

OIL PALM WASTES FOR ENERGY UTILISATION IN MALAYSIA

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INTRODUCTION

- Palm oil industry generates abundant residues
 - harvesting: fronds
 - replanting : trunks and fronds, and
 - milling processes : fruit fibres, shells and empty fruit bunches

Quantity of FFB and Oil Palm Residues in Peninsular Malaysia (1990-2000)

Year	Planted Area (hectare)	Average FFB Yield tonnes/hectare	FFB Yield (mil. tonnes)	Residues (dry weight) (mil. tonnes)		Total Residues (mil. tonnes)
				Field ¹	Mill ²	
1990	1,698,498	18.53	31.47	7.92 ³	6.50	14.42
1991	1,744,615	17.85	31.14	8.14	6.43	14.57
1992	1,775,633	17.83	31.66	8.37	6.54	14.91
1993	1,831,776	20.26	37.11	8.60	7.66	16.26
1994	1,857,626	18.42	34.22	8.84	7.06	15.90
1995	1,903,171	18.93	36.03	9.09	7.44	16.53
1996	1,926,378	18.95	36.50	9.35	7.54	16.89
1997	1,956,573	19.10	37.37	9.62	7.72	17.34
1998	1,987,190	15.98	31.76	10.18	6.56	16.74
1999	2,051,595	19.61	40.22	10.44	8.31	18.60
2000	2,045,500	18.44	39.46	10.43	8.15	18.58

Palm Oil Mill Residues Based on 1000 kg of FFB

Mill Residues	Wet Weight (%)	Wet Weight (kg)	Moisture Content (%)	Dry Weight (kg) ¹
Fruit fibre	13.5%	135	42%	78
Shell	5.5%	55	7%	51
EFB	22.0%	220	65%	77

Source: A.N Ma et al, MOPGC Report, 1999

Available Energy by Types of Mill Residues

Year	Total planted area* (m. ha)	FFB yield (m.t)	Dry Weight (mil. tonnes)			Energy from residues (dry weight basis) (TJ)			Total available energy from mill residues (TJ)
			EFB	Fibre	Shell	EFB	Fibre	Shell	
1999	2.051	40.22	3.10	3.15	2.06	32,270	52,025	42,153	126,449
2000	2.045	39.46	3.04	3.09	2.02	31,657	51,037	41,352	124,045
2005*	2.089	39.74	3.06	3.11	2.03	31,888	51,408	41,653	124,950
2010*	2.135	40.62	3.13	3.18	2.08	32,590	52,541	42,571	127,701
2015*	2.181	41.49	3.20	3.25	2.12	33,292	53,673	43,488	130,452
2020*	2.229	42.41	3.27	3.32	2.17	34,025	54,854	44,445	133,323

Forecast of Generation Capacity Available at 21% Conversion Efficiency

Year	EFB		Fruit Fibre		Shells		Total electrical power from EFB, fibre and shell (MW)
	Energy content (PJ)	Electrical power (MW)	Energy content (PJ)	Electrical power (MW)	Energy content (PJ)	Electrical power (MW)	
1999	32.27	320.73	52.03	517.12	42.15	418.92	1,257
2000	31.66	314.66	51.04	507.28	41.35	410.97	1,233
2005	31.89	316.95	51.41	510.96	41.65	413.95	1,242
2010	32.59	323.91	52.54	522.19	42.57	423.1	1,269
2015	33.29	330.86	53.67	533.42	43.49	432.24	1,297
2020	34.02	338.12	54.85	545.15	44.44	441.68	1,325

Electrical Energy from Trunks and Fronds at a Conversion Efficiency of 21%

Year	Trunks	Fronds	Total electrical power from trunks and fronds (MW)
	Electrical power (MW)	Electrical power (MW)	
1997	614.82	714.5	1,329
1998	671.57	726.13	1,398
1999	685.48	749.29	1,435
2000	685.48	747.7	1,433
2005 [^]	745.71	765.89	1,512
2010 [^]	811.71	785.77	1,597
2015 [^]	883.46	805.64	1,689
2020 [^]	961.09	827.21	1,788

Excess Generation Capacity at the Mills

Year	Electrical power potential (Shells & Fibre) (MW)	Total electrical power required by mills ¹ (MW)	Excess electrical power potential (MW)	Electrical power potential (Shell, Fibre & EFB) (MW)	Total electrical power required by mills ¹ (MW)	Excess electrical power potential (MW)
1999	936	119	817	1,257	119	1,138
2000	918	116	802	1,233	116	1,117
2005	925	117	808	1,242	117	1,125
2010	945	120	825	1,269	120	1,149
2015	966	122	844	1,297	122	1,175
2020	987	125	862	1,325	125	1,200

¹ 18 kWh / tonne FFB @ 1600 h

Conclusion

- **There is enough oil palm residues to support additional 2,550 MW of generation capacity in Peninsular Malaysia in the year 2000**

Oil Palm Residues	Excess Generation Capacity (MW)
Shells & Fruit Fibre	802
Empty Fruit Bunches	315
Trunks & Fronds	1,433
Total	2,550