Sri Lanka Energy Balance - 1987
SLEMA Journal Vol 2 No. 2, March 1989

Note from the Editor

The Sri Lanka Energy Balance for 1987 was published in Volume 2 No. 2 issue of SLEMA Journa in March 1989. The data, as published in table 1 is in error because the column in table related to the supply and consumption of diesel has been omitted. This omission and a few othe typographical errors have been corrected and the revised Energy Balance tables for 1987 ar published in the subsequent pages of this issue.

We have received a comment from Mr. J. Diandas, Member SLEMA, about the method in whic hydro electricity is converted to thermal equivalent when it is compared with other forms o Energy. We publish Mr. Diandas' comments in full in this issue.

The author of "Sri Lanka Energy Balance 1987" has prepared some concluding remarks, whic are also published.

Sri Lanka Energy Balance 1988 is also published in this issue.

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29 May 1989

The Editor,
Sri Lanka Energy Managers Association.

Sri Lanka Energy Balance 1987
by Renuka Mel in Vol 2/2 March 89

1. I congratulate the author on the above paper. Such balances should be made available to a wide audience. I hope that the author will present a similar set of figures for 1988 soon i SLEMA Journal.

2. Howver, I have to point out two types of errors in the Tables :-

   (a) Printers' or typists' errors, including omission of diesel column in table 1.
   (b) Error of principle in coverting and alocating electricity at net instead of gross heat value.

3. I enclose 6 tables recapitulating the same data.

	Tabulated in	
	Original Units	TOE
As published in tables 1 & 2	A2	A1
Corrected for minor errors only	B2	B1
Corrected for errors and conversion	C2	C1

4. The minor errors do not need discussion, but the conversion adjustment is necessary and important. All US macro Energy statements convert hydro and nuclear Energy into BTU (the common denominator) at prevailing heat rates usually around 10,000 btu per kWh. That is the amount of heat needed to obtain one kWh, whereas the heat output of one kWh is 3412 BTU. The corresponding rates are 2,500 kCal and 860 kCal respectively.

5. Using the gross rate, especially when TOE is the common denominator, makes clear the quantum of oil which would have been needed to obtain the same electricity if hydro were not available. Renuka Mel's table 1 reflects several rates as follows with equivalent heat rates alongside.

	kWh per TOE	TOE per GWh	kCal per kWh	BTU per kWh	Efficiency
Oil generation	3,259	307	3,068	12,175	28%
Hydro generation	4,167	240	2,400	9,524	35.8%
Electricity usage	11,628	86	860	3,412	100%

6. In table C1 annexed I have used 3,259 kWh/TOE (307 TOE per terrawatt hour) to reflect the acutal Energy used for generation of electricity from petroleum fuels in 1987. The difference in "the look' of the total Energy summary is seen in my footnotes on tables B1 and C1 which show the following contribution to total Energy and commercial Energy respectively.

Source of Energy	All Energy		Commercial Energy	
	B1 Mel	C1 Das	B1 Mel	C1 Das
Petroleum	18 1/2	18 1/2	81	64 1/2
Coal	1 1/2	1 1/2	7	5
Imported	20	20	88	69 1/2
Hydro	3	9	12	30 1/2
Commercial	23	29	100	100
Bio	77	71		
Total	100	100		

7. The net method substantially understates the importance of hydro Energy giving it only 12% of commercial supply as against a 30% contribution, and for all Energy 3% as against 9%.

8. This issue was address in a paper by Gunawardana and Diandas presented at the Dec 77 sessions of SLAAS.

Yours faithfully,

Sgd. J. Diandas

Table 1 SRI LANKA ENERGY BALANCE 1987 (units: Thousand Tons of Oil Equivalent TOE) AS PUBLISHED + Diesel column + Conversion rates and %

	Hydro Elect. 240/twh	Elect. Thermal equiv 86/twh	LPG/fuel gas 1.06/mT	Super petrol 1.04/mT	Naptha 1.09/mT	Av gas .89/mT	Kerosene 1.05/mT	Avtur 1.05/mT	Diesel 1.05/mT	Fuel oil .98/mT	Residual .98/mT	Other Petro. Products .89/mT	Coal .7/mT	Commercial Baggase .14/mT	Fuelwood & other biomass .45/mT	Commercial charcoal .65/mT	Crude oil 1.03/mT	Total Energy input	%
Production of primary Energy	522.57					0.22		46.18	2789			2.92	92.31	52.99	4534.47		1733.29	5110.02	
02. Imports			2.33						- 361	-39.97						-18.28		-185.44	
03. Direct Export				-0.14	-123.44	0.00			- 56.38	-378.83								-503.35	
04. Foreign Bunkers and Aviation						-0.02		-68.12	- 11.40	-4.29	-1.91	4.05	0.48			-5.47	25.14	-27.50	
05. Stock Change			1.67	-1.27	-0.12	0.06	-22.47	-11.97											
06. Total Energy Requirement	522.57		4.00	-1.41	-123.56	0.26	-22.47	-33.91	146.50	-423.09	-1.91	6.97	92.79	52.99	4534.47	-23.75	1758.43	6488.88	100
07. Energy Conversion/Transformation																	-1758.42	-26.03	
7.1 Petroleum Refineries			57.72	142.98	128.16		160.22	74.71	514.6	541.84	74.89	32.71						-335.32	
7.1 Electric Power Plants (hydro) 35.8%	-522.57	187.25							- 121.60		-40.87							-117.08	1.
7.3 Electric power plants (thermal) 28%		45.59													-81.00	25.31		-55.69	
7.4 Charcoal production (wood & shell)																		0.00	
08. Transfers																		0.00	
09. Consumption of Energy sector											-32.11							-71.94	1.
9.1 Own use		-1.33	-38.50						- 2.11									-1.44	
9.2 Losses		-1.44								-0.63								-46.01	
10. Losses in transport & distribution		-36.32		-1.11	-4.60		-1.03	-0.21											
Available after conversion	-522.57	193.75	19.22	141.87	123.56	0.00	159.19	74.50	345.25	541.21	1.91	-39.68	0.00	0.00	-81.00	25.31	-1758.42	-653.50	10
11. Consumption for non Energy usage																		-39.68	
12. Net supply		193.75	23.22	140.46	0.00	0.26	136.72	40.59	541.75	118.12	0.00	6.97	92.79	52.99	4453.47	1.57	0.01	5795.70	89
13. Final consumption		193.75	23.22	140.47		0.26	136.72	40.60	541.74	118.12	0.00	0.00	92.79	52.99	4453.42	1.57		5795.65	100
13.1 Industry		74.47								117.63			92.31	52.99	397.14			734.74	12
13.1.1 Agro industry															356.31			356.31	6
13.2 Transport									494.57									0.00	
13.2.1 Road				140.36					23.14				0.48					634.93	10
13.2.2 Rail									2.00									28.61	
13.2.3 Inland and Coastal waterways																		2.00	
13.2.4 Air						0.26		40.60		0.29								41.15	
13.3 Household & Agriculture																		0.00	
13.3.1 Rural, urban, estate household		80.87	17.96				122.52								3699.97	0.54		3921.86	67
13.3.2 Agriculture				0.11			14.20		17.04							1.01		32.30	
13.4 Other Government & Commercial		38.41	5.26															43.67	

