



West-On-Track

A Brief Exploration of Fuel Options for the Western Rail Corridor

By

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Better Energy Options.



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1. INTRODUCTION

This is a brief exploration of the options available for supplying fuel to the proposed Western Rail Corridor. It is hoped that it might stimulate discussion on the technologies and fuels available for such a project. It is not designed as an economic or technical reference document.

To stimulate discussion, it has examined the proposal from two perspectives. One is by placing it against the background of future projections of the global economy and national population patterns. The second is by examining the economics of biofuel production for the project. It should be noted that these economic calculations are not detailed but do provide some “ball-park” figures.

It is the opinion of the author that planning a proposal, such as the Western Rail Corridor without considering the current global energy situation might lead to capital costs on technologies that might prove to be economically inefficient investments in the longer term.

2. THE WESTERN RAIL CORRIDOR (WRC) IN A NATIONAL AND GLOBAL CONTEXT.

Terms like “Peak Oil” and “Energy Crisis” are starting to make their way into the public domain. It is important that they do because of the changes to our lifestyles that are forecast for the coming decades. These changes will happen for one main reason – a shortage of energy from fossil fuels. Already, increasing energy bills have drawn the public’s gaze to the issue of peak fossil fuel production. The impacts will be major in all sectors but among the first area where it will be noticed will be in the transport sector.

The voices that are speaking up on this issue at present are not all from radical sectors of society. The Al Gore film “An Inconvenient Truth” has received significant media coverage, lately. Or take the example of the following piece from an article, written earlier this year, by the Irish economist, David Mc Williams;

“... Geologists have been warning about the peak of oil production for many years. Many of them believe that the world's oil production will peak in the next three years. 52 of the 99 countries that produce oil have passed their peak production.the implications of "peak-oil" are enormous. They are epoch changing. Put simply, every assumption goes out the window....

....Did you know that Ireland is the third most oil dependent economy in the EU and the seventh most dependent in the world? This means that we are severely exposed. Where would our new suburbs be without cheap petrol and what about our out-of-town housing boom with our large kitchens, under-floor heating and super-sized fridges?

.....What are the implications for consumer spending? If the geologists are right, a large rise in the price of energy would be the economic equivalent of a massive tax hike, reducing our disposable income and depressing spending.

Economists have in the main ignored the geologists which appears irresponsible. Maybe the reason for this is economists' sometimes over-blown confidence in technology and its ability to use energy more sparingly.”

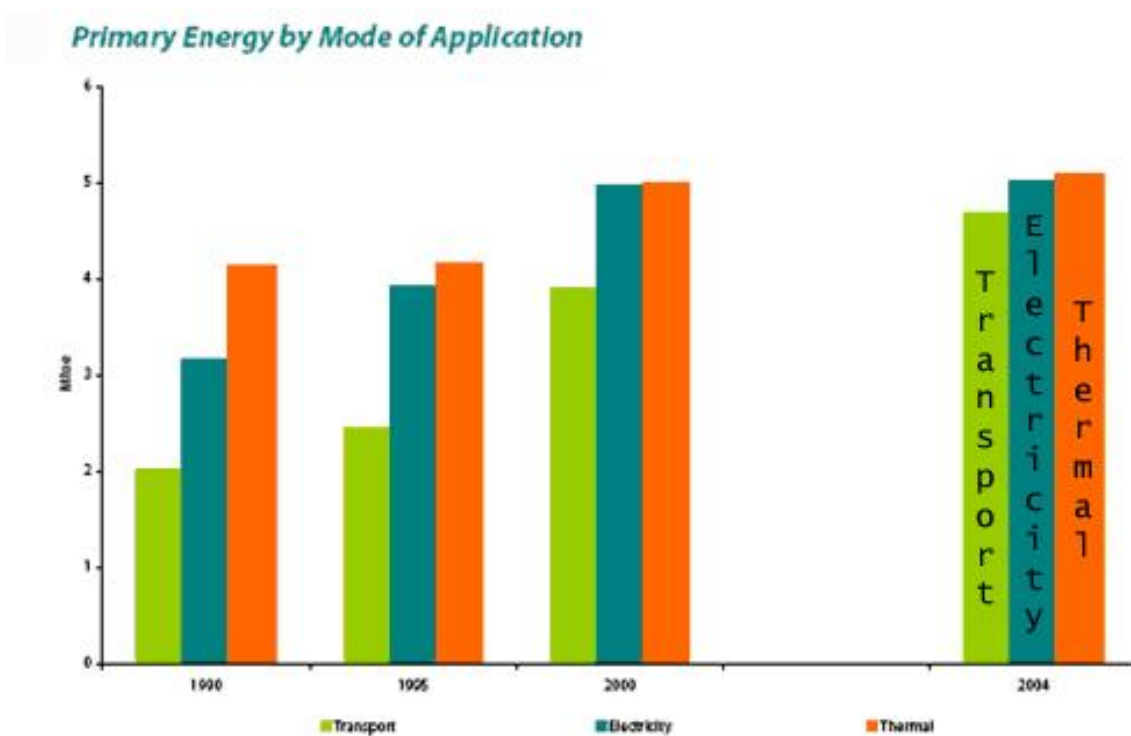
The changeover from a fossil-fuel supported global economy to an alternative global economy will undoubtedly mean changes to our current lifestyles. How significant these will be and how long they will last is not certain. However there are measures that can be taken in the interim.

What many of those in the commercial and business sectors will do in the coming years is examine how they can make energy savings. This can be achieved by carrying out an energy audit; where a factory for example, will itemise its energy consumption. It identifies where it can make savings in areas such as heating, lighting or electricity generation. They will then put more energy efficient structures and technologies into place. Homeowners may install solar-panels or wood burning stoves. They are likely to insulate their homes to a better degree. The same prudence needs to be adopted in the public sector. A sort of national energy audit is required.

Ireland is the most energy import-dependent country in Europe. At present, there are three main reasons that energy gets used in the country; transport, electricity and thermal usage. While there is no easy solution to replacing fossil fuels in any of these sectors, there are measures that can and are being taken.

Thermal usage can be tackled by growing more forests to burn wood or other renewable energy crops instead of fossil fuels. Better quality buildings with better insulation will also help. Electricity generation is being increased in the renewable energy sector. A campaign to reduce energy consumption has also recently been launched.

