



OFFICE *of the*
RAIL REGULATOR

**THE PERIODIC REVIEW OF RAILTRACK'S
ACCESS CHARGES :**

ELECTRICITY FOR TRACTION

A TECHNICAL CONSULTATION

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Introduction

1. Railtrack procures electricity for traction purposes centrally for the railway network, and then charges on the cost of electricity for traction to the various train operators. It is one of the elements of charges that vary with traffic and this paper consults the industry and other interested parties on the arrangements for these charges in the next control period from 2001. It briefly describes the current charging regime and seeks the views of the industry on the Regulator's proposed changes.
2. The method by which Railtrack's costs are allocated between operators has a direct effect on the charges which they face. At present, the amount of electricity used by individual trains is not directly measured and so there is a need for a cost estimation system. The Regulator is not proposing that the overall system by which these costs are estimated is changed, but has received representations from Railtrack and the Users' Group¹ concerning revisions to specific elements of that system to provide improved incentives for the procurement and use of electricity. The purpose of this paper is to set out these proposals, the Regulator's provisional conclusions and to consult the industry and funders on whether they agree in principle that certain changes should be made. This document also seeks views on whether it would be more efficient if operators were able to choose between competing suppliers of electricity and how this could be achieved in practice.
3. Consultees are invited to comment on the proposed changes in general and also on the specific consultation questions that are listed at the end of this paper. Responses to this consultation should be sent to:

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¹ The members of the Users' Group are drawn from the passenger and freight train operating companies, SSRA and the PTEs

to arrive **no later than 15 October 1999**. Respondents should indicate clearly whether they wish their responses to remain confidential to ORR. Otherwise these responses may be placed in ORR's library or quoted from by the Regulator. Where a response is made in confidence, it should be accompanied by a statement summarising the submission excluding confidential information, that may be quoted from by the Regulator or published.

4. Following a description of the existing arrangements, this document considers each of the main elements of the charging structure for electricity for traction:
 - the consumption rates by which volumes are estimated and proposed changes to them;
 - the wash up process and its proposed geographical disaggregation; and
 - the arrangements for regulating the tariffs which Railtrack charges for electricity.

This document then goes on to consider the possibility of allowing operators to benefit from competition in the electricity supply industry through contracting directly with electricity companies, the efficiency of Railtrack, and issues concerning regenerative braking and the introduction of metering on trains.

The current system of charging

5. Railtrack supplies electric current for traction to the train operators. The electricity is provided to the overhead line and third rail electrical systems from a number of supply points around the country. Railtrack pays electricity suppliers on the basis of the metered amount used at each of these supply points. Railtrack then recovers the costs of electricity supplied for train traction from each of the operators which use it. These charges represent nearly 6% of the total track access charges paid by the franchised passenger operators as a whole, but a larger percentage of some train operator's total access charges.
6. As the amount of electricity used by any individual train is not directly measured at present, the electricity costs of each train are estimated. For each journey the following calculation is made:

$$\text{Estimated Cost (Charge)} = \text{tariff} * \text{consumption rate} * \text{train miles}^2$$

² For locomotive hauled services, the estimated cost is equal to the tariff multiplied by the consumption rate multiplied by *tonne* miles

The tariff is measured in terms of pence per kilowatt hour. These tariffs depend on season and time of day, and geographical area. Each year they are changed in line with the annual change of the Moderately Large Users Index (MLUI) which is an electricity price index produced by the Department of Trade and Industry.

7. Consumption rates, for each train consist and service group, were derived from a simulation model called TRATIM, now owned by AEA Technology Rail. They are measured in terms of kilowatt hours per train mile for multiple unit train consists, and watt hours per tonne mile for locomotive hauled services. TRATIM simulates the electricity consumption of a particular service over a return journey, allowing for the auxiliary load (being elements such as heating or air conditioning).
8. At the end of each year there is a wash up process whereby the difference between forecast and actual consumption of electricity is calculated. The monetary amount of the wash up is the difference between the actual and modelled quantity of electricity used, multiplied by the charge paid by train operators (set in advance). Each operator then receives a surcharge or rebate as appropriate if the volumes of electricity for which electricity suppliers have been paid turn out to be different to the modelled amounts, where the amount of the wash up is allocated on the basis of train operators' original bills as a proportion of the total. The volume risk is therefore passed on to the franchised passenger operators, while the cost risk remains with Railtrack (the risk associated with changes in the annual profile of electricity use or market prices also remains with Railtrack).

