



Energy Statistics

in Asia and the Pacific
(1990–2006)

OCTOBER 2009



Energy Statistics in Asia and the Pacific (1990–2006)

October 2009

© 2009 Asian Development Bank

All rights reserved. Published 2009.
Printed in the Philippines.

ISBN 978-971-561-841-0
Publication Stock No. BBK090837

Cataloging-In-Publication Data

The Institute of Energy Economics, Japan.
Energy Statistics in Asia and the Pacific (1990–2006).
Mandaluyong City, Philippines: Asian Development Bank, 2009.

1. Energy. 2. Asia and the Pacific. I. Asian Development Bank.

The views expressed in this book are those of the authors and do not necessarily reflect the views and policies of the Asian Development Bank (ADB) or its Board of Governors or the governments they represent.

ADB does not guarantee the accuracy of the data included in this publication and accepts no responsibility for any consequence of their use.

By making any designation of or reference to a particular territory or geographic area, or by using the term “country” in this document, ADB does not intend to make any judgments as to the legal or other status of any territory or area.

ADB refers to “Taipei,China.” Asia-Pacific Economic Cooperation refers to “Chinese Taipei.”

ADB encourages printing or copying information exclusively for personal and noncommercial use with proper acknowledgment of ADB. Users are restricted from reselling, redistributing, or creating derivative works for commercial purposes without the express, written consent of ADB.

Note:
In this publication, “\$” refers to US dollars.

Asian Development Bank
6 ADB Avenue, Mandaluyong City
1550 Metro Manila, Philippines
Tel +63 2 632 4444
Fax +63 2 636 2444
www.adb.org

For orders, please contact:
Department of External Relations
Fax +63 2 636 2648
adbpub@adb.org

Definitions

The economies discussed in *Energy Statistics in Asia and the Pacific (1990-2006)* (*Energy Statistics*) are mainly classified by geographical groupings. However, the developed regional members—Australia, Japan and New Zealand—are classified as the Developed Group for the purposes of *Energy Statistics*.

- **Central and West Asia** comprises Afghanistan, Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyz Republic, Pakistan, Tajikistan, Turkmenistan, and Uzbekistan.
- **East Asia** comprises Hong Kong, China; Republic of Korea; Mongolia; People's Republic of China; and Taipei, China.
- **The Pacific** comprises Cook Islands, Fiji Islands, Kiribati, Marshall Islands, Federated States of Micronesia, Nauru, Palau, Papua New Guinea, Samoa, Solomon Islands, Timor-Leste, Tonga, Tuvalu, and Vanuatu.
- **South Asia** comprises Bangladesh, Bhutan, India, Maldives, Nepal, and Sri Lanka.
- **Southeast Asia** comprises Brunei Darussalam, Cambodia, Indonesia, Lao People's Democratic Republic, Malaysia, Myanmar, Philippines, Singapore, Thailand, and Viet Nam.
- **Developed Group:** Australia, Japan, and New Zealand.

Acronyms and Abbreviations

ADB	Asian Development Bank
APEC	Asia-Pacific Economic Cooperation
APERC	Asia Pacific Energy Research Centre
ASEAN	Association of Southeast Asian Nations
BCM	billion cubic meters
DMC	developing member country
FSU	Former Soviet Union
GCV	gross calorific value
GDP	gross domestic product
IEA	International Energy Agency
IEEJ	The Institute of Energy Economics, Japan
LNG	liquefied natural gas
LPG	liquefied petroleum gas
KTOE	thousand tons of oil equivalent
Lao PDR	Lao People's Democratic Republic
MCM	million cubic meters
MTOE	million tons of oil equivalent
NCV	net calorific value
NGL	natural gas liquids
OECD	Organisation for Economic Co-operation and Development
OGJ	Oil and Gas Journal
OPI	other Pacific islands
PNG	Papua New Guinea
PPP	purchasing power parity
PRC	People's Republic of China
PV	photovoltaic
TFEC	total final energy consumption
TPES	total primary energy supply
TOE	tons of oil equivalent
UNDP	United Nations Development Programme
UNSD	United Nations Statistics Division
USDOE	United States Department of Energy
WDI	World Development Indicators
WEC	World Energy Council

Part 3

Country/Economy Energy Profiles

Energy Profiles of DMCs in Central and West Asia

3.1 Afghanistan

Background

Afghanistan is a relatively small country in terms of gross domestic product (GDP), which registered \$7.3 billion (constant 2000 prices) in 2006.⁴ With a total population of 26.1 million, the country's per capita GDP—at \$280—was one of the lowest among the Asian Development Bank's (ADB) developing member countries (DMCs).

Table 3.1.1: Key Data and Economic Profile, 2006

Socioeconomic Data^a	
Land Area (square kilometer)	652,090
Population (thousand)	26,088
GDP (billion constant 2000 \$)	7.3
GDP (billion \$ at current PPP)	23.9
GDP per Capita (constant 2000 \$)	280
GDP per Capita (\$ at current PPP)	916
Electrification Rate (Percent)	—
Energy Reserves	
Coal (million ton) - Recoverable ^b	66.0
Gas (trillion cubic feet) - Proven ^c	1.8
Oil (billion barrel) - Proven ^c	0.0

— = data not available, GDP = gross domestic product, PPP = purchasing power parity.

Source: ^a World Bank, 2008.

^b World Energy Council (as of end-2005).

^c Oil and Gas Journal (as of 1 January 2009).

With a relatively small economy, Afghanistan's energy consumption accounted for one of the lowest among DMCs. In 2006, the country's total primary energy supply (TPES) reached 673 thousand tons of oil equivalent (KTOE), and total final energy consumption (TFEC) accounted for 538 KTOE (Table 3.1.2).

Biomass is the main energy source in Afghanistan, accounting for 57.4% of TPES in 2006. This was followed by oil at 29.9%, hydro at 7.6%, coal at 3.4%, and the remainder was natural gas. Excluding oil, the country's energy needs are met by domestic production.

The country possesses recoverable coal reserves of 66 million tons⁵ and proven natural gas reserves of 1.8 trillion cubic feet⁶ (Table 3.1.1).

⁴ GDP, land area, and population data are obtained from the *World Development Indicators 2008* of the World Bank.

⁵ World Energy Council (WEC). 2007. *2007 Survey of Energy Resources*. Available: www.worldenergy.org/documents/ser2007_final_online_version_1.pdf

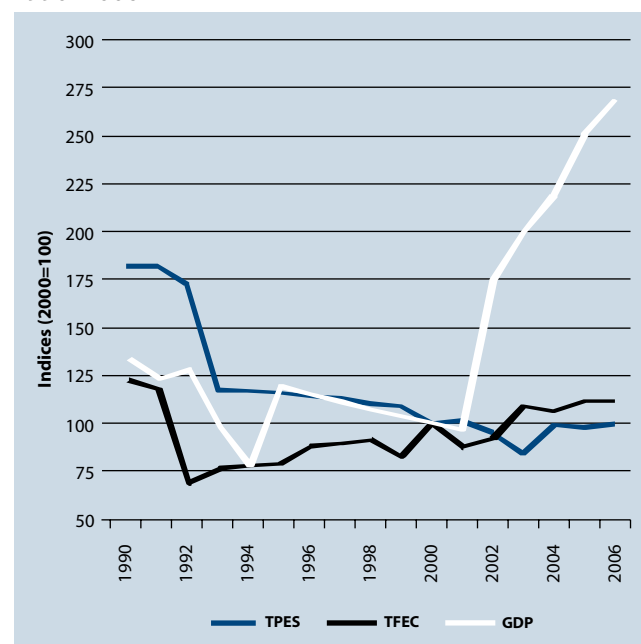
⁶ Oil and Gas Journal, 1 January 2009.

Table 3.1.2: Energy Supply and Demand, 2006

Primary Energy Supply (KTOE)	
Indigenous Production	463
Net Imports	220
Total PES	673
Coal	23
Oil	201
Gas	2
Others	446
TPES/Capita (TOE/person)	0.03
TPES/GDP (TOE/million \$ at current PPP)	28.0
Final Energy Consumption (KTOE)	
Industry	25
Transport	86
Other Sectors	428
Total FEC	538
Coal	0
Oil	91
Gas	0
Electricity	61
Others	387

FEC = final energy consumption, GDP = gross domestic product, KTOE = thousand tons of oil equivalent, PES = primary energy supply, PPP= purchasing power parity, TOE = tons of oil equivalent, TPES = total primary energy supply.

Source: United Nations Statistics Division (UNSD).

Figure 3.1.1: Growth of GDP, TPES, and TFEC, 1990–2006

GDP = gross domestic product, TFEC = total final energy consumption, TPES = total primary energy supply.

Source: Asia Pacific Energy Research Centre (APERC).

Energy Consumption and Supply

Overview

Due to civil war and political instability in the early part of 1990s, Afghanistan's energy consumption dropped substantially. From 1991 to 1992, for example, the country's energy consumption dropped by 42%. Aided by the international community, Afghanistan's government tried to achieve greater political stability, and its GDP recovered to grow at an annual rate of 11.4% between 2002 and 2006. Despite the country's efforts, persistent political instability affected energy growth trends. Primary energy supply decreased from 792 KTOE in 1993 to 673 KTOE in 2006, at an annual rate of 1.2%. By contrast, final energy consumption increased from 332 KTOE in 1992 to 538 KTOE in 2006, at an annual rate of 3.5%. However, this increase in final energy consumption was caused by increased use of biomass in the residential sector. Excluding biomass, final consumption of commercial energy decreased at an annual rate of 0.7% between 1992 and 2006.

Figure 3.1.1 shows the indices of GDP, TPES, and TFEC from 1990 to 2006.

Final Energy Consumption

The historical trends of final energy consumption by sector are shown in Figure 3.1.2. The residential sector took the largest share of the TFEC, accounting for 74.6% in 2006 (Figure 3.1.3). Because of limited access to commercial energy sources, the country's residential sector relies heavily on biomass for cooking and heating. To generate the energy necessary for these purposes, biomass requires more inputs in contrast to commercial energy sources. Therefore, the sector's energy consumption is higher than the other sectors.

The transport sector accounted for the second-largest share at 15.9% in 2006. This translated into the sector's energy consumption of 86 KTOE—again one of the lowest among DMCs. With most of the country's roads not being paved and low income level (at \$280), most of the country's passenger mobility requirements are met by nonmotorized transport.

