

## Appendix: Forecasting Methodology

---

**Jeffrey G. Brown**

**Kang Wu**

The forecasts presented in this report use a framework that allows the income elasticity of energy demand to change with income, according to a methodology developed by Medlock and Soligo (2001). The objective is to model how energy intensity changes in the major economic sectors as an economy grows.

### *The model*

---

In this model, energy consumption,  $e_{t,j}$ , in a particular time period,  $t$ , and sector of the economy,  $j$ , is a function of per-capita output,  $y_t$ , and technology,  $\tau_t$ , so

$$e_{t,j} = f(y_t, \tau_t) \quad (1)$$

Assuming that technology is a function of economic development, the function can be redefined such that

$$e_{t,j} = f(y_t, \tau(y_t)) = f^*(y_t) \quad (2)$$

It should be noted that this specification does not include energy prices. While this may introduce some bias, the availability of detailed price data is somewhat limited, so a decision was made to include a more complete panel of Asia-Pacific countries at the expense of a price variable (Medlock and Soligo 2001).

To allow for non-constant income elasticity of energy demand, it is assumed that the demand function is of the form

$$e_{t,j} = A y_t^{b_1 + b_2 \ln y_t} \quad (3)$$

A logarithmic transformation yields

$$\ln e_{t,j,i} = (\alpha_{j,i} + \theta_{t,j}) + b_1 \ln y_{t,i} + b_2 (\ln y_{t,i})^2 \quad (4)$$

The variable  $A$  has been replaced by the term  $(\alpha_{j,i} + \theta_{t,j})$ , where  $i$  represents a specific country and  $\alpha_{j,i}$  and  $\theta_{t,j}$  represent a country-specific and time-specific effect, respectively (Medlock and Soligo 2001).

Equation 4 represents the long-term relationship between energy consumption and income. The corresponding long-term income elasticity is

$$b_1 + 2b_2(\ln y_{t,i}) \quad (5)$$

which will decline as income rises, as long as  $b_1 > 0$  and  $b_2 < 0$ . This implies that per-capita energy consumption peaks at a certain level of income and then begins to decline with income, which is unlikely. It is more likely that growth in per-capita energy consumption slows as the economy continues to grow, and thus equation 5 should be considered an approximation of the relationship between energy consumption and income (Medlock and Soligo 2001).

Figure 1 illustrates a possible growth path for sectoral energy consumption in a hypothetical Asia-Pacific nation. This hypothetical growth path is derived from the forecasting framework and a set of data for Asia and the Pacific. In general, a variation of this forecasting framework provides the basis for all of the projections included in this report, unless otherwise sourced or specified.

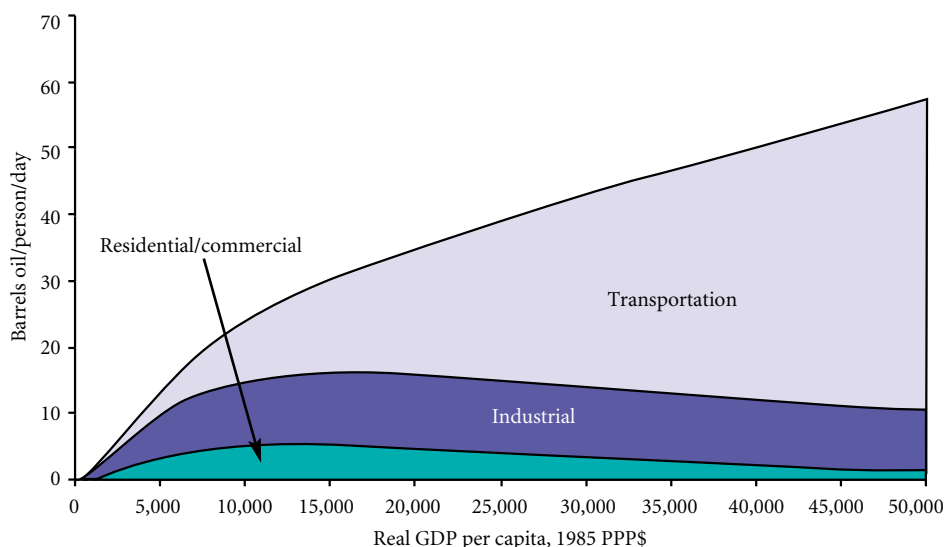
### *The Asia-Pacific data set*

The Asia-Pacific data set used to model the energy consumption path of a hypothetical country includes information from 13 countries over the period 1970 to 1998. These are Australia, Bangladesh, China, India, Indonesia, Japan, Malaysia, New Zealand, Pakistan, the Philippines, the Republic of Korea, Sri Lanka, and Thailand. The energy data are taken from the International Energy Agency (OECD/IEA 2004a; OECD/IEA 2004b), where energy consumption is defined as final energy consumption in each end-use sector (excluding biomass)—residential/commercial, transportation, and industrial. The International Energy Agency (OECD/IEA 2004a; OECD/IEA 2004b), is also the source of information on total final electricity consumption. The unit of measurement is barrels of oil equivalent per day, which is comparable across fuels and countries.

To allow comparisons across countries, a purchasing-power-parity (PPP) measure of per-capita gross domestic product (GDP) is used. This is obtained from the Penn World Tables (Summers and Heston 1995) and is denominated in 1985 international dollars. Missing data are calculated from the 1985 GDP per capita and the GDP per-capita growth rates presented by the World Bank (2003). Population data are drawn from the same source.

Future real GDP growth is forecast using projections from the International Monetary Fund and the East-West Center. This forecast is adjusted for population growth using projections from the United Nations (2002), to yield a projection of real GDP growth per capita.

Figure 1. Changes in sectoral energy consumption with growth in real GDP per capita for a hypothetical Asia-Pacific nation



Source: Authors' models.