However, transport is the sector that will shortly be using most of Ireland’s energy. It is also the sector with the highest Carbon Dioxide (CO₂) emissions. It can be seen from Figure 1 below (aviation industry figures not included) how transport will shortly overtake the other major sectors.

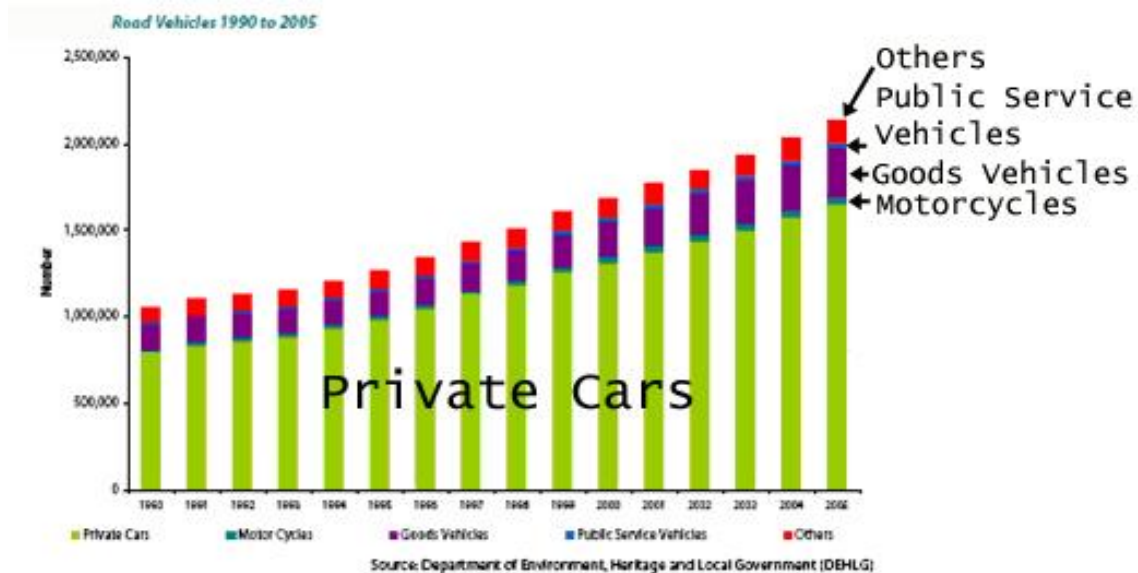


(Source: SEI 2006)

Figure 1: Energy Consumption by Transport, Electricity and Thermal Sectors.

Figure 2 shows that the number of cars on Irish roads has almost doubled since 1990. Between 1990 and 2004, the transport sector experienced an increase in

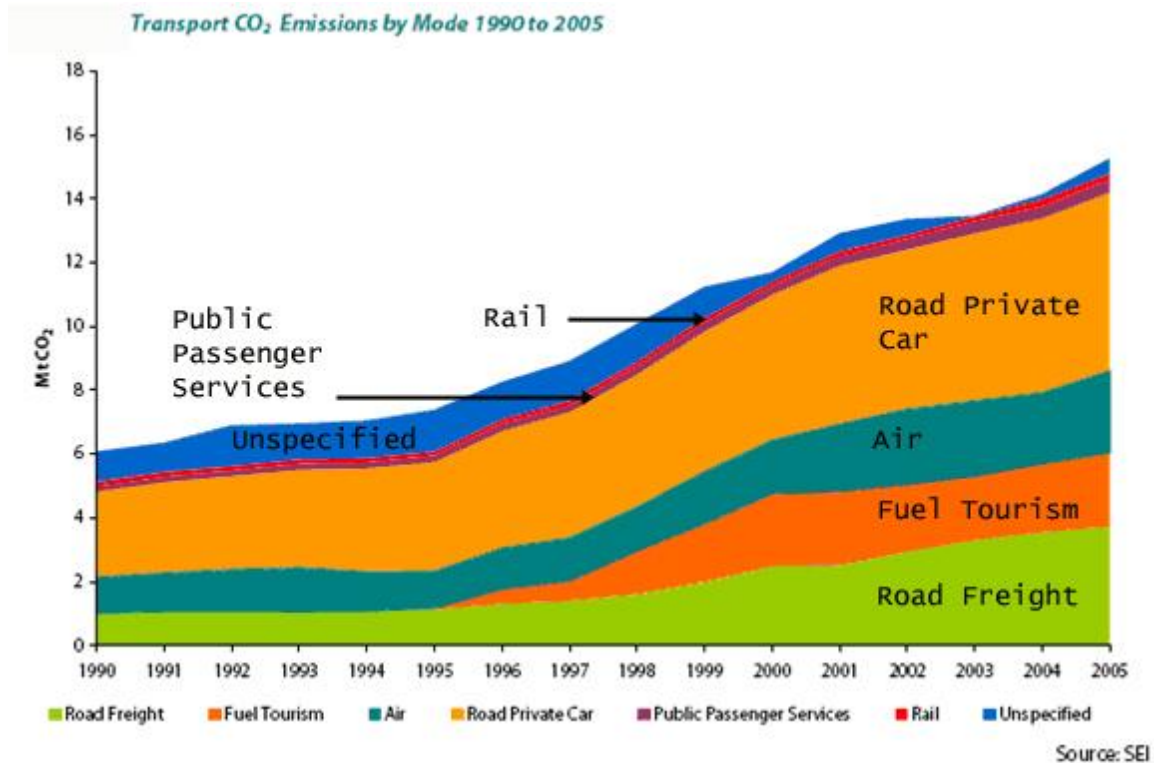
energy related CO₂ emissions of 144% based on an average annual growth rate of 7%. Emissions of greenhouse gases from the transport sector grew from approximately 9% of total national emissions to nearly 18.4% of national emissions over this period.



(Source: SEI 2006)

Figure 2: Road Vehicles 1990 to 2006

As a single solution, biofuels alone are not going to solve the energy demands of the nation's transport sector. This is because of the number of private cars on the road. An area many times the size of Ireland would have to be planted with energy crops just to meet the transport energy demands of the country at present. However, using biofuels in an effective public transport system is a feasible solution to allowing people and goods to be transported in future.

