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Appendix

Appendix A: Impact Categories and Characterisation Factors (SAIC, 2006)

Impact Category	Scale	Examples of LCI Data (i.e., classification)	Common Possible Characterisation Factor	Description of Characterisation Factor
Global Warming	Global	Carbon Dioxide (CO_2) Nitrogen Dioxide (NO_2) Methane (CH_4) Chlorofluorocarbons (CFCs) Hydrochlorofluorocarbons (HCFCs) Methyl Bromide (CH_3Br)	Global Warming Potential	Converts LCI data to carbon dioxide (CO_2) equivalents Note: Global warming potentials can be 50, 100, or 500 year potentials.
Stratospheric Ozone Depletion	Global	Chlorofluorocarbons (CFCs) Hydrochlorofluorocarbons (HCFCs) Halons Methyl Bromide (CH_3Br)	Ozone Depleting Potential	Converts LCI data to trichlorofluoromethane (CFC-11) equivalents.
Acidification	Regional Local	Sulphur Oxides (SO_x) Nitrogen Oxides (NO_x) Hydrochloric Acid (HCL) Hydrofluoric Acid (HF) Ammonia (NH_4)	Acidification Potential	Converts LCI data to hydrogen (H+) ion equivalents.
Eutrophication	Local	Phosphate (PO_4) Nitrogen Oxide (NO) Nitrogen Dioxide (NO_2) Nitrates Ammonia (NH_4)	Eutrophication Potential	Converts LCI data to phosphate (PO_4) equivalents.
Photochemical Smog	Local	Non-methane hydrocarbon (NMHC)	Photochemical Oxidant Creation Potential	Converts LCI data to ethane (C_2H_6) equivalents.
Terrestrial Toxicity	Local	Toxic chemicals with a reported lethal concentration to rodents	LC_{50}	Converts LC_{50} data to equivalents; uses multi-media modelling, exposure pathways.
Aquatic Toxicity	Local	Toxic chemicals with a reported lethal concentration to fish	LC_{50}	Converts LC_{50} data to equivalents; uses multi-media modelling, exposure pathways.
Human Health	Global Regional Local	Total releases to air, water, and soil.	LC_{50}	Converts LC_{50} data to equivalents; uses multi-media modelling, exposure pathways.
Resource Depletion	Global Regional Local	Quantity of minerals used Quantity of fossil fuels used	Resource Depletion Potential	Converts LCI data to a ratio of quantity of resource used versus quantity of resource left in reserve.
Land Use	Global Regional Local	Quantity disposed of in a landfill or other land modifications	Land Availability	Converts mass of solid waste into volume using an estimated density.
Water Use	Regional Local	Water used or consumed	Water Shortage Potential	Converts LCI data to a ratio of quantity of water used versus quantity of resource left in reserve.

Appendix B: Life Cycle Inventory of Thermal Power Generation for 1kWh Electricity Generation for 2007 in China (Sha et al., 2012)

		Unit	Consumption/ Emission
Fossil fuel	**Raw coal**	**kg**	**4.80E-01**
	Crude oil	**kg**	**3.31E-03**
	Natural gas	**m^3**	**2.96E-03**
	Coke oven gas	**m^3**	**2.92E-03**
	Other gas	**m^3**	**4.81E-03**
Pollutants	**CO_2**	**kg**	**9.70E-01**
	CH_4	**kg**	**1.06E-05**
	N_2O	**kg**	**1.51E-05**
	SO_2	**kg**	**4.41E-03**
	NO_2	**kg**	**5.44E-03**
	CO	**kg**	**1.12E-03**
	NMVOC	**kg**	**2.52E-04**
	Dust	**kg**	**1.30E-03**
	Industry water	**kg**	**6.10E-01**
	Coal fly ash	**kg**	**4.41E-02**

Appendix C: A Life Cycle Analysis of Electricity Generation Technologies (Bergerson & Lave, 2002)

Total Lifetime GWP for Various Fuels/Technologies					
	Hydroelectric	**Photovoltaic**	**Wind Farm**	**Coal**	**Natural Gas**
Output (TWh)	**5.55**	**5.55**	**5.55**	**5.55**	**5.55**
Emissions (MT CO_2 equiv.)					
CO_2 (x 10^6)	**5.10E-01**	**1.10E+00**	**8.20E-01**	**8.6E+01**	**5.1E+01**
CH_4 (x 10^4)	**8.40E-02**	**7.80E-01**	**5.40E-02**	**3.5E+01**	**5.0E+01**
N_2O (x 10^4)	**8.50E-01**	**8.70E+00**	**6.50E-01**	**2.20E+02**	**2.20E+02**
GWE (x 10^6)	**5.10E-01**	**1.10E+00**	**8.30E-01**	**8.6E+01**	**5.40E+01**

Appendix D: Environmental Assessment of International Transportation of Products (Gerilla et al., 2005)