## Appendix Tables

**Appendix Table 1.1. Annual primary commercial energy consumption from five major sources, selected Asia-Pacific countries/economies, 2005 actual and 2015 projected (thousand barrels of oil equivalent per day: boe/d), and annual percentage change**

Country/economy	Oil <sup>a</sup>			Natural gas			Coal		
	2005 (thousand boe/d)	2015 (thousand boe/d)	Annual change 2005–2015 (%)	2005 (thousand boe/d)	2015 (thousand boe/d)	Annual change 2005–2015 (%)	2005 (thousand boe/d)	2015 (thousand boe/d)	Annual change 2005–2015 (%)
Australia	794	926	1.6	470	625	2.9	1,044	1,215	1.5
Bangladesh	80	118	3.9	222	408	6.3	9	26	11.5
Brunei Darussalam	9	12	2.9	41	71	5.6	—	—	—
China	6,476	10,526	5.0	870	2,487	11.1	21,646	32,672	4.2
Democratic People's Republic of Korea	18	23	2.7	—	—	—	332	341	0.2
Hong Kong SAR <sup>b</sup>	276	335	2.0	52	103	7.1	144	141	-0.2
India	2,314	3,251	3.5	708	1,675	9.0	4,258	5,294	2.2
Indonesia	1,106	1,439	2.7	725	1,066	3.9	470	500	0.6
Japan	4,884	4,742	-0.3	1,383	1,607	1.5	2,426	2,446	0.1
Malaysia	440	601	3.2	482	570	1.7	126	161	2.5
Myanmar	36	67	6.3	23	39	5.5	1	1	0.3
Nepal	14	20	3.5	—	—	—	4	7	5.5
New Zealand	140	165	1.7	70	80	1.3	43	25	-5.2
Pakistan	348	457	2.8	549	884	4.9	82	123	4.2
Philippines	294	352	1.8	58	151	10.0	118	171	3.7
Republic of Korea	2,110	2,434	1.4	548	820	4.1	1,100	1,807	5.1
Singapore	844	1,092	2.6	105	170	5.0	—	—	—
Sri Lanka	70	112	4.8	—	—	—	1	1	0.5
Taiwan	832	1,095	2.8	224	413	6.3	763	1,001	2.8
Thailand	912	1,190	2.7	482	830	5.6	234	264	1.2
Vietnam	195	328	5.4	96	303	12.2	136	325	9.1
Other Asia-Pacific	80	110	3.2	3	4	2.0	25	27	1.0
Total Asia-Pacific	22,272	29,395	2.8	7,110	12,306	5.6	32,961	46,546	3.5
World	77,494	92,894	1.8	49,280	69,836	3.5	58,595	72,200	2.3
Share of Asia-Pacific in world (%)	28.7	31.6		14.4	17.6		56.3	64.5	

Sources: BP (2006); EIA (2006); FACTS Global Energy (2006).

Notes: Entries might not add up exactly to totals due to rounding. Data for 2015 are projections.

<sup>a</sup> Oil consumption is measured in barrels of oil equivalent per day to facilitate comparison with consumption of other energy sources. Figures for consumption of barrels of oil per day are slightly different. See Appendix Tables 3.1 and 3.2.

<sup>b</sup> Special Administrative Region.

Hydropower			Nuclear power			Total consumption		
2005 (thousand boe/d)	2015 (thousand boe/d)	Annual change 2005–2015 (%)	2005 (thousand boe/d)	2015 (thousand boe/d)	Annual change 2005–2015 (%)	2005 (thousand boe/d)	2015 (thousand boe/d)	Annual change 2005–2015 (%)
74	78	0.6	—	—	—	2,382	2,845	1.8
6	10	5.8	—	—	—	316	561	5.9
—	—	—	—	—	—	50	82	5.2
1,829	3,882	7.8	240	1,228	17.7	31,062	50,794	5.0
52	54	0.2	—	—	—	402	418	0.4
—	—	—	—	—	—	472	579	2.1
434	716	5.1	80	266	12.7	7,794	11,202	3.7
43	80	6.3	—	—	—	2,344	3,085	2.8
396	423	0.7	1,326	1,516	1.3	10,415	10,734	0.3
31	34	1.2	—	—	—	1,079	1,366	2.4
13	32	9.2	—	—	—	74	139	6.6
12	18	4.7	—	—	—	29	45	4.3
110	138	2.3	—	—	—	363	408	1.2
139	237	5.5	6	10	5.5	1,122	1,710	4.3
39	53	3.3	—	—	—	509	727	3.6
24	40	5.2	652	829	2.4	4,434	5,930	2.9
—	—	—	—	—	—	949	1,262	2.9
15	17	1.5	—	—	—	86	130	4.3
36	49	3.2	180	260	3.7	2,035	2,819	3.3
28	48	5.5	—	—	—	1,656	2,334	3.5
90	187	7.6	—	—	—	517	1,143	8.3
27	32	2.0	—	—	—	135	173	2.5
3,396	6,129	6.1	2,485	4,108	5.2	68,224	98,485	3.7
12,487	14,617	3.2	12,912	13,421	0.4	210,769	262,968	2.2
27.2	41.9		19.2	30.6		32.4	37.5	

Appendix Table 1.2. Population of Asia-Pacific countries/economies, mid-2005 actual and 2050 projected (millions)

