

Detailed Appraisal		D7: Further Electrification of the Strategic Rail Network						
Estimated total Public Sector Funding Requirement:		<i>Capital Costs/grant</i>				Phase 1: £250m - £500m, Phase 2: £250m - £500m, Phase 3: £250m - £500m, Phase 4: £250m - £500m, Phase 5: £250m - £500m - Phases 1 – 5: Each £100m – £250m -		
		<i>Annual Revenue Support Present Value of Cost to Gvt BCR/PVB</i>						
Summary Impact on STAG Criteria	Environment Safety Economy Integration Accessibility and Social Inclusion	---	--	-	0	+	++	+++
(Judgement based on available information against a 7pt. scale.)								
Intervention Description:								
<p>Rail electrification can contribute to emissions reduction by allowing train power to come from more environmentally friendly sources. There are operational benefits compared with diesel powered trains both in terms of reduced journey times and operating costs. It also gives the opportunity for interoperability and more efficient use of rolling stock, particularly in the West of Scotland where running through low level stations is generally restricted to electric rolling stock.</p> <p>It is envisaged that electrification would be delivered on a phased basis. In the short term, this would include:</p> <ul style="list-style-type: none">Phase 1 - Committed improvements as part of the Edinburgh to Glasgow improvements, comprising Edinburgh to Glasgow via Falkirk route, Diversion Routes 1 (Haymarket) and 2 (Falkirk Grahamston), and electrification on the route via Cumbernauld and to Dunblane / Alloa; andPhase 2 - Electrification of the remaining routes in the Central Belt (Shotts, Whifflet, Paisley Canal, Glasgow North Suburban, East Kilbride and Kilmarnock). <p>In the longer term, extending into the period beyond STPR, this would include:</p> <ul style="list-style-type: none">Phase 3 - Electrification of routes between Edinburgh, Perth and Dundee including the Fife Circle;Phase 4 - Electrification from Dunblane to Aberdeen; andPhase 5 - Electrification from Perth to Inverness								
Summary: Rationale for Selection								
<p>This intervention supports the Key Strategic Outcome to reduce emissions in pursuit of a Greener Scotland by providing cleaner, more efficient traction for rail services.</p> <p>Currently 23 per cent of the Scottish rail network is electrified and this intervention would see the expansion of this over the greater part of the network. Electrified services would reduce energy consumption by 15 per cent for inter-urban and 20 per cent for stopping services. There are a number of areas where objectives to reduce emissions would be supported by this intervention.</p> <p>This intervention would also allow greater flexibility and benefits for the operation of services while electrification would support other rail interventions as part of an overall strategy for 'step-change' performance across parts of the system, particularly in Fife.</p>								