Revising the consumption rates

9. For the current control period the consumption rates used were extrapolations from a sample set of simulations created using the TRATIM model, then owned by BR Research. Railtrack has reviewed the previous calculations and has commissioned further TRATIM runs selecting services where an initial review suggested that current estimates may be inaccurate. Some significant differences were discovered both upwards and downwards.
10. Railtrack has therefore fully revised the set of all consumption rates, using existing data and additional TRATIM runs. Various anomalies and errors have been removed from the existing rates, such that a more consistent use is made of the modelled rates. A revised set of all electricity consumption rates for each individual train consist by service group has been produced. The rates which Railtrack has given to the Regulator show that the consumption rates have been generally revised downwards,

though there are individual rates that increase. Overall, Railtrack has estimated that the majority of franchised passenger operators would face reduced total consumption volumes (being the consumption rates multiplied by the mileages to which the individual rates apply), assuming no change in the calibration factor discussed below.

11. The individual rates appeared to overestimate total consumption when compared to the most recent data available at the time of the 1994 determination of charges. The rates derived from the TRATIM runs were therefore subject to a downwards calibration adjustment of 10%. The difference between actual and modelled consumption rates has turned out to be less than 10%, and Railtrack currently considers that using the proposed revised consumption rates will imply a much lower calibration adjustment of this type.
12. The Regulator considers that the most open and transparent way to introduce the calibration factor would be to apply a consistent factor explicitly to the individual rates rather than including it within each consumption rate. This would introduce an extra term into the charging equation in paragraph 6 above, as follows:

Estimated Cost (Charge) = tariff * (consumption rate * calibration factor) * train miles³

The calibration factor would be a fixed number, set for the next control period, such that the expected wash up calculation would be zero. The experience of the current control period suggests that the calibration factor would decrease from the current 10%.

13. The Regulator considers that it is appropriate to subject the rates to scrutiny by users, to identify any further anomalies in the relative differences between rates. If there are significant areas where the changes appear inappropriate, or significant dispute about any of the modelled rates then the Regulator will consider appropriate action. To this end, the Regulator will be supplying each operator with its own proposed revised consumption rates.
14. **Consultees' views are invited on whether they agree with the Regulator that the set of all consumption rates should be revised such that they are internally consistent and anomalies that have been introduced are removed; and on the proposal to apply the calibration factor to each TOC's total consumption rather than individual consumption rates.**

³ Or tonne miles for locomotive hauled services.

The wash up calculation

15. Railtrack (subject to an independent audit) calculates the difference between the metered supply of electricity it receives, and the electricity that it charges on to the train operators and other consumers on the basis of modelled or metered consumption. This process applies only to the franchised train operators. Having subtracted electricity used by Railtrack itself and others, for non-traction purposes, and for traction by non-franchised operators,⁴ the remaining difference between actual and modelled consumption is calculated as a percentage of the modelled amount. Franchised operators receive a rebate or an additional bill equal to this percentage of their original bills. This calculation is done on a national basis and in practice has led to significant extra bills for the operators (i.e. the modelled consumption has consistently and significantly been below the actual level).⁵
16. If the modelled and other consumption estimates were accurate the wash up would be zero. Increasing the accuracy of the modelled rates through the revision of the consumption rates and calibration factor described above, should therefore reduce the size of the wash up. The experience of a positive wash up calculation is another factor that suggests that the calibration factor should be lower in the next control period. Railtrack has proposed that the wash up be geographically disaggregated i.e. calculated on the basis of a number of individual regions. The regions proposed by Railtrack are described in the Annex. Railtrack argues that this will increase incentives on operators more efficiently to consume electricity for traction, as their own behaviour will more directly affect their total bills via the wash up.
17. In principle, the Regulator supports these changes. Choosing geographical areas into which to split the wash up is not a simple process, however, since there are few completely electrically isolated systems.
18. Geographical disaggregation will mean that individual operators will be able more directly to affect and benefit from a reduction in the size of the wash up, or a negative wash up, arising from more efficient use of electricity for traction and so will be better

⁴ These include Eurostar, Heathrow Express, freight operators, LUL, open access operators and charter operators. It has been proposed by Railtrack that the non franchised operators be included within the wash up, as they represent a significant proportion of electricity for traction consumption overall. However, the Regulator does not have the legal power to impose the required amendments to relevant access agreements, and so will not be pursuing this option at the present.

