transport, most of them mutually-reinforcing and many of them offering positive rates of return within relatively short payback periods. They, nevertheless, vary enormously in their cost effectiveness, levels of upfront investment, scalability and the speed with which they can be implemented. The challenge for managers and public policy-makers with responsibility for freight transport is to co-ordinate and phase their deployment in a way that maximises carbon reductions with minimum cost and delay. To assist them in this endeavour there is now an extensive literature on the subject^x, a range of online decision-support tools^{xi} and numerous green freight organizations around the world^{xii} committed to working with businesses and governments to drive down transport-related emissions. Unfortunately what we lack in the logistics sector is the necessary sense of urgency and a willingness to prioritise carbon mitigation above other, short-term commercial goals. There is still a tendency to see climate change as a longer-term, somewhat remote problem for future generations of manager to deal with.

ⁱ OECD /International Transport Forum (2017) '*Transport Outlook 2017*' Paris

ⁱⁱ Smokers, R., Wilkins, S., Kok, R., van Zyl, S., & Spreen, J. (2017). *Decarbonising Commercial Road Transport*. Delft: TNO.

ⁱⁱⁱ McKinnon, A.C. (2018) '*Decarbonising Logistics: Distributing Goods in a Low Carbon World*' Kogan Page, London

^{iv} McKinnon, A.C. (2018) '3D Printing: a Decarbonising Silver Bullet?' *Logistics and Transport Focus*, October.

^v Along these corridors investment in terminals, IT and services improve the co-ordination of transport modes making it easier for firms to switch mode.

^{vi} Synchronomodality involves co-ordinating the scheduling of services on different modal networks to minimize delays at interchange points and thereby facilitate the use of more than one mode for a freight movement.

^{vii} Ballot, E., Russell, M., & Montreuil, B. (2014). *The Physical Internet: the Network of Logistics Networks*. Paris: PREDIT

^{viii} Energy Transitions Commission (2018) '*Mission Possible*' <http://www.energy-transitions.org/mission-possible>

^{ix} McKinnon, A.C. 'Freight Transport Deceleration: Its Possible Contribution to the Decarbonisation of Logistics' *Transport Reviews*, vol. 36, no.4

^x My new book, for example, reviews around 630 publications on the subject.

^{xi} Such as EcoTransIT (<https://www.ecotransit.org/>) and the SRF Optimiser (<http://www.csrf.ac.uk/srf-optimiser-2/>)

^{xii} Such as SmartWay (in the US and Canada), Lean and Green (in several Europe countries) and the China Green Freight Initiative.

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