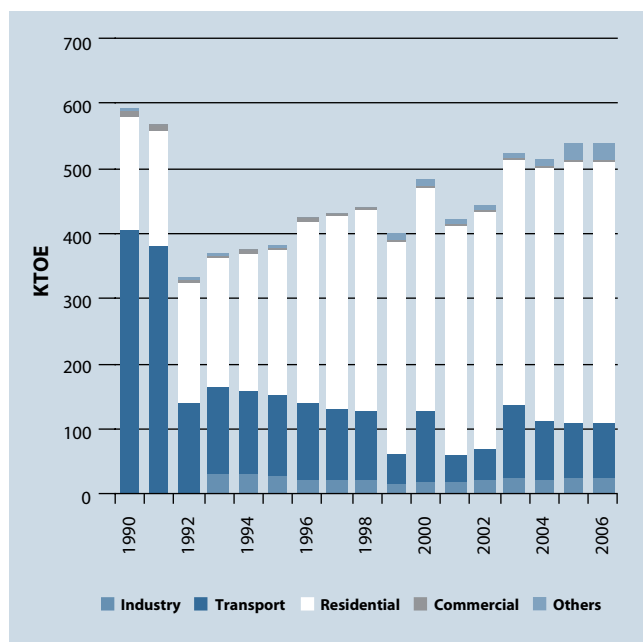
The industry sector accounted for 4.6% of final energy consumption in 2006. The sector's activities were limited due to political instability, and its energy consumption of 25 KTOE in 2006 represented one of the lowest among DMCs.

In terms of consumption by type of energy, oil decreased by 78%, from 405 KTOE to 91 KTOE from 1990 to 2006, which lowered its share of TFEC from 68.6% in 1990 to 16.8% in 2006. This large drop resulted from the contraction of the transport sector due to the decline of trade activities.

Electricity, which comprises a minor part of the final energy consumption, continued to decline until 2001; it, however, started to increase from 2002 to 2006 as a result of economic recovery. Consequently, its share of the TFEC increased from 5.9% in 1990 to 11.3% in 2006.

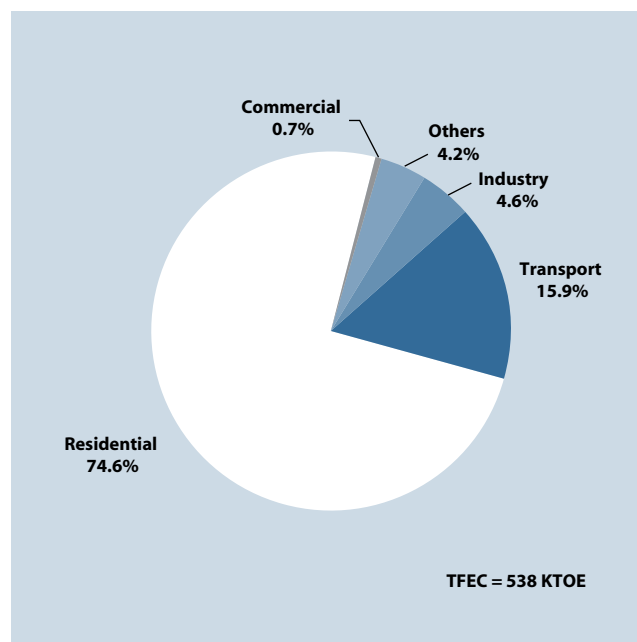
Figure 3.1.4 shows the evolution of final energy consumption by type of energy.

Figure 3.1.2: Final Energy Consumption by Sector, 1990–2006

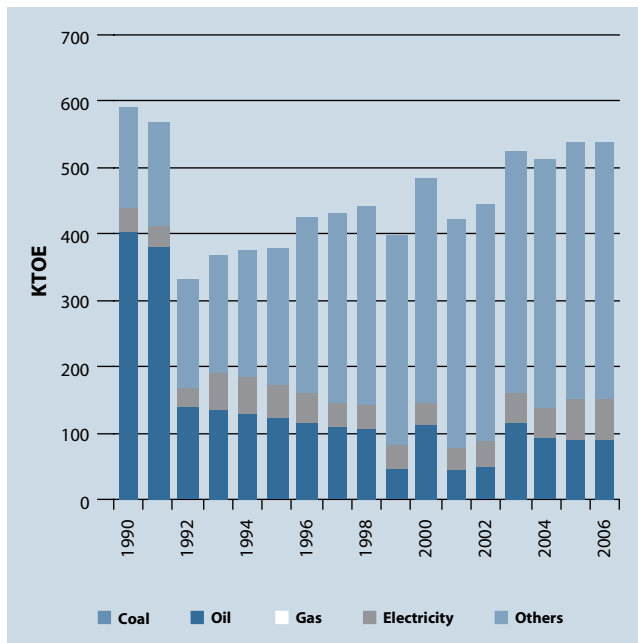


Source: UNSD.

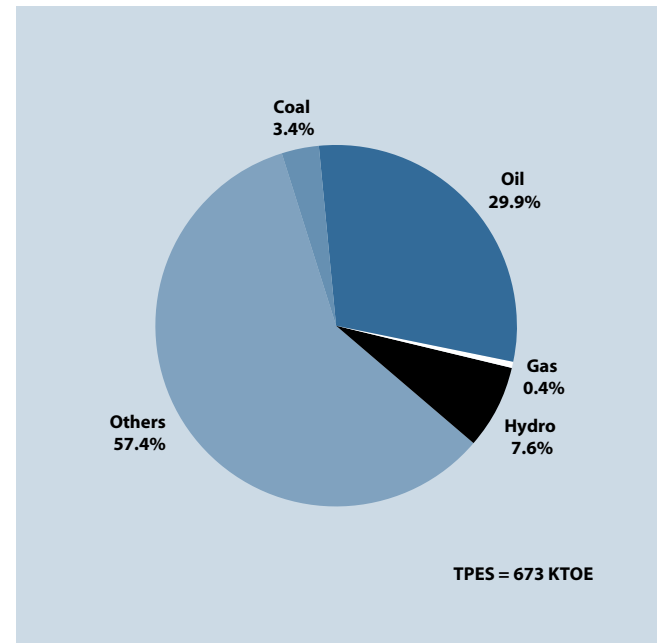
Figure 3.1.3: Final Energy Consumption by Sector, 2006



Source: UNSD.

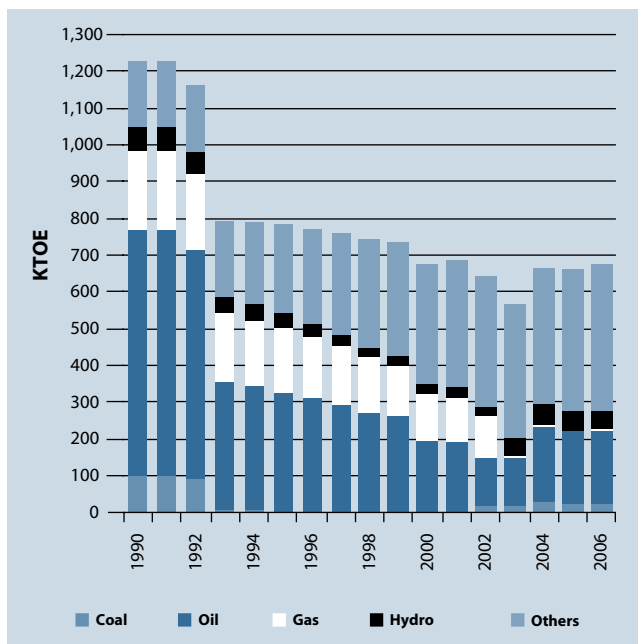
Figure 3.1.4: Final Energy Consumption by Type, 1990–2006

Source: UNSD.

Figure 3.1.5: Primary Energy Supply by Source, 2006

Note : Others in this chart consist of biomass and electricity imports.

Source: UNSD.

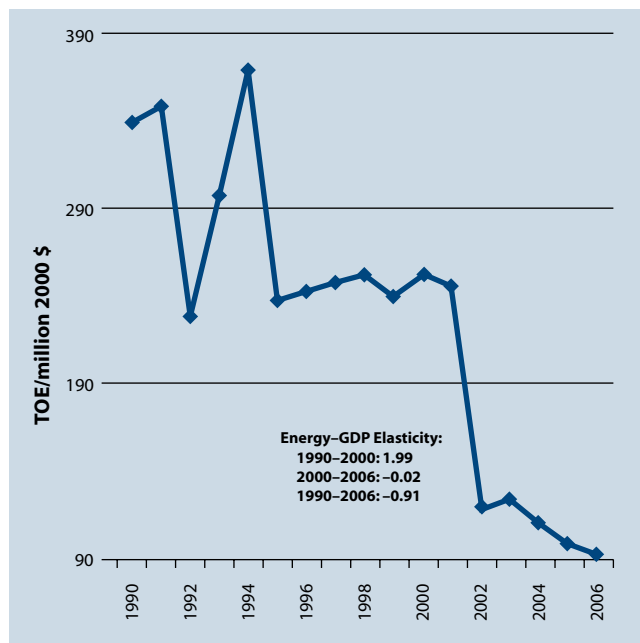
Figure 3.1.6: Primary Energy Supply by Source, 1990–2006

Source: UNSD.

Primary Energy Supply

Afghanistan's primary energy requirement was supplied mainly by oil and biomass, which comprised 29.9% and 57.4%, respectively, of TPES in 2006 (Figure 3.1.5). Gas was also a primary energy source during the early 1990s; however, consumption decreased since 2002 due to the contraction of domestic production. Meanwhile, in 2006 hydro and coal each comprised a small share of 7.6% and 3.4%, respectively.

Figure 3.1.6 shows the evolution of primary energy supply. As the figure shows, Afghanistan's primary energy supply decreased from 1,227 KTOE in 1990 to 673 KTOE in 2006. Excluding biomass, all energy sources decreased during the same period. The largest decline was registered by oil, which decreased by 70% from 671 KTOE to 201 KTOE due to the contraction of the transport sector. Given the limited domestic energy resources, biomass—mainly used by the residential sector—more than doubled, from 178 KTOE in 1990 to 395 KTOE in 2006.

Figure 3.1.7: Energy Intensity and Elasticity, 1990–2006

Source: APERC.

Energy Intensity and Elasticity

The energy intensity in Afghanistan had been on a declining trend from 339 TOE/million \$ (constant 2000 prices) in 1990 to 92 TOE/million \$ in 2006 (Figure 3.1.7). During the same period, the energy–GDP elasticity ratio was calculated at -0.91 , indicating that for every 1% growth in GDP, the energy consumption even decreased by 0.91%.

3.3 Azerbaijan

Background

Azerbaijan is one of the relatively small republics in the Former Soviet Union (FSU) region in terms of land area and population. However, its gross domestic product (GDP), which in 2006 registered at \$13.3 billion (at constant 2000 prices) and its per capita GDP, standing at \$1,571, were among the highest in the region [World Bank, 2008] (Table 3.3.1).