Table 2- SRI LANKA ENERGY BALANCE 1987 (in original units) AS PUBLISHED

	Hydro Generation (GWh)	Elect themal equiv. (GWh)	LPG/ fuel gas ('000 MT)	Super petrol ('000 MT)	Naptha ('000 MT)	Av gas ('000 MT)	Kerosene ('000 MT)	Avtur ('000 MT)	Disolene ('000 MT)	Fuel oil ('000 MT)	Residual ('000 MT)	Other petroleum Products ('000 MT)	Coal ('000 MT)	Commercial bagasse ('000 MT)	Fuelwood & other biomass ('000 MT)	Commercial charcoal ('000 MT)	Crude oil ('000 MT)
01. Production of primary Energy	2177.367													132.470	10076.590		
02. Imports			2.200			0.205		43.984	207.513			3.286	131.873				1682.801
03. Direct Export				-0.125	-113.246	-0.001			-3.440	-40.786						-28.122	
04. Foreign Bunkers Aviation						-0.015		-64.872	-53.691	-386.563							
05. Stock Change			1.572	-1.162	-0.108	0.053	-1.178	-11.398	5.140	-4.377	-1.944	4.546	0.686			-6.350	24.404
06. Total Energy Requirement	2177.367		3.772	-1.287	-113.354	0.242	-1.178	-32.286	155.522	-431.726		7.832	132.559	132.470	10076.590	-34.472	1707.205
07. Energy Conversion Trannsformation																	
7.1 Petroleum Refineries			54.457	131.171	117.582		152.592	71.149	494.438	552.903	76.415	36.754					
7.1 Electric Power Plants (hydro)	-2177.367	2177.367															-1707.205
7.3 Electric power plants (thermal)		530.147							-116.000								
7.4 Charcoal production (wood &shell)											-41.702				-180.100	38.945	
08. Transfers																	
09. Consumption of energy sector																	
9.1 Own use		-15.514	-36.324								-32.769						
9.2 Losses		-16.790															
10. Losses in transport & distribution		-422.367		-1.010	-4.228		-0.985	-0.200	-2.010	-0.640							
Available after conversion		2252.843	18.133	130.161	113.354	0.000	151.607	70.949	376.428	552.263	1.944	-7.832			-180.100	38.945	-1707.205
11. Consumption for non energy usages												-44.586					
12. Net supply		2252.843	21.905	128.874		0.242	150.429	38.663	531.950	120.537	1.944		132.559	132.470	9896.490	4.473	
13. Final consumption		2252.843	21.905	128.874		0.242	150.429	38.663	531.950	120.537			132.559	132.470	9896.490	4.473	
13.1 Industry		865.923								120.238			131.873	132.470	882.530	2.060	
13.1.1 Agro industry							20.224		16.000						791.800		
13.2 Transport																	
13.2.1 Road				128.769					471.019								
13.2.2 Rail									26.795	0.299			0.686				
13.2.3 Air						0.242		38.663									
13.2.4 Inland and coastal waterways									1.905								
13.3 Household & Agriculture																	
13.3.1 Rural, urban, estate household		940.293	16.945				116.685		16.231						8222.160	0.836	
13.3.2 Agriculture				0.105			13.520									1.577	
13.4 Other Government & Commercial		446.627	4.960														

Table 1 SRI LANKA ENERGY BALANCE 1987 (units - Thousand Tons of Oil Equivalent TOE). CORRECTED FOR ERRORS ONLY

