

Energy Security, Energy Efficiency, and Energy Dialogue

Introduction

Energy Security

Energy security is defined by the International Energy Agency (IEA) as the secure and affordable supply of energy. Energy security is a term for the association between national security and the availability of natural resources for energy consumption.

In recent years, the challenge of climate change has resulted in the concept being refined to be *“the provision of reasonably priced, reliable and environmentally-friendly energy”*. To provide energy security is to ensure the reliable supply of energy services to consumers at a price that they can afford and in a way that does not damage the environment.

Energy security means different things in different places. This view of energy security focuses on the interests of **energy importing states** as the emphasis is upon security of supply and affordability. **Energy-exporting states** tend to emphasise security of demand. They want to ensure that they receive a fair price for their energy exports and that there will be sufficient future demand to justify investment in expensive energy projects. Thus, there is a clear difference between the interests of energy importing economies and the demands of energy exporting economies.

Energy security which has been a non-traditional security issue now plays an important role in national security of any given country. It has become one of the most important strategic challenges facing the world today.

Access to cheap energy has become essential to the functioning of modern economies. However, the uneven distribution of energy supplies among countries has led to significant vulnerabilities.

Factors of energy security include but not limited to:

1. *Affordability*. The importance of price asserted itself quickly in forums' discussion of energy security.

2. *Environmental acceptability.* Most forums about energy treat the environment and security as discrete matters to be dealt with accordingly.
3. *Durability of supply.* Security means energy flows can withstand and adapt to the interruption of supply. The threat to energy flows can take many forms. In the past few years, major disruptions have come from hurricanes, revolutions, labour strikes, war and terrorism.
4. *Diversification of source.* Durability of supply improves as the number of supplier increases. If terrorism is the main threat to energy flows, diversification lifts the number of targets terrorists must hit if they are to create general economic havoc. Less noticed in a terrorized age, although no less important, is diversification's relationship to another element of security: price. The more sellers exist of something, the less able any one seller can be to raise prices without losing customers.
5. *Sufficiency relative to demand.* Unmet need does nothing constructive for security; by raising prices, in fact, it does quite the opposite (see above on affordability).
6. *Relationship with water.* As an issue of supply security, water is at least as pressing as energy. Increasingly, the two issues are linked. Meeting the world's growing demand for fresh water requires rising amounts of energy. Meeting growing demand for energy requires rising amounts of water. Arid countries understand these relationships.
7. *Equity among nations.* Some countries have lots of oil, some lots of money, and some lots of both. Some countries have little of either but lots of hungry people. This is a security problem.
8. *Relationships among nations.* Energy trade is not just business; it is geopolitics as well.
9. *The morality of consumption.* The morality of consumption in energy security encompasses elements such as equity among nations, water, and the environment.

Energy security should consist of simultaneously improving the availability, affordability, efficiency and stewardship of energy services for end users. Availability involves diversifying the fuels and technologies in energy production and minimizing dependence on imports. Affordability means providing electricity and fuel within the income range of most consumers. Efficiency means improving the performance of equipment and lowering demand for energy. Stewardship is minimizing political,

social, and environmental hazards associated with energy production and consumption.

Energy Developments and Concerns Facing the Future of Energy

Long gone are the days when raw materials like oil and gas were considered strictly economic goods. Numerous fossil fuel-rich countries struggle with political instability, and new security risks are posed by the suspension or shortage of global energy resources. Energy supplies have been disrupted for strategic reasons (for example Russia's interruption of the gas supply to Ukraine in January 2006) and we have witnessed the use of resources as a strategic weapon by undemocratic problem states. Anti-Western energy-producer alliances have formed, for example between Venezuela and Iran, and then there is the threat of international terrorism to energy supplies. Not least, we face the global environmental problems that result from the use of fossil fuels. Climate change can cause hitherto unseen migration, as well as the outbreak of conflict over food, water, and energy.

The world economy is the key driver of energy consumption. Energy plays an important role in the national security of any given country as a fuel to power the economic and social development in individual countries. The modern world relies on a vast energy supply to fuel everything from transportation to communication, to security and health delivery systems. Energy affects commercial and political relations between countries. Energy fuels the world economy and impacts the environment. Energy influences international politics and international politics influence energy developments. Energy is crucial for reaching the Millennium Development Goals. Therefore, energy security concern is today at the top of the political agenda world-wide.

The last few years have seen increasing attention being paid to the issue of energy security. Threats to energy security include the political instability of several energy producing countries, the manipulation of energy supplies, the competition over energy sources, attacks on supply infrastructure, as well as accidents, natural disasters, rising terrorism, and dominant countries reliance to the foreign oil supply.

Foreign oil supplies are vulnerable to unnatural disruptions from in-state conflict, exporters' interests, and non-state actors targeting the supply and transportation of oil resources. The political and economic instability caused by war or other factors such as strike action can also prevent the proper functioning of the energy industry in a supplier country.

Exporters may have political or economic incentive to limit their foreign sales or cause disruptions in the supply chain. The 1973 oil embargo against the U.S. is a historical example in which oil supplies were cut off to the U.S. due to U.S. support of

Israel during the Yom Kippur War. This has also been done to apply pressure during economic negotiations such as during the Russia-Belarus energy dispute.

Terrorist attacks targeting oil facilities, pipelines, tankers, refineries, and oil fields are so common they are referred to as “industry risks”. Infrastructure for producing the resource is extremely vulnerable to sabotage. One of the worst risks to oil transportation is the exposure of the five ocean check-points, like the Iranian controlled Strait of Hormuz. Oil export revenues have also been known to be used to finance terrorist groups, like Hamas and Hizballah.

New threats to energy security have also emerged in the form of the increased world competition for energy resources due to the increased pace of industrialization in countries such as India and China. Increased competition over energy resources may also lead to the formation of security compacts to enable an equitable distribution of oil and gas between major powers. This may happen at the expense of less developed economies.

The following are concerns and fears on energy security though not limited to:

- Oil and other fossil fuel depletion (peak oil, etc)
- Reliance on foreign sources of energy
- Geopolitics (such as supporting dictatorships, rising terrorism, “stability” of nations that supply energy)
- Energy needs of poorer countries, and demands from advancing developing countries such as China and India
- Economic efficiency versus population growth debate
- Environmental issues, in particular climate change
- Renewable and other alternative energy sources

Our current energy system is based primarily on hydrocarbons or fossil fuels: coal, oil and gas. At present, these three fuels account for 80.9% of primary energy supply and the International Energy Agency (IEA) estimates that they will still account for 80% of fuels in 2030. These are finite non-renewable resources that are only found in particular parts of the world.

It is geology that determines the energy resource base (the total amount of coal, oil and gas reserves that are in existence on earth). However, not all of resource base is available to be exploited. Much of it still remains undiscovered and of that exists, not all can be developed under existing economic conditions and with current technology.

What we call **proven reserves** can be defined as those quantities that geological and engineering information indicates with reasonable certainty can be recovered in the future from known reservoirs under existing economic and operating conditions.

This means that at any moment in time there is a physical limit to how much oil, or gas or coal can be produced. In reality, increasingly it is not these 'below the ground' geological factors that limit energy production and threaten energy security; but rather the above the ground's geopolitical, economic and environmental factors that limit production.

Some industrial economies, principally the United States, have domestic access to oil. Others, such as the European powers, have to develop the capacity to develop oil abroad and transport it home. After the Second World War, the economics and geopolitics of oil and gas production have changed dramatically.

The major oil-exporting regions of the world, first and foremost the Middle East, are no longer the subject of European colonialism and are no longer under the control of the International Oil Companies. Instead, the oil rich regions are now under the control of independent states with their own national oil companies. In the case of oil, these oil rich states have created a cartel, the Organisation of Petroleum Exporting Countries (OPEC) to protect their interests.

Most recently, the collapse of the Soviet Union has resulted in the emergence of new oil and gas exporting states, such as Russia, Azerbaijan, Kazakhstan, and Uzbekistan. Equally, there are now major oil exporting states in Africa (Nigeria), Sudan, Angola and Latin America, Columbia, Ecuador and Venezuela. Many of these states have created their own national oil companies and are driving a hard bargain when it comes to allowing the international oil companies access to their reserves, a trend that energy importing states in the developed world term 'resource nationalism'.

A significant global shift in the geography of oil and gas production could also be seen away from the industrially developed north towards the so-called developing world. India and China have become the new centres of demand in the developing world, fast changing the geographic landscape of demand.

It is now recognised that the majority of the future growth in energy demand will come from the developing world, which continues to experience rapid rates of population growth, urbanisation and economic growth. The IEA predicts that between now and 2030 the developing world will account for 87% of the growth in global energy demand. All of this means that there are more states and consumers chasing a limited amount of energy production.

According to BP's 2009 Statistical Review of World Energy, 2008 was the first year when energy consumption in the developing world (non-OECD) was greater than the developed world (OECD). World primary energy consumption grew by 2.5% in 2011, roughly in line with the 10-year average. Consumption in OECD countries fell by 0.8%, the third decline in the past four years. Non-OECD consumption grew by

5.3%, in line with the 10-year average. Global consumption growth decelerated in 2011 for all fuels, as did total energy consumption for all regions.

Oil remains the world's leading fuel, at 33.1% of global energy consumption, but oil continues to lose market share for the twelfth consecutive year and its current market share is the lowest in the data set, which begins in 1965. Emerging economies particularly in Asia – China alone accounted for 71% of global energy consumption growth – accounted for all of the net growth in energy consumption, with demand in the OECD – led by a sharp decline in Japan – falling for a third time in the last four years (BP Statistical Review of World Energy 2012).