Table 3.3.1: Key Data and Economic Profile, 2006

Socioeconomic Data^a	
Land Area (square kilometer)	82,660
Population (thousand)	8,484
GDP (billion constant 2000 \$)	13.3
GDP (billion \$ at current PPP)	53.3
GDP per Capita (constant 2000 \$)	1,571
GDP per Capita (\$ at current PPP)	6,282
Electrification Rate (Percent)	
	–
Energy Reserves	
Coal (million ton) - Recoverable	–
Gas (trillion cubic feet) - Proven ^b	30.0
Oil (billion barrel) - Proven ^b	7.0

– = data not available, GDP = gross domestic product, PPP = purchasing power parity.

Source: ^a World Bank.

^b Oil and Gas Journal (as of 1 January 2009).

At current purchasing power parity, Azerbaijan's 2006 GDP was equivalent to \$53 billion, with corresponding per capita GDP of \$6,282.

From 1990 to 2000, Azerbaijan's energy consumption decreased at an average annual rate of 7.8% in parallel with the decline in economic growth. However, as a result of Azerbaijan's economic recovery starting in 2000, energy consumption began to grow positively at an average annual rate of 3.3% until 2006.

Azerbaijan is currently one of the region's largest producers of oil and gas, and one of its largest exporters of oil. The country has abundant proven energy resources with 30 trillion cubic feet of natural gas and 7 billion barrels of oil (Oil and Gas Journal, 2009).

Energy Consumption and Supply

Overview

After the collapse of the Soviet Union in 1990, Azerbaijan's economy decreased at an annual rate of 5.2% (1990–2000). Supported by the export of oil and natural gas, combined with the higher international energy prices, from 2000 onwards, Azerbaijan's GDP grew at a remarkable annual average rate of 16.7%, making it one of the fastest-growing economies in the world.

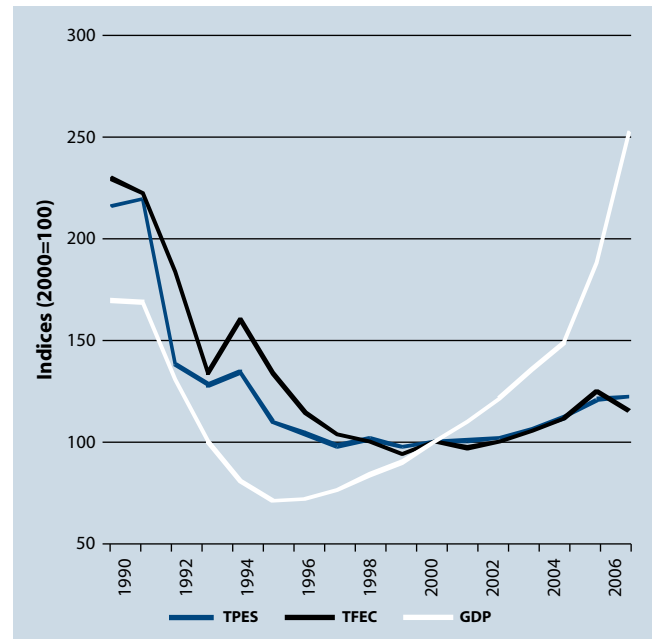
The evolution of the growth of GDP, total final energy consumption (TFEC), and total primary energy supply (TPES) from 1990 to 2006 is shown in Figure 3.3.1. Until the country's GDP started growing at a double-digit rate in 2000, both TFEC and TPES declined at an annual rate of 8% and 7.8%, respectively, during the period 1990–2000. Between 2000 and 2006, both TFEC and TPES grew at average annual rates of 2.4% and 3.3%, respectively. These growth rates are relatively slow, compared to that of GDP, which grew at 16.7% per annum.

Table 3.3.2: Energy Supply and Demand, 2006

Primary Energy Supply (KTOE)	
Indigenous Production	38,127
Net Imports	-24,203
Total PES	14,076
Coal	0
Oil	4,836
Gas	8,941
Others	297
TPES/Capita (TOE/person)	1.66
TPES/GDP (TOE/million \$ at current PPP)	266
Final Energy Consumption (KTOE)	
Industry	1,630
Transport	2,186
Other Sectors	4,142
Total FEC	7,958
Coal	0
Oil	2,689
Gas	3,115
Electricity	1,716
Others	438

FEC = final energy consumption, GDP = gross domestic product, KTOE = thousand tons of oil equivalent, PES = primary energy supply, PPP= purchasing power parity, TOE = tons of oil equivalent, TPES = total primary energy supply.

Source: International Energy Agency (IEA).

Figure 3.3.1: Growth of GDP, TPES, and TFEC, 1990–2006

GDP = gross domestic product, TFEC = total final energy consumption, TPES = total primary energy supply.

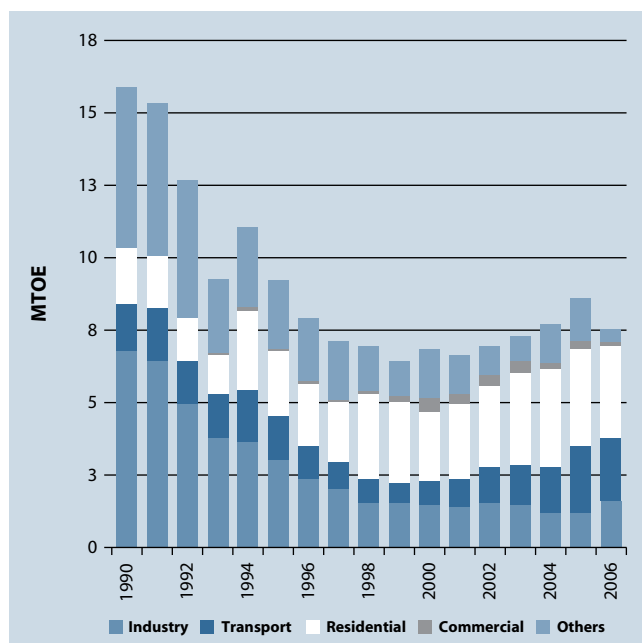
Source: Asia Pacific Energy Research Centre (APERC).

Final Energy Consumption

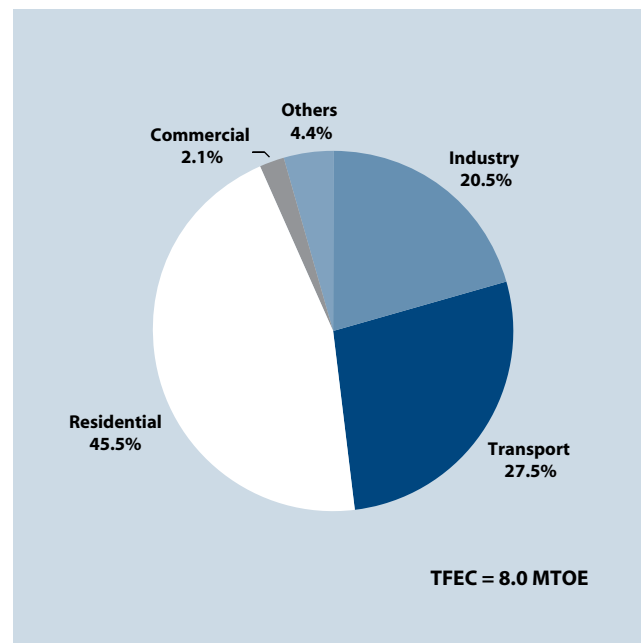
The evolution of TFEC by sector is shown in Figure 3.3.2. TFEC in Azerbaijan decreased from 15.9 MTOE in 1990 to 6.9 MTOE in 2000 at an annual rate of 8%. As a result of the double-digit economic recovery registered from 2000 onwards, TFEC increased from 6.9 MTOE in 2000 to 8.0 MTOE in 2006.

From 2000 to 2006, the fastest increase in energy consumption was registered by the transport sector, at 16.9% per year. With this high growth rate, the transport sector's energy consumption more than doubled—from 0.9 MTOE in 2000 to 2.2 MTOE in 2006. The transport sector's growth was driven by (i) gasoline for passenger transport, accounting for 32% of incremental growth between 2000 and 2006, (ii) the growth in jet kerosene for international air transport, and (iii) the growth in diesel for both passenger and freight transport.

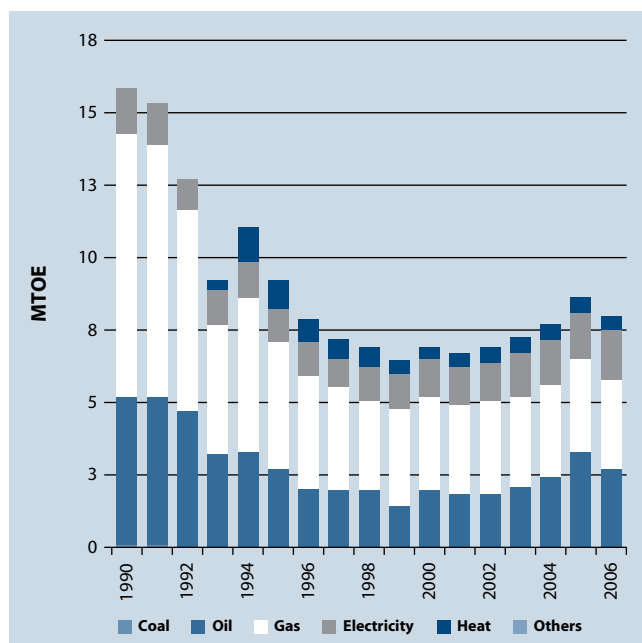
The residential sector grew at the second fastest rate in TFEC at 7.2% (2000–2006). Gas and electricity are the main energy sources consumed in this sector, accounting for 65% and 33%, respectively, of the total residential energy consumption in 2006. Assisted by the growth in per capita income, consumption of gas and electricity increased at annual rates of 5.4% and 2.0%, respectively, between 2000 and 2006.

Figure 3.3.2: Final Energy Consumption by Sector, 1990–2006

Source: IEA.

Figure 3.3.3: Final Energy Consumption by Sector, 2006

Source: IEA.

Figure 3.3.4: Final Energy Consumption by Type, 1990–2006

Source: IEA.

The industry sector grew at a slow rate of 1.4% between 2000 and 2006. The chemical and mining sectors both grew at double-digit rates, while the nonspecified industry sector declined at an annual rate of 24%, which offset the overall growth in the other industry subsectors.

Due to these trends, the sectoral shares in final energy consumption in 2006 are as follows: residential, 45.5%; transport, 27.5%; industry, 20.5%; others, 4.4%; and commercial, 2.1% (Figure 3.3.3).