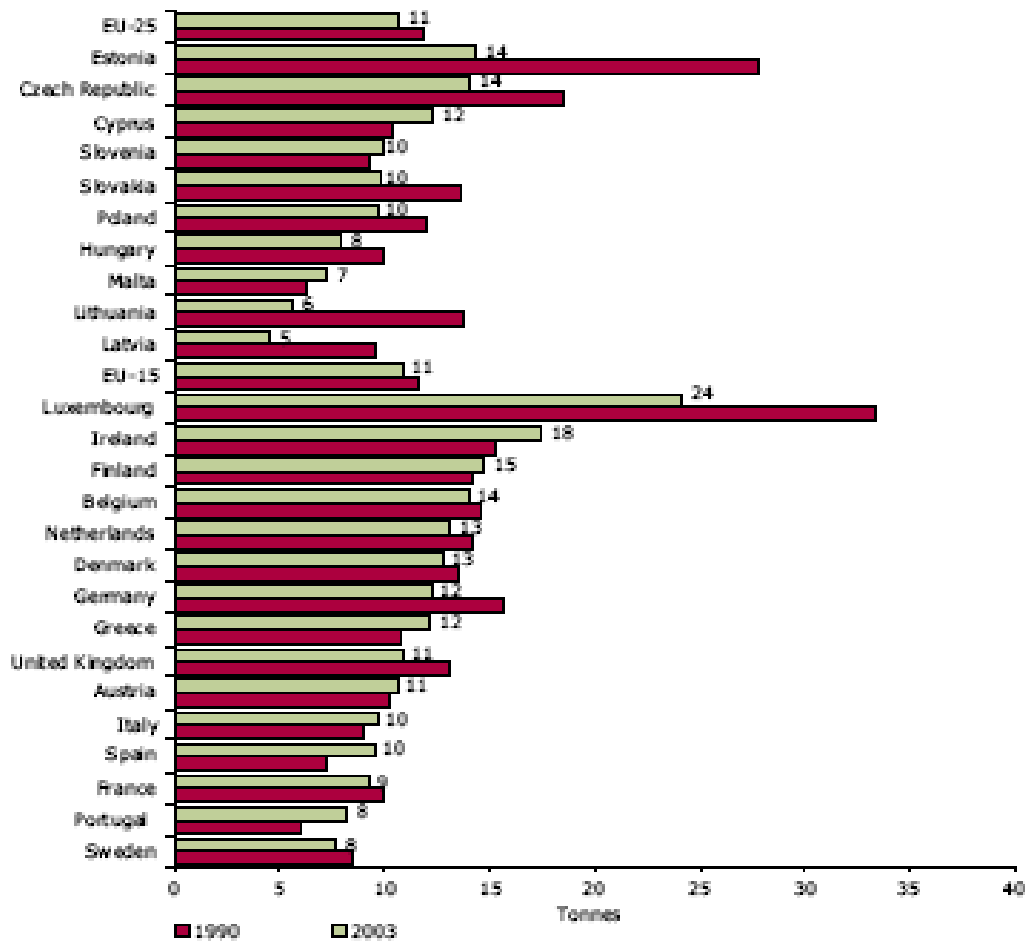


(Source: SEI 2006)

Figure 3: Ireland's Transport CO₂ Emissions by Mode 1990 to 2005.

Figure 3 above shows the various sources of our transport emissions while figure 4 below shows that Ireland's greenhouse gas emissions, per capita, are second only to Luxembourg and almost twice that of the EU average. However, as the section of the European Environment Agency's 2005 (figure 5) report shows, Luxembourg is likely to meet its 2010 emissions target, Ireland is not.

Figure 3.2 Greenhouse gas emissions per capita of EU-25 Member States for 1990–2003



Source: EEA, Eurostat.

(Source: EEA 2005)

Figure 4: Greenhouse Gas Emissions Per Capita within the EU.

CO₂ emissions are not only bad for the environment and health, they also hit our pocket. Having signed up to the Kyoto agreement, the fines that will arise from being over our carbon emissions targets are likely to have a significant impact on tax-payers.

Member States assessment (EU-15)



(Source: EEA 2005)

Figure 5: Summary of EU-15 Member States Greenhouse Gas Emissions Targets

Another economic reason for giving serious consideration to public transport infrastructure is to ensure ease of travel between rural and urban spaces. This is important if the economy is to remain stable into the future.

When making projections of future Irish population patterns, it is necessary to consider possible employment and labour markets. One scenario sees the continued location of foreign companies in Ireland. The foreign companies and Irish companies are likely to base themselves in business parks, located on the rural-urban divide between a rural hinterland and urban centres (with populations over 10,000). In this way, they can readily recruit a skilled and knowledgeable

workforce from both urban centres and the surrounding rural hinterlands. This is a well established practice in countries such as Spain, Italy and France where a significant amount of the urban workforce commutes from the city to the surrounding business parks.

The fundamental assumption with the above labour-market scenario is that once fossil fuel exploration becomes economically unviable, companies and governments will invest large amounts of money and time in developing other technologies that will replace fossil fuels in the global economy. This is a fair assumption, as in the last millennium or so various technologies have emerged that have changed how economies have functioned from using charcoal-fired hearths to make metal, to coal furnaces to the steam engine to oil wells to electrification, etc, etc.

However, some forecasters claim that newly emerging energy technologies require huge amounts of investment in money and research now; if we wait for price signals from the market to trigger the transition, developments may come too late, causing the global economy to begin a downward spiral. They claim that alongside this immediate large-scale investment in time and brainpower, a serious reduction in the consumption of energy is also required. This, they claim, is because many of the alternative energy sources at research stage at present (e.g. hydrogen, zinc fuel cells) are either merely energy carriers (like electricity) or do not have the same net energy content as the fossil fuel sources currently the backbone of the world economy.

Other non-renewable sources of energy such as nuclear power also have limited life-spans, as the raw material required to “create” the energy (e.g. uranium) has a limited supply. As demand increases for this limited supply, a similar impact to diminishing oil sources on the global economy, is likely to occur.

Therefore, if this camp is correct, another scenario emerges for Irish population patterns, where they return to a 19th century model of densely packed urban areas. The current sprinkling of once-off rural houses will no longer be viable as labour-markets would be required much closer to the source of employment.

What emerges from both of these visions of a future Ireland is the importance of an effective public transport system that allows people to commute to work, travel between urban nodes and permits goods and products to be moved efficiently.