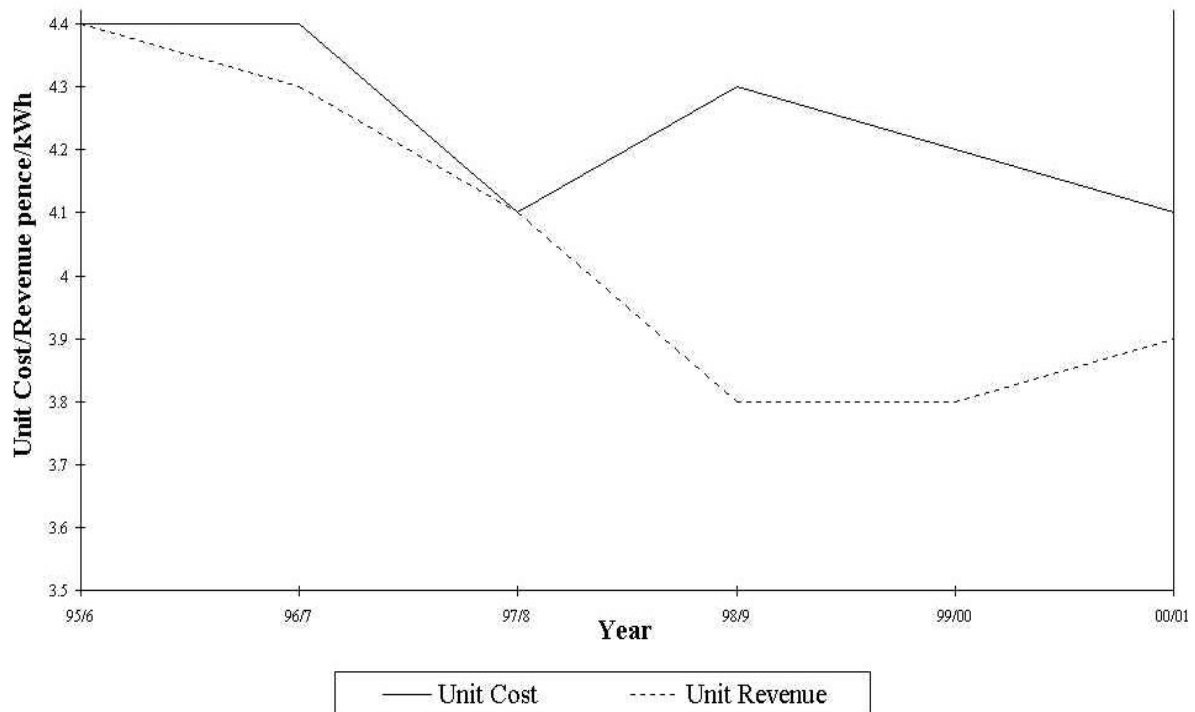
⁵ Operators in aggregate have been required to make wash up payments of £6.62 million (6.9% of the total bill) in 1995/96, £6.79 million (7.2%) in 1996/97 and £4.07 million (4.3%) in 1997/98.

incentivised to use electricity efficiently. In economic terms there is currently a free rider problem, whereby it is in no individual operator's interest to attempt to reduce the size of the wash up by more efficient use, as the benefit will be distributed to all franchised operators, greatly reducing the direct effect on the individual operator. These changes to the wash up will also involve the redefinition of the existing tariff zones, having knock on effects on the calculation of tariffs.

