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Article

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Implications for the Rail-freight Sector of Stricter EU Locomotive Emission Limits: a UK perspective

INTRODUCTION

The European rail freight sector has grown exponentially over the past twenty to thirty years as the limitations of road transport have become increasingly apparent.¹ Moreover, moving more freight by rail is seen as a greener alternative.² Thus, in some respects it is a case of 'back to the future' and the halcyon days when the majority of freight was moved by rail; although it must be acknowledged that in the twenty-first century the bulk of freight is still moved by road and this is likely to be the case for the foreseeable future. This has resulted in an unprecedented demand for new motive power. A number of European rail freight companies have had their chequebooks out in recent years in order to increase capacity and fulfil contracts.

Within the EU the rail freight sector is a truly European affair, largely as a result of deregulation which occurred in 2007 under the first of the EU Commission's 'Railway Packages.' This has enabled European rail freight companies, such as DB Schenker, to have free rein to provide services in other EU states.³ Added to which is the fact that many highly successful locomotive and rolling stock manufacturers are based in the EU such as Siemens and Vossloh. Moreover a number of global manufacturers, such as Bombardier and Hitachi, have plants within the EU. However, to a large extent, the industry is still shaped by the differing ways in which the industry evolved in each

¹ In 2015 the amount of freight carried by rail in the UK was 22.21 billion net tonne kilometres, the second highest figure in the past 12 years. In 1995 13.30 billion net tonne kilometres was moved by rail. See Office of Road and Rail Regulation, 'Freight Rail Usage Statistics' <<http://dataportal.orr.gov.uk/browse/reports/13>> (accessed 5 April 2016). The pattern is repeated throughout the EU although there are considerable regional variations. Some states have seen considerable increases in the volume of freight moved by rail over the past 20 years whereas growth in other states has been more modest. For example, in the Netherlands rail freight has increased by 76% and in Denmark it has increased by 71%. See Commission, 'Fourth report on monitoring development of the rail market' (Report from the Commission to the Council and the European Parliament) COM (2014) 353 final.

² For example, rail freight produces 70% less carbon dioxide per tonne carried than road, 90% less PM10 and fifteen times less NOx: see Department for Transport (DfT), 'Delivering Sustainable Transport: the logistics perspective' (DfT, London 2008). See generally, Allan Woodburn and Anthony Whiteing, 'Transferring freight to 'greener' transport modes' in Alan McKinnon, Michael Browne, Alan Whiteing and Maja Piecyk (eds), *Green Logistics: Improving the Environmental Sustainability of Logistics* (3rd edn, Kogan 2015).

³ The first railway package was adopted in 2001 and consisted of a suite of Directives designed to establish a single market in the railway sector. This was followed by two further railway packages in 2004 and 2007. The legislation has been recast and is currently enshrined in European Parliament and Council Directive 2012/34/EU of 21 November 2012 establishing a single European railway area [2012] OJ L343/32. Article 10 enables European rail freight operators to access rail networks in other EU states on non-discriminatory terms. In January 2013 the Commission published proposals for a fourth railway package and, at the time of writing, this was still being considered by the European Institutions: See EU Commission (Transport) railway packages website <http://ec.europa.eu/transport/modes/rail/packages/index_en.htm> accessed 7 April 2016.

Member State. Customs, history, tradition, working practices and domestic political factors all conspire to create distinctive market conditions in a particular territory which poses a major challenge to trans-European operators. Such factors partition the market along national boundaries and undermine attempts to establish a single European railway area. Nowhere is this more clearly shown than the situation in the UK. The UK pioneered railway engineering and technology in the early nineteenth century; however, it has been slow to adopt more recent innovations such as high speed rail.⁴ Furthermore, as an island nation with limited connectivity with continental Europe,⁵ hitherto there has been little incentive to harmonize systems and equipment. This is most starkly shown by the exceedingly slow rate of electrification. In the immediate post-war years when most of continental Europe had set about electrification in earnest, the newly nationalized British industry actually commissioned a new set of standard steam locomotives to take advantage of cheap and abundant domestic coal.⁶ The working life of these locomotives proved to be short but, as a result of the lack of electrification, the UK had to turn to diesel as the main motive power. Despite recent improvements in fuel quality and engine technology, diesel is still a highly polluting source of energy and, as will be seen below, is the subject of ever more stringent pollution controls. In recent years there has been a renewed push to electrify a greater proportion of the UK network but progress has been exceedingly slow. In any event, current programmes are confined to a limited number of