3. ECONOMIC ANALYSIS OF USING BIOFUELS FOR THE WRC.

This is a short economic exploration of using biofuels for the proposed Western Rail Corridor. A more detailed economic analysis of fuel costs for the proposal should take several factors into consideration. These would include a cost-benefit analysis of using fossil fuels, as compared to biofuels for the project. To allow a fair comparison to be made between them, a range of projected fossil fuel costs could be used. These might be based on the presumptions of a number of sources; ranging from oil-industry projections to independent geologists to the projections of organisations such as the *Association for the Study of Peak Oil (ASPO)*, the *Oil Depletion Analysis Centre (ODAC)*; and the *Post Carbon Institute (PCI)*.

In any case, a cost-benefit analysis based purely on projected fuel costs, economic benefits to the Treasury and GDP could be considered of very narrow value in its exploration of the benefits of establishing a relatively small-scale bio-fuel company for the proposed project. A more holistic approach to the benefits of “alternative” rail transport technologies and fuels might also include considerations, such as the following, over the projected life-time of the project;

- Chains of supply of fuel product - their economics and stability
- Economic and social benefits to local and national communities
- Job creation over the life time of the project
- Kyoto obligations and environmental benefits
- Economic and health benefits of reduced carbon and other pollutant emissions
- Injecting self-sufficiency into an energy economy that is 90% dependent on imports.

- Creating confidence in the ability of Irish regions to compete at an international level for essential commodities.
- Social and economic spin-off benefits from a more self-sufficient society; more entrepreneurship, manufacturing e.g. vegetable oils for food, vegetable oils for soap, fuels for heating, etc and less dependency on grants and subsidies.

In the longer term, giving consideration to the alternative technologies and fuels presently available might yield better infrastructural, social and economic benefits to the Western region, the state and the island as a whole.

3.1. FUEL CONSUMPTION ESTIMATE OF THE WRC.

In order to make cost estimates for the fuel consumption of the proposed rail corridor, the following factors were considered;

- Routes & Distances
- Number of journeys per day on each route
- Idling times & Contingency
- Fuel consumption rate

These factors, which are each described in further detail (Sections 3.1.1 to 3.1.4), were then used to compile the table shown in Table 2 below. This table shows an estimate of the annual fuel consumption for the proposed route by route segment and in total. It should be noted that these were the author's own estimates.

3.1.1 ROUTES & DISTANCES

For the purposes of this report, a full Western rail corridor was envisaged running from County Donegal to County Cork. This route was broken up into the following segments and their satellite routes;

- Letterkenny to Sligo (102km one way)
- Sligo to Limerick (233km one way)
- Galway to Oranmore (8.5km one way)
- Limerick to Cork (129km one way)

Route	Daily Journeys	Total Daily km's
Letterkenny to Sligo	3 return journeys	612km
	(6 x 102km)	
Sligo to Limerick	6 return journeys	2796km
	(12 x 233km)	
Galway to Oranmore	20 return journeys	340km
	(40 X 8.5km)	
Limerick to Cork	6 return journeys	1548km
	(12 x 129km)	
Total Daily kms		5296km

Table 1. Total Daily Distance in Kilometres by Route Segment.

3.1.2 IDLING TIMES & CONTINGENCY

Trains are required to idle at stations between journeys. An estimate of the litres of fuel that might be consumed during idling times was made for the various segments of each route. To allow for an overall conservative estimate a 20% contingency was built into the combined travelling and idling fuel consumption total. It should be noted that this is a high contingency value.

3.1.3 FUEL CONSUMPTION RATE

For the purpose of this report, a diesel consumption rate of 5 miles per gallon was used. This equates to approximately 8.05km per gallon or in exact terms; 8.04672km per 4.54609 litres. Therefore for every kilometre the train travels, it will use 0.565 litres of diesel.

Route	Journeys	Distance (km)	Total (km)	Litres	*Percentage
Letterkenny - Sligo	6	102	612	346	
Idling				28	
Sub-total				374	
20% contingency				75	
Daily Total				449	
Annual Total				163705	
Route	Journeys	Distance(km)	(km)	litres	
Sligo - Limerick	12	233	2796	1580	
Idling				91	
Sub-total				1671	
20% contingency				334	
Daily Total				2005	
Annual Total				731737	53.5
Route	Journeys	Distance(km)	(km)	litres	
Galway - Oranmore	40	8.5	340	192	
Idling				6	
Sub-total				198	
20% contingency				40	
Daily Total				237	
Annual Total				86658	6.3
Route	Journeys	Distance(km)	(km)	litres	
Limerick - Cork	12	129	1548	875	
Idling				9	
Sub-total				883	
20% contingency				177	
Daily Total				1060	
Annual Total				386888	28.3
Total (Western Rail Corridor) Fuel Consumption per annum.				1368989	

* The percentage column shows what percentage of the total fuel consumption, each segment route of the proposed line uses.

Table 2. Annual Fuel Consumption in Litres of Western Rail Corridor

4. EXAMPLES OF BIOFUELS THAT COULD BE USED FOR THE WRC.

Biofuels that might be examined as a source of energy for the train include those generated from ethanol and those from biodiesel. These are some but not all of the options available;

- Biodiesel from rapeseed
- Pure Plant Oil from rapeseed
- Biodiesel from recovered vegetable oil
- Biodiesel from Tallow
- Ethanol from Wheat
- Ethanol from Sugar Beet
- Ethanol from other crops (e.g. Miscanthus, Hemp)

Table 3 below shows the diesel/petrol equivalent for a number of fuel sources in litres per hectare;

Crop	Diesel / Petrol Equivalent (l/ha)	
	Grain /Root	Straw/Stem
Winter Oilseed Rape (4.2 t/ha)	1250	1330
Spring Oilseed Rape (2.7t/ha)	800	760
Wheat (10t/ha)	2260	1710
Beet (50t/ha)	2820	
Willow (12t DM* /ha)		5800
Miscanthus (14t/DM/ha)		6100
Hemp (14.7t / DM / ha)		6400

*DM = dry matter

Table 3. Diesel/Petrol Equivalent of Various Crops in Litres Per Hectare.

The rotation period for these crops varies and the amount of land required to grow them, as part of a continuous supply chain, will vary according to type.

The amount of hectares required to supply the fuel consumption for the Western Rail Corridor was calculated on a yearly basis and presented below in Table 4 and summarised in Table 5.