- 19. Consultees' views are invited on Railtrack's proposal for geographical disaggregation of the wash up process and on Railtrack's proposed potential geographical areas for disaggregation of the wash up, attached as an Annex.**

Indexation issues

20. The electricity tariffs which Railtrack charges to operators are changed each year in line with the annual percentage changes of an average price index. This is the Moderately Large Users' Index (MLUI) produced by the Department of Trade and Industry. Railtrack has argued that this index is not suitable for this process as the customers that are used to compile the index have a different profile of consumption to the rail industry. Railtrack has stated that they significantly under-recover their electricity purchase costs as a result.
21. Figure 1 shows Railtrack figures for the difference between the unit cost that it pays for electricity, and the unit revenue that it receives as a result of prices being adjusted in line with the MLUI each year. Railtrack has estimated that as a result they will lose significant amounts of money from the supply of electricity to operators, and have proposed the use of an interim index based on electricity pool prices, until such time as a new index may be determined to be suitable by the Regulator. Railtrack has suggested that such a new index may arise from the review of electricity trading arrangements currently being conducted by the Office of Gas and Electricity Markets. Railtrack has also proposed that the tariffs be rebased at the start of the next control period (i.e. in 2001) before being linked to a new index.

Figure 1: Unit Cost and Unit Revenue for EC4T in current control period

Source: Railtrack Note: The final two years are Railtrack's forecasts.

22. Railtrack has made representations to the Regulator that the MLUI index is an unsuitable index in the long term as it is based on medium-sized manufacturing companies, whose demand profiles are significantly different from that of the rail industry. Railtrack contends that these companies have stable demand for electricity and the ability to shift consumption away from peak periods, while Railtrack's electricity procurement is largely determined by train operators with peak usage coinciding with electricity system peaks.
23. The Regulator accepts that MLUI comprises customers with different consumption patterns to the rail industry's, due to the particular nature of electricity procurement required for the railway. However, the Regulator does not believe it appropriate to move to an interim index based on pool prices.
24. First, Railtrack has proposed the use of an index calculated on the basis of pool prices as an interim measure, to provide a fall back measure in case another suitable index cannot be found, and so that access contracts can be redrafted in the interim. The present proposals concerning the electricity trading review are that the pool prices

would cease to be available and be replaced by "imbalance prices". The Regulator does not believe that a suitable fall back position would therefore be created by the use of a pool price index, which would anyway need to be reassessed as a result of the move to "imbalance prices". The creation, checking, and agreement of a new index following the commencement of the new electricity trading arrangements could not be carried out in time for introduction into access agreements for the 2001-2006 control period. In any case, a pool price index would exclude any changes in costs arising from changes in electricity transportation costs which might be expected to fall in real terms.

25. Second, inspection of figure 1 shows that, based on Railtrack's own forecasts, the significant divergence of MLUI from the unit costs that Railtrack have paid occurs in a single year. The Regulator therefore considers it appropriate to continue the use of MLUI, with a possible upwards adjustment being made at the beginning of the next control period. In assessing the case for such an upward adjustment the Regulator will need to consider further the reasons for this divergence and the potential lags in the system. The Regulator will keep this situation under review. A suitable index may be available for implementation at the next periodic review, as a result of changes to electricity trading arrangements. If such an index were proposed the Regulator could consider whether it improved on MLUI during the remainder of the control period from 2001.
26. **Consultees' views are invited on the Regulator's current view that the tariffs should be rebased at the start of the next control period and continue using the MLUI in order to calculate the access charges by which Railtrack recovers its electricity procurement costs.**

Competition

27. At present, train operators have no option but to obtain their electricity requirements through Railtrack. Unlike other large users of electricity they cannot therefore choose their supplier. Since the remainder of the electricity market has now been opened to competition, the Regulator considers that this anomaly is unlikely to operate in the interests of users and funders of the railways.
28. As an alternative to the current system of setting tariffs, Railtrack suggested the possibility of joint procurement of electricity between train operators and Railtrack. The tariffs so negotiated would then be passed through to train operators. An alternative would be to allow individual train operators to opt out of the system of electricity for traction charging, and contract directly with the electricity suppliers.
29. Both options would require significant legal and practical issues to be addressed. One issue would be how Railtrack would charge for the use of its electricity network and the way in which this would be regulated. The absence of metering should not be an obstacle to the introduction of competition since electricity trading operates on the basis of estimated consumption profiles similar to those used by Railtrack. However, it would be necessary to allocate usage between entry points since the charges for use of the National Grid and regional electricity companies' networks will vary geographically. Another issue concerns the way in which this charge could be introduced during the next price control period.
30. **Consultees' views are invited on whether train operators (either jointly or individually) should be able to negotiate directly for electricity, the issues that would need to be considered in the introduction of such a regime, the timeframe over which it could be introduced and the costs and benefits of these proposals.**