Country/economy	Population (millions)		Country/economy	Population (millions)	
	Mid-2005	2050 projected		Mid-2005	2050 projected
<b>South Asia</b>			<b>East Asia (continued)</b>		
Afghanistan	29.9	81.9	Macao SAR <sup>a</sup>	0.5	0.5
Bangladesh	144.2	231.0	Mongolia	2.6	3.9
Bhutan	1.0	2.0	Republic of Korea	48.3	42.3
India	1,103.6	1,628.0	Taiwan	22.7	19.8
Maldives	0.3	0.5	East Asia subtotal	1,535.3	1,639.3
Nepal	25.4	47.8			
Pakistan	162.4	295.0	<b>Pacific</b>		
Sri Lanka	19.7	22.4	Australia	20.4	26.3
South Asia subtotal	1,486.5	2,308.6	Federated States of Micronesia	0.1	0.1
			Fiji	0.8	0.9
<b>Southeast Asia</b>			French Polynesia	0.3	0.4
Brunei Darussalam	0.4	0.6	Guam	0.2	0.2
Cambodia	13.3	24.6	Kiribati	0.1	0.2
Timor-Leste	0.9	3.3	Marshall Islands	0.1	0.1
Indonesia	221.9	308.4	Nauru	0.0	0.0
Lao People's Democratic Republic	5.9	11.6	New Caledonia	0.2	0.4
Malaysia	26.1	47.0	New Zealand	4.1	5.0
Myanmar	50.5	63.7	Palau	0.0	0.0
Philippines	84.8	142.2	Papua New Guinea	5.9	10.6
Singapore	4.3	5.2	Samoa	0.2	0.2
Thailand	65.0	73.2	Solomon Islands	0.5	0.9
Vietnam	83.3	115.4	Tonga	0.1	0.2
Southeast Asia subtotal	556.4	795.2	Tuvalu	0.0	0.0
			Vanuatu	0.2	0.4
<b>East Asia</b>			Pacific subtotal	33.2	46.0
China	1,303.7	1,437.0			
Democratic People's Republic of Korea	22.9	26.4	Total Asia-Pacific	3,611.4	4,789.1
Hong Kong SAR <sup>a</sup>	6.9	8.8	World	6,477.0	9,262.0
Japan	127.7	100.6	Share of Asia-Pacific in world (%)	55.8	51.7

Source: PRB (2005).

<sup>a</sup> Special Administrative Region.

Appendix Table 1.3. Annual per-capita primary commercial energy consumption from five major sources, selected Asia-Pacific countries/economies, 2005 (barrels of oil equivalent: boe)

Country/economy	Annual per-capita primary commercial energy consumption (boe)					Total
	Oil	Natural gas	Coal	Hydro-power	Nuclear power	
Australia	14.21	8.41	18.68	1.32	—	42.62
Bangladesh	0.20	0.56	0.02	0.01	—	0.80
Brunei Darussalam	7.99	37.43	—	—	—	45.43
China	1.81	0.24	6.06	0.51	0.07	8.70
Democratic People's Republic of Korea	0.29	—	5.30	0.83	—	6.41
Hong Kong SAR <sup>a</sup>	14.60	2.73	7.62	0.00	—	24.95
India	0.77	0.23	1.41	0.14	0.03	2.58
Indonesia	1.82	1.19	0.77	0.07	—	3.86
Japan	13.96	3.95	6.93	1.13	3.79	29.77
Malaysia	6.15	6.74	1.76	0.43	—	15.09
Myanmar	0.26	0.17	0.01	0.10	—	0.53
Nepal	0.20	—	0.06	0.17	—	0.42
New Zealand	12.46	6.24	3.79	9.80	—	32.29
Pakistan	0.78	1.23	0.18	0.31	0.01	2.52
Philippines	1.27	0.25	0.51	0.17	—	2.19
Republic of Korea	15.95	4.14	8.31	0.18	4.93	33.51
Singapore	71.64	8.88	—	—	—	80.52
Sri Lanka	1.29	—	0.02	0.28	—	1.59
Taiwan	13.38	3.60	12.27	0.58	2.90	32.72
Thailand	5.12	2.70	1.31	0.16	—	9.30
Vietnam	0.85	0.42	0.60	0.39	—	2.26
Others	0.47	0.02	0.14	0.15	—	0.78
Total Asia-Pacific	2.25	0.72	3.33	0.34	0.25	6.90
World	4.37	2.78	3.30	0.73	0.70	11.88

Sources: BP (2006); FACTS Global Energy (2006); PRB (2005).

Notes: Entries might not add up exactly to totals due to rounding. Calculations are based on population estimates as of mid-2005.

<sup>a</sup> Special Administrative Region.

Appendix Table 1.4. Average annual growth rate of real gross domestic product (GDP) and primary commercial energy consumption, selected Asia-Pacific countries/economies, the European Union, and the United States, 1980–2005 (percent)

Country/economy	Average annual growth rate, 1980–2005 (percent)	
	Real GDP	Primary commercial energy consumption
Australia	3.4	2.4
Bangladesh	4.5	7.2
Brunei	1.1	-0.1
China	9.6	5.3
Hong Kong SAR <sup>a</sup>	5.3	5.5
India	5.8	5.5
Indonesia	4.7	6.4
Japan	2.4	1.5
Malaysia	6.1	7.2
Myanmar	5.1	3.2
Nepal	4.5	8.6
New Zealand	2.8	2.3
Pakistan	4.9	5.9
Philippines	2.7	3.5
Republic of Korea	6.8	7.2
Singapore	6.8	6.6
Sri Lanka	4.6	4.3
Taiwan	6.3	5.7
Thailand	5.9	8.2
Vietnam	6.8	7.9
Total Asia-Pacific	4.2	4.4
European Union	2.1	0.6
United States	3.2	1.0

Sources: IMF (2006); OECD/IEA (2006); FACTS Global Energy (2006).

<sup>a</sup> Special Administrative Region.