	Hydro Elect. 240/twh	Elect. Thermal equiv 86/twh	LPG/fuel gas 1.06/mT	Super petrol 1.04/mT	Naptha 1.04/mT	Av gas 1.04/mT	Kerosene 1.05/mT	Avtur 1.05/mT	Diesel 1.05 mT	Fuel oil .98/mT	Residual .98/mT	Other Petro. Products .94/mT	Coal .7/mT	Commercial Baggase .4/mT	Fuelwood & other biomass .45/mT	Commercial charcoal .62/mT	Crude oil 1.03/mT	Total Energy input	%
ction of primary Energy	522.57																		
ports			2.33			0.22		46.18	217.69			2.92	92.31	52.99	4534.47			5110.03	
ct Export				-0.14	-123.44	0.00			- 341	-39.97							1733.28	2095.13	
ign Bunkers and Aviation						-0.02		-68.11	- 56.38	-376.83						-18.28		-185.44	
k Change			1.67	-1.27	-0.12	0.06	- 1.24	-11.97	5.40	-4.29	-1.91	4.05	0.48					-503.35	
al Energy Requirement	522.57		4.00	-1.41	-123.56	0.26	- 1.24	-33.90	163.30	-423.09	-1.91	6.97	92.79	52.99	4534.47	-4.12	25.14	11.88	
gy Conversion/Transformation																-23.40	1758.42	6528.26	100
Petroleum Refineries			57.72	142.98	128.16		160.22	74.71	519.46	541.64	74.89	32.71							
Electric Power Plants (hydro) 35.8%	-522.57	187.25															-1758.42	-26.03	.4
Electric power plants (thermal) 28%		45.59							- 121.80		-40.87							-335.32	2
Charcoal production (wood & shell)																		-117.08	1.5
sfers																		-55.74	.9
mption of Energy sector																			
On use		-1.33	-38.50								-32.11								
Losses		-1.44																-71.94	1.1
ses in transport & distribution		-36.32		-1.10	-4.60		-1.03	-0.21	- 2.11	-0.63								-1.44	
Available after conversion	-522.57	193.75	19.22	141.89	123.56		159.19	74.50	345.25	541.21	1.91	32.71			-81.05	25.31	-1758.42	-46.00	.7
mption for non Energy usage												-39.68						-653.55	10.1
Supply		193.75	23.22	140.47		0.26	157.45	40.60	558.55	118.12			92.79	52.99	4453.42	2.91		-39.68	.6
al consumption		193.75	23.22	140.47		0.26	157.45	40.60	558.55	118.12			92.79	52.99	4453.42	2.91		5835.03	89.3
Industry		74.47								117.63			92.31	52.99	397.14	1.34		5835.03	100
.1 Agro industry							21.23		16.80						356.31			736.08	12.6
Transport																		394.34	6.8
.2.1 Road				140.36					454.57										
.2.2 Rail									28.14									634.93	10.9
.2.3 Inland and Coastal waterways									2.00				0.48					28.62	.5
.2.4 Air						0.26		40.60		0.29								2.00	
Household & Agriculture																		41.15	.7
.3.1 Rural, urban, estate household		80.87	17.96				122.52								3699.97	0.54			
.3.2 Agriculture				0.11			14.20		17.04							1.03		3921.86	67.2
Other Government & Commercial		38.41	5.26															32.38	.6
																		43.67	.7

CONTRIBUTIONS TO NET SUPPLY

	10^3 TOE	%	%
Petroleum direct	1039.17	17.8	78.4
Petroleum for electricity	37.94	.6	2.8
Total petroleum	1077.11	18.4	81.2
Coal	92.79	1.6	7.0
Total imported	1.169.90	20.0	88.2
Hydro electric	155.81	2.7	11.8
Total Commercial	1.325.71	22.7	100.
Bio mass	4 509.32	77.3	
Grand total	5.835.03	100	

Table 2- SRI LANKA ENERGY BALANCE 1987 (in original units) CORRECTED FOR ERRORS ONLY

	Hydro Generation (GWh)	Elect themal equiv. (GWh)	LPG/ fuel gas ('000 MT)	Super petrol ('000 MT)	Naptha ('000 MT)	Av gas ('000 MT)	Kerosene ('000 MT)	Avtur ('000 MT)	Disolene ('000 MT)	Fuel oil ('000 MT)	Residual ('000 MT)	Other petroleum Products ('000 MT)	Coal ('000 MT)	Commercial bagasse ('000 MT)	Fuelwood & other biomass ('000 MT)	Commercial charcoal ('000 MT)	Crude oil ('000 MT)
01. Production of primary Energy	2177.367					0.205		43.984	207.513			3.286	131.873		132.470	10076.590			
02. Imports			2.200														1682.001
03. Direct Export				-0.125	-113.246	-0.001			-3.440	-40.786						-28.122	
04. Foreign Bunkers Aviation						-0.015		-64.872	-53.691	-386.563							
05. Stock Change			1.572	-1.162	-0.108	0.053	-1.178	-11.398	5.140	-4.377	-1.944	4.546	0.686			-6.350	24.404
06. Total Energy Requirement	2177.367		3.772	-1.287	-113.354	0.242	-1.178	-32.286	155.522	-431.726	-1.944	7.832	132.559	132.470	10076.590	-34.472	1707.205
07. Energy Conversion Transsformation																	
7.1 Petroleum Refineries			54.457	131.171	117.582		152.592	71.149	494.438	552.903	76.415	36.754					-1707.205
7.1 Electric Power Plants (hydro)	-2177.367	2177.367															
7.3 Electric power plants (thermal)		530.147							-116.000		-4.702						
7.4 Charcoal production (wood &shell)															-180.100	38.945	
08. Transfers																	
09. Consumption of energy sector																	
9.1 Own use		-15.514	-36.324								-32.769						
9.2 Losses		-16.790															
10. Losses in transport & distribution		-422.367		-1.010	-4.228		-0.985	-0.200	-2.010	-0.640							
Available after conversion		2252.843	18.133	130.161	113.354		151.607	70.949	376.428	552.263	1.944	36.754			-180.100	38.945	-1707.205
11. Consumption for non energy usages												-44.586					
12. Net supply		2252.843	21.905	128.874		0.242	150.429	38.663	531.950	120.537			132.559	132.470	9896.490	4.473	
13. Final consumption		2252.843	21.905	128.874		0.242	150.429	38.663	531.950	120.537			132.559	132.470	9896.490	4.473	
13.1 Industry		865.923								120.238			131.873	132.470	882.530	2.060	
13.1.1 Agro industry							20.224		16.000						791.800		
13.2 Transport																	
13.2.1 Road				128.769					471.019								
13.2.2 Rail									26.795	0.299			0.686				
13.2.3 Air						0.242		38.663									
13.2.4 Inland and coastal waterways									1.905								
13.3 Household & Agriculture																	
13.3.1 Rural, urban, estate household		940.293	16.945				116.685								8222.160	0.836	
13.3.2 Agriculture				0.105			13.520		16.231							1.577	
13.4 Other Government & Commercial		446.627	4.960														