⁴ To date only one high speed railway line has been built linking London with the Channel Tunnel (The Channel Tunnel Fixed Link or High Speed 1). Legislation is currently progressing through Parliament to authorize the construction of High Speed 2 linking London with Birmingham: See High Speed Rail (London – West Midlands) Bill 2013-14 to 2015-16 <<http://services.parliament.uk/bills/2015-16/highspeedrailondonwestmidlands.html>> accessed 7 April 2016. It should be noted that part of the rationale for a new high speed link between the first two cities of the UK is that it would free up capacity on existing routes for more freight.

⁵ For obvious reasons the only fixed rail link between the UK and continental Europe is through the Channel Tunnel. The tunnel is obviously somewhat of a bottleneck and freight trains must be threaded through the numerous Eurostar passenger and Shuttle trains (which carry cars and lorries through the tunnel). For this reason the bulk of freight carried through the tunnel is carried on lorries moved through the tunnel by the shuttle trains. This short hop by rail through the tunnel does little to alleviate the pressure on Europe's road network and disappointment has been expressed at the limited number of long distance trans-European freight trains which pass through the tunnel. See European Union Committee, *Liberalising Rail Freight Movement in the EU* (HL 2004-05, 52) ch 4. Efforts are afoot to increase connectivity through the tunnel pursuant to the requirements of European Parliament and Council Regulation (EU) 913/2010 of 22 September 2010 concerning a European rail network for competitive freight [2010] OJ L276/22. This requires Member States to cooperate in securing improvements in the compatibility of their rail infrastructure so as to facilitate more trans-European freight trains. The physical constraints of the Channel Tunnel render this an especially difficult exercise in the UK added to which is the problem of the UK's non-standard loading gauge (dealt with in more detail below). Network Rail orchestrated a lengthy consultation process on the subject and proposals for improved connectivity are currently being developed: see Network Rail, 'European rail freight corridor – linking UK and continental Europe' <<https://www.networkrail.co.uk/freight/european-rail-freight-corridor/>> accessed 7 April 2016.

⁶ See Christian Wolmar, *Fire and Steam: A New History of the Railways in Britain* (Atlantic Books, 2007), ch 14.

intercity passenger routes, such as London to Bristol and South Wales, and there are no plans to electrify large parts of the remaining network.⁷

Thus, lack of electrification, especially in the UK, has been at the heart of complex problems facing the rail freight industry. In order to meet increased demand it is necessary to order new diesel locomotives which must meet increasingly stringent EU emissions standards. For various technical reasons which shall be outlined in more detail below, this is far easier said than done. In 2014 there was a rush to purchase new locomotives complying with less stringent standards before new and more rigorous emission limits were enforced.⁸ In fact, these more stringent standards were already in force. From 1 January 2015, however, a period of grace under which a number of locomotives could be marketed which only complied with the less onerous standards, expired. As a result of these developments the sector is struggling to procure sufficient motive power to meet demand. If contracts cannot be fulfilled there is a risk that more freight could move back on to road.

NON-ROAD MOBILE MACHINERY

The emissions controls in question are set out in Directive 96/68/EC on non-road mobile machinery, as amended (NRMM Directive).⁹ The Directive covers all moveable plant and machinery which does not operate on roads and uses spark ignition (SI) or compression ignition (CI) engines. This encompasses everything from construction machinery to canal boats. However, the Directive was not expanded to cover locomotives and railcars until it was amended by Directive 2004/26/EC.¹⁰ In the UK the requirements are transposed into domestic law by way of the Non-Road Mobile Machinery (Emission of Gaseous and Particulate Pollutants) Regulations 1999 (as amended)¹¹ The Directive established emissions standards in respect of some of the key pollutants associated with diesel including sulphur dioxide, nitrogen oxide and particulates; these were introduced in increasingly stringent phases. Upon being brought within the scope of the Directive, locomotives

⁷ Delays and cost overruns associated with current electrification programmes in the UK, such as London to the West Country and South Wales and the 'electric spine' from Southampton to the Midlands and the North, have been the subject of much adverse media attention. Matters were brought to a head earlier this year by the 'Hendy Report' which proposed radical restructuring and rescheduling of certain projects: see Network Rail, 'Report from Sir Peter Hendy to the Secretary of State for Transport on the re-planning of Network Rail's Investment Programme' (November 2015).