Table 1: BP Statistical Review of World Energy 2012

Oil

Proved reserves

	At end 1991	At end 2001	At end 2010	At end 2011			
	Thousand million barrels	Thousand million barrels	Thousand million barrels	Thousand million tonnes	Thousand million barrels	Share of total	R/P ratio
Australia	3.2	5.0	3.8	0.4	3.9	0.2%	21.9
Brunei	1.1	1.2	1.1	0.1	1.1	0.1%	18.2
China	15.5	15.4	14.8	2.0	14.7	0.9%	9.9
India	6.1	5.5	5.8	0.8	5.7	0.3%	18.2
Indonesia	5.9	5.1	4.2	0.6	4.0	0.2%	11.8
Malaysia	3.7	4.5	5.9	0.8	5.9	0.4%	28.0
Thailand	0.2	0.6	0.4	0.1	0.4	*	3.5
Vietnam	0.2	2.2	4.4	0.6	4.4	0.3%	36.7
Other Asia Pacific	0.9	1.1	1.2	0.1	1.1	0.1%	10.4
Total Asia Pacific	37.0	40.5	41.7	5.5	41.3	2.5%	14.0

Production

Thousand barrels daily											Change		2011 share of total
	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2011 over 2010	
Australia	757	759	664	582	580	542	559	547	518	561	484	-14.5%	0.5%
Brunei	203	210	214	210	206	221	194	175	168	172	166	-3.8%	0.2%
China	3310	3351	3406	3486	3642	3711	3742	3814	3805	4077	4090	0.3%	5.1%
India	727	753	756	773	738	762	769	767	756	827	858	3.9%	1.0%
Indonesia	1387	1289	1176	1130	1090	996	972	1003	990	1003	942	-5.6%	1.1%
Malaysia	666	698	738	762	704	667	683	688	659	642	573	-10.9%	0.7%
Thailand	191	204	236	223	265	286	305	321	331	334	345	0.8%	0.3%
Vietnam	350	354	364	427	393	358	337	315	347	320	328	2.1%	0.4%
Other Asia Pacific	194	192	195	236	287	305	321	339	329	315	300	-5.1%	0.3%
Total Asia Pacific	7786	7811	7748	7829	7904	7848	7881	7969	7903	8251	8086	-2.0%	9.7%

Consumption

Thousand barrels daily											Change		2011 share of total
	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2011 over 2010	
Australia	839	839	844	855	886	918	925	936	931	956	1003	5.7%	1.1%
Bangladesh	80	80	81	82	93	87	92	94	100	102	104	2.2%	0.1%
China	4859	5262	5771	6738	6944	7437	7817	7937	8212	9251	9758	5.5%	11.4%
China Hong Kong SAR	243	267	269	313	285	305	324	293	334	361	363	1.0%	0.4%
India	2288	2376	2420	2574	2567	2571	2835	3068	3267	3332	3473	3.9%	4.0%
Indonesia	1138	1184	1210	1278	1263	1234	1271	1263	1316	1426	1430	-1.1%	1.6%
Japan	5392	5319	5410	5243	5327	5182	5007	4809	4381	4413	4418	0.5%	5.0%
Malaysia	479	520	511	529	520	536	596	592	593	606	608	0.7%	0.7%
New Zealand	132	139	144	150	150	152	154	153	147	150	148	-1.5%	0.2%
Pakistan	365	356	319	324	311	354	385	386	412	410	408	-0.2%	0.5%
Philippines	345	330	329	336	314	284	301	266	282	265	256	-3.6%	0.3%
Singapore	706	690	660	739	817	865	941	990	1067	1154	1192	3.3%	1.5%
South Korea	2266	2320	2340	2294	2312	2320	2399	2308	2339	2392	2397	-0.1%	2.6%
Taiwan	939	957	998	1043	1053	1043	1096	992	987	1028	951	-7.5%	1.1%
Thailand	797	848	911	981	1016	1012	1023	1004	1042	1052	1080	2.2%	1.2%
Vietnam	186	205	220	263	258	254	283	300	304	329	358	8.9%	0.4%
Other Asia Pacific	289	292	300	312	314	320	335	328	333	337	353	4.5%	0.4%
Total Asia Pacific	21343	21983	22738	24053	24429	24875	25783	25720	26047	27563	28301	2.7%	32.4%

Production

Million tonnes	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Change 2011 over 2010	2011 share of total
Australia	34.5	34.3	29.7	25.9	25.6	23.8	24.7	24.4	22.6	24.6	21.0	-14.5%	0.5%
Brunei	9.9	10.2	10.5	10.3	10.1	10.8	9.5	8.5	8.2	8.4	8.1	-3.8%	0.2%
China	164.8	166.9	169.6	174.1	181.4	184.8	186.3	190.4	189.5	203.0	203.6	0.3%	5.1%
India	34.1	35.2	35.4	36.3	34.6	35.8	36.1	36.1	35.4	38.9	40.4	3.9%	1.0%
Indonesia	67.9	63.0	57.3	55.2	53.1	48.9	47.5	49.0	47.9	48.3	45.6	-5.6%	1.1%
Malaysia	31.2	32.6	34.4	35.5	32.6	30.9	31.7	32.1	30.6	29.8	26.6	-10.9%	0.7%
Thailand	7.5	8.2	9.6	9.1	10.8	11.8	12.5	13.3	13.7	13.8	13.9	0.8%	0.3%
Vietnam	17.1	17.3	17.7	20.8	19.1	17.4	16.4	15.4	16.9	15.5	15.9	2.1%	0.4%
Other Asia Pacific	8.9	8.8	8.9	10.4	12.3	13.0	13.9	14.7	14.2	13.6	13.0	-5.1%	0.3%
Total Asia Pacific	375.9	376.5	373.1	377.6	379.7	377.1	378.6	383.8	379.0	396.1	388.1	-2.0%	9.7%

Consumption

Million tonnes	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Change 2011 over 2010	2011 share of total
Australia	38.1	38.0	38.3	39.1	40.2	41.5	41.8	42.5	42.2	43.4	45.9	5.7%	1.1%
Bangladesh	3.9	3.9	3.9	4.0	4.5	4.2	4.5	4.6	4.8	4.9	5.0	2.2%	0.1%
China	228.4	247.5	271.7	318.9	327.8	351.2	369.3	376.0	388.2	437.7	461.8	5.5%	11.4%
China Hong Kong SAR	11.8	12.9	13.0	15.4	13.8	15.0	16.1	14.6	16.6	17.9	18.1	1.0%	0.4%
India	107.0	111.3	113.1	120.2	119.6	120.4	133.4	144.1	153.7	156.2	162.3	3.9%	4.0%
Indonesia	54.1	56.2	57.3	60.5	59.5	57.8	59.3	58.7	60.6	65.2	64.4	-1.1%	1.6%
Japan	247.3	243.4	248.5	241.1	244.4	237.1	228.7	220.9	198.3	200.3	201.4	0.5%	5.0%
Malaysia	22.0	23.8	23.4	24.3	23.7	24.5	27.3	27.1	26.5	26.7	26.9	0.7%	0.7%
New Zealand	6.1	6.5	6.7	7.0	7.0	7.1	7.2	7.2	6.9	7.0	6.9	-1.5%	0.2%
Pakistan	18.3	17.9	15.8	16.0	15.3	17.6	19.2	19.3	20.6	20.5	20.4	-0.2%	0.5%
Philippines	16.5	15.6	15.5	15.9	14.8	13.3	14.1	12.3	13.1	12.2	11.8	-3.6%	0.3%
Singapore	36.4	35.5	33.9	38.1	42.3	45.1	49.0	52.0	56.1	60.5	62.5	3.3%	1.5%
South Korea	103.5	105.3	106.4	104.6	104.6	104.7	107.6	103.1	103.7	106.0	106.0	-0.1%	2.6%
Taiwan	44.2	44.9	46.7	48.9	49.3	48.6	50.4	45.1	44.3	46.3	42.8	-7.5%	1.1%
Thailand	36.2	38.7	41.6	45.1	46.2	45.5	45.6	44.2	45.6	45.8	46.8	2.2%	1.2%
Vietnam	9.0	9.8	10.5	12.5	12.2	12.0	13.3	14.1	14.1	15.1	16.5	8.9%	0.4%
Other Asia Pacific	13.9	14.0	14.3	14.9	15.0	15.3	16.0	15.7	15.9	16.0	16.7	4.5%	0.4%
Total Asia Pacific	996.5	1025.0	1060.7	1126.4	1140.2	1160.9	1202.8	1201.6	1211.2	1281.7	1316.1	2.7%	32.4%

Trade movements

Thousand barrels daily	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Change 2011 over 2010	2011 share of total
Imports													
US	11618	11357	12254	12898	13525	13612	13632	12872	11453	11689	11337	-3.0%	20.8%
Europe	11531	11895	11993	12538	13261	13461	13953	13751	12486	12094	12086	-0.1%	22.1%
Japan	5202	5070	5314	5203	5225	5201	5032	4925	4263	4567	4491	-1.7%	8.2%
Rest of World	16436	16291	17191	18651	19172	20287	22937	23078	24132	25160	26666	6.0%	48.9%
Total World	44787	44613	46752	49290	51182	52561	55554	54626	52333	53510	54580	2.0%	100.0%
Exports													
US	910	904	921	991	1129	1317	1439	1967	1947	2154	2573	19.4%	4.7%
Canada	1804	1959	2096	2148	2201	2330	2457	2498	2518	2599	2804	7.9%	5.1%
Mexico	1882	1966	2115	2070	2065	2102	1975	1609	1449	1539	1487	-3.4%	2.7%
S. & Cent. America	3143	2965	2942	3233	3528	3681	3570	3616	3748	3568	3763	5.5%	6.9%
Europe	1947	2234	2066	1993	2149	2173	2273	2023	2034	1888	2065	9.4%	3.8%
Former Soviet Union	4679	5370	6003	6440	7076	7155	8334	8184	7972	8544	8888	1.7%	15.9%
Middle East	19098	18062	18943	19630	19821	20204	19680	20128	18409	18893	19750	4.6%	36.2%
North Africa	2724	2620	2715	2917	3070	3225	3336	3260	2938	2871	1930	-32.8%	3.5%
West Africa	3182	3134	3612	4048	4358	4704	4830	4587	4364	4601	4655	1.2%	8.5%
Asia Pacific†	3914	3848	3978	4189	4243	4312	6004	5392	5631	6226	6233	0.1%	11.4%
Rest of World	1506	1551	1361	1631	1542	1359	1656	1363	1323	637	631	-0.9%	1.2%
Total World	44789	44613	46752	49290	51182	52561	55554	54626	52333	53510	54580	2.0%	100.0%