The historical trends in final energy consumption by type of energy are shown in Figure 3.3.4. Natural gas represented the largest share of TFEC, at 39%, in 2006. Despite maintaining the largest share, gas consumption from 2000 to 2006 declined at an average annual rate of 0.7%, reflecting the consumption decline in the industry sector.

Oil represented the second largest share, at 34%, in TFEC in 2006. Driven mainly by the growth in the transport sector, oil increased at an annual rate of 5.3% (2000–2006).

Electricity accounted for the third largest share, at 22%, in 2006. Driven by the increase in the industry sector and the “others” sector, electricity consumption grew at an annual rate of 5.0% (2000–2006).

Primary Energy Supply

The evolution of TPES by energy type from 1990 to 2006 is shown in Figure 3.3.5.

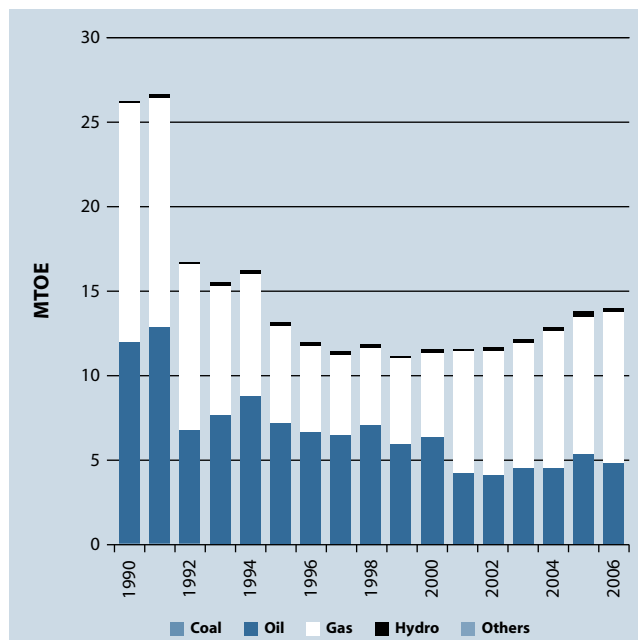
During the period 1990–2006, Azerbaijan’s TPES decreased at an average annual rate of 3.8%. However, looking at different time periods, it is evident that although TPES declined at the average rate of 7.8% from 1990 to 2000, it actually grew at an annual average rate of 3.3% from 2000 to 2006.

Azerbaijan’s TPES is currently dominated by natural gas, which garnered 63.5% of the total in 2006 (Figure 3.3.6). Its supply declined at an average annual rate of 2.9% during 1990–2006.

Oil comprised the second largest share of the TPES of 34.4% in 2006 (its 1990 share was 45.3%). However, oil supply decreased during 1990–2006 at an average annual rate of 5.4%.

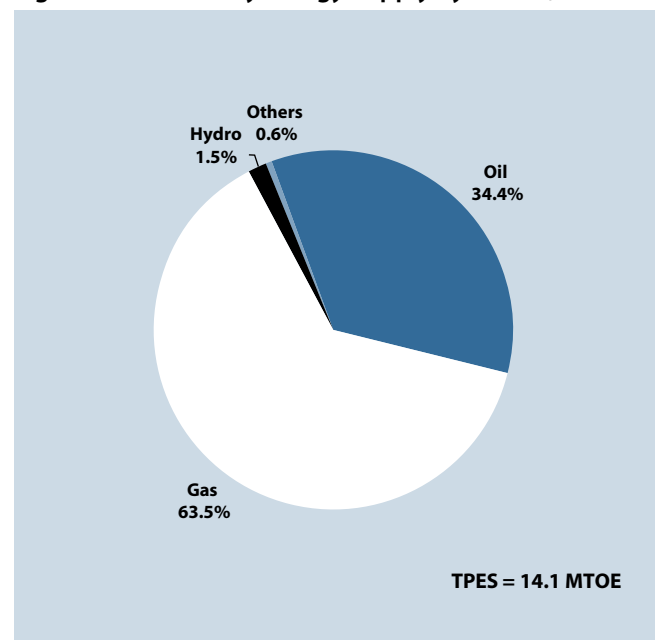
The combined share of TPES of other energy, which included biomass and hydro energy, was 2.1% as of 2006.

Figure 3.3.5: Primary Energy Supply by Source, 1990–2006



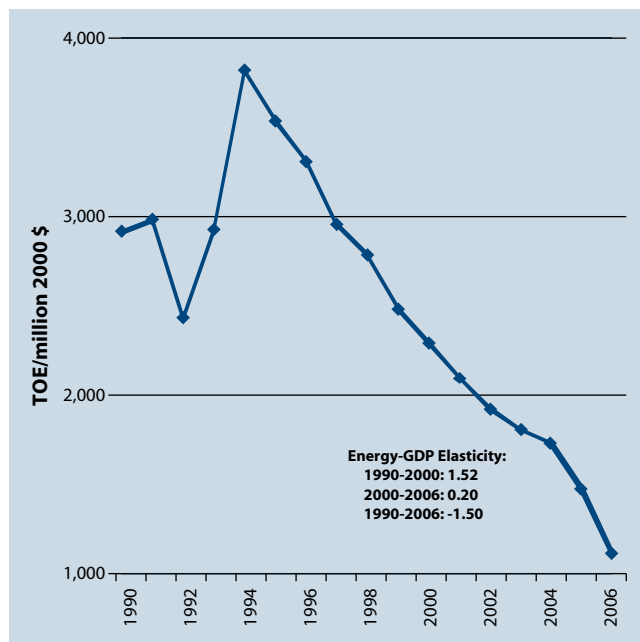
Source: IEA.

Figure 3.3.6: Primary Energy Supply by Source, 2006



Source: IEA.

Figure 3.3.7: Energy Intensity and Elasticity, 1990–2006



Source: APERC.

Energy Intensity and Elasticity

The energy intensity in Azerbaijan, which dropped from 2,912 TOE/million \$ (constant 2000 prices) in 1990 to 2,428 TOE/million \$ in 1992, increased to 3,817 TOE/million \$ in 1994 (Figure 3.3.7). Since 1994, however, it has been steadily declining, dropping to 1,107 TOE/million \$ in 2006.

3.5 Kazakhstan

Background

Excluding the Russian Federation, Kazakhstan is the largest country in Central Asia in terms of economic size and land area. Kazakhstan's gross domestic product (GDP) in 2006 reached \$33.2 billion (at constant 2000 prices) (World Bank, 2008), which was bigger than the combined total of those of all the other Central Asian countries (Table 3.5.1). Its population reached 15.3 million in 2006, and its per capita GDP was \$2,166 in the same year.

Table 3.5.1: Key Data and Economic Profile, 2006

Socioeconomic Data^a	
Land Area (square kilometer)	2,699,700
Population (thousand)	15,308
GDP (billion constant 2000 \$)	33.2
GDP (billion \$ at current PPP)	150.5
GDP per Capita (constant 2000 \$)	2,166
GDP per Capita (\$ at current PPP)	9,831
Electrification Rate (Percent)	
—	
Energy Reserves	
Coal (billion ton) - Recoverable ^b	31.3
Gas (trillion cubic feet) - Proven ^c	85.0
Oil (billion barrel) - Proven ^c	30.0

— = data not available, GDP = gross domestic product, PPP = purchasing power parity.

Source: ^a World Bank.

^b World Energy Council (as of end-2005).

^c Oil and Gas Journal (as of 1 January 2009).

Kazakhstan's economy started its recovery in 2000, registering a double-digit growth rate through 2006. In parallel, energy consumption grew substantially, at an annual rate of 6.5% (2000–2006). In 2006, coal accounted for the largest share of total energy at 49%, followed by natural gas at 31%, oil at 19%, and hydro at 1%.

Kazakhstan possesses abundant energy reserves, with 31.3 billion tons of recoverable coal reserves (World Energy Council, 2007), 85 trillion cubic feet of natural gas, and 30 billion barrels of oil (Oil and Gas Journal, 2009). Given these large energy reserves, Kazakhstan's energy production and exports represented the highest level in Central Asia. In 2006, about 67% of total indigenous energy production was dedicated to export, with oil representing the highest level at 58.9 million tons of oil equivalent (MTOE), followed by natural gas at 12.4 MTOE, coal at 12.3 MTOE, petroleum products at 3.3 MTOE, and electricity at 0.3 MTOE.

Energy Consumption and Supply

Overview

As a result of the collapse of the Former Soviet Union, Kazakhstan's GDP decreased from \$26.3 billion in 1990 to \$16.2 billion in 1998. Due largely to the increased oil and gas exports, the country's GDP grew positively in 1999 at 3%, followed by a 10.4% average annual growth rate between 2000 and 2006.

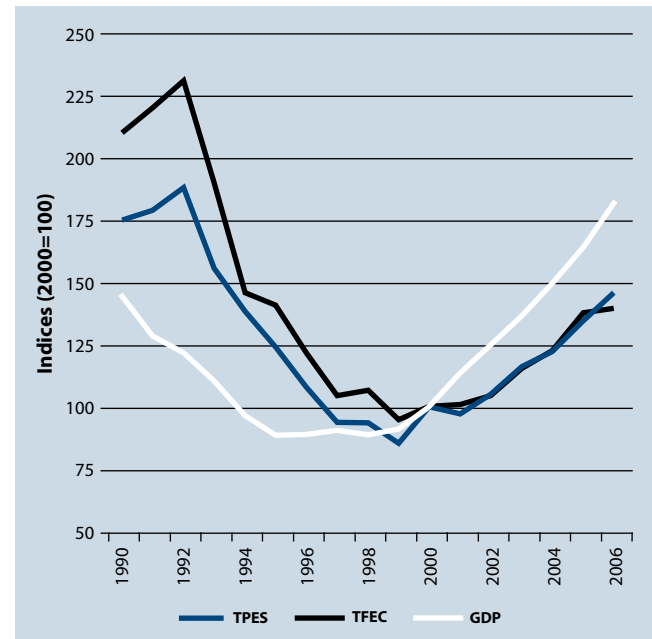
The historical trends in GDP, total final energy consumption (TFEC), and total primary energy supply (TPES) in indices are shown in Figure 3.5.1. As the figure shows, TFEC and TPES rebounded from 2000 to 2006 in parallel with the economic recovery during the same period. It is interesting to note that the growth trends in TFEC and TPES were relatively lower compared with that of GDP.