Table 6 shows the areas under various crops by Western Rail Corridor counties for selected years during the period 1856 to 1996. This shows that according to records there is more than adequate land available in Western Corridor counties to meet the needs of the proposed rail line. However, in order to identify the areas most suited for growing crops within the listed counties, other factors need to be taken into account. This has been done in the map below, which shows that the areas **highly suitable** for tillage in the Western Corridor counties are all contained in County Cork. Other areas **suitable** for tillage are in North Kerry, East Limerick, East Galway, South Roscommon and North-East Donegal.

Even the smallest of these areas (North Kerry or East Galway) could avail of many times more tillage land than was required to fuel the proposed rail line.



(Source:Gardiner 1981)

Figure 6: Areas Suited to Tillage in Ireland.

Route	Litres	Percentage	Hectares						
			Winter/oilseed rape (4.2t/ha)	Spring Oilseed Rape (2.7t/ha)	Wheat (10t/ha)	Beet (50t/ha)	Willow (12t DM* /ha)	Miscanthus (14t/DM/ha)	Hemp (14.7t / DM / ha)
Letterkenny – Sligo	163705	12	64	105	41	58	28	27	26
Sligo – Limerick	731737	54	284	469	184	260	126	120	114
Galway - Oranmore	86658	6	33	55	22	31	15	14	13
Limerick - Cork	386888	28	150	248	98	137	67	64	61
Western Rail Corridor total	1368988		531	878	345	486	236	225	214

Table 4: Area in Hectares, of Selected Crops, Required to Meet Continuous Fuel Demand of Western Rail Corridor.

Crop	Hectares
Winter Oilseed Rape (4.2 t/ha)	531
Spring Oilseed Rape (2.7t/ha)	878
Wheat (10t/ha)	345
Beet (50t/ha)	485
Willow (12t DM* /ha)	236
Miscanthus (14t/DM/ha)	224
Hemp (14.7t / DM / ha)	214

Table 5: Summary of Area in Hectares, of Selected Crops, Required to meet the Continuous Fuel Demand of the Western Rail Corridor.

Areas under selected crops ('000 hectares) by County 1850 - 1995*

	Year	Corn Crops	Wheat	Oats	Barley	Root & Green	Potatoes	Turnips	Sugar Beet	Flax	Crops, Fruit & Horticulture	Hay & Pasture	Crops & Pasture
Donegal	1850	50	3	42	4	25	16	7	-	6	80	197	276
	1900	34	0	33	0	25	16	8	-	3	62	198	261
	1950	27	1	26	0	16	12	3	0	2	44	128	173
	1960	22	2	20	1	13	11	2	0	-	35	125	161
	1970	17	0	10	7	9	8	1	0	-	26	156	182
	1980	15	0	4	10	7	6	0	0	-	22	145	167
	1990	7	0	1	6	4	3	0	0	-	11	102	113
	1995	6	0	1	5	-	3	0	0	0	10	120	130
Leitrim	1850	16	1	15	0	8	7	1	-	0	25	83	109
	1900	4	0	3	0	7	5	0	-	0	10	109	119
	1950	4	0	3	0	3	3	0	0	0	7	102	109
	1960	2	0	2	0	2	2	0	0	-	4	101	105
	1970	1	0	1	0	1	1	0	0	-	1	110	112
	1980	0	0	0	0	1	0	0	0	-	1	106	107
	1990	0	0	0	0	0	0	0	0	-	0	70	70
	1995	0	0	0	0	-	0	0	0	-	0	73	73
Sligo	1850	19	1	17	2	10	8	2	-	0	30	89	120
	1900	6	0	6	0	8	6	1	-	0	14	111	126
	1950	6	1	6	0	5	4	0	0	0	12	109	121
	1960	4	0	3	0	3	3	0	0	-	7	112	119
	1970	2	0	1	0	2	1	0	0	-	3	119	122
	1980	1	0	0	0	1	1	0	0	-	1	119	120
	1990	0	0	0	0	0	0	0	0	-	0	87	87
	1995	0	0	0	0	-	0	0	0	-	0	90	90
Mayo	1850	33	3	26	4	22	16	5	-	0	56	197	257
	1900	18	0	16	0	21	16	3	-	0	39	241	280
	1950	17	1	15	0	14	12	1	0	0	32	203	235
	1960	12	0	10	2	10	8	1	0	-	22	204	227
	1970	7	0	5	1	5	4	1	0	-	12	236	248
	1980	5	0	3	2	4	3	0	0	-	8	232	240
	1990	1	0	0	0	1	0	0	0	-	2	180	181
	1995	1	0	0	0	-	0	0	0	-	2	199	201
scommon	1850	32	5	26	1	13	11	1	-	0	45	105	149
	1900	8	0	7	0	12	8	2	-	0	19	174	194
	1950	10	2	8	0	7	6	1	0	0	18	180	197
	1960	7	1	5	1	5	4	0	0	-	12	177	189
	1970	4	0	2	1	3	2	0	0	-	6	192	198
	1980	3	0	0	2	1	1	0	0	-	4	194	199
	1990	1	0	0	0	1	0	0	0	-	1	140	141
	1995	1	0	0	1	-	0	0	0	-	1	145	146

Areas under selected crops ('000 hectares) by County 1850 - 1995* (continued)

	Year	Corn Crops	Wheat	Oats	Barley	Root & Green	Potatoes	Turnips	Sugar Beet	Flax	Crops, Fruit & Horticulture	Hay & Pasture	Crops & Pasture
Galway	1850	46	9	30	5	24	16	6	-	0	70	272	345
	1900	18	2	15	1	23	15	4	-	0	41	344	385
	1950	28	5	20	2	20	13	3	2	0	48	270	318
	1960	22	3	14	4	17	9	2	3	-	38	268	307
	1970	16	1	9	6	13	6	3	2	-	29	307	336
	1980	11	0	3	8	7	4	1	1	-	18	299	318
	1990	5	0	2	4	2	1	1	0	-	7	245	253
	1995	4	0	1	3	-	0	1	0	-	7	266	273
Clare	1850	33	5	16	8	15	10	4	-	0	48	171	219
	1900	6	1	4	0	12	8	2	-	0	17	235	253
	1950	6	1	4	1	9	6	1	0	0	16	203	219
	1960	4	1	3	1	6	3	1	0	-	11	198	209
	1970	2	0	1	1	3	2	1	0	-	5	229	234
	1980	1	0	0	0	2	1	0	0	-	2	220	222
	1990	0	0	0	0	0	0	0	0	-	1	173	174
	1995	0	0	0	0	-	0	0	0	-	1	172	173
imerick	1850												
	1900	6	1	5	0	9	6	2	-	0	15	223	238
	1950	8	3	5	1	7	4	1	0	0	16	224	240
	1960	6	2	2	2	5	2	1	0	-	11	227	239
	1970	2	0	0	1	2	1	0	0	-	4	237	241
	1980	3	0	0	2	1	0	0	0	-	4	236	240
	1990	2	0	0	1	0	0	0	0	-	2	190	192
	1995	1	0	0	1	-	0	0	0	-	2	189	191
Cork	1850	102	28	56	18	60	41	16	-	0	163	388	556
	1900	49	3	39	7	43	19	13	-	0	92	469	561
	1950	69	28	35	6	31	12	7	4	1	101	435	536
	1960	77	11	28	37	27	8	5	6	-	105	419	524
	1970	75	10	9	54	22	5	5	7	-	97	450	548
	1980	73	5	3	65	19	4	2	10	-	93	451	544
	1990	50	12	4	32	17	3	1	10	-	68	404	472
	1995	43	8	4	29	-	3	1	11	-	67	410	477