Natural gas

Proved reserves

	At end 1991	At end 2001	At end 2010	At end 2011			
	Trillion cubic metres	Trillion cubic metres	Trillion cubic metres	Trillion cubic feet	Trillion cubic metres	Share of total	R/P ratio
Australia		0.9	2.7	132.8	3.8	1.8%	83.6
Bangladesh		0.7	0.3	12.5	0.4	0.2%	17.8
Brunei		0.4	0.4	10.2	0.3	0.1%	22.5
China		1.0	1.4	107.7	3.1	1.5%	29.8
India		0.7	0.8	43.8	1.2	0.6%	26.9
Indonesia		1.8	2.6	104.7	3.0	1.4%	39.2
Malaysia		1.7	2.5	86.0	2.4	1.2%	39.4
Myanmar		0.3	0.3	7.8	0.2	0.1%	17.8
Pakistan		0.8	0.7	27.5	0.8	0.4%	19.9
Papua New Guinea		0.4	0.4	15.6	0.4	0.2%	*
Thailand		0.2	0.4	9.9	0.3	0.1%	7.6
Vietnam		†	0.2	21.8	0.6	0.3%	72.3
Other Asia Pacific		0.3	0.4	12.1	0.3	0.2%	18.9
Total Asia Pacific		9.3	13.1	592.5	16.8	8.0%	35.0

Production

Billion cubic metres	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Change 2011 over 2010	2011 share of total
Australia	32.5	32.6	33.2	35.3	37.1	38.9	40.0	38.3	42.3	45.6	45.0	-1.3%	1.4%
Bangladesh	10.7	11.4	12.3	12.8	13.8	14.9	15.9	17.0	18.5	19.9	19.9	-0.1%	0.6%
Brunei	11.4	11.5	12.4	12.2	12.0	12.6	12.3	12.2	11.4	12.3	12.8	4.2%	0.4%
China	30.3	32.7	35.0	41.5	49.3	58.6	69.2	80.3	85.3	94.8	102.5	8.1%	3.1%
India	26.4	27.6	29.5	29.2	29.6	29.3	30.1	30.5	39.2	50.8	46.1	-9.3%	1.4%
Indonesia	63.3	69.7	73.2	70.3	71.2	70.3	67.6	69.7	71.9	82.0	75.6	-7.8%	2.3%
Malaysia	46.9	48.3	51.8	53.9	61.1	63.3	64.6	64.7	64.1	62.6	61.8	-1.3%	1.9%
Myanmar	7.0	8.4	9.6	10.2	12.2	12.6	13.5	12.4	11.5	12.1	12.4	2.6%	0.4%
Pakistan	22.7	24.6	30.4	34.5	35.5	36.1	36.8	37.5	38.4	39.6	39.2	-1.2%	1.2%
Thailand	19.6	20.5	21.5	22.4	23.7	24.3	26.0	28.8	30.9	36.3	37.0	2.0%	1.1%
Vietnam	2.0	2.4	2.4	4.2	6.4	7.0	7.1	7.5	8.0	9.4	8.5	-9.2%	0.3%
Other Asia Pacific	9.5	10.9	10.7	10.1	11.1	14.6	17.4	18.3	18.6	18.1	18.3	1.0%	0.6%
Total Asia Pacific	282.4	300.6	322.0	336.4	363.1	382.4	400.5	417.1	440.3	483.6	479.1	-0.9%	14.6%

Consumption

Billion cubic metres	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Change 2011 over 2010	2011 share of total
Australia	22.0	22.4	22.4	22.8	22.2	24.4	26.6	25.5	25.2	25.7	25.6	-0.4%	0.8%
Bangladesh	10.7	11.4	12.3	12.8	13.8	14.9	15.9	17.0	18.5	19.9	19.9	-0.1%	0.6%
China	27.4	29.2	33.9	39.7	46.8	56.1	70.5	81.3	89.5	107.6	130.7	21.5%	4.0%
China Hong Kong SAR	3.0	2.9	1.8	2.7	2.7	2.9	2.7	3.2	3.1	3.8	3.1	-20.4%	0.1%
India	26.4	27.6	29.5	31.9	35.7	37.3	40.1	41.3	51.0	61.9	61.1	-1.2%	1.9%
Indonesia	31.0	32.9	35.0	32.2	33.2	33.2	31.3	33.3	37.4	40.3	37.9	-5.9%	1.2%
Japan	74.3	72.7	79.8	77.0	78.6	83.7	90.2	93.7	87.4	94.5	105.5	11.6%	3.3%
Malaysia	25.2	26.2	27.3	24.7	31.4	33.7	33.4	33.8	33.7	31.9	28.5	-10.5%	0.9%
New Zealand	5.9	5.6	4.3	3.9	3.6	3.7	4.1	3.8	4.0	4.3	3.9	-10.0%	0.1%
Pakistan	22.7	24.6	30.4	34.5	35.5	36.1	36.8	37.5	38.4	39.6	39.2	-1.2%	1.2%
Philippines	0.1	1.8	2.7	2.5	3.3	2.6	3.2	3.3	3.3	3.1	3.6	16.0%	0.1%
Singapore	0.9	3.6	4.0	5.0	6.8	7.1	8.6	8.2	8.1	8.4	8.8	4.4%	0.3%
South Korea	20.8	23.1	24.2	28.4	30.4	32.0	34.7	35.7	33.9	43.0	46.6	8.3%	1.4%
Taiwan	7.3	8.2	8.4	10.2	10.3	11.1	11.8	11.6	11.3	14.1	15.5	10.1%	0.5%
Thailand	24.8	26.9	28.6	29.9	32.5	33.3	35.4	37.4	39.2	45.1	46.6	3.3%	1.4%
Vietnam	2.0	2.4	2.4	4.2	6.4	7.0	7.1	7.5	8.0	9.4	8.5	-9.2%	0.3%
Other Asia Pacific	3.8	3.6	4.2	4.5	5.2	5.5	6.0	5.7	5.2	5.3	5.7	7.3%	0.2%
Total Asia Pacific	308.4	325.0	351.3	366.6	398.4	424.7	458.3	479.8	497.2	557.9	590.6	5.9%	18.3%

Production

Million tonnes oil equivalent	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Change 2011 over 2010	2011 share of total
Australia	29.2	29.3	29.9	31.7	33.4	35.0	36.0	34.4	38.1	41.0	40.5	-1.3%	1.4%
Bangladesh	9.7	10.3	11.1	11.5	12.4	13.4	14.3	15.3	16.6	17.9	17.9	-0.1%	0.6%
Brunei	10.3	10.3	11.1	11.0	10.8	11.3	11.0	10.9	10.3	11.1	11.5	4.2%	0.4%
China	27.3	29.4	31.5	37.3	44.4	52.7	62.3	72.3	76.7	85.4	92.3	8.1%	3.1%
India	23.8	24.8	26.6	26.3	26.7	26.4	27.1	27.5	35.3	45.8	41.5	-9.3%	1.4%
Indonesia	57.0	62.7	65.9	63.3	64.1	63.2	60.9	62.7	64.7	73.8	68.0	-7.8%	2.3%
Malaysia	42.2	43.5	46.6	48.5	55.0	57.0	58.1	58.2	57.7	56.3	55.6	-1.3%	1.9%
Myanmar	6.3	7.6	8.6	9.2	11.0	11.3	12.2	11.2	10.4	10.9	11.2	2.6%	0.4%
Pakistan	20.4	22.1	27.4	31.0	32.0	32.5	33.1	33.8	34.6	35.7	35.2	-1.2%	1.2%
Thailand	17.7	18.5	19.3	20.1	21.3	21.9	23.4	25.9	27.8	32.7	33.3	2.0%	1.1%
Vietnam	1.8	2.2	2.1	3.7	5.8	6.3	6.4	6.7	7.2	8.5	7.7	-9.2%	0.3%
Other Asia Pacific	8.5	9.8	9.6	9.1	10.0	13.2	15.7	16.5	16.7	16.3	16.4	1.0%	0.6%
Total Asia Pacific	254.2	270.5	289.8	302.8	326.8	344.2	360.4	375.4	396.2	435.2	431.2	-0.9%	14.6%

Consumption

Million tonnes oil equivalent	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Change 2011 over 2010	2011 share of total
Australia	19.8	20.2	20.2	20.5	19.9	22.0	23.9	23.0	22.7	23.1	23.0	-0.4%	0.8%
Bangladesh	9.7	10.3	11.1	11.5	12.4	13.4	14.3	15.3	16.6	17.9	17.9	-0.1%	0.6%
China	24.7	26.3	30.5	35.7	42.1	50.5	63.5	73.2	80.6	96.8	117.6	21.5%	4.0%
China Hong Kong SAR	2.7	2.6	1.7	2.4	2.4	2.6	2.5	2.9	2.8	3.4	2.7	-20.4%	0.1%
India	23.8	24.8	26.6	28.7	32.1	33.5	36.1	37.2	45.9	55.7	55.0	-1.2%	1.9%
Indonesia	27.9	29.6	31.5	29.0	29.9	29.9	28.2	30.0	33.6	36.3	34.1	-5.9%	1.2%
Japan	66.8	65.4	71.8	69.3	70.7	75.4	81.2	84.4	78.7	85.1	95.0	11.6%	3.3%
Malaysia	22.7	23.6	24.6	22.2	28.3	30.4	30.1	30.4	30.3	28.7	25.7	-10.5%	0.9%
New Zealand	5.3	5.1	3.9	3.5	3.2	3.3	3.6	3.4	3.6	3.9	3.5	-10.0%	0.1%
Pakistan	20.4	22.1	27.4	31.0	32.0	32.5	33.1	33.8	34.6	35.7	35.2	-1.2%	1.2%
Philippines	0.1	1.6	2.4	2.2	3.0	2.4	2.8	3.0	3.0	2.8	3.2	16.0%	0.1%
Singapore	0.8	3.2	3.6	4.5	6.2	6.3	7.8	7.4	7.3	7.6	7.9	4.4%	0.3%
South Korea	18.7	20.8	21.8	25.5	27.3	28.8	31.2	32.1	30.5	38.7	41.9	8.3%	1.4%
Taiwan	6.6	7.4	7.6	9.2	9.3	10.0	10.6	10.5	10.2	12.7	14.0	10.1%	0.5%
Thailand	22.3	24.2	25.7	26.9	29.3	30.0	31.8	33.6	35.3	40.6	41.9	3.3%	1.4%
Vietnam	1.8	2.2	2.1	3.7	5.8	6.3	6.4	6.7	7.2	8.5	7.7	-9.2%	0.3%
Other Asia Pacific	3.4	3.3	3.8	4.1	4.7	4.9	5.4	5.1	4.6	4.8	5.2	7.3%	0.2%
Total Asia Pacific	277.6	292.5	316.2	330.0	358.6	382.3	412.4	431.8	447.4	502.1	531.5	5.9%	18.3%

