



L. Fuel Properties

Table L.1: Solid Fuel Calorific Values (Gross)

Region	Mine	Type	Mbtu/tonne	Megajoules/kg
Waikato	Huntly	Sub-bituminous	21.315	22.49
	Maramarua	Sub-bituminous	19.116	20.17
Buller	Stockton	Bituminous	29.996	31.65
Reefton	Echo*	Bituminous	29.257	30.87
	Terrace	Sub-bituminous	23.675	24.98
Greymouth	Strongman*	Bituminous	28.688	30.27
	Spring Creek	Bituminous	28.271	29.83
Canterbury	Mt. Somers	Sub-bituminous	16.785	17.71
Otago	Kai Point	Sub-bituminous	18.642	19.67
Southland	Ohai	Sub-bituminous	22.850	24.11
	Waimumu	Lignite	14.453	15.25
	Mataura	Lignite	13.079	13.80
* Largest of several mines				
			Sampled at the Mine Ready for Delivery	
			Mbtu/tonne	Megajoules/kg
Average Coal Figures (weighted for 2003 production)				
Bituminous (Export)			29.788	31.43
Bituminous (Used In New Zealand)			28.224	29.78
Sub-bituminous			21.248	22.42
Lignite			15.003	15.83
Peat			7.108	7.50
Type of Wood	% of Moisture/kg of Wet Wood		Mbtu/tonne	Megajoules/kg
Oven-dried Wood	0 - 0		19.47	20.55
Fresh Harvested	50 - 55		8.84	9.33
Bark	60 - 70		8.59	9.06
Fuelwood	38 - 41		11.45	12.08
Wooden Containers	23 - 29		14.15	14.94
Furniture Residues	12 - 14		16.86	17.79
Black Liquor	50 - 50		9.95	10.50

The calorific values of coal are based on CRL's 2004 Analysis Update. These Coal Research Association of New Zealand Inc. analyses are generally of samples collected at the minesite stockpiles ready for delivery to industrial users. The calorific value of a coal varies with moisture content, which depends on storage and transport conditions and the weather.

Table L.2: Solid Fuel Calorific Values (Net)

Region	Mine	Type	Mbtu/tonne	Megajoules/kg
Waikato	Huntly	Sub-bituminous	20.026	21.13
	Maramarua	Sub-bituminous	17.770	18.75
Buller	Stockton	Bituminous	28.811	30.40
Reefton	Echo*	Bituminous	28.063	29.61
	Terrace	Sub-bituminous	22.471	23.71
Greymouth	Strongman*	Bituminous	27.541	29.06
	Spring Creek	Bituminous	27.039	28.53
Canterbury	Mt. Somers	Sub-bituminous	15.496	16.35
Otago	Kai Point	Sub-bituminous	17.239	18.19
Southland	Ohai	Sub-bituminous	21.580	22.77
	Waimumu	Lignite	12.946	13.66
	Mataura	Lignite	11.553	12.19
* Largest of several mines				
			Sampled at the Mine Ready for Delivery	
			Mbtu/tonne	Megajoules/kg
Average Coal Figures (weighted for 2003 production)				
Bituminous (Export)			28.603	30.18
Bituminous (Used In New Zealand)			26.859	28.34
Sub-bituminous			19.959	21.06
Lignite			13.515	14.26
Peat			5.213	5.50
Type of Wood	% of Moisture/kg of Wet Wood		Mbtu/tonne	Megajoules/kg
Oven-dried Wood	0 - 0		18.20	19.20
Fresh Harvested	50 - 55		7.01	7.40
Bark	60 - 70		6.63	7.00
Fuelwood	38 - 41		9.76	10.30
Wooden Containers	23 - 29		12.60	13.30
Furniture Residues	12 - 14		15.45	16.30
Black Liquor	50 - 50		8.15	8.60

The calorific values of coal are based on CRL's 2004 *Analysis Update*. These Coal Research Association of New Zealand Inc. analyses are generally of samples collected at the minesite stockpiles ready for delivery to industrial users. The calorific value of a coal varies with moisture content, which depends on storage and transport conditions and the weather.