* Where figures for a particular year were unavailable, the closest year was used.

Table 6: Historical Data for Areas under Various Crops by County.

5. COSTS OF PRODUCING BIOFUELS.

The production of some bio-fuels allows significant revenues to be created from by-products. In analysing the costs involved, revenues from sales of these by-products were included. The main by-product is a cake-feed for animals (e.g. cattle). In the case of rape-seed, this cake provides a higher protein-yield than standard animal feeds and has a high market demand.

5.1 WHEAT & SUGAR BEET COSTS

	Agricultural Costs (€/litre)	Bioethanol Production Costs (€/litre)	Total Costs (€/litre)	Production Costs (before additional revenue)	Annual Total Production Cost Estimate for Western Rail corridor
Wheat	0.28	0.37	0.65	€890,000	€641,000
Sugar Beet	0.31	0.26	0.57	€780,000	€780,000

Table 7: Costs of Producing Ethanol from Sugar Beet and Wheat.

The cost in euros per litre for producing bio-ethanol in Ireland is 65c per litre for wheat and 57c for sugar beet. Therefore the annual production costs for producing ethanol, before additional revenue sales, would be €889,842 from wheat. For Sugar Beet, the equivalent cost would be €780,323.

The last column for wheat, in Table 4.1 above, takes into account the revenues for cake meal, which would bring the figure for wheat ethanol production under the cost of sugar beet. It would therefore be estimated that the cheapest ethanol costs, for running the train on the route from Letterkenny to Cork per annum would be **€640,686** per annum.

It should be noted that the *Agricultural Production Costs* figures were taken from contractor's charges and that many farmers would expect to achieve costs lower than these with sensible machinery management.

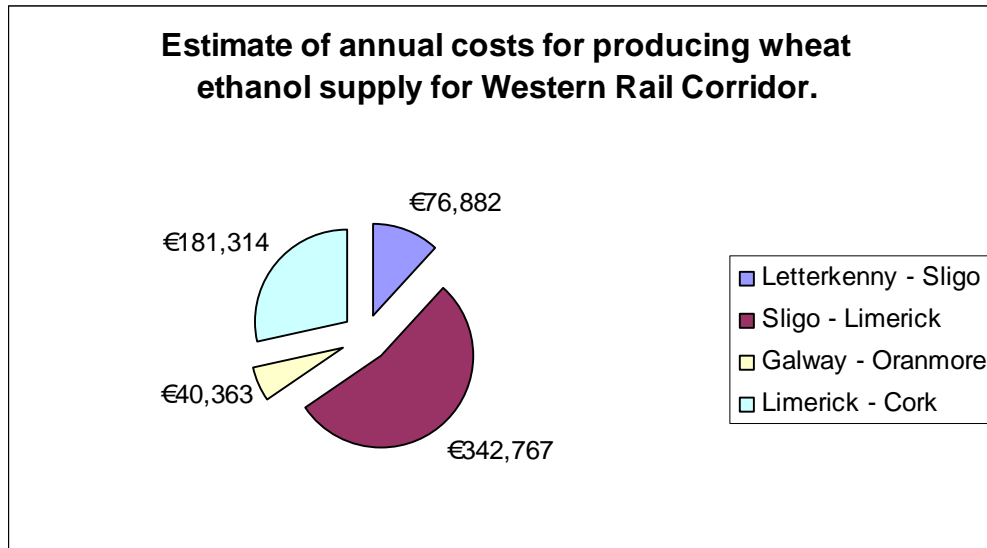


Figure 7. Pie-Chart Showing the Annual Costs of Producing Ethanol from Wheat by Various Routes on Western Rail Corridor.

5.2 OIL-SEED RAPE PRODUCTION COSTS

Rape-seed Production Costs per Ha (€)		
	Winter	Spring
Materials	477	276
Operations	410	304
Miscellaneous	44	19
Total Variable	931	599
Variable cost	233	218
	2095	1416

Table 8: Costs of Producing Winter and Spring Oil-Seed Rape

For the Western Rail Corridor, these costs would be;

Western Rail Corridor line costs (€)			
	Winter	Spring	Average
Materials	759384	726708	
Operations	652720	800432	
Miscellaneous	70048	50027	
Total Variable	1482152	1577167	
Variable cost (€)	370936	573994	
Annual Cost	1111747	1242776	1177261

Table 9: Costs of Producing Winter and Spring Oil-Seed Rape for Western Rail Corridor.

Therefore an average figure for total annual costs of producing a Pure Plant Oil (PPO) biodiesel for the line would be €1.18 million, before cake sales. After revenues from cake sales, the figure is conservatively estimated to be at €0.7 per litre. This would therefore equate to **€58,292** per annum.