Table 3.5.2: Energy Supply and Demand, 2006

Primary Energy Supply (KTOE)	
Indigenous Production	130,974
Net Imports	-69,286
Total PES	61,423
Coal	30,292
Oil	11,550
Gas	18,767
Others	813
TPES/Capita (TOE/person)	4.01
TPES/GDP (TOE/million \$ at current PPP)	407
Final Energy Consumption (KTOE)	
Industry	16,017
Transport	3,986
Other Sectors	20,250
Total FEC	40,254
Coal	5,836
Oil	9,004
Gas	12,779
Electricity	4,219
Others	8,415

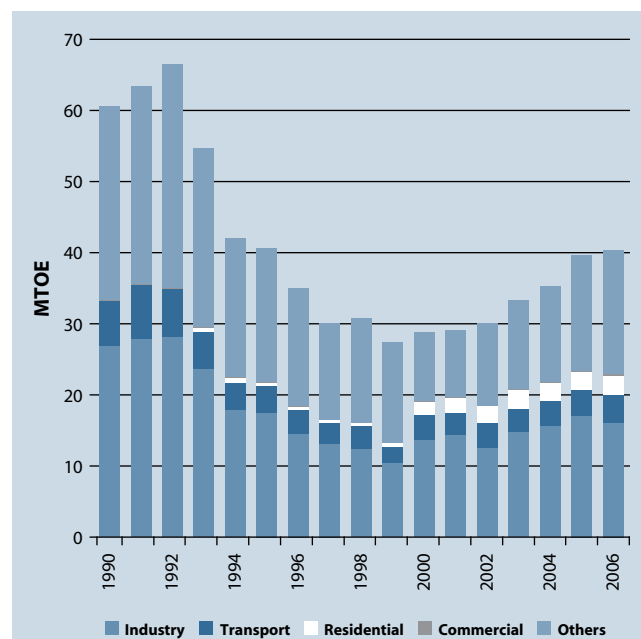
FEC = final energy consumption, GDP = gross domestic product, KTOE = thousand tons of oil equivalent, PES = primary energy supply, PPP= purchasing power parity, TOE = tons of oil equivalent, TPES = total primary energy supply.

Source: International Energy Agency (IEA).

Figure 3.5.1: Growth of GDP, TPES, and TFEC, 1990–2006

GDP = gross domestic product, TFEC = total final energy consumption, TPES = total primary energy supply.

Source: Asia Pacific Energy Research Centre (APEREC).

Figure 3.5.2: Final Energy Consumption by Sector, 1990–2006

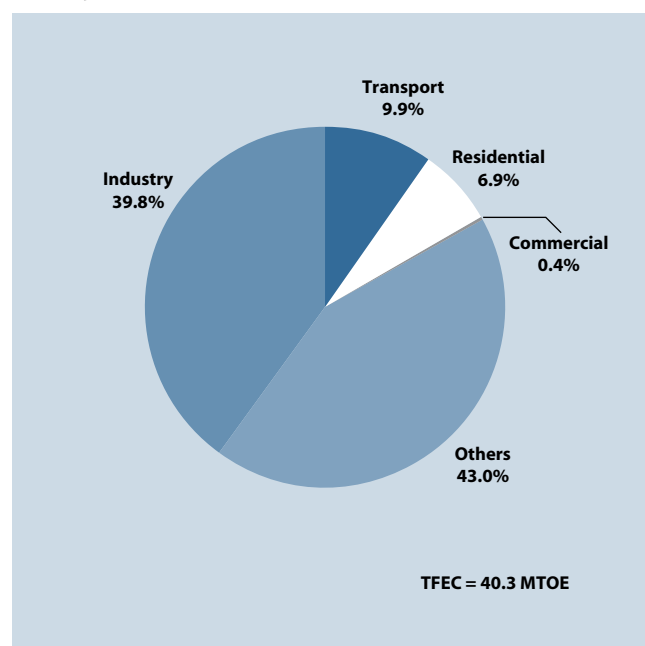
Source: IEA.

Final Energy Consumption

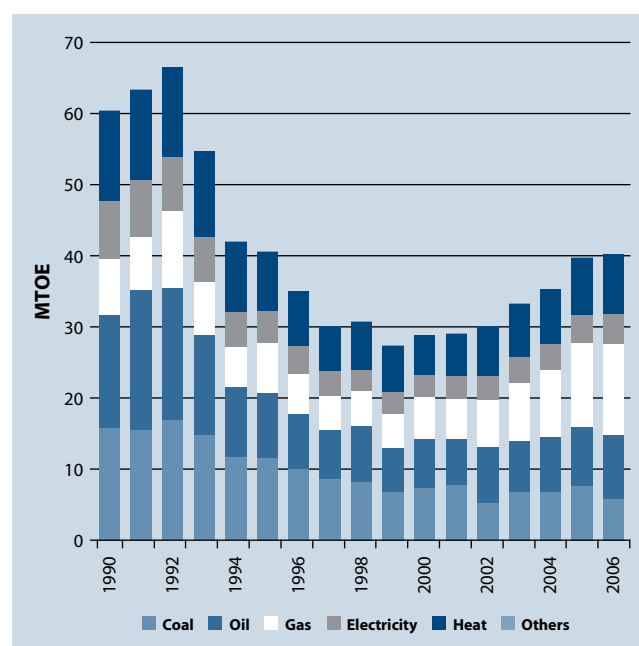
The historical trends in TFEC by sector (1990–2006) are shown in Figure 3.5.2. TFEC in Kazakhstan decreased at an average annual rate of 2.5%, from 60.5 MTOE in 1990 to 40.3 MTOE in 2006.

Figure 3.5.3 shows the final energy consumption in Kazakhstan in 2006. During the year, the industry sector accounted for the largest share (39.8%) of TFEC aside from the Others sector (43.0%).⁹ Having reached the lowest level at 10.4 MTOE in 1999, the industry sector's energy consumption increased at an annual rate of 6.4% (to 16.0 MTOE in 2006). The industry's recent increase in energy consumption was led by the iron and steel, nonferrous metals, chemicals, and mining subsectors. Despite the increase, the

⁹ Due to classification problem, some data on consumption in the industry, transport, and residential/commercial sectors are categorized under the Others sector.

Figure 3.5.3: Final Energy Consumption by Sector, 2006

Source: IEA.

Figure 3.5.4: Final Energy Consumption by Type, 1990–2006

Source: IEA.

industry's energy consumption in 2006, at 16.0 MTOE, was about 40% lower than that of the 1990 level.

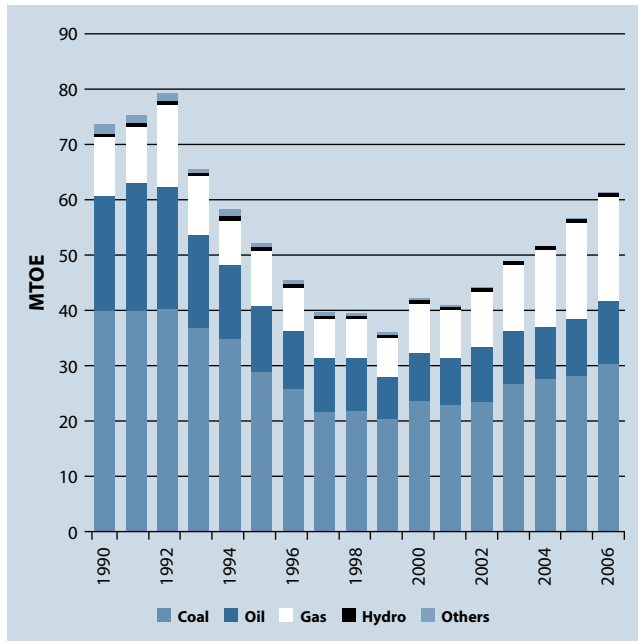
The transport sector represented the second largest share of TFEC, at 9.9%, in 2006. From its lowest level of 2.4 MTOE in 1999, the transport sector's energy consumption increased nearly 70%, reaching 4.0 MTOE in 2006. Gasoline for passenger transport accounted for about 85% of incremental growth in transport energy consumption (1999–2006). This was followed by diesel, which accounted for 17% of total increments by the transport energy consumption during the same period.

Energy consumption by the residential sector accounted for the third largest share, at 6.9%, in 2006. In parallel with the economic recovery, household income grew substantially, which translated into a nearly sixfold increase in residential energy consumption, from 0.47 MTOE in 1999 to 2.8 MTOE in 2006.

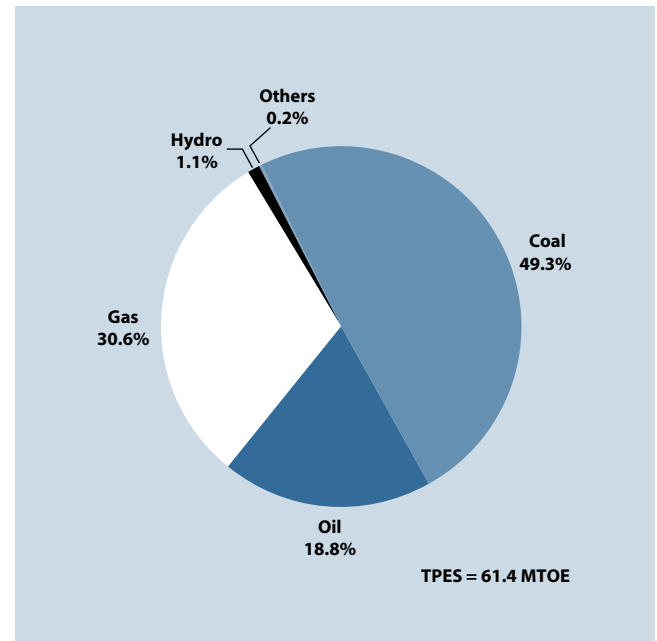
In terms of consumption by energy type (Figure 3.5.4), coal and oil comprised the bulk of TFEC in the early 1990s. In 1990, for example, coal and oil made up 26.1% and 26.4%, respectively, of TFEC. By 2006, the share of coal and oil had dropped to 14.5% and 22.4%, respectively.

On the other hand, the share of gas in TFEC increased from 12.8% in 1990 to 31.7% in 2006. Gas is used across sectors in Kazakhstan. Having reached the lowest level of consumption in 1998 at 4.8 MTOE, gas consumption more than doubled to reach 12.8 MTOE in 2006.

The share of electricity stood at 10.5% of TFEC in 2006. Again, in parallel with the economic recovery, electricity consumption increased at an annual rate of 5.7% (2000–2006). The industry sector led the growth in electricity, accounting for 60% of total incremental growth in electricity consumption (2000–2006).

Figure 3.5.5: Primary Energy Supply by Source, 1990–2006

Source: IEA.