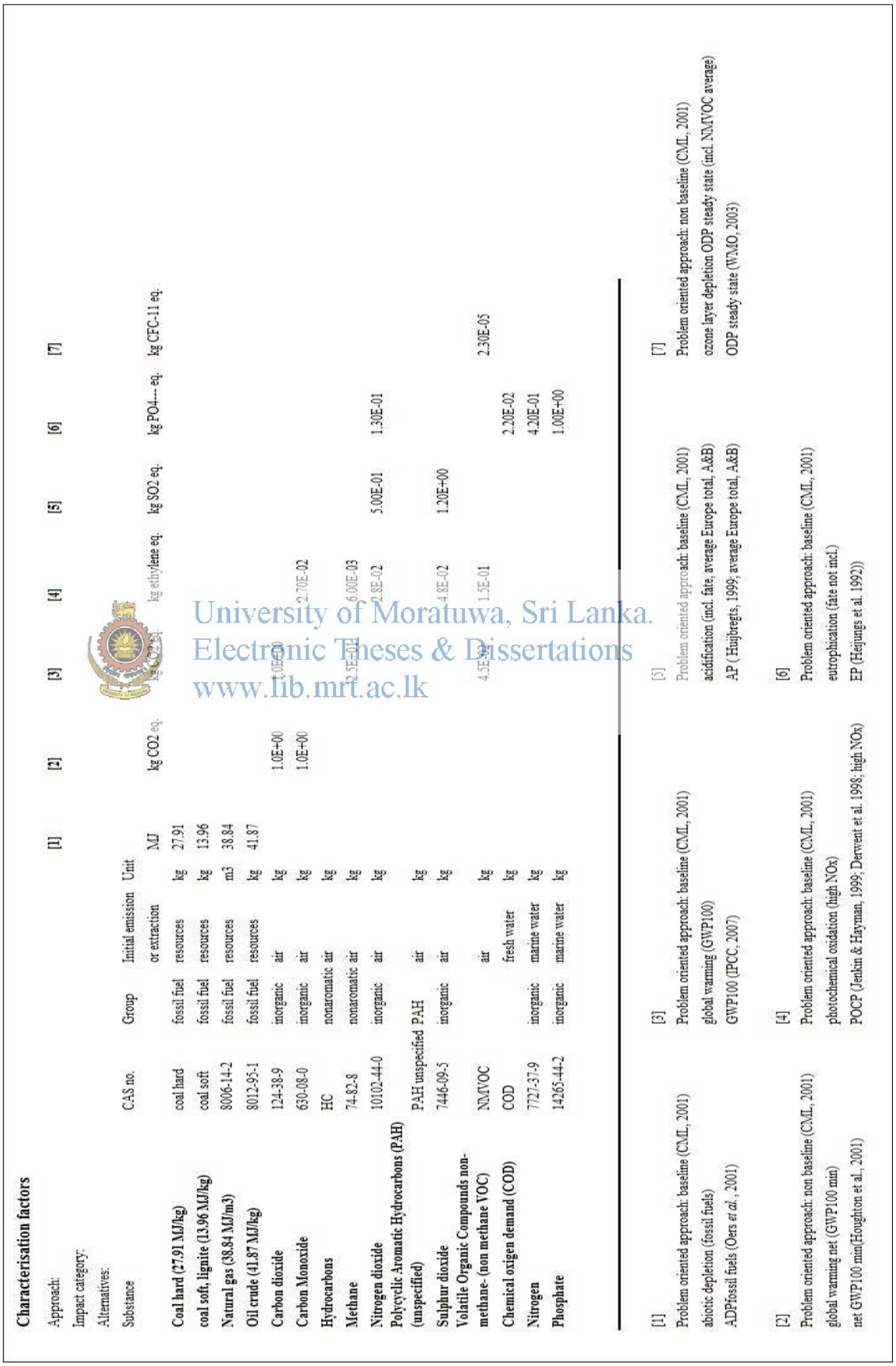
Emission element	CO_2	NO_x	SO_2	HC	PM	CO
Energy of engine: (gram/kWh) 1	665.5	12	207	0.5	0.27	1.2
Efficiency of engine: (%)	40	40	40	40	40	40
Conversion to fuel: (grams/kWh(fuel)	266.2	4.8	82.8	0.2	0.108	0.48
Energy content of fuel: (kWh/litre)	9.77	4.8	9.77	9.77	9.77	9.77
Emission factors: (grams/litre)	2600.77	46.89	808.95	1.95	1.05	4.68

(The emission factor for truck transport in Gothenburg)

Appendix E: Life Cycle Assessment – Environmental Profile of Cotton and Polyester-cotton (Kalliala & Nousiainen, 1999) and The Environmental Index Model for Textiles and Textile Services (Kalliala, n.d.)