⁸ This was extensively covered in the industry press. See for example, Richard Clinnick, 'GBRf spends £50m on new Class 66/7s and Class 92s' *Rail* 741 (February 5 – February 18 2014).

⁹ European Parliament and Council Directive 97/68/EC of 16 December 1997 on the approximation of the laws of the Member States relating to measures against the emission of gaseous and particulate pollutants from internal combustion engines to be installed in non-road mobile machinery [1997] OJ L59/1.

¹⁰ European Parliament and Council Directive 2004/26/EC of 21 April 2004 amending Directive 97/68/EC on the approximation of the laws of the Member States relating to measures against the emission of gaseous and particulate pollutants from internal combustion engines to be installed in non-road mobile machinery [2004] OJ L146/1.

¹¹ SI 1999/1053.

were made subject to Stage IIIA emission limits. Stage IIIB emission limits came into force on 1 January 2011 in place of Stage IIIA and, as will be seen below, presented the industry with major technical challenges. The Directive also established Stage IV standards to take effect from 1 January 2014 but these were never applied to locomotives and railcars. As will be seen below, a series of complex derogations and flexibility requirements were introduced in subsequent years.

Most recently, the Commission published a draft Regulation designed to replace the original NRMM Directive and its various amending instruments.¹² If adopted the Regulation will continue to exempt locomotives from the Stage IV standards (which will be confined to other types of non-road mobile machinery) and instead require compliance with new Stage V standards due to take effect from 2021. Thus, the rail industry will be allowed to bypass the Stage IV standards and concentrate their efforts on securing compliance with a new set of standards designed to consolidate Stage IIIB.

FLEXIBILITY

The rail industry expressed concern that the Stage IIIB requirements were too much of a step up from Stage IIIA and presented technical difficulties which could not be solved in the time frame. As the Association of the European Rail Industry (UNIFE) put it:-

At present, no proven solutions are available for stage IIIB. When answering call for tenders, engine manufacturers refuse to make any commitment on reliability or fuel consumption. When they do take the risk of quoting a price it can be twice as much as for a IIIA compliant diesel power package (i.e. about 15 to 20% of the whole locomotive cost). This increase is in itself an indication of the lack of maturity of the technology and may also deter possible locomotive orders.¹³

The rail industry and those governments whose rail sectors are heavily reliant on diesel traction, such as the UK, lobbied hard for the inclusion of flexibility requirements so as to extend the period in which Stage IIIA compliant locomotives could continue to be marketed. The EU Commission eventually agreed and a flexibility scheme was inserted into the NRMM Directive under Annex XIII¹⁴. This enabled a limited number of new locomotives to be placed on the market for a period of 3 years

¹² Commission, 'Proposal for a Regulation of the European Parliament and of the Council on requirements relating to emission limits and type-approval for internal combustion engines for non-road mobile machinery' COM (2014) 581 final.

¹³ UNIFE, 'NRMM Directive – Introduction of Flexibility for Rail Applications' (July 2009).