C1

Table 1- SRI LANKA ENERGY BALANCE 1987 (units: Thousand Tons of Oil Equivalent TOE) CORRECTED FOR ERRORS AND HYDRO CONVERSION

	Hydro Elect.	Electricity	LPG/fuel gas	Super petrol	Naptha	Av gas	Kerosene	Avtur	Diesel	Fuel oil	Residual	Other Petro. Products	Coal	Commercial Baggase	Fuelwood & other biomass	Commercial charcoal	Crude oil	Total Energy input	%
		307/twh	1.06/mt	1.49/mt	1.09/mt	1.89/mt	1.65/mt	1.05/mt	1.05/mt	.98/mt	.98/mt	.91/mt	.7/mt	.4/mt	.45/mt	.65/mt	1.03/mt		
1. Production of primary Energy		668.10				0.22		46.18	21.89			2.92	92.31	52.99	4534.47		1733.28	2095.14	31.4
2. Imports			2.33						- 3.41	-39.97						-18.28		-185.44	- 2.8
3. Direct Export				-0.14	-123.44	0.00			- 56.35	-378.83								-503.35	- 7.5
4. Foreign Bunkers and Aviation						-0.02		-68.11	5.40										
5. Stock Change			1.67	-1.27	-0.12	0.06	- 1.24	-11.97		-4.29	-1.91	4.05	0.48			-4.12	25.14	11.88	.2
6. Total Energy Requirement		668.10	4.00	-1.41	-123.56	0.26	- 1.24	-33.90	163.30	-423.09	-1.91	6.97	92.79	52.99	4534.47	-22.40	1758.42	6673.79	100
7. Energy Conversion/Transformation																			
7.1 Petroleum Refineries			57.72	142.98	128.16		160.22	74.71	514.6	541.84	74.89	32.71					-1758.42	-26.03	.4
7.2 Electric Power Plants (hydro)																			
7.3 Electric power plants (thermal) 29%		162.67							- 121.80		-40.87								
7.4 Charcoal production (wood & shell)															-81.05	25.31		-55.74	.9
8. Transfers																			
9. Consumption of Energy sector											-32.11							- 75.37	1.1
9.1 On use		- 4.76	-38.50															- 5.15	.1
9.2 Losses		- 5.15																- 134.28	2.1
10. Losses in transport & distribution		- 129.60		-1.10	-4.60		-1.03	-0.21	- 2.4	-0.63									
Available after conversion		23.16	19.22	141.88	123.56		159.19	74.50	345.25	541.21	1.91	32.71			-81.05	25.31	-1758.42	- 301.57	4.5
11. Consumption for non Energy usage												-39.68						-39.68	.6
12. Net supply		691.26	23.22	140.47		0.26	157.95	40.60	558.	118.12			92.79	52.99	4453.42	2.91		6332.54	94.9
		691.26	23.22	140.47		0.26	157.95	40.60	558	118.12			92.79	52.99	4453.42	2.91		6332.54	100
13. Final consumption		265.703								117.83			92.31	52.99	397.14	1.34		927.31	14.7
13.1 Industry							21.23		16.80						356.31			394.34	6.2
13.1.1 Agro industry																			
13.2 Transport									494.57									634.93	10.0
13.2.1 Road				140.36					28.14				0.48					28.62	.5
13.2.2 Rail									2.00									2.00	
13.2.3 Inland and Coastal waterways																			
13.2.4 Air						0.26		40.60		0.29								41.15	.7
13.3 Household & Agriculture																			
13.3.1 Rural, urban, estate household		288.52	17.96				122.52								3699.97	0.54		4129.51	65.2
13.3.2 Agriculture				0.11			14.20		17.04							1.03		32.38	.5
13.4 Other Government & Commercial		137.04	5.26															142.30	2.2

CONTRIBUTIONS TO NET SUPPLY	10^3 TOE	%	%
Petroleum direct	1039.17	16.4	57.0
Petroleum via electricity	135.35	2.1	7.4
Total petroleum	1174.52	18.5	64.4
Coal	92.79	1.5	5.1
Total imported	1267.31	20.0	69.5
Hydro electricity	555.91	8.8	30.5
Total Commercial	1823.22	28.8	100.
	4509.32	71.2	