Efficiency of Railtrack

31. As he has previously stated, the Regulator regards it as important that the mechanisms for measuring costs and charging for electricity should provide the right incentives for both operators and Railtrack to increase their efficiency. With respect to electricity for traction there are two elements to Railtrack's efficiency. First, Railtrack should efficiently procure electricity for use on the railway network. Second, Railtrack should efficiently transport that electricity on its own electrical network to the overhead wire or third rail system.

32. The indexation of electricity prices discussed above provides Railtrack with incentives to procure electricity efficiently. In efficiently delivering the electricity between the point of supply and the train, Railtrack needs to maintain properly the electrical equipment on the railway, such that it does not need to procure significantly more electricity for traction than is necessary owing to losses in delivering that electricity to the point of use.
33. In the absence of metering on each train it is not possible to quantify the magnitude of these losses or to devise a financial incentive for Railtrack to optimise losses. The Regulator will therefore include this element of efficiency within his general review of the efficient renewal and maintenance of the network that will be required of Railtrack during the next control period. The Regulator has appointed the consultants Booz Allen & Hamilton to assist him in coming to a view as to what the efficient levels of maintenance and renewal should be across all Railtrack's activities. He will, however, keep this issue under review in the light of developments in metering.

Regenerative braking

34. With respect to electricity one important element of upgrading the network is to allow the use of regenerative braking, which reduces overall electricity consumption by returning energy to the wires or conductor rail as the train brakes. The Regulator would expect Railtrack to work with operators in order to provide such a capability where it is a reasonable requirement of operators or funders in accordance with Condition 7 of Railtrack's network licence. It has been suggested that Railtrack be incentivised to deliver regenerative braking capability through the electricity charging mechanism. The Regulator does not believe that this would be appropriate as it would single out a particular element of enhancement to be treated differently.
35. Where operators do use the regenerative braking facilities on their trains, a reduction needs to be made to the modelled consumption rates produced by TRATIM, which does not estimate the savings made through its use. Currently there is a single discount rate that is used. This discount was calculated as an average figure. The recent or imminent introduction of services that use regenerative braking on certain systems allows a before and after comparison of the savings actually made. This analysis is suggesting that there is a difference in the savings made between AC electrification systems (using an overhead line) and DC systems (using a third rail). For example, preliminary analysis done by Railtrack suggests that regenerative braking provides an electricity consumption saving of about 20% for AC systems, and a much lower saving for the DC systems.

36. The Regulator encourages further analysis in this area, and, following a review of its findings, will propose adjusting accordingly the estimated consumption of operators who use regenerative braking, once Railtrack have delivered the appropriate analysis. Currently the reduction for regenerative braking is contained within the relevant consumption rates. Railtrack have proposed that the reduction be a factor applied separately in the charging formula, which is conditional on the facility being used. The Regulator is presently sympathetic to these proposals.
37. **Consultees' views are invited on the proposals to create different discounts for regenerative braking dependent on the type of electrification system being used, applied separately to the modelled consumption rates.**

Metering

38. The introduction of meters on trains directly measuring the consumption of individual trains, if it can be done in a way that is robust and technically feasible, would remove the need to estimate consumption rates. As mentioned above, if meters were installed on all trains then the cost of losses could be one of Railtrack's costs and an incentive could be created on Railtrack to optimise those losses and improve efficiency. The Regulator has previously stated that he believes basing traction current charges on metered consumption desirable in the longer term. The Regulator recognises that this will not be possible in the short to medium term on a wide scale. However, the Regulator continues to support the development of the use of on train metering. He is therefore considering whether to introduce measures actively to encourage its introduction where possible.
39. The Regulator considers that there are two options for such measures. Operators and Railtrack could be required to install appropriate systems to meter directly each train's consumption of electricity by a particular date. The Regulator would need to consider what the appropriate mechanism for so doing would be. Alternatively, operators could be provided with financial incentives to introduce meters to their trains.
40. Financial incentives might be provided through progressively exempting operators installing meters from the wash up, perhaps related to the percentage of the electrically powered trains that they run with meters being used. An alternative financial incentive could be created through differential tariffs for metered and estimated consumption with the wash up continuing to apply to all the franchised passenger operators. The Regulator invites consultees to describe any other methods

of financially incentivising the installation of meters on trains that they consider appropriate.