Appendix Table 1.5. Share of primary commercial energy consumption from five major sources, selected Asia-Pacific countries/economies, 2005 (percent)

Country/economy	Share of primary commercial energy consumption (percent)					Total
	Oil	Natural gas	Coal	Hydro-power	Nuclear power	
Australia	33.3	19.7	43.8	3.1	0.0	100
Bangladesh	25.3	70.2	2.8	1.7	0.0	100
Brunei Darussalam	17.6	82.4	0.0	0.0	0.0	100
China	20.8	2.8	69.7	5.9	0.8	100
Democratic People's Republic of Korea	4.4	0.0	82.6	13.0	0.0	100
Hong Kong SAR <sup>a</sup>	58.5	11.0	30.5	0.0	0.0	100
India	29.7	9.1	54.6	5.6	1.0	100
Indonesia	47.2	30.9	20.1	1.8	0.0	100
Japan	46.9	13.3	23.3	3.8	12.7	100
Malaysia	40.8	44.7	11.7	2.8	0.0	100
Myanmar	49.6	31.1	1.4	17.9	0.0	100
Nepal	47.6	0.0	13.2	39.2	0.0	100
New Zealand	38.6	19.3	11.7	30.3	0.0	100
Pakistan	31.0	48.9	7.3	12.3	0.5	100
Philippines	57.7	11.5	23.2	7.6	0.0	100
Republic of Korea	47.6	12.4	24.8	0.5	14.7	100
Singapore	89.0	11.0	0.0	0.0	0.0	100
Sri Lanka	81.2	0.0	1.3	17.5	0.0	100
Taiwan	40.9	11.0	37.5	1.8	8.9	100
Thailand	55.1	29.1	14.1	1.7	0.0	100
Vietnam	37.7	18.5	26.3	17.4	0.0	100
Others	59.5	2.6	18.2	19.7	0.0	100
Total Asia-Pacific	32.6	10.4	48.3	5.0	3.6	100
World	36.8	23.4	27.8	5.9	6.1	100

Source: FACTS Global Energy (2006).

<sup>a</sup> Special Administrative Region.



Appendix Table 1.6. Primary commercial energy production from five major sources, selected Asia-Pacific countries/economies, 2005 (thousand barrels of oil equivalent per day: boe/d)

Country/economy	Primary commercial energy production (thousand boe/d)					Total
	Oil	Natural gas	Coal	Hydro-power	Nuclear power	
Australia	400	668	4,048	74	0	5,190
Bangladesh	7	256	0	6	0	268
Brunei Darussalam	194	216	0	0	0	410
China	3,607	900	22,154	1,829	240	28,731
India	597	548	3,992	434	80	5,651
Indonesia	1,027	1,368	1,664	43	0	4,102
Japan	13	0	0	396	1,326	1,735
Malaysia	694	1,080	4	31	0	1,808
Myanmar	25	180	0	13	0	219
New Zealand	18	66	64	110	0	258
Pakistan	60	538	32	139	6	775
Philippines	17	65	23	39	0	144
Republic of Korea	0	6	0	24	652	682
Taiwan	1	14	0	36	180	231
Thailand	150	386	118	28	0	682
Vietnam	361	92	366	90	0	909
Others	50	0	431	105	0	586
Total Asia-Pacific	7,221	6,383	32,896	3,396	2,485	52,382
World	76,965	48,668	55,020	12,487	12,912	206,053
Share of Asia-Pacific in world (%)	9.4	13.1	59.8	27.2	19.2	25.4

Source: FACTS Global Energy (2006).

Appendix Table 1.7. Share of primary commercial energy production from five major sources, selected Asia-Pacific countries/economies, 2005 (percent)

Country/economy	Share of primary commercial energy production (percent)					Total
	Oil	Natural gas	Coal	Hydro-power	Nuclear power	
Australia	7.7	12.9	78.0	1.4	0.0	100
Bangladesh	2.5	95.4	0.0	2.1	0.0	100
Brunei Darussalam	47.4	52.6	0.0	0.0	0.0	100
China	12.6	3.1	77.1	6.4	0.8	100
India	10.6	9.7	70.6	7.7	1.4	100
Indonesia	25.0	33.4	40.6	1.1	0.0	100
Japan	0.8	0.0	0.0	22.8	76.4	100
Malaysia	38.4	59.7	0.2	1.7	0.0	100
Myanmar	11.5	82.5	0.0	6.0	0.0	100
New Zealand	7.1	25.6	24.8	42.6	0.0	100
Pakistan	7.8	69.4	4.1	17.9	0.7	100
Philippines	12.0	45.3	15.9	26.8	0.0	100
Republic of Korea	0.0	0.9	0.0	3.5	95.6	100
Taiwan	0.4	5.9	0.0	15.5	78.2	100
Thailand	21.9	56.6	17.3	4.2	0.0	100
Vietnam	39.7	10.1	40.3	9.9	0.0	100
Others	8.5	0.0	73.5	18.0	0.0	100
Total Asia-Pacific	13.8	12.2	62.8	6.5	4.7	100
World	37.4	23.6	26.7	6.1	6.3	100

Sources: BP (2006); FACTS Global Energy (2006).

Appendix Table 1.8. Estimated oil, natural-gas, and coal reserves and reserve-to-production (R/P) ratios, selected Asia-Pacific countries/economies, end of 2005

Country/economy	Oil		Natural gas		Coal	
	Reserves (billion barrels)	R/P ratio <sup>a</sup> (years)	Reserves (trillion cubic feet)	R/P ratio <sup>a</sup> (years)	Reserves (million tonnes)	R/P ratio <sup>a</sup> (years)
Australia	4.0	20.0	89.0	67.9	78,500	213
Bangladesh	0.0	11.0	15.4	30.7	—	—
Brunei Darussalam	1.1	14.9	12.0	28.3	—	—
China	16.0	12.1	83.0	47.0	114,500	52
Democratic People's Republic of Korea	—	—	—	—	600	20
India	5.9	20.7	38.9	36.2	92,445	217
Indonesia	4.3	10.4	97.4	36.3	4,968	37
Japan	0.1	9.0	—	—	359	323
Malaysia	4.2	13.9	87.5	41.4	4	11
Myanmar	0.1	5.1	17.7	38.5	2	2
New Zealand	0.1	7.4	0.9	6.0	571	111
Pakistan	0.3	12.2	34.0	32.2	3,050	871
Papua New Guinea	0.2	12.2	15.1	>1,000.0	—	—
Republic of Korea	—	—	—	—	80	28
Thailand	0.5	5.2	12.5	16.5	1,354	64
Vietnam	3.1	21.8	8.3	45.6	150	5
Others	0.1	19.6	12.2	52.7	312	27
Total Asia-Pacific	40.0	14.6	523.7	41.2	296,889	92
World	1,200.7	40.6	6,348.1	65.1	909,064	155
Share of Asia-Pacific in world (%)	3.4		8.3		32.7	

Sources: BP (2006); *Oil & Gas Journal* (2005).