Table 2- SRI LANKA ENERGY BALANCE 1987 (in original units) CORRECTED FOR ERRORS

	Hydro Generation (GWh)	Elect thermal equiv. (GWh)	LPG/ fuel gas ('000 MT)	Super petrol ('000 MT)	Naptha ('000 MT)	Av gas ('000 MT)	Kerosene ('000 MT)	Avtur ('000 MT)	Disolene ('000 MT)	Fuel oil ('000 MT)	Residual ('000 MT)	Other petroleum Products ('000 MT)	Coal ('000 MT)	Commercial baggase ('000 MT)	Fuelwood & other biomass ('000 MT)	Commercial charcoal ('000 MT)	Crude
01. Production of primary Energy	2177.367													132.470	10076.590		
02. Imports			2.200			0.205		43.984	207.513			3.286	131.873				160
03. Direct Export				-0.125	-113.246	-0.001			-3.440	-40.786						-28.122	
04. Foreign Bunkers Aviation						-0.015		-64.872	-53.691	-386.563							
05. Stock Change			1.572	-1.162	-0.108	0.053	-1.178	-11.398	5.140	-4.377	-1.944	4.546	0.686			-6.350	24
06. Total Energy Requirement	2177.367		3.772	-1.287	-113.354	0.242	-1.178	-32.286	155.522	-431.726	-1.944	7.832	132.559	132.470	10076.590	-34.472	1701
07. Energy Conversion Transsformation																	
7.1 Petroleum Refineries			54.457	131.171	117.582		152.592	71.149	494.438	552.903	76.415	36.754					-170
7.1 Electric Power Plants (hydro)	-2177.367	2177.367															
7.3 Electric power plants (thermal)		530.147							-116.000		-41.702						
7.4 Charcoal production (wood &shell)															-180.100	38.945	
08. Transfers																	
09. Consumption of energy sector																	
9.1 Own use		-15.514	-36.324								-32.769						
9.2 Losses		-16.790															
10. Losses in transport & distribution		-422.367		-1.010	-4.228		-0.985	-0.200	-2.010	-0.640							
Available after conversion		2252.843	18.133	130.161	113.354		151.607	70.949	376.428	552.263	1.944	36.754			-180.100	38.945	-170
11. Consumption for non energy usages												-44.586					
12. Net supply		2252.843	21.905	128.874		0.242	150.429	38.663	531.950	120.537			132.559	132.470	9896.490	4.473	
13. Final consumption		2252.843	21.905	128.874		0.242	150.429	38.663	531.950	120.537			132.559	132.470	9896.490	4.473	
13.1 Industry		865.923								120.238			131.873	132.470	882.530	2.060	
13.1.1 Agro industry							20.224		16.000						791.800		
13.2 Transport																	
13.2.1 Road				128.769					471.019								
13.2.2 Rail									26.795	0.299			0.686				
13.2.3 Air						0.242		38.663									
13.2.4 Inland and coastal waterways									1.905								
13.3 Household & Agriculture																	
13.3.1 Rural, urban, estate household		940.293	16.945				116.685								8222.160	0.836	
13.3.2 Agriculture				0.105			13.520		46.231							1.577	
13.4 Other Government & Commercial		446.627	4.960														

Comments from Mrs. Renuka Mel - Author "Sri Lanka Energy Balance 1987", SLEMA Journal Volume 2 No. 2, March 1989. Additional comments from Mr. A. Abeywardane.

(1) The observations of Mr. Diandas' about the omission of diesel column in table 1 and the minor errors are accepted. These errors have been corrected and the revised tables are published in this issue of the Journal.

(2) I thank Mr. Diandas for his interest in providing a discussion about the method in which hydro electricity is converted to heat units. The suggested modifications are to the figures in the 1st and 2nd data columns in tables 1 and 2. Our tabulation format includes 2 columns to represent the electricity in the country. Mr. Diandas proposes a single column. In our format, the first column indicates hydro electricity input for the country and the 2nd column, as it is labelled, indicates the thermal equivalent of electricity. In a single column labelled "Electricity", Mr. Diandas has included both hydro and thermal electricity, using a common conversion factor of 307 TOE/GWh, reflecting an efficiency of 28%.

I summarise the difference between the two approaches as follows.

	Published	Mr. Diandas
Column in EB dealing with electricity	2	1
Apparent share of electricity in the total Energy	low (3%)	high (9%)
Conversion efficiency	28% thermal 36% thermal equivalent of hydro	28%
Electricity column shows	Net heat rates	Gross heat rates

Our 2-column representation of hydro electricity and its thermal equivalent, and the addition of the thermal electricity to the latter, is very similar to that used by the United Nations Statistical office. The information in Mr. Diandas' format is also available on our tables too, but the reader has to be aware of the following.

(1) The electricity column indicates only its thermal equivalent.
(2) Row 7.3 indicates the output from thermal power plants and the input each full type of each plant.

From our tables, I would calculate the ratios of each primary source as follows-

Primary Energy	TOE	%
Hydro	522	8.0
Petroleum	1317	20.2
Coal	93	1.4
Biomass	4587	70.4

I agree that if comparisons are made based on row 12 of table 1, the share of electricity will appear to be low.

I also like to point out that the primary Energy, conversion and final Energy cannot be compared unless they are compared on the same basis. Therefore, the calculations attributed to my tabulations in para 6 of Mr. Diandas's comment cannot be fair, unless the assumption is mentioned.