Coal

Proved reserves at end 2011

Million tonnes	Anthracite and bituminous	Sub-bituminous and lignite	Total	Share of total	R/P ratio
Australia	37100	39300	76400	8.9%	184
China	62200	52300	114500	13.3%	33
India	56100	4500	60600	7.0%	103
Indonesia	1520	4009	5529	0.6%	17
Japan	340	10	350	*	275
New Zealand	33	538	571	0.1%	115
North Korea	300	300	600	0.1%	19
Pakistan	-	2070	2070	0.2%	*
South Korea	-	126	126	*	60
Thailand	-	1239	1239	0.1%	58
Vietnam	150	-	150	*	3
Other Asia Pacific	1583	2125	3708	0.4%	88
Total Asia Pacific	159326	106517	265843	30.9%	53

Production

Million tonnes oil equivalent	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Change 2011 over 2010	2011 share of total
Australia	180.2	184.3	189.4	196.8	205.7	210.8	217.1	224.1	232.1	236.0	230.8	-2.2%	5.8%
China	809.5	853.8	1013.4	1174.1	1302.2	1406.4	1501.1	1557.1	1652.1	1797.7	1956.0	8.8%	49.5%
India	133.6	138.5	144.4	155.7	162.1	170.2	181.0	195.6	210.8	217.5	222.4	2.3%	5.6%
Indonesia	56.9	63.5	70.3	81.4	93.9	119.2	133.4	147.8	157.6	169.2	199.8	18.1%	5.1%
Japan	1.8	0.8	0.7	0.7	0.6	0.7	0.8	0.7	0.7	0.5	0.7	38.7%	*
New Zealand	2.5	2.8	3.2	3.3	3.3	3.6	3.0	3.0	2.8	3.3	3.1	-7.7%	0.1%
Pakistan	1.5	1.6	1.5	1.5	1.6	1.7	1.6	1.8	1.6	1.5	1.4	-4.1%	*
South Korea	1.7	1.5	1.5	1.4	1.3	1.3	1.3	1.2	1.1	0.9	0.9	0.1%	*
Thailand	5.6	5.7	5.3	5.6	5.8	5.3	5.1	5.0	5.0	5.1	6.0	16.7%	0.2%
Vietnam	7.5	9.2	10.8	14.7	18.3	21.8	22.4	23.0	25.2	24.6	24.9	1.1%	0.6%
Other Asia Pacific	19.9	19.6	20.3	22.1	24.9	25.3	23.9	25.6	28.5	36.3	40.2	10.8%	1.0%
Total Asia Pacific	1220.7	1281.2	1460.8	1657.3	1819.6	1966.3	2090.7	2184.8	2317.4	2492.7	2686.3	7.8%	67.9%

Consumption

Million tonnes oil equivalent	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Change 2011 over 2010	2011 share of total
Australia	48.2	51.1	49.4	50.8	53.5	56.0	54.1	54.6	54.5	43.8	49.8	13.6%	1.3%
Bangladesh	0.4	0.4	0.4	0.4	0.4	0.5	0.4	0.6	0.6	0.9	1.0	6.1%	*
China	720.8	760.4	900.2	1065.6	1186.2	1317.7	1392.5	1441.1	1579.5	1676.2	1839.4	9.7%	49.4%
China Hong Kong SAR	4.9	5.4	6.6	6.6	6.7	7.0	7.5	7.0	7.6	6.3	7.7	21.4%	0.2%
India	145.2	151.8	156.8	172.3	184.4	195.4	210.3	230.4	253.8	270.8	295.6	9.2%	7.9%
Indonesia	16.8	18.0	24.2	22.2	25.4	30.1	37.8	30.1	34.6	41.2	44.0	6.7%	1.2%
Japan	103.0	106.6	112.2	120.8	121.3	119.1	125.3	128.7	108.8	123.7	117.7	-4.8%	3.2%
Malaysia	3.0	3.6	5.3	6.6	6.9	7.3	8.8	9.8	10.6	13.8	15.0	9.2%	0.4%
New Zealand	1.4	1.4	2.0	2.1	2.3	2.2	1.7	2.1	1.6	1.4	1.4	1.9%	*
Pakistan	2.1	2.4	2.9	3.8	4.1	4.2	5.1	5.3	4.7	4.5	4.2	-5.9%	0.1%
Philippines	4.5	4.7	4.7	5.0	5.7	5.5	5.9	7.0	6.7	7.7	8.3	7.0%	0.2%
Singapore	-	-	-	-	-	-	-	-	-	-	-	-	-
South Korea	45.7	49.1	51.1	53.1	54.8	54.8	59.7	66.1	68.6	75.9	79.4	4.6%	2.1%
Taiwan	30.6	32.7	35.1	36.6	38.1	39.6	41.8	40.2	38.7	40.3	41.6	3.4%	1.1%
Thailand	8.8	9.2	9.4	10.4	11.2	12.4	14.1	15.3	14.5	15.3	13.9	-9.4%	0.4%
Vietnam	5.0	5.3	5.5	8.2	8.0	9.5	10.1	10.0	14.0	13.9	15.0	8.3%	0.4%
Other Asia Pacific	19.4	18.5	18.8	19.2	20.5	21.0	17.8	19.5	19.0	18.7	19.1	2.2%	0.5%
Total Asia Pacific	1160.0	1220.5	1384.6	1583.4	1729.5	1892.5	1993.2	2067.6	2217.8	2354.4	2553.2	8.4%	68.6%

Nuclear Energy

Consumption

Million tonnes oil equivalent	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Change 2011 over 2010	2011 share of total
Australia	-	-	-	-	-	-	-	-	-	-	-	-	-
Bangladesh	-	-	-	-	-	-	-	-	-	-	-	-	-
China	4.0	5.7	9.8	11.4	12.0	12.4	14.1	15.5	15.9	16.7	19.5	16.9%	3.3%
China Hong Kong SAR	-	-	-	-	-	-	-	-	-	-	-	-	-
India	4.3	4.4	4.1	3.8	4.0	4.0	4.0	3.4	3.8	5.2	7.3	39.6%	1.2%
Indonesia	-	-	-	-	-	-	-	-	-	-	-	-	-
Japan	72.7	71.3	52.1	64.7	66.3	69.0	63.1	57.0	65.0	66.2	36.9	-44.3%	6.2%
Malaysia	-	-	-	-	-	-	-	-	-	-	-	-	-
New Zealand	-	-	-	-	-	-	-	-	-	-	-	-	-
Pakistan	0.5	0.4	0.4	0.5	0.6	0.6	0.6	0.4	0.6	0.6	0.8	39.6%	0.1%
Philippines	-	-	-	-	-	-	-	-	-	-	-	-	-
Singapore	-	-	-	-	-	-	-	-	-	-	-	-	-
South Korea	25.4	27.0	29.3	29.6	33.2	33.7	32.3	34.2	33.4	33.6	34.0	1.1%	5.7%
Taiwan	8.0	8.9	8.8	8.9	9.0	9.0	9.2	9.2	9.4	9.4	9.5	1.2%	1.6%
Thailand	-	-	-	-	-	-	-	-	-	-	-	-	-
Vietnam	-	-	-	-	-	-	-	-	-	-	-	-	-
Other Asia Pacific	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Asia Pacific	114.8	117.7	104.6	119.0	125.2	128.7	123.3	119.7	128.2	131.7	108.0	-18.0%	18.0%

Hydroelectricity

Consumption

Million tonnes oil equivalent	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Change 2011 over 2010	2011 share of total
Australia	3.6	3.6	3.7	3.6	3.6	3.6	3.3	2.7	2.8	2.8	2.4	-15.6%	0.3%
Bangladesh	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.3	0.3	1.8%	0.1%
China	62.8	65.2	64.2	80.0	89.8	98.6	109.8	132.4	139.3	163.4	157.0	-3.9%	19.8%
China Hong Kong SAR	-	-	-	-	-	-	-	-	-	-	-	-	-
India	16.3	15.5	15.7	19.0	22.0	25.4	27.7	26.0	24.0	25.0	29.8	18.9%	3.8%
Indonesia	2.6	2.3	2.1	2.2	2.4	2.2	2.6	2.6	2.6	4.0	3.5	-12.8%	0.4%
Japan	18.6	18.9	21.1	21.1	17.9	20.4	17.5	17.5	16.4	20.6	19.2	-6.7%	2.4%
Malaysia	1.5	1.2	1.3	1.3	1.2	1.6	1.5	2.0	1.6	1.6	1.7	6.3%	0.2%
New Zealand	4.9	5.6	5.3	6.1	5.3	5.3	5.3	5.1	5.5	5.6	5.7	1.5%	0.7%
Pakistan	4.1	4.6	5.8	5.5	6.9	6.8	7.1	6.1	6.4	6.7	6.9	3.9%	0.9%
Philippines	1.6	1.6	1.8	1.9	1.9	2.2	1.9	2.2	2.2	1.8	2.1	21.0%	0.3%
Singapore	-	-	-	-	-	-	-	-	-	-	-	-	-
South Korea	0.5	0.7	1.1	1.0	0.8	0.8	0.8	0.7	0.6	0.8	1.2	40.9%	0.1%
Taiwan	1.1	0.6	0.7	0.7	0.9	0.9	1.0	0.9	0.8	0.9	0.9	-4.6%	0.1%
Thailand	1.4	1.7	1.7	1.4	1.3	1.8	1.8	1.6	1.6	1.3	1.8	47.5%	0.2%
Vietnam	4.2	4.1	4.3	4.3	3.7	4.5	5.1	5.9	6.8	6.3	6.7	7.9%	0.9%
Other Asia Pacific	5.5	5.5	6.0	6.1	6.5	7.4	8.0	8.5	8.1	8.6	8.8	2.3%	1.1%
Total Asia Pacific	128.9	131.4	135.0	154.3	164.6	181.9	193.8	214.6	219.0	249.7	248.1	-0.6%	31.3%