Figure 3.5.6: Primary Energy Supply by Source, 2006

Source: IEA.

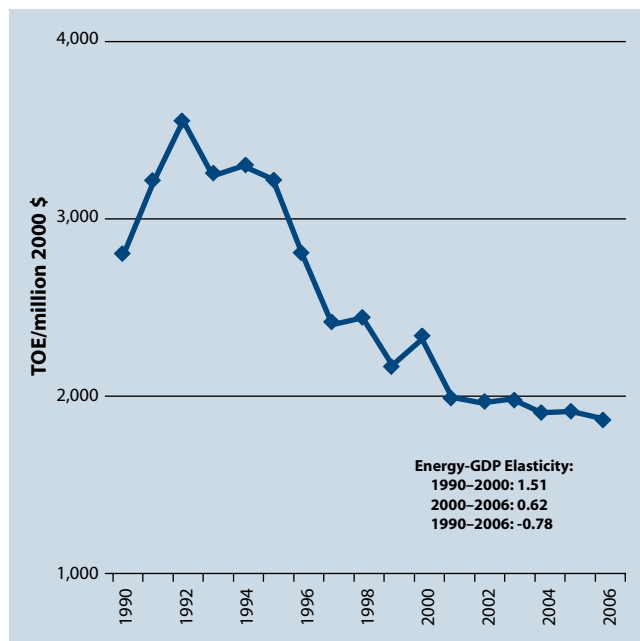
Heat constituted a relatively large share of TFEC, at 21%, in 2006. In fact, heat's share of TFEC remained the same, at about 20%, from 1990 to 2006. In Kazakhstan, in 2006, heat was utilized across sectors, with industry accounting for the highest share at 49%, followed by residential at 24%, and the remainder by the Others sectors.

Primary Energy Supply

The historical trends in TPES in Kazakhstan (1990–2006) are shown in Figure 3.5.5. Kazakhstan's TPES decreased from 73.6 MTOE in 1990 to 36.0 in 1999. Driven by the economic recovery in 1999, TPES increased at an annual rate of 7.9%, reaching 61.4 MTOE in 2006.

Growth trends vary by energy source. Coal was the main energy source in TPES, accounting for 49.3% of TPES in 2006 (Figure 3.5.6). Primary supply of coal reached its lowest level, at 20.5 MTOE, in 1999—down nearly 50% from 40.0 MTOE in 1990. From 1999 onwards, coal supply increased at an annual rate of 5.8% to reach 30.3 MTOE in 2006. The power sector was the main user of coal: in 2006, 85% of the total coal supply went to the power sector. In addition, output from coal-fired generation has been accounting for more than 70% of total electricity generation since 1990. Therefore, the overall growth trend in coal supply in Kazakhstan has been primarily due to its use for the power sector.

Natural gas represented the second largest share of TPES, at 30.6%, in 2006. Similar to coal, natural gas supply reached its lowest level in 1997 at 7.0 MTOE and, thereafter, increased at an annual rate of 11.5% until 2006 in response to demand from the industry, residential, and commercial sectors. As a result of this double-digit growth, natural gas supply in 2006 represented a higher level (at 18.8 MTOE) than that of 1990.

Figure 3.5.7: Energy Intensity and Elasticity, 1990–2006

Source: APERC.

Oil accounted for the third largest share of TPES, at 18.8%, in 2006. Since 1999 when oil supply hit the lowest level after 1990, it started increasing positively at an annual rate of 6.6% until 2006. In Kazakhstan, as of 2006, the transport sector was the main consumer of oil, accounting for 38% of total supply, followed by the industry sector at 28%.

Energy Intensity and Elasticity

The historical trends in energy intensity are shown in Figure 3.5.7. Energy intensity in Kazakhstan declined rapidly from 2,795 TOE/million \$ (constant 2000 prices) in 1990 to 1,852 TOE/million \$ in 2006. From 1990 to 1999, the economic downturn and corresponding decline in energy consumption affected the overall drop in energy intensity. In contrast, from 1999 onwards, energy consumption increased slowly relative to the GDP growth, causing energy intensity to decline.

3.6 Kyrgyz Republic

Background

The Kyrgyz Republic is the second smallest country in Central Asia in terms of gross domestic product (GDP), registering \$1.7 billion in 2006 (World Bank, 2008). In 2006, with a population of 5.2 million, the country's GDP per capita reached \$326 (Table 3.6.1).

Table 3.6.1: Key Data and Economic Profile, 2006

Socioeconomic Data^a	
Land Area (square kilometer)	191,800
Population (thousand)	5,192
GDP (billion constant 2000 \$)	1.7
GDP (billion \$ at current PPP)	9.4
GDP per Capita (constant 2000 \$)	326
GDP per Capita (\$ at current PPP)	1,810
Electrification Rate (Percent)	
–	
Energy Reserves	
Coal (million ton) - Recoverable ^b	812
Gas (trillion cubic feet) - Proven ^c	0.2
Oil (billion barrel) - Proven ^c	0.04

– = data not available, GDP = gross domestic product, PPP = purchasing power parity.

Source: ^a World Bank.

^b World Energy Council (as of end-2005).

^c Oil and Gas Journal (as of 1 January 2009).

After gaining independence from the Former Soviet Union in 1991, Kyrgyz Republic's GDP declined substantially. From 1990 to 1995, the country's GDP grew negatively, at 13% per year. Along with the decline in GDP, Kyrgyz Republic's total primary energy supply (TPES) decreased from 7.6 million tons of oil equivalent (MTOE) in 1990 to 2.4 MTOE in 1995—a nearly 70% decline within 5 years. From 1995 to 2006, the country's primary energy supply (PES) increased slowly at an annual rate of 1.3%, while GDP grew at an annual rate of 4.5%.

The Kyrgyz Republic possesses recoverable coal reserves estimated at 812 million tons (World Energy Council, 2007), proven natural gas reserves of 0.2 trillion cubic feet, and proven oil reserves of 0.04 billion barrels (Oil and Gas Journal, 2009).

Energy Consumption and Supply

Overview

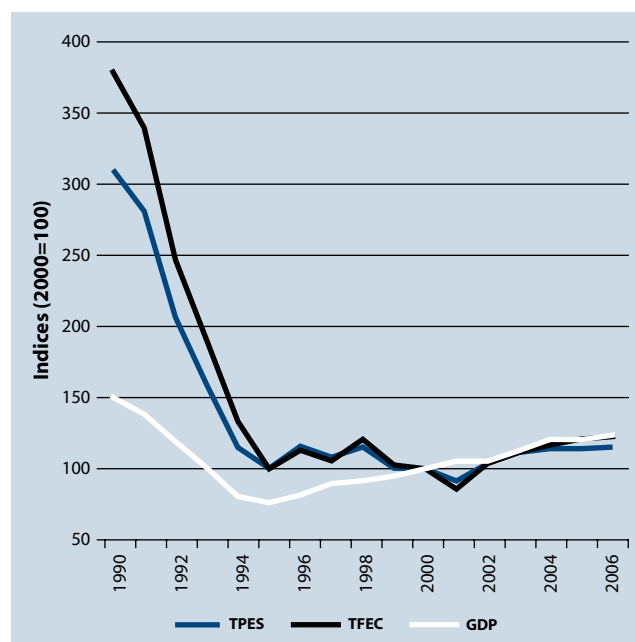
The evolution of the growth of TPES, total final energy consumption (TFEC), and GDP from 1990 to 2006 is shown in Figure 3.6.1. Following the collapse of the Soviet Union, Kyrgyz Republic's GDP declined sharply in the early 1990s. Between 1990 and 1995, GDP grew negatively at 13%, and, thereafter, GDP registered a positive annual growth rate of 4.5% (1995–2006). Despite the economy's recovery after 1995, both TFEC and TPES levels remained constant until 2006.

Table 3.6.2: Energy Supply and Demand, 2006

Primary Energy Supply (KTOE)	
Indigenous Production	1,488
Net Imports	1,326
Total PES	2,814
Coal	516
Oil	585
Gas	645
Others	1,067
TPES/Capita (TOE/person)	0.54
TPES/GDP (TOE/million \$ at current PPP)	299
Final Energy Consumption (KTOE)	
Industry	673
Transport	385
Other Sectors	1,204
Total FEC	2,263
Coal	368
Oil	582
Gas	241
Electricity	890
Others	182

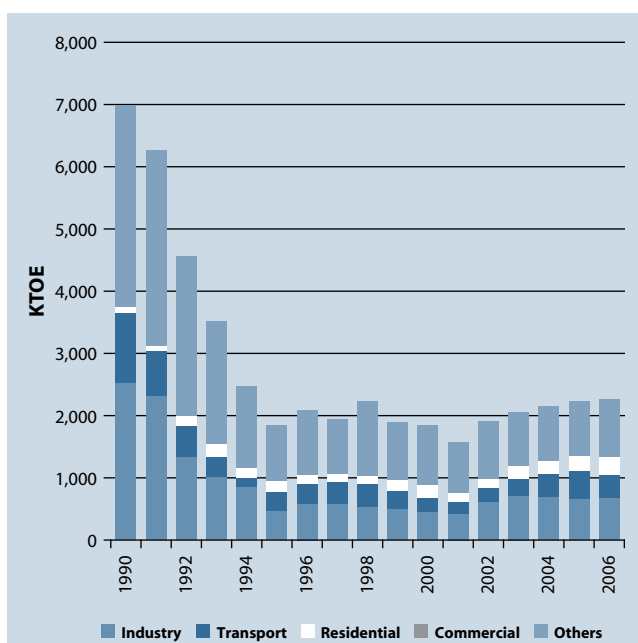
FEC = final energy consumption, GDP = gross domestic product, KTOE = thousand tons of oil equivalent, PES = primary energy supply, PPP= purchasing power parity, TOE = tons of oil equivalent, TPES = total primary energy supply.

Source: International Energy Agency (IEA).

Figure 3.6.1: Growth of GDP, TPES, and TFEC, 1990–2006

GDP = gross domestic product, TFEC = total final energy consumption, TPES = total primary energy supply.

Source: Asia Pacific Energy Research Centre (APEREC).