REVISED

Table 1- SRI LANKA ENERGY BALANCE 1987 (units- Thousand Tons of Oil Equivalent TOE)

	Hydro Elect.	Elect. Thermal equiv.	LPG/fuel gas	Super petrol	Naptha	Av gas	Kerosene	Avtur	Disolene
01. Production of primary Energy	522.57								
02. Imports			2.33			0.22		46.18	217.89
03. Direct Export				-0.14	-123.44	0.00			-3.61
04. Foreign Bunkers and Aviation						-0.02		-68.12	-56.38
05. Stock Change			1.67	-1.27	-0.12	0.06	-1.24	-11.97	-11.40
06. Total Energy Requirement	522.57		4.00	-1.41	-123.56	0.26	-1.24	-33.91	146.50
07. Energy Conversion/Transformation									
7.1 Petroleum Refineries			57.72	142.98	128.16		160.22	74.71	519.16
7.1 Electric Power Plants (hydro)	-522.57	187.25							
7.3 Electric power plants (thermal)		45.59							-121.80
7.4 Charcoal production (wood & shell)									
08. Transfers									
09. Consumption of Energy sector									
9.1 Own use		-1.33	-38.50						
9.2 Losses		-1.44							
10. Losses in transport & distribution		-36.32		-1.11	-4.60		-1.03	-0.21	-2.11
Available after conversion	-522.57	193.75	19.22	141.87	123.56	0.00	159.19	74.50	395.25
11. Consumption for non Energy usage									
12. Net supply		193.75	23.22	140.46	0.00	0.26	157.95	40.59	541.75
13. Final consumption		193.75	23.22	140.47		0.26	157.95	40.60	541.74
13.1 Industry		74.47							
13.1.1 Agro industry							21.23		
13.2 Transport									
13.2.1 Road				140.36					494.57
13.2.2 Rail									28.13
13.2.3 Inland and Coastal waterways									2.00
13.2.4 Air						0.26		40.60	
13.3 Household & Agriculture									
13.3.1 Rural, urban, estate household		80.87	17.96				122.52		
13.3.2 Agriculture				0.11			14.20		17.04
13.4 Other Government & Commercial		38.41	5.26						

(contd.)

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Table 1 (contd.)- SRI LANKA ENERGY BALANCE 1987 (units- Thousand Tons of Oil Equivalent TOE)

	Fuel oil	Residual	Other Petro. Products	Coal	Commercial Baggase	Fuelwood & other biomass	Commercial charcoal	Crude oil	Total Energy input
01. Production of primary Energy					52.99	4534.47			5110.02
02. Imports			2.92	92.31				1733.29	2095.14
03. Direct Export	-39.97						-18.28		-185.44
04. Foreign Bunkers and Aviation	-378.83								-503.35
05. Stock Change	-4.29	-1.91	4.05	0.48			-5.47	25.14	-6.27
06. Total Energy Requirement	-423.09	-1.91	6.97	92.79	52.99	4534.47	-23.75	1758.43	6510.11
07. Energy Conversion/Transformation									
7.1 Petroleum Refineries	541.84	74.89	32.71					-1758.42	-26.03
7.1 Electric Power Plants (hydro)									-335.32
7.3 Electric power plants (thermal)		-40.87							-117.08
7.4 Charcoal production (wood & shell)						-81.00	25.31		-55.69
08. Transfers									0.00
09. Consumption of Energy sector									0.00
9.1 Own use		-32.11							-71.94
9.2 Losses									-1.44
10. Losses in transport & distribution	-0.63								-46.01
Available after conversion	541.21	1.91	-32.71	0.00	0.00	-81.00	25.31	-1758.42	-653.50
11. Consumption for non Energy usage			-39.68						-39.68
12. Net supply	118.12	0.00	0.00	92.79	52.99	4453.47	1.57	0.01	5816.93
13. Final consumption	118.12	0.00	0.00	92.79	52.99	4453.42	1.57		5816.88
13.1 Industry	117.83			92.31	52.99	397.14			734.74
13.1.1 Agro industry						356.31			377.54
13.2 Transport									0.00
13.2.1 Road									634.93
13.2.2 Rail				0.48					28.61
13.2.3 Inland and Coastal waterways									2.00
13.2.4 Air	0.29								41.15
13.3 Household & Agriculture									0.00
13.3.1 Rural, urban, estate household						3699.97	0.54		3921.86
13.3.2 Agriculture							1.03		32.38
13.4 Other Government & Commercial									43.67

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Table 2- SRI LANKA ENERGY BALANCE 1987 (in original units)

	Hydro Generation (GWh)	Elect thermal equiv. (GWh)	LPG/ fuel gas ('000 MT)	Super petrol ('000 MT)	Naptha ('000 MT)	Av gas ('000 MT)	Kerosene ('000 MT)	Avtur ('000 MT)	Disolene ('000 MT)
01. Production of primary Energy	2177.367								
02. Imports			2.200			0.205		43.984	207.513
03. Direct Export				-0.125	-113.246	-0.001			-3.440
04. Foreign Bunkers Aviation						-0.015		-64.872	-53.691
05. Stock Change			1.572	-1.162	-0.108	0.053	-1.178	-11.398	5.140
06. Total Energy Requirement	2177.367		3.772	-1.287	-113.354	0.242	-1.178	-32.286	155.522
07. Energy Conversion Transformation									
7.1 Petroleum Refineries			54.457	131.171	117.582		152.592	71.149	494.438
7.1 Electric Power Plants (hydro)	-2177.367	2177.367							-116.000
7.3 Electric power plants (thermal)		530.147							
7.4 Charcoal production (wood &shell)									
08. Transfers									
09. Consumption of energy sector									
9.1 Own use		-15.514	-36.324						
9.2 Losses		-16.790							
10. Losses in transport & distribution		-422.367		-1.010	-4.228		-0.985	-0.200	-2.010
Available after conversion		2252.843	18.133	130.161	113.354	0.000	151.607	70.949	376.428
11. Consumption for non energy usages									
12. Net supply		2252.843	21.905	128.874		0.242	150.429	38.663	531.950
13. Final consumption		2252.843	21.905	128.874		0.242	150.429	38.663	531.950
13.1 Industry		865.923					20.224		16.000
13.1.1 Agro industry									
13.2 Transport				128.769					471.019
13.2.1 Road									26.795
13.2.2 Rail						0.242		38.663	
13.2.3 Air									1.905
13.2.4 Inland and coastal waterways									
13.3 Household & Agriculture		940.293	16.945				116.685		16.231
13.3.1 Rural, urban, estate household				0.105			13.520		
13.3.2 Agriculture		446.627	4.960						
13.4 Other Government & Commercial									