Note: Entries might not add up exactly to totals due to rounding.

<sup>a</sup> The reserve-to-production (R/P) ratio is the reserves remaining at the end of 2005 divided by production in 2005. The result is an estimated number of years that existing reserves can be expected to last if production continues at the same rate and no new reserves are discovered.

Appendix Table 2.1. Coal consumption in selected Asia-Pacific countries/economies (thousand barrels of oil equivalent per day: boe/d), 1980, 2005, and 2015, and average annual growth rate (percent), 1980–2005 and 2005–2015

Country/economy	Annual consumption (thousand boe/d)			Average annual growth rate (percent)	
	1980	2005	2015	1980–2005	2005–2015
Australia	522	1,044	1,215	2.8	1.5
Bangladesh	2	9	26	5.2	11.5
China	6,251	21,646	32,672	5.1	4.2
Democratic People's Republic of Korea	512	332	341	-1.7	0.2
Hong Kong SAR <sup>a</sup>	0	144	141	32.8	-0.2
India	1,142	4,258	5,294	5.4	2.2
Indonesia	6	470	500	19.1	0.6
Japan	1,152	2,426	2,446	3.0	0.1
Malaysia	1	126	161	22.3	2.5
Myanmar	3	1	1	-4.1	0.3
Nepal	1	4	7	5.0	5.5
New Zealand	20	43	25	3.0	-5.2
Pakistan	15	82	123	6.9	4.2
Philippines	7	118	171	11.8	3.7
Republic of Korea	264	1,100	1,807	5.9	5.1
Sri Lanka	0	1	1	17.6	0.5
Taiwan	78	763	1,001	9.6	2.8
Thailand	9	234	264	13.7	1.2
Vietnam	45	136	325	4.5	9.1
Others	3	25	27	8.5	1.0
Total Asia-Pacific	10,035	32,961	46,546	4.9	3.5

Sources: BP (2006); FACTS Global Energy (2006).

Note: Data for 2015 are forecasts.

<sup>a</sup> Special Administrative Region.

Appendix Table 2.2. Consumption of combustible renewable and waste energy (thousand barrels of oil equivalent per day: boe/d) and share of renewable and waste sources in total primary energy consumption (PEC) (percent), selected Asia-Pacific countries, 1980, 1990, and 2003

Country	Consumption of combustible renewable and waste energy (thousand boe/d)			Share in total PEC <sup>a</sup> (percent)		
	1980	1990	2003	1980	1990	2003
Australia	72	79	100	5	4	4
Bangladesh	113	137	160	67	53	37
China	3,599	4,008	4,379	30	22	16
India	2,963	3,516	4,224	59	48	38
Indonesia	593	746	867	53	40	27
Malaysia	32	42	52	14	9	5
Myanmar	151	180	201	80	84	74
Nepal	88	109	152	95	92	84
New Zealand	11	14	18	4	4	4
Democratic People's Republic of Korea	17	19	20	3	3	5
Pakistan	281	375	517	53	42	34
Philippines	140	153	206	36	30	24
Sri Lanka	62	78	80	63	63	46
Thailand	213	293	294	47	33	16
Vietnam	306	378	458	78	76	49
Others	125	168	319	1	1	2
Total Asia-Pacific	8,765	10,297	12,048	28	23	17

Sources: Calculated from OECD/IEA (2005a; 2005b).

Note: Entries may not add to totals exactly due to rounding.

<sup>a</sup> Primary energy consumption includes commercial and non-commercial energy.

Appendix Table 3.1. Oil production, consumption, and net surplus/deficit (thousand barrels per day: b/d) and dependence on imports (percent of total consumption), selected Asia-Pacific countries/economies, 2005

Country/economy	Production (thousand b/d)	Consumption (thousand b/d)	Net surplus/deficit (thousand b/d)	Dependence on imports (percent total consumption)
Australia	421	828	-407	49
Bangladesh	7	88	-81	92
Brunei Darussalam	199	11	188	—
China	3,617	6,431	-2,862	44
Democratic People's Republic of Korea	0	23	-23	100
Hong Kong SAR <sup>a</sup>	0	287	-287	100
India	645	2,384	-1,739	73
Indonesia	1,061	1,243	-182	15
Japan	14	5,066	-5,052	100
Malaysia	780	537	243	—
Myanmar	27	46	-19	41
Nepal	0	18	-18	100
New Zealand	20	147	-127	87
Pakistan	65	295	-230	78
Papua New Guinea	54	21	33	—
Philippines	19	299	-281	94
Republic of Korea	0	2,237	-2,237	100
Singapore	0	755	-755	100
Sri Lanka	0	88	-88	100
Taiwan	1	948	-947	100
Thailand	184	970	-786	81
Vietnam	371	246	126	—
Other Asia-Pacific	0	80	-80	100
Total Asia-Pacific	7,485	23,048	-15,611	68

Source: FACTS Global Energy (2006).

Note: Entries might not add or subtract to totals exactly due to rounding.

<sup>a</sup> Special Administrative Region.