Figure 3.6.2: Final Energy Consumption by Sector, 1990–2006

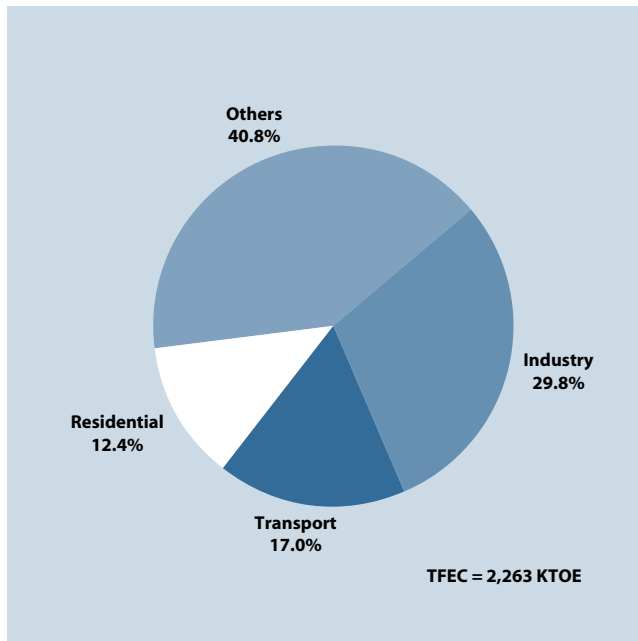
Source: IEA.

Final Energy Consumption

The Kyrgyz Republic's TFEC decreased from 7.0 MTOE in 1990 to 2.3 MTOE in 2006 at an average annual rate of 6.8%. The industry sector, which comprised 29.8% of TFEC in 2006, recorded the largest decrease, 73%, during the same period. Meanwhile, the transport sector logged a decrease of 66%, from 1.1 MTOE in 1990 to 0.39 MTOE in 2006. In contrast, the energy consumption of the residential sector more than tripled during the same period, from 85.1 MTOE to 280.3 MTOE. Figure 3.6.2 shows the evolution of final energy consumption by sector.

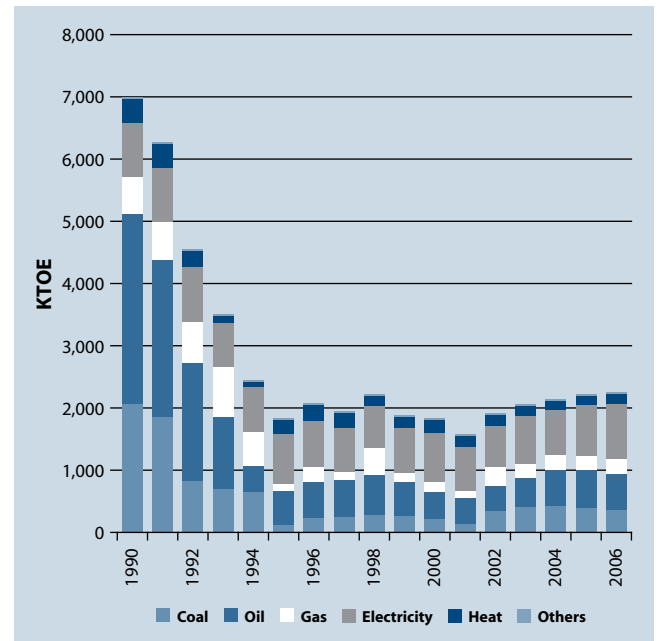
In terms of TFEC by type of energy, electricity, oil, and coal are the three main energy sources in the Kyrgyz Republic. Excluding electricity, consumption of all energy sources decreased from 1990 to 2006. Coal and oil experienced the largest decreases of about 80% due to the contraction of the industry and transport sectors. Electricity consumption showed a slight increase of 4.3% during the same period.

Figure 3.6.3: Final Energy Consumption by Sector, 2006



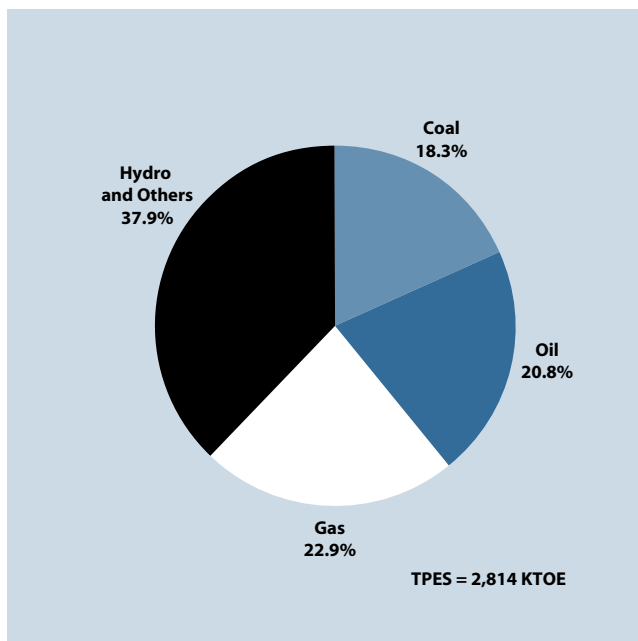
Source: IEA.

Figure 3.6.4: Final Energy Consumption by Type, 1990–2006



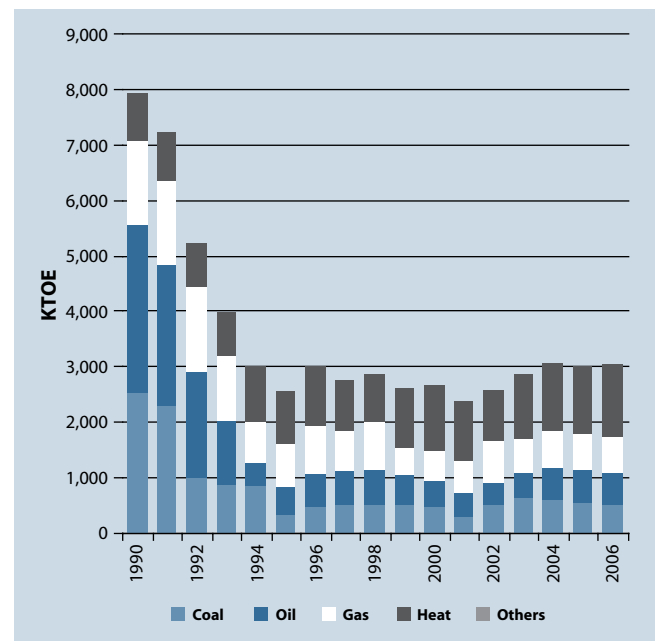
Source: IEA.

Figure 3.6.5: Primary Energy Supply by Source, 2006



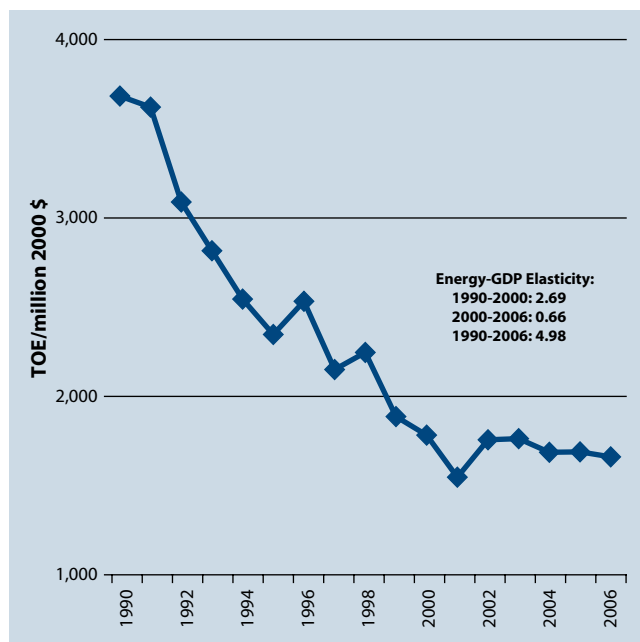
Source: IEA.

Figure 3.6.6: Primary Energy Supply by Source, 1990–2006



Source: IEA.

Figure 3.6.4 shows the evolution of TFEC by type of energy in the Kyrgyz Republic from 1990 to 2006.

Figure 3.6.7: Energy Intensity and Elasticity, 1990–2006

Source: APERC.

Energy intensity in the Kyrgyz Republic was on a declining trend, from 3,684 TOE/million \$ (constant 2000 prices) in 1990 to 1,661 TOE/million \$ in 2006 (Figure 3.6.7). During the same period, the energy–GDP elasticity ratio was calculated at 4.98 as the 1.2% decline in GDP had a correspondingly larger decrease in primary energy consumption of 6.0%.

Primary Energy Supply

The Kyrgyz Republic's primary energy is supplied mainly by hydro, coal, oil, and gas. Hydro and other sources comprised 37.9% of TPES in 2006, while coal, oil, and gas each accounted for about 20% each (Figure 3.6.5).

TPES decreased from 7.6 MTOE in 1990 to 2.8 MTOE in 2006. In parallel with the primary energy supply, all fuels, except for hydro, decreased during the period, with coal and oil experiencing the largest decreases of about 80%. On the other hand, the supply of all fuels showed an increasing trend after 2001, in line with the Kyrgyz Republic's economic growth.

Figure 3.6.6 shows the evolution of TPES in the Kyrgyz Republic from 1990 to 2006.

Energy Intensity and Elasticity

3.8 Tajikistan

Background

Tajikistan is the smallest economy in Central Asia in terms of its gross domestic product (GDP) of \$1.6 billion (constant 2000 prices) in 2006 (World Bank, 2008). Likewise, in 2006, its population size was relatively small at 6.6 million, and its GDP per capita, at \$247, represented one of the lowest levels in Central Asia.

Table 3.8.1: Key Data and Economic Profile, 2006

Socioeconomic Data^a	
Land Area (square kilometer)	139,960
Population (thousand)	6,640
GDP (billion constant 2000 \$)	1.6
GDP (billion \$ at current PPP)	10.7
GDP per Capita (constant 2000 \$)	247
GDP per Capita (\$ at current PPP)	1,611
Electrification Rate (Percent)	
	—
Energy Reserves	
Coal (million ton) - Recoverable	—
Gas (trillion cubic feet) - Proven ^b	0.20
Oil (billion barrel) - Proven ^b	0.01

— = data not available, GDP = gross domestic product, PPP = purchasing power parity.

Source: ^a World Bank.

^b Oil and Gas Journal (as of 1 January 2009).

As a result of the economic downturn caused by the collapse of the Soviet Union, as well as civil war, Tajikistan's primary energy demand declined by about 40% from 1990 to 1994. It maintained a similar level during the rest of the 1990s. In parallel with the economic recovery since 2000, primary energy demand began to increase at an annual rate of 4.2% (2000–2006).

Because of its limited energy resource base, Tajikistan's indigenous energy production meets only 41% of its total primary energy demand. Among its indigenous energy production, hydro is by far the largest domestic supply source, accounting for 95% of the country's total indigenous production.

The country holds 0.2 trillion cubic feet of natural gas reserves and 10 million barrels of oil reserves (World Energy Council, 2007). Tajikistan is the smallest oil reserves holder in Central Asia.