Table L.3: Petroleum Calorific Values (Gross)

	kg/ litre	bb/ tonne	Megajoules/ bbl	Megajoules/ kg	Megajoules/ litre
Indigenous Crudes					
Kapuni Condensate	0.766	8.21	5,693.9	46.75	35.81
Maui Condensate	0.739	8.51	5,536.6	47.12	34.82
McKee Crude	0.832	7.56	6,062.8	45.83	38.13
Kaimiro Crude	0.794	7.92	5,854.0	46.37	36.82
Waihapa Crude	0.886	7.10	6,311.2	44.80	39.69
Ngatoro Crude	0.854	7.36	5,030.2	37.05	31.64
Imported Crudes					
Kuwait Crude	0.870	7.23	6,260.8	45.26	39.38
Arabian Light Crude	0.859	7.32	6,204.9	45.43	39.02
Arabian Medium Crude	0.869	7.24	6,256.4	45.28	39.35
Arabian Heavy Crude	0.887	7.09	6,346.5	45.00	39.92
Arun Condensate	0.761	8.26	5,665.2	46.82	35.63
Iranian Light Crude	0.852	7.38	6,167.9	45.53	38.79
Attaka Crude	0.810	7.76	5,943.7	46.15	37.38
Miri Light Crude	0.842	7.47	6,116.9	45.69	38.47
Seria Crude	0.836	7.52	6,083.9	45.77	38.26
Basrah Crude	0.875	7.19	6,285.7	45.18	39.53
Refinery Feedstocks					
Naphtha	0.750	8.39	5,601.2	46.97	35.23
Middle Distillate	0.820	7.67	5,997.5	46.00	37.72
Lgo/Kero Ex Naphtha	0.810	7.76	5,943.7	46.15	37.38
Intermediate Variation	0.767	8.20	5,700.1	46.74	35.85
Intermediate Residue	0.899	7.00	6,405.2	44.81	40.28
Blendstock	0.840	7.49	6,105.0	45.71	38.40
Petroleum Products*					
Premium Unleaded Gasoline	0.755	8.33	5,631.1	46.90	35.42
Regular Unleaded Gasoline	0.735	8.56	5,512.8	47.16	34.67
Automotive Gas Oil	0.841	7.48	6,099.9	45.62	38.36
Marine Diesel Oil	0.848	7.42	6,136.5	45.50	38.59
Light Fuel Oil	0.922	6.82	6,428.9	43.84	40.43
Heavy Fuel Oil	0.949	6.63	6,492.7	43.03	40.83
Bunker Fuel Oil	0.955	6.58	6,498.9	42.79	40.87
Power Station Fuel Oil	0.890	7.07	6,360.9	44.95	40.01
Export Fuel Oil	0.940	6.69	6,598.7	44.15	41.50
Lighting Kerosene	0.795	7.91	5,865.2	46.40	36.89
Jet Fuel	0.799	7.87	5,884.1	46.29	37.01
Aviation Gasoline	0.698	9.01	5,249.4	47.30	33.02
Blended Heating Oil	0.824	7.63	6,079.1	46.40	38.23
Bitumen	1.030	6.11	6,758.0	41.26	42.50
Natural Gasoline	0.668	9.42	5,130.0	48.30	32.26
Liquid Petroleum Gas**					
LPG 60/40	0.534	11.78	4,203.8	49.51	26.44
General Product LPG	0.536	11.73	4,219.6	49.51	26.54
Propane	0.508	12.38	4,027.5	49.86	25.33
Butane	0.572	11.00	4,465.5	49.10	28.09

Sources: * The New Zealand Refining Company Limited.

** Natural Gas Corporation.

Table L.4: Petroleum Calorific Values (Net)