Appendix Table 3.2. Oil consumption (thousand barrels per day: b/d), selected Asia-Pacific countries/economies, 1970–2015, and average annual increase, 1970–2005 and 2005–2015

Country/economy	Oil consumption (thousand b/d)							Average annual increase (%)	
	1970	1980	1990	2000	2005	2010	2015	1970–2005	2005–2015
Australia	469	601	660	762	828	895	966	1.6	1.6
Bangladesh	13	31	36	64	88	107	130	5.5	3.9
Brunei Darussalam	1	4	6	9	11	13	15	6.1	2.9
China	545	1,614	2,205	4,565	6,431	8,549	10,434	7.3	5.0
Democratic People's Republic of Korea	14	49	43	20	23	25	29	1.4	2.7
Hong Kong SAR <sup>a</sup>	73	126	135	245	287	327	349	4.0	2.0
India	390	616	1,119	2,158	2,384	2,848	3,350	5.3	3.5
Indonesia	149	405	603	1,051	1,243	1,398	1,617	6.3	2.7
Japan	4,126	4,896	5,174	5,427	5,066	4,961	4,918	0.6	-0.3
Malaysia	81	158	264	460	537	637	732	5.6	3.2
Myanmar	19	25	13	35	46	66	85	2.6	6.3
Nepal	1	2	5	15	18	21	25	8.5	3.5
New Zealand	78	86	99	126	147	161	173	1.8	1.7
Pakistan	62	98	205	364	295	339	388	4.6	2.8
Papua New Guinea	3	8	17	20	21	24	27	5.6	2.4
Philippines	145	196	208	329	299	329	359	2.1	1.8
Republic of Korea	173	505	1,021	2,156	2,237	2,431	2,581	7.6	1.4
Singapore	78	173	407	642	755	907	977	6.7	2.6
Sri Lanka	24	30	31	73	88	114	141	3.8	4.8
Taiwan	123	368	549	863	948	1,101	1,248	6.0	2.8
Thailand	104	223	401	775	970	1,093	1,266	6.6	2.7
Vietnam	125	33	53	157	246	325	414	1.9	5.4
Others	28	37	52	65	80	95	111	3.1	3.4
Total Asia-Pacific	6,825	10,284	13,308	20,382	23,048	26,766	30,335	3.5	2.8

Source: FACTS Global Energy (2006).

Note: Data for 1970–2005 are actual, and data for 2010 and 2015 are forecasts. Entries might not add up exactly to totals due to rounding.

<sup>a</sup> Special Administrative Region.

Appendix Table 3.3. Petroleum refining capacity and consumption of petroleum products  
(thousand barrels per day: b/d), selected Asia-Pacific countries/economies, 2005

Country/economy	Refining capacity at end of 2005 (thousand b/d)	Annual domestic consumption, 2005 (thousand b/d)
Australia	718	828
Bangladesh	31	88
Brunei Darussalam	12	11
China	6,459	6,431
Democratic People's Republic of Korea	69	23
India	2,651	2,384
Indonesia	1,106	1,243
Japan	4,436	5,066
Malaysia	522	537
Myanmar	57	46
New Zealand	95	147
Pakistan	272	295
Papua New Guinea	33	21
Philippines	292	299
Republic of Korea	2,579	2,237
Singapore	1,299	755
Sri Lanka	45	88
Taiwan	1,237	948
Thailand	1,049	970
Vietnam	5	246
Others	0	384
Total Asia-Pacific	22,967	23,048

Source: FACTS Global Energy (2006).

Note: Refining capacity is usually referred to in terms of crude distillation units, or CDU, and is commonly measured as barrels per calendar day.



Appendix Table 3.4. International trade in petroleum products (thousand barrels per day: b/d), selected Asia-Pacific countries/economies, 2005 and 2010 projected

Country/economy	Trade in 2005 (thousand b/d)			Trade in 2010 (thousand b/d)		
	Exports	Imports	Net surplus/deficit	Exports	Imports	Net surplus/deficit
Australia	122	206	-83	71	195	-124
China	353	849	-495	171	980	-808
India	433	257	176	1,047	126	922
Indonesia	172	478	-305	137	390	-253
Japan	157	1,054	-897	174	953	-779
Malaysia	122	142	-20	150	200	-50
Pakistan	26	106	-80	61	83	-22
Philippines	29	114	-85	20	146	-125
Republic of Korea	720	491	229	752	644	108
Singapore	1,380	963	417	1,325	1,022	303
Taiwan	321	176	145	340	230	110
Thailand	149	99	50	152	138	15
Vietnam	1	236	-235	0	190	-190
Other	43	599	-555	43	721	-678
Total Asia-Pacific	4,030	5,769	-1,740	4,443	6,016	-1,573

Source: FACTS Global Energy (2006).

Note: Data for 2005 are preliminary, and data for 2010 are forecasts.

**Appendix Table 3.5. Trend in oil demand, supply, and net imports (million barrels per day: b/d) and dependence on imports (percent), Asia-Pacific region, 2000–2010**

	2000	2002	2005	2006	2008	2010
Oil demand (million b/d) <sup>a</sup>	20.8	20.8	23.2	24.0	25.3	27.0
Oil supply (million b/d) <sup>b</sup>	7.8	7.8	7.8	8.1	8.6	8.6
Net imports (million b/d)	13.0	13.0	15.4	15.9	16.8	18.4
Dependence on imports (%)	63	62	66	66	66	68

Source: FACTS Global Energy (2006).

Note: Data for 2000 and 2002 are actual, data for 2005 are preliminary, and data for 2006–2010 are forecasts.

Entries might not add up exactly to totals due to rounding.

<sup>a</sup> Crude oil refined and consumed directly, plus non-refinery liquefied petroleum gas (LPG)/naphtha, plus net imports of petroleum products. This definition is slightly different from oil consumption.

<sup>b</sup> Crude oil plus nonrefinery LPG/naphtha produced, which is slightly higher than crude oil production alone.

**Appendix Table 3.6. Crude oil imports (million barrels per day: b/d) and share from the Middle East (percent), Asia-Pacific region, 2000–2010**

	2000	2002	2005	2006	2008	2010
Total imports (million b/d)	13.1	12.9	15.6	16.2	17.3	18.8
From Middle East	9.7	9.3	11.4	12.0	12.9	14.3
From within region	1.8	1.9	1.7	1.8	1.8	1.8
From outside region, not Middle East	1.5	1.7	2.4	2.4	2.6	2.8
Middle-East share of total (%)	74	72	73	74	75	76
Middle-East share of total outside region (%)	86	85	83	83	83	84

Source: FACTS Global Energy (2006).

Note: Data for 2000 and 2002 are actual, data for 2005 are preliminary, and data for 2006–2010 are forecasts.