Renewable Energy

Other renewables consumption

Million tonnes oil equivalent	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Change 2011 over 2010	2011 share of total
Australia	0.3	0.3	0.4	0.4	0.5	0.7	0.9	1.2	1.5	1.8	2.2	23.5%	1.1%
Bangladesh	†	†	†	†	†	†	†	†	†	†	†	-	0.1%
China	0.7	0.7	0.8	0.9	1.0	1.4	1.8	3.6	6.9	11.9	17.7	48.4%	9.1%
China Hong Kong SAR	-	-	-	-	-	†	†	†	†	†	†	-	0.1%
India	0.9	1.0	1.2	1.9	2.3	3.3	4.0	4.8	6.3	7.6	9.2	20.6%	4.7%
Indonesia	1.4	1.4	1.4	1.5	1.5	1.5	1.6	1.9	2.1	2.1	2.1	-	1.1%
Japan	4.4	4.8	5.2	5.4	6.5	6.6	6.9	6.8	6.8	7.2	7.4	3.8%	3.8%
Malaysia	-	-	-	-	-	-	†	†	†	†	†	-	0.1%
New Zealand	0.8	0.8	0.7	0.8	1.0	1.0	1.1	1.3	1.6	1.8	2.0	6.8%	1.0%
Pakistan	-	-	-	-	-	-	-	-	†	†	†	-	0.1%
Philippines	2.3	2.3	2.1	2.3	2.2	2.4	2.3	2.4	2.4	2.3	2.3	1.3%	1.2%
Singapore	†	†	†	†	†	†	†	†	†	†	†	-	0.1%
South Korea	0.1	0.2	0.1	0.1	0.1	0.1	0.2	0.3	0.5	0.5	0.6	9.3%	0.3%
Taiwan	0.5	0.7	0.7	0.7	0.7	0.8	0.9	0.9	0.9	1.0	1.2	10.5%	0.6%
Thailand	0.4	0.5	0.7	0.8	0.9	0.9	1.1	1.2	1.3	1.4	1.6	10.5%	0.8%
Vietnam	-	-	-	-	-	-	-	†	†	†	†	60.0%	0.1%
Other Asia Pacific	†	†	†	†	0.1	0.1	0.1	0.1	0.1	0.1	0.1	-	0.1%
Total Asia Pacific	11.8	12.6	13.4	14.9	16.9	18.9	21.1	24.6	30.5	37.9	46.4	22.4%	23.8%

Biofuels production

Thousand tonnes oil equivalent	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Change 2011 over 2010	2011 share of total
Australia	-	-	-	4	20	54	70	110	174	246	284	15.5%	0.5%
China	4	146	396	492	622	846	901	1094	1124	1124	1149	2.2%	2.0%
India	85	91	94	99	114	134	136	161	201	177	286	61.8%	0.5%
Malaysia	-	-	-	-	-	48	110	197	197	103	97	-6.0%	0.2%
South Korea	-	1	2	4	9	39	74	140	343	491	202	-58.8%	0.3%
Thailand	-	-	-	3	52	80	138	495	618	661	915	38.4%	1.6%
Other Asia Pacific	-	-	-	-	18	78	133	270	549	726	716	-1.3%	1.2%
Total Asia Pacific	89	238	491	603	834	1280	1563	2468	3207	3528	3649	3.4%	6.2%

Primary Energy

Consumption

Million tonnes oil equivalent	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Change 2011 over 2010	2011 share of total
Australia	110.0	113.1	111.9	114.3	117.8	123.8	124.0	124.0	123.7	115.0	123.3	7.2%	1.0%
Bangladesh	14.1	14.8	15.6	16.1	17.6	18.5	19.6	20.8	22.5	24.1	24.3	0.6%	0.2%
China	1041.4	1105.8	1277.3	1512.5	1659.0	1831.9	1951.0	2041.7	2210.3	2402.9	2613.2	8.8%	21.3%
China Hong Kong SAR	19.4	20.8	21.2	24.3	22.9	24.7	26.2	24.5	27.0	27.7	28.6	3.0%	0.2%
India	297.4	308.8	317.4	345.8	364.5	382.1	415.5	445.9	487.6	520.5	559.1	7.4%	4.6%
Indonesia	102.8	107.5	116.4	115.4	118.8	121.5	129.4	123.3	133.6	148.8	148.2	-0.4%	1.2%
Japan	512.8	510.3	511.0	522.4	527.1	527.6	522.9	515.3	474.0	503.0	477.6	-5.0%	3.9%
Malaysia	49.1	52.2	54.6	54.5	60.1	63.7	67.7	69.2	69.0	70.7	69.2	-2.1%	0.6%
New Zealand	18.5	19.3	18.7	19.4	18.8	19.0	19.0	19.1	19.1	19.7	19.4	-1.3%	0.2%
Pakistan	45.5	47.4	52.4	56.8	58.9	61.8	65.1	64.8	66.9	67.9	67.6	-0.4%	0.6%
Philippines	25.1	25.8	26.5	27.4	27.6	25.9	27.1	27.0	27.3	26.7	27.7	3.5%	0.2%
Singapore	37.2	38.7	37.6	42.7	48.5	51.5	56.8	59.5	63.4	68.1	70.4	3.4%	0.6%
South Korea	193.9	203.1	209.8	213.8	220.8	222.9	231.9	236.4	237.4	255.6	263.0	2.9%	2.1%
Taiwan	91.0	95.2	99.6	105.0	107.3	108.9	113.9	106.8	104.4	110.6	109.9	-0.6%	0.9%
Thailand	69.1	74.2	79.1	84.6	88.9	90.5	94.5	95.9	98.3	104.3	106.0	1.6%	0.9%
Vietnam	19.9	21.4	22.5	28.7	29.8	32.3	34.9	36.7	42.1	43.7	45.9	5.0%	0.4%
Other Asia Pacific	42.2	41.3	43.0	44.3	46.8	48.7	47.3	48.8	47.7	48.2	49.9	3.5%	0.4%
Total Asia Pacific	2689.5	2799.8	3014.5	3328.0	3535.0	3755.2	3946.7	4059.9	4254.1	4557.6	4803.3	5.4%	39.1%

Energy Policy of Malaysia

National Energy Policy is the first Malaysia's energy policy emphasising on oil and gas resources to serve the need of energy in Malaysia. The main purpose of the policy is to ensure the availability of the energy supply and that the supplies are reasonable in price to support the nation's economy developments. The energy policy of Malaysia is determined by the Malaysian Government, which address issues of energy production, distribution, and consumption. The Department of Electricity and Gas Supply acts as the regulator while other players in the energy sector include energy supply and service companies, research and development institutions and consumers. Government-linked companies Petronas and Tenaga Nasional Berhad are major players in Malaysia's energy sector.

Governmental agencies that contribute to the policy are the Ministry of Energy, Green Technology and Water, Energy Commission (Suruhanjaya Tenaga), and the Malaysia Energy Centre (Pusat Tenaga Malaysia). Among the documents that the policy is based on are the 1974 Petroleum Development Act, 1975 National Petroleum Policy, 1980 National Depletion Policy, 1990 Electricity Supply Act, 1993 Gas Supply Acts, 1994 Electricity Regulations, 1997 Gas Supply Regulation and the 2001 Energy Commission Act.

The Ministry of Energy, Green Technology and Water has identified three principal energy objectives that would be instrumental in guiding the development of its energy sector.

Supply

To ensure the provision of adequate, secure and cost-effective energy supplies through developing indigenous energy resources both non-renewable and renewable energy resources using the latest cost options and diversification of supply sources both from within and outside the country.

In pursuit of the supply objective, policy initiatives, particularly with respect to crude oil and natural gas, we have aimed at both extending the life of domestic non-renewable energy resources, as well as diversification away from oil dependence to include other forms of energy sources.

Utilization

To promote the efficient utilization of energy and discourage wasteful and non-productive patterns of energy consumption.

The policy's approach to realize this objective is to rely heavily on the energy industry and consumers to exercise efficiency in energy production, transportation,

energy conversion, utilization and consumption through the implementation of awareness programs. Demand side management initiatives by the utilities, particularly through tariff incentives, have had some impact on efficient utilization and consumption.

Government initiatives to encourage cogeneration are also aimed at promoting an efficient method for generating heat energy and electricity from a single energy source.

Environmental

To minimize the negative impacts of energy production, transportation, conversion, utilization and consumption on the environment.

The environment objective has seen limited policy initiatives in the past. All major energy development projects are subjected to the mandatory environmental impact assessment requirement. Environmental consequences, such as emissions, discharges and noise are subjected to the environmental quality standards like air quality and emission standards.

Renewable Energy and Kyoto Protocol: Adoption in Malaysia

The Kyoto Protocol to the UNFCCC is an amendment to the international treaty signed in 1992 on climate change, assigning mandatory emission limitations for the reduction of greenhouse gas emissions to the signatory nations. The objective of the protocol is the stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Malaysia is a party to the UNFCCC and has ratified the Kyoto Protocol.

As a developing country, Malaysia has no quantitative commitments under the Kyoto Protocol at present. However, together with all other countries, Malaysia is already committed under the UNFCCC to formulate, implement, publish and regularly update national and, where appropriate, regional programmes containing measures to mitigate climate change by addressing anthropogenic emissions by sources and removals by sinks of all greenhouse gases.