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Table 2 (contd.) - SRI LANKA ENERGY BALANCE 1987 (in original units)

	Fuel oil	Residual	Other petroleum Products	Coal	Commercial baggase	Fuelwood & other biomass	Commercia charcoal	Crude oil
	('000 MT)	('000 MT)	('000 MT)	('000 MT)	('000 MT)	('000 MT)	('000 MT)	('000 MT)
01. Production of primary Energy					132.470	10076.590		
02. Imports			3.286	131.873				1682.801
03. Direct Export	-40.786						-28.122	
04. Foreign Bunkers Aviation	-386.563							
05. Stock Change	-4.377	-1.944	4.546	0.686			-6.350	24.404
06. Total Energy Requirement	-431.726	-1.944	7.832	132.559	132.470	10076.590	-34.472	1707.205
07. Energy Conversion Transformation								
7.1 Petroleum Refineries	552.903	76.415	36.754					-1707.205
7.1 Electric Power Plants (hydro)								
7.3 Electric power plants (thermal)		-41.702						
7.4 Charcoal production (wood &shell)						-180.100	38.945	
08. Transfers								
09. Consumption of energy sector								
9.1 Own use		-32.769						
9.2 Losses								
10. Losses in transport & distribution	-0.640							
Available after conversion	552.263	1.944	36.754			-180.100	38.945	-1707.205
11. Consumption for non energy usages			-44.586					
12. Net supply	120.537	0.000		132.559	132.470	9896.490	4.473	
13. Final consumption	120.537			132.559	132.470	9896.490	4.473	
13.1 Industry	120.238			131.873	132.470	882.530	2.060	
13.1.1 Agro industry						791.800		
13.2 Transport								
13.2.1 Road								
13.2.2 Rail	0.299			0.686				
13.2.3 Air								
13.2.4 Inland and coastal waterways								
13.3 Household & Agriculture								
13.3.1 Rural, urban, estate household						8222.160	0.836	
13.3.2 Agriculture							1.577	
13.4 Other Government & Commercial								

Table 1- SRI LANKA ENERGY BALANCE 1988 (units- Thousand Tons of Oil Equivalent TOE)

	Hydro Elect.	Elect. Thermal equiv.	LPG/fuel gas	Super petrol	Naphtha	Av gas	Kerosene	Avtur	Disolene
01. Primary Energy	623.3								
02. Imports			2.3			0.2		0.0	133.9
03. Direct Export				-0.2	-112.5	0.0			-5.3
04. Foreign Bunkers and Aviation						0.0		-53.2	-61.5
05. Stock Change			1.8	0.8	7.8	0.1	-2.7	9.8	-1.6
06. Total Energy Requirement	623.3		4.1	0.6	-104.7	0.2	-2.7	-43.4	65.5
07. Energy Conversion/Transformation									
7.1 Petroleum Refineries			55.3	173.2	104.7		171.0	90.0	522.2
7.1 Electric Power Plants(hydro)	-623.3	223.3							-34.3
7.3 Electric power plants (thermal)		17.3							
7.4 Charcoal production (wood & shell)									
08. Consumption of Energy sector									
8.1 Own use		-1.2	-34.1						
8.2 Losses		0.0							
09. Losses in transport & distribution		-35.5		-1.4	-0.1		-1.1	-0.3	-2.5
10. Consumption for non Energy usage									
11. Net supply		204.0	25.3	172.4	0.0	0.2	167.1	46.3	550.8
12. Final consumption		204.0	25.3	172.4	0.0	0.2	167.1	46.3	550.8
12.1 Industry		77.8							10.8
12.1.1 Agro industry									
12.2 Transport									
12.2.1 Road				172.2					518.2
12.2.2 Rail									21.9
12.2.3 Inland and Coastal waterways									
12.2.4 Air						0.2		46.3	
12.3 Household & Agriculture									
12.3.1 Rural, urban, estate household		60.6	21.4				145.2		
12.3.2 Agriculture				0.1			21.9		
12.4 Other Government & Commercial		65.6	4.0						

Table 1 (contd.)- SRI LANKA ENERGY BALANCE 1988 (units- Thousand Tons of Oil Equivalent ToE)