41. Whichever system was used in order to incentivise the installation of meters on trains, interim arrangements would be required as it is likely that there would be a substantial changeover period. A system of estimating consumption, as described above, will be required at least for the duration of the next control period as a result. However, if changes are to be made operators (and rolling stock manufacturers) will need to be able to start planning them as soon as practicable.
42. **Consultees' views are invited on methods of incentivising greater use of on train electricity meters, the appropriate form of any transition arrangements and the costs involved in the installation of meters.**

Questions for consultation

43. Consultees' views are invited on:

- whether they agree with the Regulator that the set of all consumption rates should be revised such that they are internally consistent and anomalies that have been introduced are removed; and on the proposal to apply the calibration factor to each TOC's total consumption rather than individual consumption rates. (Paragraphs 9-14)
- Railtrack's proposal for geographical disaggregation of the wash up process and on Railtrack's proposed potential geographical areas for disaggregation of the wash up, attached as an Annex. (Paragraphs 15-19)
- the Regulator's current view that the tariffs should be rebased at the start of the next control period and continue using the MLUI in order to calculate the access charges by which Railtrack recovers its electricity procurement costs. (Paragraphs 20-26)
- whether train operators (either jointly or individually) should be able to negotiate directly for electricity, the issues that would need to be considered in the introduction of such a regime, the time frame over which it could be introduced, and the costs and benefits of these proposals. (Paragraphs 27-30)
- the proposals to create different discounts for regenerative braking dependent on the type of electrification system being used, applied separately to the modelled consumption rates. (Paragraphs 34-37)
- on methods of incentivising greater use of on train electricity meters, the appropriate form of any transition arrangements and the costs involved in the installation of meters. (Paragraphs 38-42)

ANNEX: Railtrack's Proposed Areas for Geographical Disaggregation of Wash Up

Electrical Region	% of total supply	Description
Merseyside (DC lines)	2%	Stand alone Merseyrail DC system
Midland Main Line (AC lines) – London - Bedford	2%	Stand alone 25kV AC London to Bedford section of the MML. Services are run by Thameslink from Bedford to Farringdon and Moorgate and St Pancras.
LT&S (AC lines)	3%	Consists of the LT&S routes from Fenchurch Street to Southend and Shoeburyness.
Great Eastern	6%	AC lines East out of Liverpool Street up to Norwich. The main passenger services are Anglia and Great Eastern services from Liverpool Street to Southend, Ipswich and Norwich.
West Anglia	3%	Covers services from Liverpool Street to Enfield, Chingford, Stansted Airport and King's Lynn, excluding the first section of the route from Liverpool St as far as Hackney Downs, which is included in the Great Eastern region.
East Coast	12%	Covers the ECML from Kings Cross to the border with Scotland. It also includes a short piece of electrically isolated DC track between Moorgate and Drayton Park. The main services in this region are GNER service from Kings Cross, WAGN services up to Peterborough, Northern Spirit services in the North East and freight.
Scotland (AC lines)	7%	Covers the electrified track north of the two interfaces at Upperby on the WCML and at Chathill on the ECML.
West Coast Main Line & North London Lines (AC/DC lines)	22%	Covers the AC electrified lines from the interface with Scotland at Upperby, to Euston and at Acton and Westway/North Pole. The DC lines from Euston to Watford Junction and North Woolwich to Camden/Willesden are also

		included.
Southern (DC lines)	43%	Covers the electrified track south of the three AC/DC interfaces with other regions in the London area, these being with the West Coast North London (WCNL) region at Acton and Westway/North Pole and with MML (Thameslink) at Farringdon.
Western Main Line (AC lines) Paddington - Heathrow	1%	The electrified track from Paddington to Heathrow. The only electric service on this route is the Heathrow Express.

Note: Isle of Wight and Heathrow Express supplies are excluded from the wash up at present as they are isolated electrical systems with a single operator.