Renewable Energy Policy

The Malaysian government is seeking to intensify the development of renewable energy, particularly biomass, as the 'fifth fuel' resource under the country's Fuel Diversification Policy. The policy, which was set out in 2001, had a target of renewable energy providing 5% of electricity generation by 2005, equal to between

500 and 600 megawatt (MW) of installed capacity. The policy has been reinforced by fiscal incentives, such as investment tax allowances and the Small Renewable Energy Programme (SREP), which encourages the connection of small renewable power generation plants to the national grid.

The Small Renewable Energy Program allows renewable projects with up to 10 MW of capacity to sell their electricity output to TNB, under 21-year licence agreements. Numerous applications for the program have been received, mainly involving biomass, and of these over half are for palm oil waste. In 2005 there were 28 approved biomass projects involving the installation of 194 MW of grid-connected capacity. There were also four approved landfill gas-based projects, with 9 MW of capacity, and 18 mini hydro-electric projects offering 69.9 MW of total capacity.

National Renewable Energy Policy 2010

After suffering years of market failure to promote renewable energy, Malaysia government has launched the National Renewable Energy (RE) Policy 2010 after analysing the issues which brought upon the previous failures. The vision of National RE Policy 2010 is to enhance the utilisation of indigenous RE resources to contribute towards national electricity supply security and sustainable socio-economic development. This policy consists of five objectives that embody elements of energy, industry and environmental policies, making it convergent in nature.

Five objectives under National RE Policy 2010 include:

1. To increase RE contribution in the national power generation mix.
2. To facilitate the growth of the RE industry.
3. To ensure reasonable RE generation costs.
4. To conserve the environment for future generation.
5. To enhance awareness on the role and importance of RE.

Table 2: Malaysia's key emphasis from 7 MP to 10 MP for energy development

Malaysia Plan	Key Emphasis
Seventh Malaysia Plan (1996–2000)	<p>Emphasis on sustainable development and of depletable resources and the diversification of energy resources.</p> <p>Ensuring adequacy of generating efficiency as well as expanding and upgrading the transmission and distribution infrastructures.</p> <p>Encouraged the use of new and alternative energy sources as well as efficient utilisation of energy.</p>

Eighth Malaysia Plan (2001–2005)	<p>Emphasis on the sustainable development of energy resources, both depletable and renewable. The energy mix includes five fuels: oil, gas, coal, hydro, and RE.</p> <p>Intensive efforts on ensuring adequacy, quality and security of energy supply.</p> <p>Greater emphasis on energy efficiency (EE): encourage efficient utilisation of gas and RE as well as provide adequate electricity generating capacity.</p> <p>Supports the development of industries in production of energy-related products and services.</p> <p>Highlights in promoting RE and EE:</p> <p>Incentives for EE.</p> <p>Incentives for the use of RE resources.</p> <p>Incentives to maintain quality of power supply.</p>
Ninth Malaysia Plan (2006–2010)	<p>Emphasis on strengthening initiatives for EE especially in transport, commercial and industrial sectors, and in government buildings.</p> <p>Encourage better utilisation of RE through diversify fuel sources.</p> <p>Intensify efforts to further reduce the dependency on petroleum provides for more to integrate alternative fuels.</p> <p>Incentives in promoting RE and EE are further enhanced.</p>
Tenth Malaysia Plan (2011–2015)	<p>Short term goals vested in National Green Technology Policy:</p> <p>Increased public awareness and commitment for the adoption and application of green technology through advocacy programmes.</p> <p>Widespread availability and recognition of green technology in terms of products, appliances, equipment, and systems in the local market through standards, rating and labelling programmes.</p> <p>Increased foreign and domestic direct investment in green technology manufacturing and services sector.</p> <p>Expansion of local research institutes and institutions of higher learning to expand research, development and innovation activities on green technology towards commercialization through appropriate mechanisms.</p> <p>New RE act and FiT mechanism to be launched.</p>

Source: H. Hashim, W.S. Ho / *Renewable and Sustainable Energy Reviews* 15 (2011)

To ensure the objectives of National RE Policy 2010 is met, five strategic thrusts had been identified. From the launch of the Policy, it is expected that it will bring a positive impact by year 2020. The outcome of National RE Policy 2010 is as shown in Table 3.

Table 3: National RE policy 2010 outcome

Year ending	Cum. total RE (MW)	Share of RE capacity	Annual RE generation (G W h)	RE mix	Annual CO2 avoidance (tonne)
2011	219	1%	1230	1%	848,493
2015	985	6%	5385	5%	3,715,415
2020	2080	11%	11,246	9%	7,759,474
2030	4000	17%	17,232	12%	11,889,887
2050	21,370	73%	44,208	24%	30,503,589

Source: H. Hashim, W.S. Ho / *Renewable and Sustainable Energy Reviews* 15 (2011)

Five thrusts to ensure the success of National RE Policy 2010 includes:

Thrust 1: Introduce appropriate regulatory framework.

Thrust 2: Provide conducive-environments for RE businesses.

Thrust 3: Intensify human capital development.

Thrust 4: Enhance RE research and development.

Thrust 5: Design and implement an RE advocacy programme.

Expected Impact of National RE Policy 2010 by year 2020 as is outlined below:

1. Minimum RM 2.1 billion savings of external cost to mitigate CO2 emissions (total 42 million tonnes avoided from 2011 to 2020, on the basis of RM 50 per tonne of external cost).
2. Minimum RM 19 billion of loan values for RE projects, which will provide local banks with new sources of revenues (at 80% debt financing for RE projects).
3. Minimum RM 70 billion of RE business revenues generated from RE power plants operation, which can generate tax income of minimum RM 1.75 billion to the Government.

4. 50,000 jobs created to construct, operate and maintain RE power plants (on the basis of 15–30 job per MW).

Production and Consumption

Traditionally, energy production in Malaysia has been based around oil and natural gas. Malaysia currently has 13GW of electrical generation capacity. Power generation capacity connected to the Malaysian National Grid is 19,023 MW, with a maximum demand of 13,340 MW as of July 2007 according to Suruhanjaya Tenaga. Total electricity generation for 2007 is 108,539 GW·h with a total consumption of 97,113 GW·h or 3,570 kW·h per capita. The generation fuel mix is 62.6% gas, 20.9% coal, 9.5% hydro and 7% from other forms of fuel. In 2007, the country as a whole consumes 514 thousand barrels (23.6 million tonnes) of oil daily against a production of 755 thousand barrels (34.2 million tonnes) per day.

However, Malaysia only has 33 years of natural gas reserves, and 19 years of oil reserves, whilst the demand for energy is increasing. Due to this, the Malaysian government is expanding into renewable energy sources. Currently 16% of Malaysian electricity generation is hydroelectric, the remaining 84% being thermal. The oil and gas industry in Malaysia is currently dominated by state owned Petronas, and the energy sector as a whole is regulated by Suruhanjaya Tenaga, a statutory commission who governs the energy in the peninsula and Sabah, under the terms of the Electricity Commission Act of 2001.

Energy Efficiency (EE)

Industrial consumers use about 40% of primary energy, as well as about 55% of the electricity (which consumes about 38% of primary energy) used in Malaysia. This means that industrial consumers use about 60% of the total energy used in Malaysia. The Malaysian Energy Commission has set up various energy efficiency programs.

Energy Demand in Malaysia

Oil and gas have been the main energy sources in Malaysia. However, with its gas reserves estimated to last for another 33 years and oil reserves another 19 years, the Malaysian government is strengthening the role of renewable energy (RE) as the fifth cornerstone of energy generation. Many manufacturing companies in Malaysia are already trying to save energy costs. This creates opportunities to companies offering energy management services to determine ways for saving energy and costs.

Malaysia's commercial demand for energy is projected to continue its upward trend, from 1,244 Petajoule (PJ) in 2000 to an estimated 2,218 PJ in 2010. This consumption growth is mainly driven by industrialisation. As it is common perception that a nation's economy and use of energy will always grow hand-in-hand, the Malaysian government, in its 8th Malaysian Plan (2001-2005) has declared RE as the country's fifth fuel in the energy supply mix to diversify its energy source. Currently, the energy supply mix in the country is made up of gas (70 percent), coal (22 percent), oil (2 percent) and hydro power (6 percent).

Solution for Energy Crisis and Environmental Issues

The EE strategies aim at energy saving features in the industrial and commercial sectors. In this regard, EE features such as efficient lighting and air-conditioning systems as well as encouraging the establishment of a comprehensive energy management system. Under the Malaysian Industrial Energy Efficiency Improvement Project (MIEIP), energy audits to identify ways for potential energy savings are undertaken in 11 energy-intensive industries, which are cement; ceramics; food; glass; iron and steel; pulp and paper; rubber and wood; oleo-chemical; plastic; and textile industries.

On the government front, new sources of energy such as solar and wind will be developed with emphasis on utilising cost-efficient technology as well as strengthening capacity building under the 9MP. In this regard, efforts will be undertaken to co-ordinate R&D activities of the various energy-related research centres. The government has also launched several fiscal incentives to stimulate the emergence of RE and EE activities and technologies. These incentives include pioneer status, investment tax allowance and import duty and sales tax exemption for equipment used in energy conservation. For the private sector, an increasing number of local companies are already taking advantage of RE technologies to begin reaping energy costs and revenue. It is expected that as Malaysian industry becomes increasingly aware of the bottom-line benefit of EE equipment and applications, demand for these should rise as well.

Mechanisms under Kyoto Protocol

Flexible mechanisms, also sometimes known as Flexibility Mechanisms or Kyoto Mechanisms, refers to Emissions Trading, the Clean Development Mechanism and Joint Implementation. These are mechanisms defined under the Kyoto Protocol intended to lower the overall costs of achieving its emissions targets. These mechanisms enable parties to achieve emission reductions or to remove carbon from the atmosphere cost-effectively in other countries. While the cost of limiting

emissions varies considerably from region to region, the benefit for the atmosphere is in principle the same, wherever the action is taken.