Entries might not add up exactly to totals due to rounding.

Appendix Table 4.1. Natural-gas production, consumption by economic sector, imports, and exports in the Asia-Pacific region, 1975–2015 (million standard cubic feet per day: scf/d)

Year	Production (million scf/d)	Consumption (million scf/d)					Total	Imports <sup>b</sup> (million scf/d)	Exports <sup>b</sup> (million scf/d)
		Power	Industry	Residential and commercial	Transport	Other <sup>a</sup>			
1975	3,007	840	1,322	328	3	767	3,259	678	441
1980	6,712	2,374	2,163	708	6	1,214	6,465	2,263	1,788
1985	10,672	4,540	3,260	1,170	17	1,209	10,196	3,819	3,172
1990	15,091	6,683	3,981	1,821	13	2,246	14,745	5,180	4,480
1991	16,556	7,323	4,164	1,924	24	2,856	16,291	5,696	4,852
1992	17,466	7,649	4,301	2,178	25	2,998	17,151	5,978	5,225
1993	18,354	7,927	4,545	2,383	32	3,163	18,049	6,228	5,601
1994	19,638	8,957	4,785	2,535	33	3,446	19,756	6,868	6,087
1995	20,912	9,551	5,106	2,799	38	3,652	21,145	7,132	6,288
1996	22,824	10,320	5,467	3,171	48	3,921	22,926	8,116	7,268
1997	24,484	11,553	5,530	3,316	61	4,373	24,834	8,667	7,508
1998	25,365	11,981	5,891	3,388	77	4,401	25,738	8,873	7,494
1999	27,157	12,743	6,439	3,661	97	4,727	27,668	9,524	7,783
2000	27,891	13,508	6,976	3,946	125	4,546	29,100	10,149	7,851
2001	28,882	14,629	7,173	4,235	155	4,771	30,963	10,888	7,915
2002	31,072	15,762	7,602	4,450	181	4,649	32,644	11,188	8,596
2003	33,045	17,197	8,094	4,762	207	5,157	35,417	12,449	8,746
2004	34,074	18,131	8,723	5,142	238	5,234	37,468	13,201	9,370
2005	36,831	18,634	9,556	5,564	293	5,599	39,647	13,876	10,335
2010	46,903	24,151	12,235	7,716	551	6,728	51,381	18,143	12,623
2015	55,293	31,023	15,388	11,099	1,238	7,844	66,592	26,981	15,315

Source: FACTS Global Energy (2006).

Note: Data for 1975–2004 are actual, data for 2005 are preliminary, and data for 2010 and 2015 are forecasts.

<sup>a</sup> Includes agricultural use, field use, and non-specified other uses; excludes distribution losses.

<sup>b</sup> Includes imports and exports among countries within the region and to and from other regions.

Appendix Table 4.2. Average annual growth rate of natural-gas production, consumption by economic sector, imports, and exports in the Asia-Pacific region, 1975–2015 (percent)

Year	Production (percent)	Consumption (percent)					Total	Imports (percent)	Exports (percent)
		Power	Industry	Residential and commercial	Transport	Other <sup>a</sup>			
1975–1990	11.4	14.8	7.6	12.1	9.6	7.4	10.6	14.5	16.7
1990–2000	6.3	7.3	5.8	8.0	25.6	7.3	7.0	7.0	5.8
2000–2005	5.7	6.6	6.5	7.1	18.6	4.3	6.4	6.5	5.7
2005–2010	5.0	5.3	5.1	6.8	13.5	3.7	5.3	5.5	4.1
2010–2015	3.3	5.1	4.7	7.5	17.6	3.1	5.3	8.3	3.9
2005–2015	4.1	5.2	4.9	7.1	15.5	3.4	5.3	6.9	4.0

Source: FACTS Global Energy (2006).

Note: Based on actual data for 1975–2000, preliminary data for 2005, and forecasts for 2010 and 2015.

<sup>a</sup> Includes agricultural use, field use, and non-specified other uses; excludes distribution losses.

Appendix Table 4.3. Natural-gas production, consumption by economic sector, imports, and exports in selected countries/economies of the Asia-Pacific region, 2005 (million standard cubic feet per day: scf/d)

Country/economy	Production (million scf/d)	Consumption (million scf/d)					Imports (million scf/d)	Exports (million scf/d)	
		Power	Industry	Residential and commercial	Transport	Other <sup>a</sup>			Total
Australia	4,140	700	1,054	478	40	301	2,573	0	1,567
Bangladesh	1,294	574	555	163	0	2	1,294	0	0
Brunei	1,067	111	0	0	0	74	186	0	881
China	4,885	349	2,144	964	38	1,026	4,521	0	297
Hong Kong SAR <sup>b</sup>	0	282	0	0	0	0	282	297	0
India	3,090	1,357	714	103	125	1,001	3,300	588	0
Indonesia	7,457	531	1,184	325	7	1,707	3,754	0	3,703
Japan	270	5,290	1,058	1,482	0	46	7,877	7,577	0
Malaysia	6,460	2,408	695	11	8	555	3,676	250	3,076
Myanmar	978	106	46	0	0	15	168	0	810
New Zealand	366	157	140	54	1	15	366	0	0
Pakistan	3,620	1,359	1,111	619	62	280	3,431	0	0
Philippines	350	308	0	0	1	0	309	0	0
Republic of Korea	48	1,050	439	1,249	8	28	2,775	2,695	0
Singapore	0	584	44	0	0	2	631	631	0
Taiwan	53	735	88	117	1	32	973	964	0
Thailand	2,245	2,277	232	0	2	515	3,026	874	0
Vietnam	508	452	53	0	0	0	504	0	0
Total Asia-Pacific	36,831	18,634	9,556	5,564	293	5,599	39,647	13,876	10,335

Source: FACTS Global Energy (2006).

Note: Entries might not add up exactly to totals due to rounding.

<sup>a</sup> Includes agricultural use, field use, and non-specified other uses; excludes distribution losses.