¹⁴ European Parliament and Council Directive (EU) 2011/88 amending Directive 97/68/EC as regards the provisions for engines placed on the market under the flexibility scheme [2011] OJ L305/1. In the UK this change was transposed by The Non-Road Mobile Machinery (Emission of Gaseous and Particulate Pollutants) (Amendment) Regulations 2013 SI 2013/1687 which amended the 1999 NRMM Regs (n 11 above).

after the Stage IIIB requirements came into force; this period expired on 31 December 2014 and hence the rush to place orders. In fact, to some extent the UK was singled out for special treatment on the grounds that the lack of compatibility of UK infrastructure with continental Europe created additional technical difficulties. As the preamble to the amending Directive noted:

Taking into account the special infrastructure of the United Kingdom rail network, which results in a different structural gauge and consequently weight and dimensional constraints, and therefore requires a longer adaptation period for the new emission limits, it is appropriate to provide for more flexibility for this particular market in engines for use in locomotives.¹⁵

The flexibility scheme is complex and requires some explanation.¹⁶ The first point to note is that the scheme relates to engines rather than the completed locomotive. A cap was placed upon the number of new engines, only complying with the earlier Part IIIA standards, which could be 'placed on the market' between 1 January 2012 and 31 December 2014. The term 'placed on the market' is defined as 'making available on the Community market, for payment or free of charge, a product covered by this Directive, with a view to distribution and/or use in the Community.'¹⁷ Locomotive manufacturers are defined under the NRMM Directives as Original Equipment Manufacturers (OEMs).¹⁸ The flexibility scheme enabled OEMs to request permission for their engine supplier to place a limited number of engines on the market within the defined timeframe provided that the engines were for the relevant OEMs 'exclusive use.'¹⁹ Thus, as will be seen below, the OEM Vossloh uses engines manufactured by Caterpillar in some of its locomotives at the heart of the emissions debate. Under the terms of the scheme it could request permission for Caterpillar to provide it with a certain number of engines for its exclusive use meaning that they cannot be sold to any other manufacturer. Some OEMs, such as General Electric, manufacture their own engines in which case they must ensure that the engines are only used in their own locomotives. In essence, each OEM is provided with a quota of Part IIIA compliant engines and the 'exclusive use' requirement prevented the establishment of a secondary market whereby OEMs traded engines amongst themselves.

¹⁵ Directive 2011/88/EU (n 14), para 12 of the preamble.

¹⁶ The flexibility scheme is set out in Annex XIII in the consolidated text of the NRMM Directive. As regards the UK the relevant provisions can be found in schedule 9, paras 9 to 12 of the amended 1999 NRMM Regs.

¹⁷ Article 2 NRMM Directive (n 9).

¹⁸ Ibid.

¹⁹ See Annex VIII (1.1) NRMM Directive. This means that, provided the engines were manufactured and allocated to an OEM before the end of 2014, new locomotives fitted with those engines could be supplied after the deadline. This enabled the rail-freight company Colas to place a two stage order for class 70 Powerhaul locomotives manufactured by the OEM General Electric. An order for ten was placed in 2013 and an order for a further seven was placed in 2015; these will not be delivered until 2017: see Robert Pritchard, 'More 70s for Colas Rail' (2016) 170 *Today's Railways* 58.

As regards the specific caps or quotas relating to the number of engines placed on the market, the flexibility scheme only permitted each OEM to place 16 new locomotives on the market in the time frame.²⁰ The UK managed to negotiate an additional 10 locomotives provided that they were for exclusive use on the UK rail system.²¹ Given that channel tunnel freight trains are operated by electric locomotives this presumably means that the operators are prohibited from lending or selling them to continental operators. This concession fell considerably short of what the UK freight sector originally desired. As the report of the European Parliamentary Scrutiny Committee shows, the freight sector argued that each manufacturer would need an allowance of 40 locomotives under the flexibility scheme in order to meet demand.²² The 16 plus 10 approach meant that the maximum number of new locomotives which each OEM could hope to place on the UK market was 26.

TECHNICAL DIFFICULTIES ASSOCIATED WITH STAGE IIIB COMPLIANCE

At present there are very few locomotives which are fully compliant with Part IIIB standards. Since privatization, the UK rail freight sector has become very reliant on imported American locomotives, in particular, a type known as Class 66 in the UK produced by the OEM Electro-Motive Diesel (EMD). These largely replaced the aging and eclectic fleet of locomotives which the new private operators inherited from the state owned British Rail.²³ The Class 66 was specifically designed for the UK system (although it has also proved popular in continental Europe) and is fully compliant with Part IIIA standards but not Part IIIB. In the run up to the end of the three year 'period of grace', during which Part IIIA compliant locomotives could still be marketed despite the coming into force of Part IIIB standards, GB Railfreight rushed to purchase 21 brand new Class 66 locomotives.²⁴ This accounted for a large proportion of the maximum possible allocation of 26 locomotives which EMD could have produced for the UK market.