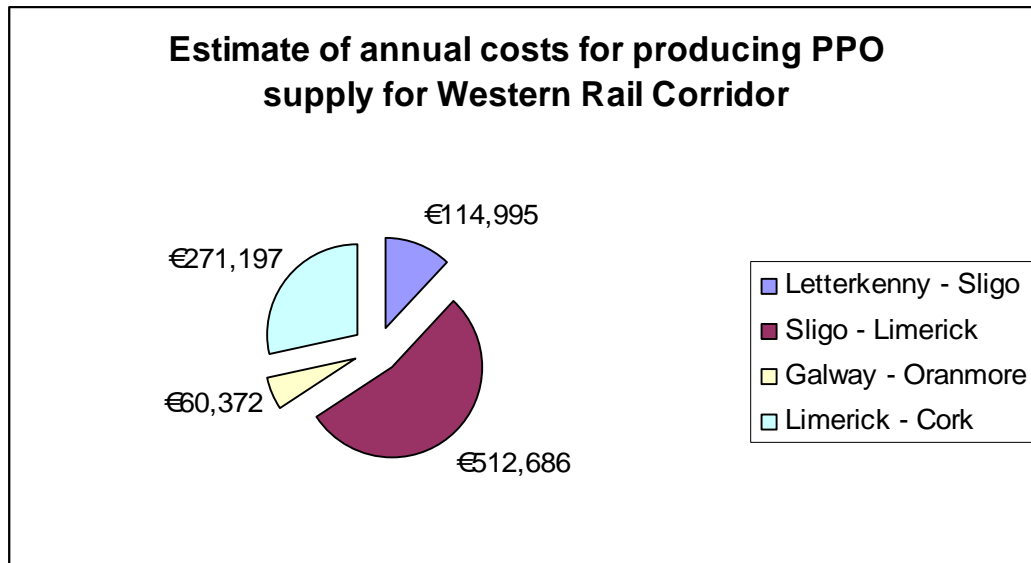


Figure 8: Pie-Chart Showing the Annual Costs of Producing PPO by Various Routes on Western Rail Corridor.

The estimate above has used 100% pure plant oil to run the train. This may require some sort of minor modification to a standard diesel train engine. An alternative and cheaper option is to use bio-diesel; this is where ethanol or methanol is blended with PPO to allow it to be used in a diesel engine without modification.

5.3 OTHER CROPS

The production costs for a variety of crops are given in the table below.

Crop							
	Winter Wheat	Winter Barley	Summer Barley	Winter Rape	Summer Rape	Beet	Potatoes
Material costs €/Ha	516	449	311	415	252	621	2820
Machinery hire €/Ha	337	309	295	396	314	509	3614
Miscellaneous €/Ha	61	53	39	39	17	232	0
Total Variable €/Ha	913	812	645	850	582	1363	6434
Production cost €/Ha	98.2	105.5	100.8	212.5	215.6	27.8	189

Table 10: Production Costs for Selected Crops.

6. OTHER CONSIDERATIONS

Other factors not detailed in this report but worth consideration are;

- **Set-aside land**

Set-aside land can be used to grow bio-fuel crops without losing the payments for set-aside land. This is a factor that should be analysed in a more detailed report.

- **Tallow Oil**

Producing oil from Tallow is often regarded as the most economical option when producing bio-fuels, as it uses what is essentially a cheap waste product. There are several meat-processing plants in the West of Ireland.

- **Knock Airport**

An additional line to Knock Airport was not considered in the fuel calculations

- **Electric trains**

Trains such as the TGV or the Japanese Bullet train use principals that could be harnessed to the West of Irelands best energy resource; the wind. A hybrid electric/(bio)diesel train (see below) would allow a diversity of fuel supply that could come from natural and locally available resources using crops grown in the region and wind generated electricity to charge the batteries.

- **By-products**

Cake for animal feed was mentioned above as a by-product of the bio-fuel process. In the case of excess land being sown under tillage, other products such as cooking oil or vegetable soaps could be produced. At the moment Ireland imports most, if not all of its cooking oil and soap.

- **Technologies in Current Use**

Appendix 1 contains references and articles to alternative public transport technologies that are currently being used.

7. CONCLUSION

Already, increasing energy bills have drawn the public's gaze to the issue of "peak oil". Peak oil will mean changes to our current lifestyles, we are not yet sure how significant these changes will be. However pro-active planning will assist in making the change from a fossil-fuel global economy to its alternative.

Part of this planning should be an effective public transport system. This is because it will be a necessity with subsequent population patterns in Ireland. Future public transport systems should use an energy source that has a stable supply and is relatively cheap. The most effective answer, that matches these requirements, is biofuel.

As shown above, the benefit of growing energy crops in the region or country is at least equal to, if not better than, importing them.

A railway, fuelled from energy crops, linking the Western half of the country would allow economic growth along not only this corridor but would also benefit other regions. Better communications between Northern Ireland and the Republic, the Border and Midland regions and the Eastern half of the country are likely to develop as a wider web of communications emerges across the island.

Earlier this month, the Department of Communications, Marine and Natural Resources published a green paper on energy *Towards a Sustainable Energy Future for Ireland*.

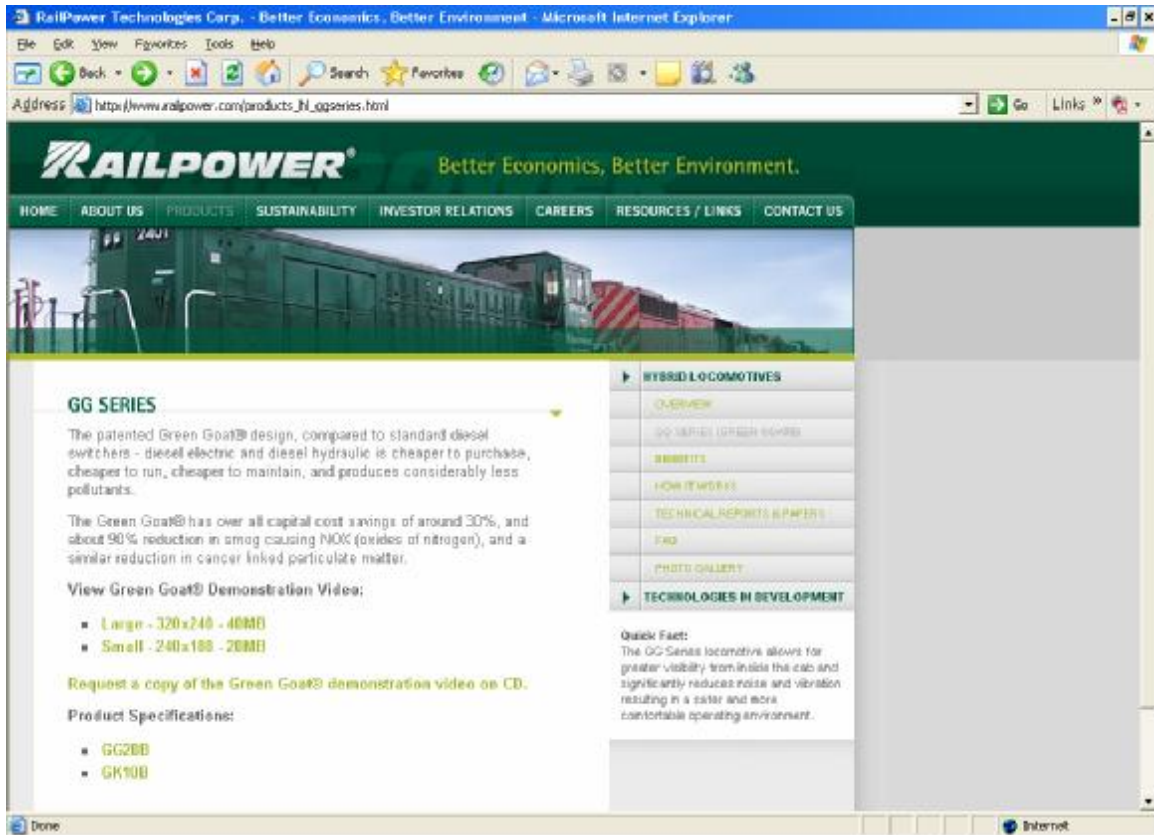
In the opening pages of the report, "cross-sectoral perspective" is featured as being of importance to a sustainable energy policy for the country. Public transport is a grave omission from the sectors mentioned in this section.