<sup>b</sup> Special Administrative Region.

Appendix Table 5.1. Primary commercial energy consumption in China by source, 1980–2015 (thousand barrels of oil equivalent per day: boe/d)

Year	Primary commercial energy consumption (thousand boe/d)					Total
	Coal	Oil	Natural gas	Hydropower	Nuclear power	
1980	6,251	1,781	263	264	—	8,558
1981	6,232	1,681	235	297	—	8,445
1982	6,574	1,668	220	337	—	8,798
1983	6,961	1,706	225	391	—	9,283
1984	7,659	1,750	230	393	—	10,031
1985	8,023	1,856	236	418	—	10,534
1986	8,355	1,964	249	428	—	10,995
1987	8,917	2,096	253	453	—	11,719
1988	9,558	2,231	263	494	—	12,545
1989	9,695	2,327	275	536	—	12,832
1990	10,845	2,207	279	574	—	13,904
1991	10,442	2,419	292	566	—	13,720
1992	10,808	2,639	292	600	—	14,339
1993	11,461	2,922	306	687	7	15,383
1994	12,232	2,902	320	758	67	16,279
1995	13,303	3,149	325	863	58	17,699
1996	13,890	3,440	328	851	65	18,574
1997	13,559	3,819	347	887	65	18,679
1998	13,416	3,750	367	942	64	18,538
1999	13,081	4,089	403	923	68	18,564
2000	13,112	4,428	447	1,007	76	19,070
2001	12,747	4,539	502	1,256	79	19,123
2002	14,144	4,881	534	1,304	114	20,976
2003	17,008	5,397	600	1,284	196	24,485
2004	19,575	6,188	718	1,540	230	28,251
2005	21,646	6,476	870	1,829	240	31,062
2010	26,993	8,623	1,410	2,717	637	40,380
2015	32,672	10,526	2,487	3,882	1,228	50,794

Sources: OECD/IEA (2006); FACTS Global Energy (2006).

Note: Data for 1980–2004 are actual, data for 2005 are preliminary, and data for 2010 and 2015 are forecasts.

Appendix Table 5.2. Primary commercial energy consumption in India by source, 1980–2015 (thousand barrels of oil equivalent per day: boe/d)

Year	Primary commercial energy consumption (thousand boe/d)					Total
	Coal	Oil	Natural gas	Hydropower	Nuclear power	
1980	1,134	616	25	211	14	1,999
1981	1,277	662	34	224	14	2,211
1982	1,336	688	45	219	9	2,297
1983	1,433	720	52	226	16	2,447
1984	1,532	774	63	244	18	2,631
1985	1,623	832	77	231	23	2,786
1986	1,743	883	106	244	23	2,999
1987	1,885	941	123	215	23	3,186
1988	2,047	1,012	146	262	26	3,493
1989	2,116	1,103	178	281	21	3,698
1990	2,290	1,119	203	324	28	3,964
1991	2,469	1,210	226	329	25	4,259
1992	2,586	1,277	262	316	30	4,472
1993	2,716	1,357	259	319	24	4,676
1994	2,824	1,521	278	374	26	5,023
1995	3,013	1,638	312	329	36	5,327
1996	3,177	1,767	346	312	41	5,644
1997	3,300	1,882	409	338	46	5,975
1998	3,223	1,994	407	376	54	6,054
1999	3,384	2,132	423	365	60	6,364
2000	3,554	2,158	438	337	77	6,564
2001	3,616	2,165	475	334	88	6,678
2002	3,749	2,187	507	290	88	6,820
2003	3,878	2,227	571	341	80	7,097
2004	4,010	2,337	640	380	76	7,444
2005	4,159	2,384	708	441	80	7,772
2010	4,756	2,848	1,159	552	184	9,500
2015	5,294	3,350	1,675	728	266	11,313

Sources: OECD/IEA (2006); FACTS Global Energy (2006).

Note: Data for 1980–2004 are actual, data for 2005 are preliminary, and data for 2010 and 2015 are forecasts.

Appendix Table 5.3. Consumption of petroleum products in India, 1970–2015 (thousand barrels of oil per day: b/d)

Year	Petroleum product consumption (thousand b/d)							Total
	Liquefied petroleum gas (LPG)	Naphtha	Gasoline	Kerosene/ jet fuel	Diesel	Fuel oil <sup>a</sup>	Other	
1970	6	24	36	91	108	89	36	390
1975	11	42	30	85	152	103	29	452
1980	13	50	36	114	232	129	42	616
1981	16	69	38	124	241	131	43	662
1982	18	69	40	133	255	130	43	688
1983	22	63	43	140	272	138	42	720
1984	28	73	48	152	290	143	40	774
1985	37	72	53	162	316	146	45	832
1986	45	74	57	172	336	149	49	883
1987	52	67	64	185	367	154	51	941
1988	60	76	70	197	394	158	57	1,012
1989	69	80	79	209	436	166	63	1,103
1990	76	79	84	215	429	171	65	1,119
1991	82	80	84	212	497	170	85	1,210
1992	91	79	85	216	529	180	98	1,277
1993	96	77	89	219	561	174	141	1,357
1994	114	76	95	248	610	213	166	1,521
1995	127	86	107	258	659	230	172	1,638
1996	136	94	116	269	726	240	186	1,767
1997	148	139	120	275	769	241	190	1,882
1998	166	194	127	298	775	246	189	1,994
1999	190	242	135	300	835	238	192	2,132
2000	220	254	151	301	816	227	188	2,158
2001	233	262	161	293	789	242	185	2,165
2002	260	279	176	277	787	228	181	2,187
2003	288	272	180	275	770	232	210	2,227
2004	333	297	187	256	827	231	206	2,337
2005	359	267	199	279	831	239	210	2,384
2010	484	307	261	332	994	238	232	2,848
2015	634	376	337	388	1,168	222	225	3,350

Source: FACTS Global Energy (2006).

<sup>a</sup> Includes direct use of crude oil for power generation and industrial purposes.