Given that there are no plans to develop a Part IIIB compliant version of the Class 66 and given that the UK rail industry has become very reliant upon this particular locomotive, the EU emissions standards could cause a major shortfall in the capacity of the industry. To some extent hopes have been placed in another US import, namely, the General Electric Class 70 'PowerHaul' locomotives. A number of these were ordered by the rail freight company Colas in the spending spree which

²⁰ See Annex VIII (1.3) NRMM Directive.

²¹ Ibid. As regards implementation in the UK see Schedule 9 para 12C of the amended NRMM Regs.

²² European Scrutiny Committee, *Emissions from non-road mobile machinery* (HC, 26th Report, 27 April 2011).

²³ Overall 450 class 66 locomotives were purchased in order to replace the aging British fleet. See Allan Woodburn and Anthony Whiteing, 'Transferring freight to "greener" transport modes in Alan McKinnon et al (eds), *Green Logistics* (n 2).

²⁴ See *Rail 741* (5-18 February 2014).

occurred in 2014.²⁵ Despite being a much more recent design than the class 66 they are still only compliant with IIIA; however, the manufacturer has indicated that future models may be made compliant with Part IIIB.

As regards European OEMs, the Vossloh Class 68 'Eurolight' locomotives ordered by Direct Rail Services (DRS) are the newest of the recent crop of freight locomotives and are the closest to full compliance with Stage IIIB emission limits. The engines (supplied by Caterpillar) are currently compliant with Stage IIIA but can be relatively easily adapted to meet Stage IIIB.²⁶ In short, the exhaust silencer would have to be replaced with a diesel particulate filter. However, there remain technical difficulties in that the machinery in question could increase the loading gauge²⁷ of the locomotive rendering it incompatible with the UK network.²⁸ Substantial redesign work may be necessary in order to manufacture a stage IIIB compliant version of the locomotive which can be used in the UK. Aside from the difficulties associated with finding space for the pollution abatement equipment, the industry has pointed out that part IIIB compliant locomotives are more expensive to operate and maintain. Moreover, the pollution abatement equipment may actually increase fuel consumption by as much as 5% thus counteracting at least some of the environmental benefits of the technology.²⁹

The only locomotive which is currently fully compliant with Stage IIIB standards is the Vossloh Class 88 'Dual Mode' locomotive which is primarily designed to operate as an electric locomotive drawing its power from overhead power lines. However, it is a hybrid and also has a diesel engine meaning that it can venture onto lines with no power supply for certain distances.

GRANDFATHERED RIGHTS

The technical difficulties and costs associated with compliance with Part IIIB standards have given rise to an example, *par excellence*, of the law of unintended consequences. For reasons which are explained below, far from bringing about a rapid growth in the use of new and cleaner locomotives,

²⁵ Ibid and see (n 19), above.

²⁶ See Chris Milner, 'Class 68: Britain's Newest Diesel Locomotives' *The Railway Magazine* (April 2014) 14.

²⁷ The loading gauge relates to the dimensions of the rolling stock and the clearance afforded by bridges, tunnels and other lineside infrastructure. The loading gauge adopted in the UK is more restrictive than in continental Europe which means that much of the rolling stock could not be accommodated on UK lines.

²⁸ Ibid. The article referred to carries a photograph of the UK version of the Eurolight (Class 68) coupled to its much wider and higher continental European counterpart during testing in the Czech Republic. The additional difficulties of fitting the additional body shell of the UK version of the locomotive are manifest.