The Emissions Trading-mechanism allows parties to the Kyoto-protocol to buy greenhouse gas emission permits from other countries to help meet their domestic emission reduction targets. Through the Joint Implementation, industrialised countries with a greenhouse gas reduction commitment may fund emission reducing projects in other industrialised countries as an alternative to emission reductions in their own countries. Typically, these projects occur in countries in the former Eastern Europe.

The Clean Development Mechanism (CDM) is an arrangement under the Kyoto Protocol allowing industrialised countries with a greenhouse gas reduction commitment to invest in projects that reduce emissions in developing countries as an alternative to more expensive emission reductions in their own or other industrialised countries. The most important factor of a carbon project is that it establishes that it would not have occurred without the additional incentive provided by emission reductions credits. The CDM allows net global greenhouse gas emissions to be reduced at a much lower global cost by financing emissions reduction projects in developing countries where costs are lower than in industrialised countries.

Rapid depletion of fossil fuel reserves as well as climate change has driven the world towards renewable energy sources which are abundant, untapped and environmentally friendly. In particular biomass fuels hold great promise as a component of CDM strategies to reduce greenhouse gases (GHG) emissions to acceptable levels. The Biomass Energy Plant Lumut was the first Malaysian project to be registered at the UNFCCC as a CDM project. The first large scale CDM project to be registered from Malaysia was this project where biomass is co-fired with coal in cement kilns in two cement works in Kanthan and Rawang. The Jendarata steam and power plant and Jendarata Palm Oil Mill have the expected combined emission reduction of carbon dioxide of more than 30,000 tonnes annually. Meanwhile, a project to combust methane at Seelong Sanitary Landfill is expected to reduce carbon dioxide emission of more than 100,000 tonnes a year. A composting project using palm oil mill effluent in Golden Hope Composting Project would have at least an annual 100,000 tonnes of carbon dioxide reduction.

Malaysia Energy Data, Statistics and Analysis

Malaysia is a significant oil and natural gas producer and is strategically located amid important routes for the seaborne energy trade. The Malaysian government is focused on efforts to enhance output from existing oil and natural gas fields and to advance exploration in deepwater areas. New tax and investment incentives introduced in 2010 aim to promote oil and natural gas exploration and development.

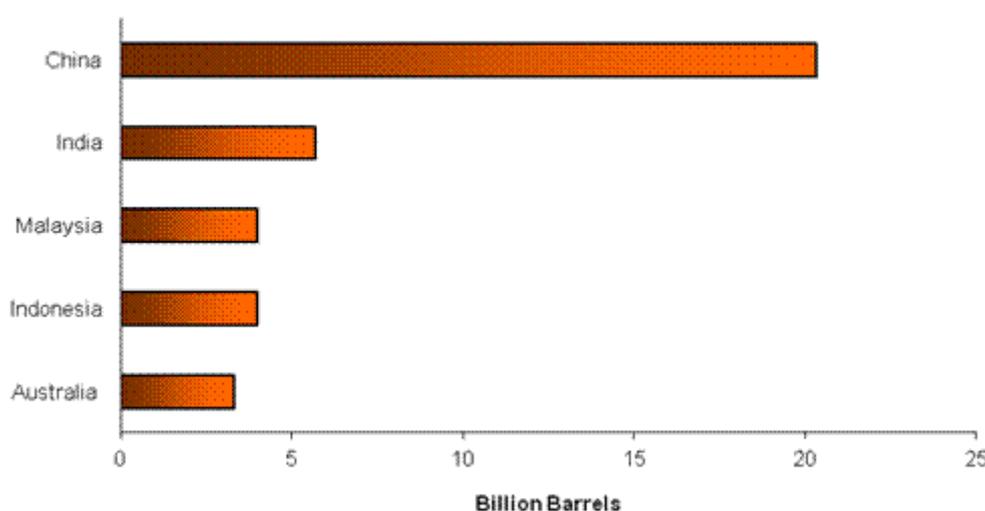
Their target is to increase aggregate production capacity by 5 percent per year up to 2020 to meet domestic demand growth and to sustain crude oil and LNG exports to overseas markets. Malaysia also aims to become a regional oil storage and trading hub, taking advantage of its strategic location in the center of the Asia-Pacific region astride key shipping lanes.

Oil

Malaysia's oil reserves are the third highest in the Asia-Pacific region after China and India.

According to the *Oil & Gas Journal (OGJ)*, Malaysia held proven oil reserves of 4 billion barrels as of January 2011. Nearly all of Malaysia's oil comes from offshore fields. The continental shelf is divided into 3 producing basins: the Malay basin offshore peninsular Malaysia in the west and the Sarawak and Sabah basins in the east. Most of the country's oil reserves are located in the Malay basin and tend to be of high quality. Malaysia's benchmark crude oil, Tapis Blend, is of the light and sweet variety with an API gravity of 44° and sulfur content of 0.08 percent by weight.

Top 5 Asia-Pacific Proven Oil Reserve Holders, January 2011



Source: *Oil and Gas Journal*

Sector Organization

Energy policy in Malaysia is set and overseen by the Economic Planning Unit (EPU) and the Implementation and Coordination Unit (ICU), which report directly to the Prime Minister. Malaysia's national oil and gas company, Petroliam Nasional Berhad (Petronas), holds exclusive ownership rights to all oil and gas exploration and production projects in Malaysia, is responsible for all licensing procedures, and is

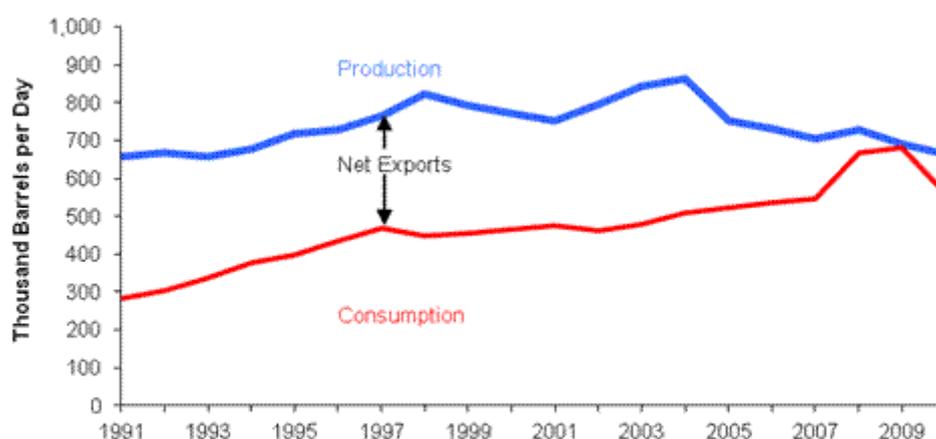
subject to only the Prime Minister, who also controls appointments to the company board. The company holds stakes in the majority of oil and gas blocks in Malaysia. It is the single largest contributor of Malaysian government revenues, (over 40 percent in 2010), by way of taxes and dividends.

Malaysia's oil and gas policy has historically focused on maintaining the reserve base to ensure long term supply security while providing affordable fuel to its population.

Exploration and Production

Total oil production in 2011 was an estimated 630,000 barrels per day (bbl/d), compared with 665,000 in 2010, of which about 83 percent was crude oil. Malaysian oil production has been gradually decreasing since reaching a peak of 862,000 bbl/d in 2004 due to its maturing reservoirs. Malaysia consumes the majority of its oil production and domestic consumption has been rising as production has been falling. The government is focused on opening up new investment opportunities by enhancing output from existing fields and developing new fields in deepwater areas offshore Sarawak and Sabah.

Malaysia's Oil Production and Consumption, 1991-2010



Source: EIA

Exports

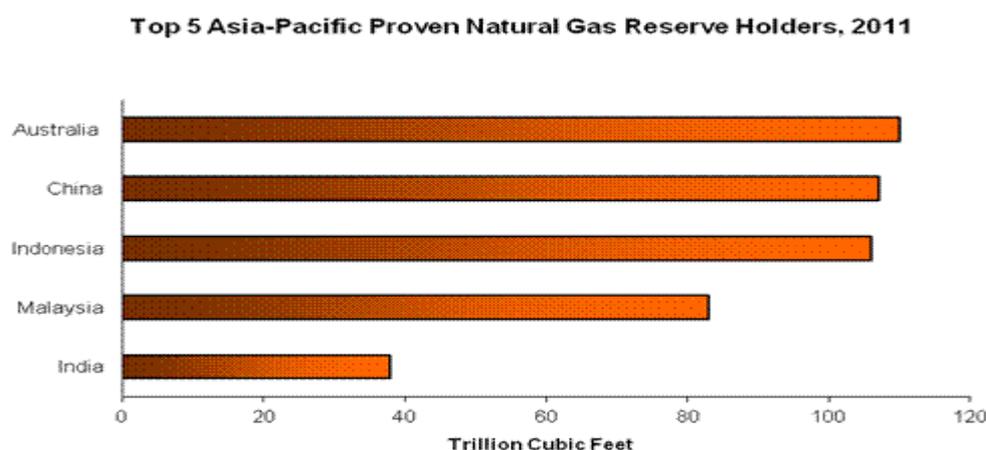
Malaysia exported 234,000 bbl/d of crude oil in 2010, down slightly from the 236,000 bbl/d exported in 2009. This was about 35 percent of Malaysia's crude oil production. In 2010, Malaysia imported 205,000 bbl/d of lower-cost crude oil for processing at its oil refineries.

Downstream Activities

According to *OGJ*, Malaysia had about 538,580 barrels per calendar day (b/cd) of refining capacity at seven facilities as of January 2011. Malaysia invested heavily in refining activities during the last two decades and is now able to meet most of its demand for petroleum products domestically.

Natural Gas

Malaysia was the world's third largest exporter of liquefied natural gas after Qatar and Indonesia in 2010. According to the *Oil and Gas Journal*, Malaysia held 83 trillion cubic feet (Tcf) of proven natural gas reserves as of January 2011, and was the fourth largest natural gas reserves holder in the Asia-Pacific region. Most of the country's natural gas reserves are in its eastern areas, predominantly offshore Sarawak.