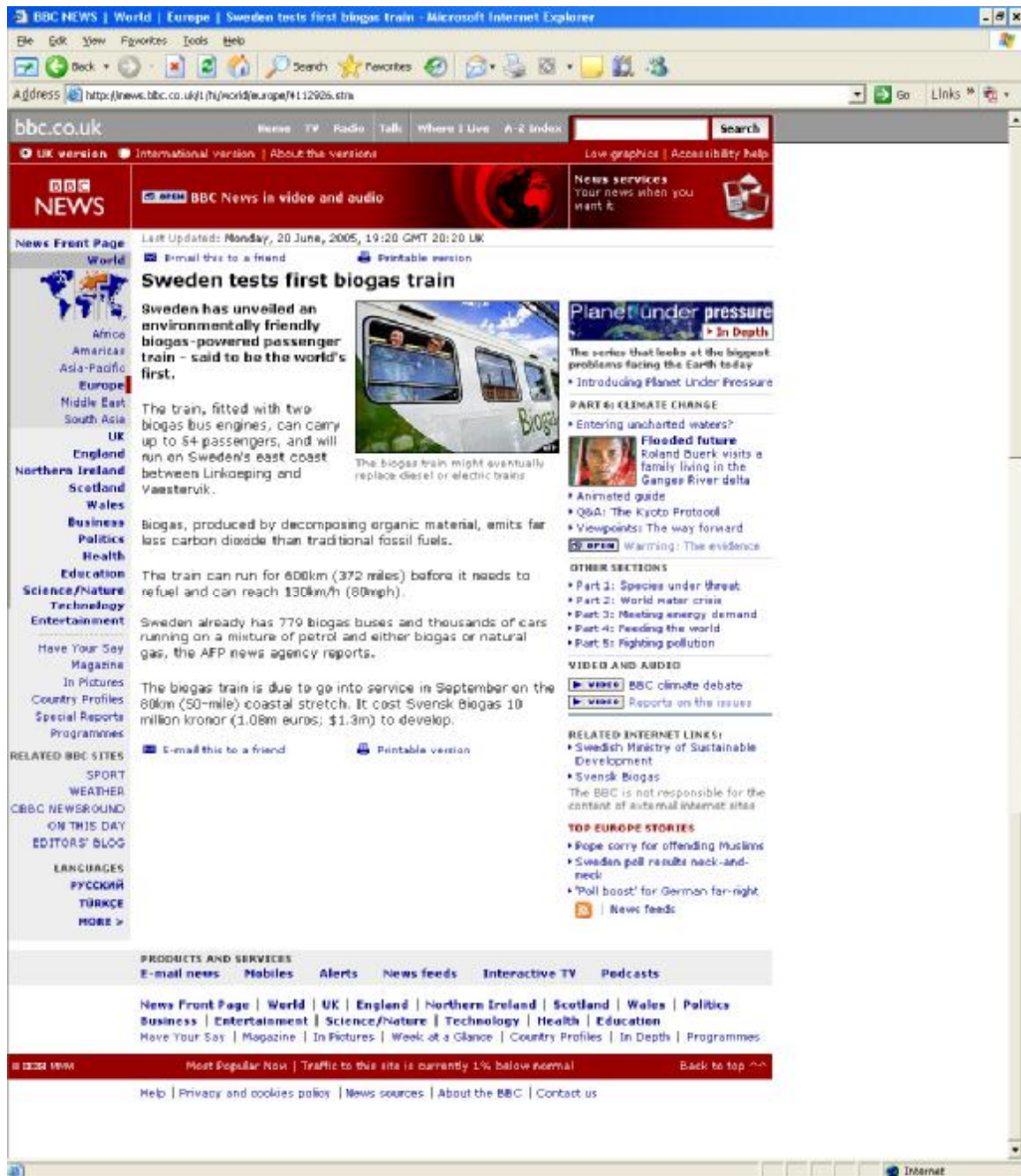
It should be noted that the paper is open to feedback from the public for the next two months.

APPENDIX 1

Alternative public transport technologies currently in use.

The screenshot shows a Microsoft Internet Explorer browser window displaying the website for the New Mexico Rail Runner Express. The browser's address bar shows the URL: http://www.nmraillrunner.com/news_biodiesel.asp. The website header features the "NEW MEXICO RAIL RUNNER EXPRESS" logo with a stylized bird graphic. A navigation menu on the left includes links for NEWS & EVENTS, STATIONS, ROUTE MAP, TICKETS, SCHEDULE, PARK/CONNECT, ABOUT, PROJECT PLANS, CONTACT, and HOME. The main content area is titled "NEWS & EVENTS" and features a news article with the headline "Governor Richardson announces Rail Runner will run on Biodiesel Fuel". The article text includes a date "(07-29-06)", a quote from Governor Bill Richardson, and information about the biodiesel fuel used by the train. A large image of a train engine is visible on the right side of the page. The footer of the website contains copyright information: "© Copyright 2006 New Mexico Rail Runner All Rights Reserved | Contact | Site Credits".





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WEBSITES

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