²⁹ See Stefanie Browne, 'Grandfather Rights favour older traction' *Rail* 755 (20 August to 2 September 2014) 62, at 63, quoting an interview with Tony Bush, Engineering and Performance Director, Direct Rail Services.

the NRMM Directive has actually resulted in a multitude of veteran diesels being brought out of retirement and pressed into service.³⁰

The original NRMM Directive was amended so as to establish a new derogation enabling replacement Stage IIIA compliant engines to be installed in locomotives already fitted with Stage IIIA engines.³¹ Most significantly, the derogation reaches even further back to allow Stage IIIA compliant engines to be fitted in locomotives which predate EU emissions controls altogether. In other words, old locomotives are afforded 'grandfathered' rights which exempt them from having to comply with the latest standards, even when there is an opportunity to replace the engine during a major overhaul. In the UK this has given rise to a burgeoning locomotive reconditioning industry which has returned many vintage locomotives to the rails, many of which date from the 1960s.³² In some cases the locomotives in question are underpowered for modern requirements. Nevertheless, even using two rebuilt locomotives together, as is the case in respect of the class 73s rebuilt by Wabtec for GB Railfreight, is still far cheaper than buying a Stage IIIB emissions compliant locomotive such as a class 88.³³ Whilst this does at least mean that very old 1960s, 70s and 80s vintage diesels will be made much cleaner by fitting Stage IIIA compliant engines during major refurbishments, by providing a quick fix solution it may slow progress towards attaining compliance with Stage IIIB.

THE NEW REGULATION

A new Regulation, designed to consolidate the existing complex web of Directives and secure further reductions in emissions, was published by the EU Commission in 2014 and is currently progressing through the legislative procedures.³⁴ However, as will be seen, as regards locomotives the measure is more concerned with securing belated compliance with Stage IIIB standards than setting even more stringent emissions limits.

The reasons for the approach adopted by the Commission are set out in the impact statement which accompanied the draft regulation.³⁵ The Commission noted that diesel locomotives constitute a 'niche market' which is gradually diminishing as a result of ongoing electrification throughout the

³⁰ Ibid.

³¹ See Article 10 NRMM Directive as amended by Directive 2011/88/EU (n 14); implemented in the UK by Schedule 9, para 7A of the amended NRMM Regs (n 11).

³² See *Rail 755* (n 29).

³³ Ibid, 67.

³⁴ (n 12).

³⁵ Commission, 'Impact Assessment: Accompanying the document Review of Directive 97/68/EC on emissions from engines in non-road mobile machinery in view of establishing a new legislative instrument' SWD (2014) 282 final.

EU.³⁶ Sales of new locomotives to EU operators are not likely to exceed 175 per year until 2020 (sales figures beyond 2020 proved difficult to estimate); thus:

Any additional costs for introducing new emission stages that require substantial technology changes must therefore be seen in the context of the aforementioned particular market characteristics, i.e. very small market volumes as of today and very limited perspectives in the future.³⁷

Moreover, compliance with the new standards proposed for other types of machinery caught by the regime would result in substantial development costs for locomotive engine manufacturers and additional operational costs. In contrast, diesel railcars (or Diesel Multiple Units (DMUs)) often use engines derived from Heavy Duty road engines where substantial technological advances have already been made. The Commission questioned whether it would be worth imposing such onerous and costly requirements on a product which is only supplied in very small quantities and is, in many respects, an old technology which is on the wane.³⁸ To some extent it would be akin to imposing stringent new technological standards on steam locomotives in the 1950s and 60s when the sun was already setting on the age of steam. The Commission also noted the aforementioned phenomenon of operators hanging on to old locomotives for 'longer than what would be economically justified, leading ultimately to increased fuel consumption and higher emissions.'³⁹ The reaction of the industry to the Stage IIIB standards and the use of grandfathered rights in order to circumvent the need to invest in new and difficult to obtain Stage IIIB compliant locomotives are cited as evidence in this respect. In particular, the Commission noted that only 80 Stage IIIB compliant locomotives were expected to be sold across the EU within the first three years of the standards coming into effect, whereas, normal sales figures for new locomotives would be in the region of 175 per year.⁴⁰

Overall, the Commission acknowledged the stringent nature of the Stage IIIB emissions and concluded that, as a result of the combination of these standards and a diminishing market in diesel traction, there was limited scope for securing substantial further reductions in emissions: 'As for locomotives, more stringent emission standards beyond the ones currently in force (Stage IIIB) do not appear justified so that no change of the existing legislation seems most recommendable.'⁴¹ Given that there was likely to be a slight rise in demand for railcars in the immediate future and

³⁶ Ibid, at [1.3.5].