Source: *Oil and Gas Journal*

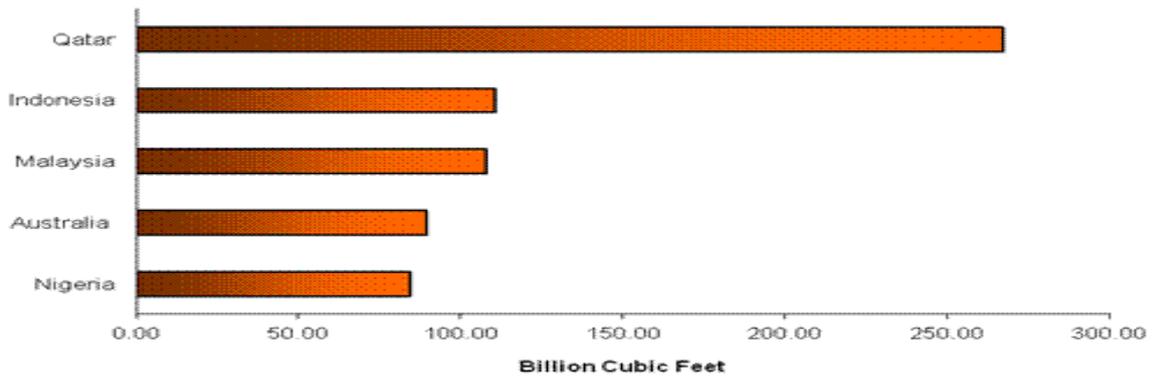
Exploration and Production

Gross natural gas production has been rising steadily, reaching 2.7 Tcf in 2010, while domestic natural gas consumption has also increased steadily, reaching 1.1 Tcf in 2010, 42 percent of production. There are several important ongoing projects that will expand natural gas production in Malaysia over the near term. Exploration and development activities in Malaysia continue to focus on offshore Sarawak and Sabah.

Exports

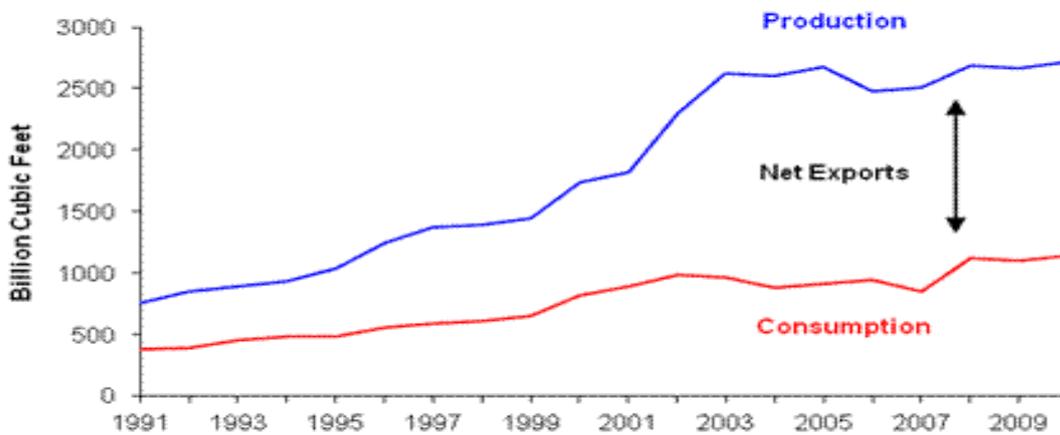
Malaysia was the third largest exporter of LNG in the world after Qatar and Indonesia in 2010, exporting over 1 Tcf of LNG, which accounted for 10 percent of total world LNG exports. Japan, South Korea, Taiwan, and China have supply contracts with Malaysia, and are the largest purchasers.

Top World LNG Exporters, 2010



Source: Cedigaz

Malaysian Natural Gas Production and Consumption, 1991-2010



Source: EIA

Energy Dialogue

Energy dialogue is important to give impact to broader-based challenges facing mankind, notably environmental harmony, sustainable development and the eradication of poverty. Oil will remain the world's leading energy source for the foreseeable future as there are enough conventional and non-conventional oil resources globally to meet the expected significant growth in demand. However, there is an increasing need for the growing diversity in the energy mix, including renewables.

Governments must hold mutual interest in stable, transparent and predictable oil markets, with reasonable prices that are consistent with the need for healthy world economic growth and steady revenue streams that are conducive to the expansion of capacity to meet rising oil demand. Governments must also recognise the importance of secure future demand for crude and products in spurring timely investment both upstream and downstream, thus contributing to greater security of supply. Every effort should be made to minimise uncertainties along the supply chain, in order to reduce investment risks and support long-term market stability.

Energy dialogue should cover:

1. The promotion of mutual interest aimed at boosting cooperation through various joint actions that will lead to more transparency and higher cooperation in the overall energy security, energy dialogue and energy efficiency.
2. Recognizing the rising global demand for energy, over-dependency on energy imports, unstable oil prices, and prospects of future depletion of energy resources particularly oil and gas call for regional cooperation for enhanced energy security and the sustainable use of energy in the Asia-Pacific region.
3. The need for long term energy conservation measures to increase energy security and to formulate and implement coherent energy policies based on comprehensive assessments of their environmental and social impacts.
4. Recognizing that energy is a fundamental component in economic development and there is a need to improve access to reliable, affordable and environmentally sound energy resources.
5. The importance for closer collaboration on the various energy technology issues and the new and renewable energy technologies to meet energy security challenges.

6. That energy dialogue makes an important contribution to deal with the broader challenges facing mankind, in particular sustainable development and the eradication of poverty.
7. All energy sources should contribute to a diverse energy mix in a non-discriminatory manner and that sustainable energy should take into account the mutually-supportive pillars of economic development, social progress and environmental protection.
8. All governments need to promote and enhance regional energy cooperation and continuous energy dialogue in addressing energy security challenges with a view to further enhancing energy security and working towards sustainable use of energy resources and development.

Conclusion

The world is becoming increasingly interdependent, with a complex energy system that is steadily developing into a more global and interconnected one, through physical infrastructures and markets. Developing countries are spending increasing proportions of their GDP on energy imports - with devastating effects on economic growth and levels of indebtedness. The IEA predicts that worldwide energy demand will increase 50% by 2030 if governments stick with current policies. An important factor that should not be overlooked is the renewed anxiety over whether there will be sufficient resources to meet the world's energy requirements in the decades ahead.

Oil and gas prices have remained the highest for many years. The focus on energy security is driven in part by an exceedingly tight oil market and high oil prices which have doubled over recent years. With regard to oil market situation, concerns have risen about expected increase in demand and possible supply interruptions over the next years which could lead to increased tightness in the oil market.

The focus on energy security is also fuelled by the threat of terrorism, instability in some exporting nations, a nationalist backlash, fears of a scramble for supplies, geopolitical rivalries, and countries' fundamental need for energy to power their economic growth.

Threats to energy security have also emerged in the form of human resources whereby a shortage of skilled labour for drilling, engineering, procurement, construction and other services and a downturn in the number of students in energy fields are seen as hampering the industry's orderly expansion, and thus constituting a serious reason for concern.

The world has witnessed distressing evidence of the effects of climate change, from devastating floods, to droughts and forest fires incurring staggering costs of climate-related disasters. Greenhouse gas concentrations in the atmosphere are higher now. Climate change is a key driver of the energy and environment policy. Nations have to redouble efforts against climate change. Without a doubt, renewable energy must play a prominent role in this fight.

The need to reduce dependence on imported energy and to increase economic stability and sustainability is reinforcing the case for diversification, particularly into renewables. Renewables are becoming progressively more competitive. It is a highly innovative, fast-developing sector, where further growth is expected and should be encouraged. In the field of bio-fuels, there is much potential to develop more advanced, higher yielding bio-fuel production processes with a better environmental profile.

Alongside energy efficiency, renewable energy should become the cornerstone of the energy and environmental policies of governments. The development of our societies has been extensively based on resources that are not renewable and will, at a certain point, be entirely consumed if we continue in this way. It is therefore essential to guarantee the preservation of the environment and of the non-renewable resources.

Energy technology has become increasingly instrumental in improving efficiency and renewable energy sources for addressing climate change, by promoting clean fossil fuel and carbon capture and storage (CCS) technologies. Cleaner fossil fuel technologies should be promoted to help foster economic growth and social progress, while contributing to the protection of the environment. There is a need for the further development and deployment of CCS technology since this would have a key role in reducing net emissions of greenhouse gases. Rapid deployment of renewable energy and energy efficiency as well as technological diversification of energy sources will result in significant energy security and economic benefits.

Governments need more and cleaner energy used in a more efficient way, accessible and affordable to a larger share of the world's population. Opportunities for energy efficiency exist over wide geographical areas, in contrast to other energy sources, which are concentrated in a limited number of countries. Clean low-cost renewable energies can offer access to energy for millions of people in developing countries, and without any risk of damage to health or the environment.

Energy security and energy efficiency need to be rethought. A wider approach is now required that takes into account the rapid evolution of the global energy trade, supply-chain vulnerabilities, terrorism, and the integration of major new economies into the world market.

The paradigm of energy security for the past few decades is too limited and must be expanded to include many new factors. It must be recognized that energy security does not stand by itself but is lodged in the larger relations among nations and how the governments interact with one another.

The challenges lie in operationalizing this imperative resource in a fair and sustainable way. Only long-term sustainable solutions to the energy challenge are able to achieve dramatic, indispensable improvements in energy efficiency and, at the same time, to expand renewable energy sources.

Energy policy and action plan must therefore be designed to enhance cooperation between the governments. Energy security has to be purposefully addressed in national policies as well as in bilateral, regional, inter-regional and wider global co-operation. It should be promoted in dialogue and co-operation not only between governments but also within the industry itself. Other stakeholders have their integrated role to play. This calls for further development of bilateral and multilateral energy discussions and agreements on energy.

Dialogue, partnerships and transparency are essential in addressing the world's energy needs in a predictable, stable and harmonious manner. The focus should be on the removal of market barriers to the effective delivery of energy services by promoting the adoption of new technologies and innovative financial and business models as well as the identification and dissemination of best practices and advocacy for universal energy access.