Table D7.1.1 STPR Objectives

STPR Objectives	
<p><u>National Objective 1:</u> To promote 'competitive' inter-urban journey times.</p> <p><u>National Objective 2:</u> To reduce inter-urban journey time on public transport.</p> <p><u>National Objective 3:</u> Promote journey time reduction on the trunk road network for prioritised vehicles and users (e.g. HOV, freight, bus) or provide improvements to journey time reliability.</p> <p><u>National Objective 4:</u> To promote journey time reductions between the Central Belt and Aberdeen/Inverness primarily to allow business to achieve an effective working day between these centres.</p> <p><u>National Objective 5:</u> Maximise the labour catchment area in city regions (favouring PT and HOVs and balancing with other policy measures that promote reduction in need to travel).</p> <p><u>National Objective 6:</u> Support the development and implementation of the emerging national development schemes.</p> <p><u>National Objective 7:</u> Reduce CO₂e emissions per person km.</p> <p><u>National Objective 8:</u> Stabilise total CO₂e emissions.</p> <p><u>National Objective 9:</u> Reduce CO₂e emissions in line with expectations from the emerging climate change bill.</p> <p><u>National Objective 10:</u> To promote continuing reduction in accident rates and severity rates across the strategic transport network, supporting the work of the Strategic Road Safety Plan.</p> <p><u>National Objective 11:</u> To promote seamless travel.</p>	<p>1: Positive - Electrification of the strategic rail network is expected to aid the delivery of competitive, reliable and reduced journey times for inter-urban journeys through improved acceleration and more reliable rolling stock.</p> <p>2: Positive - Electrification of the strategic rail network is expected to aid the delivery of reduced journey times for inter-urban journeys through improved acceleration of electric powered rolling stock.</p> <p>3: Neutral - Rail electrification would improve journey times and journey time reliability on the rail network, which may contribute towards a mode shift from road to rail; however the impact of this on journey times on the trunk road network would be marginal.</p> <p>4: Slightly Positive - Electrification of the routes from the Central Belt to Aberdeen/Inverness is expected to have a benefit for journey times through improved acceleration of electric powered rolling stock.</p> <p>5: Slightly Positive - Electrification would benefit commuter services into the city regions by reducing journey times, which in turn would help to maximise the labour catchment areas.</p> <p>6: Neutral - This intervention is not expected to have any significant impact upon supporting the development and implementation of the emerging national development interventions.</p> <p>7: Positive - Electrification would help to reduce emissions per person km by replacing diesel powered trains with more efficient electric powered trains.</p> <p>8: Positive - Electrification would help to stabilise emissions by replacing diesel powered trains with more efficient electric powered trains.</p> <p>9: Positive - Electrification would help to reduce emissions by replacing diesel powered trains with more efficient electric powered trains.</p> <p>10: Minor Positive - The primary impact in terms of safety is as a result of modal shift away from road transport, which has higher accident rates. By achieving a reduction in trips on the road network it is anticipated that road accident numbers and severity are likely to decrease with a net benefit in terms of accidents anticipated as a result of the intervention.</p> <p>11: Slightly Positive - Electrification would improve interoperability between services as there would be a more uniform fleet of train, allowing for new cross country rail services that are currently unable to operate due to different types of rolling stock/traction.</p>

<p><u>National Objective 12:</u> Improve the competitiveness of public transport relative to the car.</p> <p><u>National Objective 13:</u> To improve overall perceptions of public transport.</p>	<p>12: Positive - This intervention would improve the competitiveness of public transport by improving journey times through better acceleration, especially on commuter rail services with many stops.</p> <p>13: Positive - This intervention would improve the perception of public transport as the public generally perceive electric trains to be cleaner and quieter.</p>
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Table D7.1.2 STAG Criteria

STAG Criteria		
Criteria:	Assessment Summary:	Supporting Information:
Environment:	Moderate Benefit/Minor Negative Impact	Rail electrification reduces NO ₂ and PM ₁₀ emissions per person kilometre travelled by 15 to 20 percent when compared with the use of diesel engines. More efficient rail services are likely to promote modal shift from road to rail thereby reducing the number of private cars on the road and so potentially reducing CO ₂ e emissions further. It is possible that overhead wires could affect the settings of cultural heritage sites and sensitive landscapes; however, there is not enough detail at this stage to assess the localised impacts.
Safety:	Minor Benefit	The primary impact in terms of safety is as a result of modal shift away from road transport, which has higher accident rates. By achieving a reduction in trips on the road network it is anticipated that road accident numbers and severity are likely to decrease with a net benefit in terms of accidents anticipated as a result of the intervention.
Economy:	Moderate Benefit	<p>Transport Economic Efficiency (TEE): The proposal would improve public transport services across Scotland through reduced journey times and increased connectivity.</p> <p>Wider Economic Benefits (WEBs): This intervention would support wider economic benefits through improving public transport provision and accessibility. There would also be benefits for freight operations by providing opportunities to run electrically hauled freight services further into Scotland from destinations in England, and within Scotland itself.</p> <p>Economic Activity and Location Impacts (EALIs): Electrification of the rail network would bring benefits to commuter services into the city regions by reducing journey times. In turn, this would have a beneficial impact on the potential opportunities for employment and productivity in these areas.</p>
Integration:	Minor Benefit	<p>Transport Integration: Integration between rail services for some longer distance services may improve as it would be possible to run through services between routes that currently operate using different types of rolling stock.</p> <p>Transport and Land-Use Integration: This intervention would provide more efficient rail links to support employment development with benefits to transport and land-use integration.</p> <p>Policy Integration: There would be a positive impact on congestion from reduced car use and emissions. There would be a positive impact on accessibility and social inclusion. This intervention is in line with the policies set out in Scotland's Railways.</p>
Accessibility and Social Inclusion:	Minor Benefit	Community Accessibility: Accessibility would be improved through the possibility of running through services with electric traction that are not currently possible with the current mixture of rolling stock. There are benefits for social inclusion through improved access to jobs by reducing journey times.