³⁷ Ibid, at [1.3.5.1].

³⁸ Ibid.

³⁹ Ibid.

⁴⁰ Ibid.

⁴¹ Ibid, at [1.3.5.2].

given that reducing emissions gives rise to fewer technical challenges, the Commission concluded that there was scope for further reductions in that area.⁴²

The rail freight industry was granted a reprieve inasmuch as the Commission agreed to exempt locomotives from having to comply with Part IV standards. As noted above, these have been effectively 'leap-frogged' and the industry must now focus on compliance with the Part V standards due to come into effect from 2021. Insofar as locomotives are concerned the proposed Stage V standards are identical to Stage IIIB. Thus, the approach adopted by the Commission effectively provides the industry with a much longer period to secure compliance with Stage IIIB in that they will seamlessly merge into Stage V in 2021. Nevertheless, as the foregoing discussion demonstrates, in the UK there are still major difficulties associated with complying with Stage IIIB and there is still scepticism in some quarters regarding whether the current limits are attainable. As Cliff Perry, former Chairman of the Railway Division of the Institute of Mechanical Engineers put it in an interview with the industry press:

I suppose we should be pleased that the EU has realised that when you are digging a bad hole, the first thing to do is stop digging. 2021 is not that far away, though, when you are talking about locomotives and technology.⁴³

Given that the draft regulation does not set out any plans to limit grandfathered rights, there is every likelihood that the UK industry will continue to rely upon reconditioning old locomotives for the foreseeable future.

CONCLUSIONS

The saga of the implementation of new emission standards for locomotives is a classic example of the difficulties of harmonizing technical standards in an environmental context. The first point to note is that the NRMM Directive is a market harmonization Directive as opposed to an environmental measure. However, Article 114 of the Treaty on the Functioning of the European Union (TFEU) on market harmonization measures incorporates environmental objectives. Thus technical standards must 'take as a base a high level of protection, taking account in particular of any new development based on scientific facts.' The hope is that harmonization measures will raise environmental standards rather than adopt the lowest common denominator in a 'race to the bottom.'

⁴² Ibid.

⁴³ Stefanie Browne, 'EC Emissions Directive: UK diesels given a reprieve' *Rail* 759 (15 to 28 October 2014) 6.

This is a difficult objective to achieve, especially in the UK thanks to the legacy of Victorian railway engineering and the narrower loading gauge. Concerns have been expressed that the Stage IIIB standards constitute too much of a step-up from Stage IIIA.⁴⁴

The rail industry has also argued that focusing on tail pipe emissions is an overly narrow approach. Emissions from freight locomotives only account for a fraction of emissions from mobile sources.⁴⁵ Emissions also need to be placed in the context of the overall pattern of freight haulage in the EU where much use is made of electric traction. This will increase in future although it is never likely to provide a complete solution and, as we have seen, the rate of electrification in the UK is exceedingly slow. Nevertheless, even where there must be continued reliance on diesel traction, there are a host of other measures which can be adopted to improve fuel efficiency.⁴⁶

There is also concern that the ambitious approach adopted by the EU risks undermining the achievements of the past 20 years. The Part IIIA compliant locomotives, which were brought into the UK after privatization of the industry, constituted a vast improvement on the veteran British Rail era diesels upon which the industry had hitherto been reliant.⁴⁷ However, as noted above, there is a gulf between Stage IIIA and Stage IIIB standards. It has been argued that the gap is so great it cannot be bridged with incremental improvements; major redesign work may be necessary instead. Had the gap been less wide it might have been possible for manufacturers of locomotives such as the Class 66 to make further significant improvements to existing engines.⁴⁸

These concerns all have merit but must be approached with a degree of circumspection. When faced with demands for cleaner technology manufacturers tend to argue that they are already doing the best that they can and that improvements will be infeasible or excessively costly.⁴⁹ The reaction of

⁴⁴ See UNIFE (n 13).