	Fuel oil	Residual Fuel	Other Petro. Products	Coal	Commercial Baggase	Fuelwood & other biomass	Commercial charcoal	Crude oil	Total Energy
01. Primary Energy					72.3	4544.0			5239.6
02. Imports			2.9	1.3				1954.6	2095.3
03. Direct Export	-133.9						-9.6		-261.5
04. Foreign Bunkers and Aviation	-327.3								-442.0
05. Stock Change	15.0	0.2	9.0	2.9			-15.1	-129.7	-101.6
06. Total Energy Requirement	-446.2	0.2	11.9	4.3	72.3	4544.0	-24.7	1824.9	6529.9
07. Energy Conversion/Transformation									
7.1 Petroleum Refineries	585.8	63.4	27.7					-1824.9	-31.6
7.1 Electric Power Plants(hydro)									-399.9
7.3 Electric power plants (thermal)		-23.8							-40.8
7.4 Charcoal production (wood & shell)						-55.4	25.2		-30.1
08. Consumption of Energy sector									
8.1 Own use		-39.8							-75.2
8.2 Losses									0.0
09. Losses in transport & distribution	-2.1								-43.1
10. Consumption for non Energy usage			-39.7						-39.7
11. Net supply	137.5	0.0	0.0	4.3	72.3	4488.7	0.5	0.0	5869.5
12. Final consumption	137.2	0.0	0.0	4.3	72.3	4488.7	0.5		5869.5
12.1 Industry	137.2			3.6	72.3	325.5			627.1
12.1.1 Agro industry						309.4			309.4
12.2 Transport									
12.2.1 Road									0.0
12.2.2 Rail									690.4
12.2.3 Inland and Coastal waterways				0.7					22.6
12.2.4 Air	0.0								46.6
12.3 Household & Agriculture									0.3
12.3.1 Rural, urban, estate household									
12.3.2 Agriculture						3853.8	0.5		4081.5
							0.0		22.0
12.4 Other Government & Commercial									69.6

Table 2- SRI LANKA ENERGY BALANCE 1988 (in original units)

	Hydro Generation (GWh)	Elect themal equiv. (GWh)	LPG/ fuel gas ('000 MT)	Super petrol ('000 MT)	Naptha ('000 MT)	Av gas ('000 MT)	Kerosene ('000 MT)	Avtur ('000 MT)	Disolene ('000 MT)
01. Primary Energy	2597.0								
02. Imports			2.2			0.2		0.0	127.6
03. Direct Export				-0.2	-103.2	0.0			-5.1
04. Foreign Bunkers and Aviation						0.0		-50.7	-58.6
05. Stock Change			2.7	0.7	7.2	0.1	-12.9	9.4	11.6
06. Total Energy Requirement	2597.0		4.9	0.6	-96.0	0.2	2.5	-41.3	75.5
07. Energy Conversion/Transformation									
7.1 Petroleum Refineries			52.2	158.9	96.1		162.9	85.7	497.3
7.1 Electric Power Plants(hydro)	-2597.0	2597.0							
7.3 Electric power plants (thermal)		201.7							-32.7
7.4 Charcoal production (wood & shell)									
08. Consumption of Energy sector									
8.1 Own use		-14.5	-32.2						
8.2 Losses		0.0							
09. Losses in transport & distribution		-412.3		-1.3	-0.1		-1.1	-0.3	-2.4
10. Consumption for non Energy usage									
11. Net supply		2372.0	24.9	158.1	0.0	0.2	164.3	44.1	537.7
12. Final consumption		2372.0	23.9	158.1	0.0	0.2	164.3	44.1	537.7
12.1 Industry		904.8							10.2
12.1.1 Agro industry							5.1		13.1
12.2 Transport									
12.2.1 Road				158.0					493.5
12.2.2 Rail									20.9
12.2.3 Inland and Coastal waterways									
12.2.4 Air						0.2		44.1	
12.3 Household & Agriculture									
12.3.1 Rural, urban, estate household		704.3	20.2				138.3		
12.3.2 Agriculture				0.1			20.9		
12.4 Other Government & Commercial		762.9	3.7						

	Fuel oil ('000 MT)	Residual ('000 MT)	Other petroleum Products ('000 MT)	Coal ('000 MT)	Commercial baggase ('000 MT)	Fuelwood & other biomass ('000 MT)	Commercial charcoal ('000 MT)	Crude oil ('000 MT)
01. Primary Energy					180.9	10097.8		
02. Imports			3.3	1.9				1897.7
03. Direct Export	-136.6						-14.7	
04. Foreign Bunkers and Aviation	-333.9							
05. Stock Change	17.2	0.2	10.1	4.2			-3.7	-125.9
06. Total Energy Requirement	-453.4	0.2	13.4	6.1	180.9	10097.8	-18.4	1771.8
07. Energy Conversion/Transformation								
7.1 Petroleum Refineries	597.7	64.7	31.2					-1771.8
7.1 Electric Power Plants(hydro)								
7.3 Electric power plants (thermal)	-1.9	-24.3						
7.4 Charcoal production (wood & shell)						-123.0	38.8	
08. Consumption of Energy sector								
8.1 Own use		-40.6						
8.2 Losses								
09. Losses in transport & distribution	-2.2							
10. Consumption for non Energy usage			-44.6					
11. Net supply	140.3	0.0	0.0	6.1	180.9	9974.8	20.4	0.0
12. Final consumption	140.3	0.0	0.0	6.1	180.9	9974.8	20.4	0.0
12.1 Industry	140.0			5.1	180.9	723.3	19.6	
12.1.1 Agro industry						687.5		
12.2 Transport								
12.2.1 Road								
12.2.2 Rail	0.3			1.0				
12.2.3 Inland and Coastal waterways								
12.2.4 Air								
12.3 Household & Agriculture								
12.3.1 Rural, urban, estate household						8564.0	0.8	
12.3.2 Agriculture							0.0	
12.4 Other Government & Commercial								