		Comparative Accessibility: This intervention would have a positive impact on improving accessibility and social inclusion throughout Scotland.
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Table D7.1.3 Key Strategic Outcomes

Key Strategic Outcomes (KSO's)		
Objective:	Assessment Summary:	Supporting Information:
Improve Journey Times and Connections:	Minor Benefit	There would be a minor benefit in journey times as electric traction tends to have a higher power to weight ratio, allowing better acceleration for journeys with a high frequency of station stops. Connections may also be improved as it would be possible to run through services between routes that currently operate using different types of rolling stock.
Reduce Emissions:	Moderate Benefit	Various studies have shown that while it is unclear as to the efficiencies gained in use of electric trains compared to diesel, there is a general reduction in NO ₂ and PM10 emissions of around 15-20 per cent per person kilometre travelled. More efficient rail services are likely to promote a modal shift from road to rail, thereby reducing the number of private cars on the road and so potentially further reducing CO ₂ e emissions.
Improve Quality, Accessibility and Affordability:	Minor Benefit	There are operational benefits compared with diesel powered trains both in terms of reduced journey times and operating costs. It also gives the opportunity for interoperability and more efficient use of rolling stock, particularly in the West of Scotland where the low level lines through Glasgow are generally restricted to electric rolling stock. This intervention would not impact on affordability.

Table D7.1.4 Scottish Government's Strategic Objectives

Scottish Government's Strategic Objectives		
Objective:	Assessment Summary:	Supporting Information:
Safer and Stronger:	Minor Benefit	The primary impact in terms of safety is as a result of modal shift away from road transport, which may result in a reduction in accident rates. This intervention would improve the quality of public transport. It would have no effect on accessibility or affordability of public transport.
Smarter:	Minor Benefit	This intervention would have a minor benefit towards improving access to higher educational facilities through reducing journey times and improving connectivity across the rail network into the major cities.
Wealthier and Fairer:	Moderate Benefit	The proposal would improve journey times, service frequency and journey time reliability, sustaining and promoting economic growth in Scotland.
Greener:	Moderate Benefit	Rail electrification has emissions benefits compared with diesel engines and could encourage a modal shift away from the car onto the rail network thereby further reducing transport-related emissions.
Healthier:	Neutral	This intervention would not improve access to health services and facilities but would encourage a shift from car to public transport.

Table D7.1.5 Implementability Appraisal

Implementability Appraisal	
Technical:	<p>In general, no untried techniques would be required when implementing any aspects of this intervention. However, as the design stages progress, localised issues may arise that require increased technical capabilities to overcome.</p> <p>Construction of some aspects of this intervention may have an impact on operating existing services, however much of this work could be carried out at times when the disruption would be minimised.</p>
Operational:	<p>The responsibility for operational issues on the proposed measures in this intervention would remain with Transport Scotland and its maintenance contractors. No factors are anticipated to adversely affect the operation of the intervention during its projected life.</p>
Public:	<p>The objective to electrify Scotland's rail network has been in the public domain for some time now through Scotland's Railways. It is generally accepted that this intervention would provide a number of positive benefits to the general public in terms of faster journey times and a reduction in emissions.</p>