⁴⁵ See (n 2), above.

⁴⁶ For an overview of some of the key methods of improving fuel efficiency using existing technology see Woodburn and Whiteing (n 2). These include better training for drivers, improved in-cab information, low power modes or shutdown rather than idling, better pathing to reduce stop-start journeys (necessitating infrastructure improvements in some cases), and cleaner diesel fuel. McKinnon, Allen and Woodburn also refer to improvements to the design of rolling stock so as to increase payloads without necessarily requiring additional motive power; this facilitates longer and hence fewer trains which results in energy savings overall. See Alan McKinnon, Julian Allen and Allan Woodburn, 'Development of greener vehicles, aircraft and ships' in McKinnon et al (eds) *Green Logistics* (n 2).

⁴⁷ See Woodburn and Whiteing, 'Transferring Freight to "Greener" Transport Modes (n 2) 159-160. According to industry figures cited by the authors the Class 66s reduced carbon monoxide emissions by 95%, hydrocarbons by 89% and nitrous oxides by 38%.

⁴⁸ See *Rail 755* (n 29) 67, citing an interview with John Smith, Managing Director of GB Railfreight.

⁴⁹ This phenomenon is clearly demonstrated in respect of environmental measures pertaining to industrial emissions where standards must be underpinned by the 'Best Available Technique' (BAT) requirement. Cost factors filter into the 'availability' component of the test and there is always a risk that the standard may be captured and defined by the very industry which it is seeking to regulate. As regards the definition of BAT see

the locomotive manufacturers to Stage IIIB is a classic example of this. If the regulator relies too heavily upon the guidance delivered by industry itself there is a risk that existing standards will crystallize as the 'state of the art' and become difficult to change. The Commission responded to these concerns by engaging the industry in a research programme as part of a technology forcing scheme. This is known as the CleanER-D programme⁵⁰ and is partly funded by the EU Commission under the 7th environmental action programme. This produced viable solutions to achieving the Stage IIIB standards and is most clearly demonstrated by many features of the Vossloh Eurolight locomotive. Although it must be acknowledged that significant difficulties remain in terms of developing a version of the locomotive which is compatible with the UK rail network. Moreover, as noted above, there are those who argue that some of the innovations may increase running costs and reduce fuel efficiency.

From the perspective of business it is vital that these issues are resolved. Transportation costs form a major component in the pricing of goods and is 'extremely sensitive to price'.⁵¹ If the cost of compliance with the Stage IIIB (and future Stage V) imposes excessive costs on the industry a major shift back to road haulage could occur. The environmental damage arising from this would outweigh any harm caused by reliance on locomotives which do not meet Stage IIIB requirements. In the grand scheme of things these only amount to a very small number of mobile sources of pollution. On a wider level there is a risk that the rail freight market, which the Commission has made extensive efforts to liberalise through its rail packages, could be partitioned along national boundaries. This is exacerbated by the fact that connectivity between the UK and continental Europe is already constrained by the bottle neck of the Channel Tunnel.

The UK has perhaps been rightly criticised in the past for relying upon its island status as a reason for doing things differently. However, as regards the rail industry, the barriers to harmonization caused by geographic factors and the legacy of Victorian infrastructure constitute physical as opposed to metaphorical or ideological obstacles to European integration. It is to be hoped that the *de facto* additional 'period of grace' afforded by the Commission proposal for compliance with Stage IIIB standards (which will be absorbed by Stage V from 2021) will be sufficient to secure the requisite technological developments.

European Parliament and Council Directive 2010/75/EU on industrial emissions [2010] OJ L 334/17, Article 3(10). For an analysis of the industry capture problem in one particular sector see Mark Wilde, 'Best Available Techniques (BAT) and Coal-fired Power Stations: Can the Energy Gap be Plugged Without Increasing Emissions?' (2008) 20(1) JEL 87.

⁵⁰ See website at <<http://www.cleaner-d.eu/about.htm>> accessed 14 April 2016.

⁵¹ According to UNIFE (the Association of the European Rail Industry) quoted in *Rail* 755 (n 29).