	kg/ litre	bbl/ tonne	Megajoules/ bbl	Megajoules/ kg	Megajoules/ litre
Indigenous Crudes					
Kapuni Condensate	0.766	8.21	5,326.1	43.73	33.50
Maui Condensate	0.739	8.51	5,170.0	44.00	32.52
McKee Crude	0.832	7.56	5,691.0	43.02	35.79
Kaimiro Crude	0.794	7.92	5,480.3	43.41	34.47
Waihapa Crude	0.886	7.10	5,987.1	42.50	37.66
Ngatoro Crude	0.854	7.36	4,728.3	34.82	29.74
Imported Crudes					
Kuwait Crude	0.870	7.23	5,873.5	42.46	36.94
Arabian Light Crude	0.859	7.32	5,825.2	42.65	36.64
Arabian Medium Crude	0.869	7.24	5,873.6	42.51	36.94
Arabian Heavy Crude	0.887	7.09	5,951.6	42.20	37.43
Arun Condensate	0.761	8.26	5,294.9	43.76	33.30
Iranian Light Crude	0.852	7.38	5,787.2	42.72	36.40
Attaka Crude	0.810	7.76	5,567.6	43.23	35.02
Miri Light Crude	0.842	7.47	5,740.7	42.88	36.10
Seria Crude	0.836	7.52	5,705.1	42.92	35.88
Basrah Crude	0.875	7.19	5,907.2	42.46	37.15
Refinery Feedstocks					
Naphtha	0.750	8.39	5,218.4	43.76	32.82
Middle Distillate	0.820	7.67	5,623.3	43.13	35.37
Lgo/Kero Ex Naphtha	0.810	7.76	5,570.2	43.25	35.03
Intermediate Variation	0.767	8.20	5,328.1	43.69	33.51
Intermediate Residue	0.899	7.00	5,999.2	41.97	37.73
Blendstock	0.840	7.49	5,729.7	42.90	36.04
Petroleum Products*					
Premium Unleaded Gasoline	0.755	8.33	5,259.0	43.80	33.08
Regular Unleaded Gasoline	0.735	8.56	5,143.2	44.00	32.35
Automotive Gas Oil	0.841	7.48	5,722.7	42.80	35.99
Marine Diesel Oil	0.848	7.42	5,759.3	42.71	36.22
Light Fuel Oil	0.922	6.82	6,058.5	41.32	38.10
Heavy Fuel Oil	0.949	6.63	6,128.3	40.61	38.54
Bunker Fuel Oil	0.955	6.58	6,136.5	40.41	38.59
Power Station Fuel Oil	0.890	7.07	5,717.0	40.40	35.96
Export Fuel Oil	0.940	6.69	6,174.2	41.31	38.83
Lighting Kerosene	0.795	7.91	5,511.3	43.60	34.66
Jet Fuel	0.799	7.87	5,508.1	43.33	34.64
Aviation Gasoline	0.698	9.01	4,938.7	44.50	31.06
Blended Heating Oil	0.824	7.63	5,686.1	43.40	35.76
Bitumen	1.030	6.11	6,407.8	39.12	40.30
Natural Gasoline	0.668	9.42	4,812.5	45.31	30.27
Liquid Petroleum Gas**					
LPG 60/40	0.534	11.78	3,876.3	45.65	24.38
General Product LPG	0.536	11.73	3,890.9	45.66	24.47
Propane	0.508	12.38	3,713.5	45.98	23.36
Butane	0.572	11.00	4,118.2	45.28	25.90

Sources: * The New Zealand Refining Company Limited.

** Natural Gas Corporation.

Table L.5: Oil Conversion Factors¹

	Thousand Tonnes/PJ	m ³ /PJ
Crude Oil and Condensate	21.389	28,357
Refinery Blendstocks and Other Feedstocks	21.395	27,894
Oil Products Total	21.803	25,772
Petrol Total	21.284	29,156
Premium Unleaded Petrol	21.191	27,994
Regular Unleaded Petrol	21.308	28,298
Diesel	21.752	26,463
Fuel Oil	22.664	24,635
Aviation Fuels	21.566	27,127
Other Petroleum Products	26.858	31,747
LPG/NGL	20.197	37,541

Note:

¹ These conversion factors apply for the December 2003 year only. Conversion factors depend upon source (weight average) feedstocks and products.

Table L.6: Gas Physical Properties

	Liquid Density	Gas Density	Relative Density		Gross		Net	
	kg/m ³	kg/m ³	Water =1	Air = 1	MJ/kg	MJ/m ³	MJ/kg	MJ/m ³
Kapuni Wellhead				1.062		25.7		23.3
Kapuni Processed				0.666 *		41.3 *		37.4 *
Maui Wellhead				0.955		47.2		43.1
Maui Processed				0.666 *		39.3 *		35.5 *
McKee Processed				0.712 *		41.3 *		37.3 *
Methane	300.0	0.678	0.300	0.554	55.6	37.7	50.1	34.0
Ethane	356.6	1.272	0.358	1.038	51.9	66.0	47.5	60.4
Propane	506.7	1.865	0.508	1.523	50.4	94.0	46.4	86.5
n-Butane	583.1	2.458	0.585	2.007	49.5	121.8	45.7	112.5
iso-Butane	562.1	2.458	0.564	2.007	49.4	121.4	45.6	112.1
n-Pentane	629.9	3.052	0.632	2.491	49.0	149.7	45.4	138.5
iso-Pentane	623.3	3.052	0.625	2.491	48.9	149.3	45.3	138.1
n-Hexane	662.7	3.644	0.664	2.975	48.7	177.6	45.1	164.5
n-Heptane	686.9	4.237	0.689	3.460	48.5	205.4	45.0	190.5
n-Octane	705.6	4.831	0.707	3.944	48.3	233.3	44.8	216.5
n-Nonane	720.6	5.426	0.722	4.428	48.1	261.2	44.7	242.5
n-Decane	732.8	6.017	0.735	4.913	48.0	289.1	44.6	268.6
Hydrogen						11.9		10.1
Acetylene						55.4		52.6

* Source: Natural Gas Corporation.