Parameter	Unit	Fibre Production	Fibre and Fabric Production	Laundry
		Cotton (kg)		
Energy Consumption	**MJ**	**5.98E+01**	**9.93E+01**	**7.70E+00**
Electricity	MJ	1.21E+01	3.46E+01	9.40E-01
Fossil fuel	MJ	4.77E+01	5.98E+01	6.76E+00
Others	MJ	–	4.90E+01	2.30E-07
Non-renewable resources	**kg**	**1.40E+00**	**2.20E+01**	**2.00E-01**
Natural gas	**kg**	**3.50E-01**	**6.20E-01**	**1.57E+02**
Crude oil	**kg**	**5.30E-01**	**6.70E-01**	**2.00E+00**
Coal	**kg**	**5.20E-01**	**9.20E-01**	**1.40E+01**
LP gas	**kg**	**3.00E-02**	**4.00E-02**	–
Hydro power	**MJ**	**1.00E+00**	**5.80E+00**	**2.10E-01**
Natural uranium	**Mg**	**1.40E+01**	**5.54E+01**	**1.80E+00**
Fertilisers	**g**	**4.57E+02**	**5.37E+02**	–
Pesticides	**g**	**1.60E+01**	**1.89E+01**	–
Water	**kg**	**2.22E+04**	**2.61E+04**	**1.60E+01**
Detergents	**g**	–	–	**1.26E+01**
Emissions to air				
CO_2	**kg**	**4.27E+00**	**6.55E+00**	**4.90E-04**
CH_4	**kg**	**7.60E-03**	**1.30E-02**	**1.42E-03**
SO_2	**kg**	**4.00E-03**	**6.30E-03**	**9.00E-05**
NO_x	**kg**	**2.27E-02**	**3.02E-02**	**1.30E-03**
CH	**kg**	**5.00E-03**	**6.90E-03**	**7.00E-05**
CO	**kg**	**1.61E-02**	**2.82E-02**	**5.00E-04**
PM	**kg**	–	–	–
Emissions to water				
COD	**kg**	–	**1.33E+01**	**1.20E+00**
BOD	**kg**	–	**5.10E+00**	**6.40E+00**
Tot-P	**kg**	–	**5.20E-02**	**5.00E-02**
Tot-N	**kg**	–	**4.00E-02**	**1.30E-01**

Appendix F: Abstract of Characterisation Factors Published by the Institute of Environmental Sciences (2013)



Characterisation factors

Approach:					[1]	[2]	[3]	[4]	[5]	[6]	[7]
Impact category:											
Alternatives:											
Substance	CAS no.	Group	Initial emission or extraction	Unit	MJ	kg CO2 eq.	kg CO2 eq.	kg ethylene eq.	kg SO2 eq.	kg PO4--- eq.	kg CFC-11 eq.
Coal hard (27.91 MJ/kg)	coal hard	fossil fuel	resources	kg	27.91						
coal soft, lignite (13.96 MJ/kg)	coal soft	fossil fuel	resources	kg	13.96						
Natural gas (38.84 MJ/m3)	8006-14-2	fossil fuel	resources	m3	38.84						
Oil crude (41.87 MJ/kg)	8012-95-1	fossil fuel	resources	kg	41.87						
Carbon dioxide	124-38-9	inorganic	air	kg		1.0E+00					
Carbon Monoxide	630-08-0	inorganic	air	kg		1.0E+00		2.70E-02			
Hydrocarbons	HC	nonaromatic	air	kg							
Methane	74-82-8	nonaromatic	air	kg				6.00E-03			
Nitrogen dioxide	10102-44-0	inorganic	air	kg				2.8E-02	5.00E-01	1.30E-01	
Polycyclic Aromatic Hydrocarbons (PAH) (unspecified)	PAH unspecified	PAH	air	kg							
Sulphur dioxide	7446-09-5	inorganic	air	kg				4.8E-02	1.20E+00		
Volatile Organic Compounds non-methane- (non methane VOC)	NMVOC		air	kg			4.5E-01	1.5E-01			2.30E-05
Chemical oxigen demand (COD)	COD		fresh water	kg						2.20E-02	
Nitrogen	7727-37-9	inorganic	marine water	kg						4.20E-01	
Phosphate	14265-44-2	inorganic	marine water	kg						1.00E+00	

[1]	[3]	[5]	[7]
Problem oriented approach: baseline (CML, 2001)	Problem oriented approach: baseline (CML, 2001)	Problem oriented approach: baseline (CML, 2001)	Problem oriented approach: non baseline (CML, 2001)
abiotic depletion (fossil fuels)	global warming (GWP100)	acidification (incl. fate, average Europe total, A&B)	ozone layer depletion ODP steady state (incl. NMVOC average)
ADPfossil fuels (Oers *et al.*, 2001)	GWP100 (IPCC, 2007)	AP (Huijbregts, 1999; average Europe total, A&B)	ODP steady state (WMO, 2003)

[2]	[4]	[6]
Problem oriented approach: non baseline (CML, 2001)	Problem oriented approach: baseline (CML, 2001)	Problem oriented approach: baseline (CML, 2001)
global warming net (GWP100 min)	photochemical oxidation (high NOx)	eutrophication (fate not incl.)
net GWP100 min(Houghton et al., 2001)	POCP (Jenkin & Hayman, 1999; Derwent et al. 1998; high NOx)	EP (Heijungs et al. 1992))