Energy Consumption and Supply

Overview

Tajikistan's economy grew rapidly at an annual average rate of 9.0% from 2000 to 2006. In contrast, its population growth during the same period was 1.2% per year.

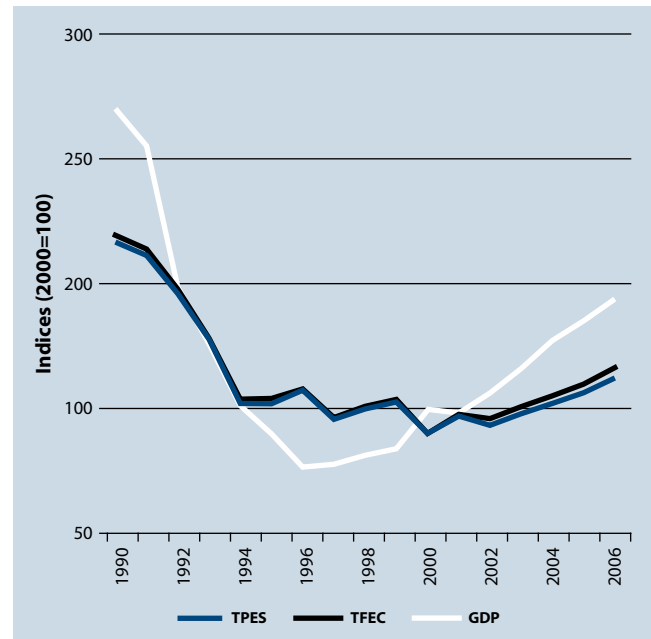
From 1990 to 2006, the country's total final energy consumption (TFEC) and total primary energy supply (TPES) decreased by 33% and by 35%, respectively. As shown in Figure 3.8.1, both TFEC and TPES declined sharply in the early 1990s after the collapse of the Former Soviet Union. After hitting their lowest levels in 2000, both TFEC and TPES started to register positive growth rates, but still in 2006, these did not reach the 1990 levels.

Table 3.8.2: Energy Supply and Demand, 2006

Primary Energy Supply (KTOE)	
Indigenous Production	1,500
Net Imports	2,136
Total PES	3,636
Coal	48
Oil	1,626
Gas	489
Others	1,473
TPES/Capita (TOE/person)	0.55
TPES/GDP (TOE/million \$ at current PPP)	340
Final Energy Consumption (KTOE)	
Industry	573
Transport	1,348
Other Sectors	1,379
Total FEC	3,300
Coal	48
Oil	1,625
Gas	273
Electricity	1,265
Others	90

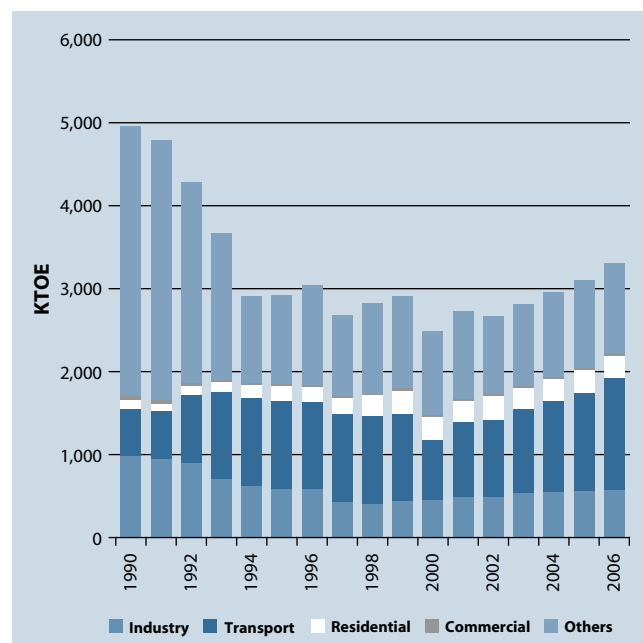
FEC = final energy consumption, GDP = gross domestic product, KTOE = thousand tons of oil equivalent, PES = primary energy supply, PPP= purchasing power parity, TOE = tons of oil equivalent, TPES = total primary energy supply.

Source: International Energy Agency (IEA).

Figure 3.8.1: Growth in GDP, TPES, and TFEC, 1990–2006

GDP = gross domestic product, TFEC = total final energy consumption, TPES = total primary energy supply.

Source: Asia Pacific Energy Research Centre (APEREC).

Figure 3.8.2: Final Energy Consumption by Sector, 1990–2006

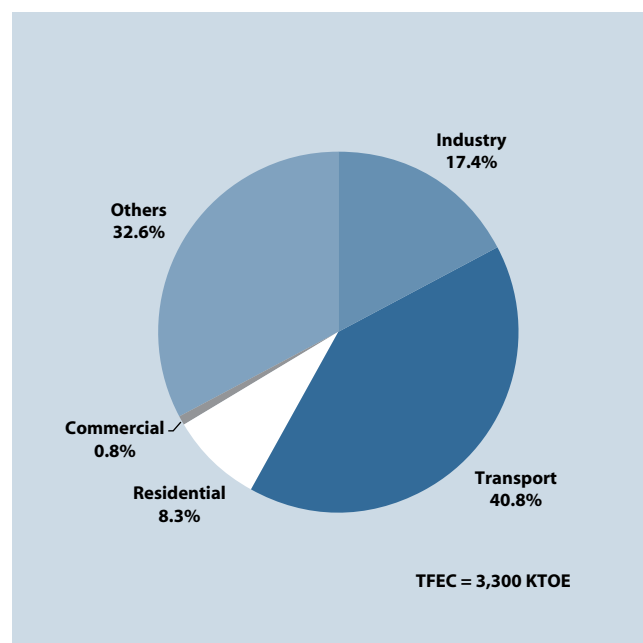
Source: IEA.

Final Energy Consumption

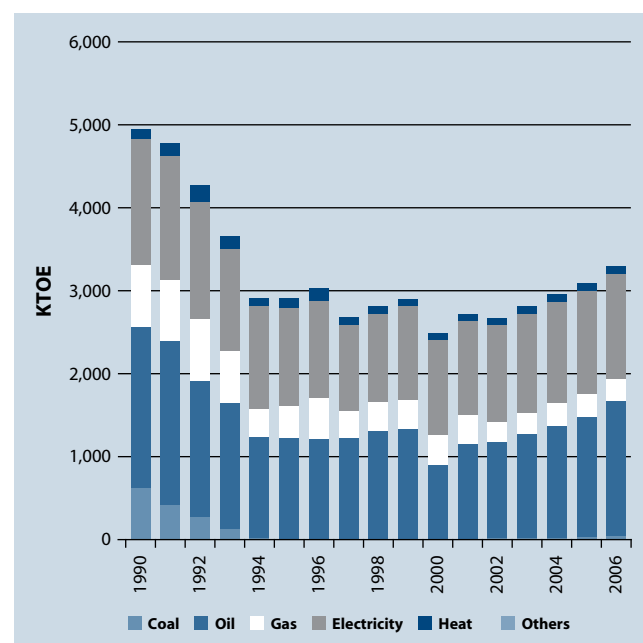
TFEC in Tajikistan decreased from 4.95 million tons of oil equivalent (MTOE) in 1990 to 3.30 MTOE in 2006. The Others sector represented the largest decline in consumption.¹¹ Since this sector is the single largest sector, it drove the overall decrease during this period. It is interesting to note, as Figure 3.8.2 shows, the low energy consumption of the residential and commercial sectors in Tajikistan and that the growth in the transport sector affected the overall positive growth in TFEC from 2000 to 2006.

The transport sector's energy consumption more than doubled, from 0.56 MTOE in 1990 to 1.3 MTOE, in 2006. Growth in gasoline consumption drove the overall

¹¹ Due to data classification problems, consumption that should have been categorized under the industry, residential, and commercial sectors is included in the Others sector.

Figure 3.8.3: Final Energy Consumption by Sector, 2006

Source: IEA.

Figure 3.8.4: Final Energy Consumption by Type, 1990–2006

Source: IEA.

growth in the transport sector. As a result of income growth and road infrastructure development, some passengers shifted from nonmotorized to motorized transport, thereby driving a more-than-twofold increase in gasoline consumption from 0.54 MTOE in 1990 to 1.3 MTOE in 2006.

Although maintaining a low level, the residential sector's energy consumption more than doubled, from 0.11 MTOE in 1990 to 0.28 MTOE in 2006. This increase was led entirely by the sector's increased electricity consumption.

Figure 3.8.3 shows the sectoral final energy consumption in Tajikistan in 2006.

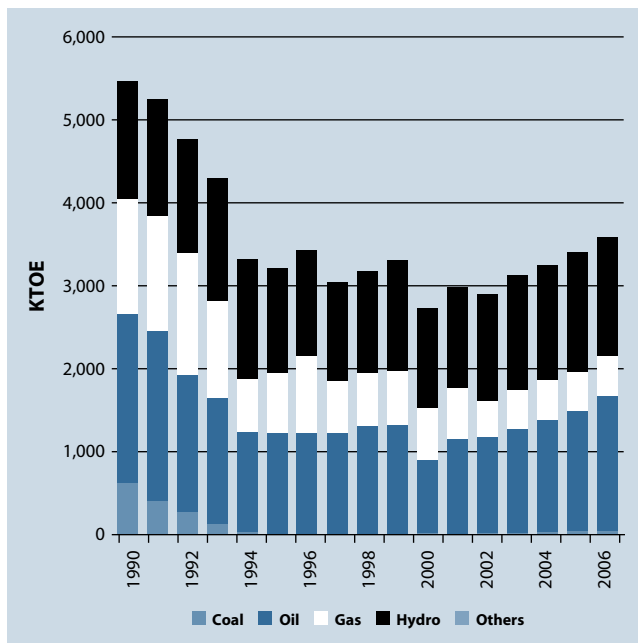
In terms of consumption by energy type, oil represented the largest share of TFEC, at 49%, in 2006—up from 39% in 1990. The increase in oil's share of TFEC reflects the recent rapid increase in oil consumption at an average annual rate of 10.5% (2000–2006)—much faster than the annual growth rate of overall TFEC of 4.9% during the same period.

In Tajikistan, consumption of all energy sources decreased between 1990 and 2006. Coal consumption registered the largest decrease, from 0.63 MTOE in 1990 to only 0.048 MTOE in 2006. Although coal consumption was included in the Others sector, the shift away from coal to other energy sources (such as natural gas and electricity) in the industry, residential, and commercial sectors may explain the substantial decline in coal's consumption.

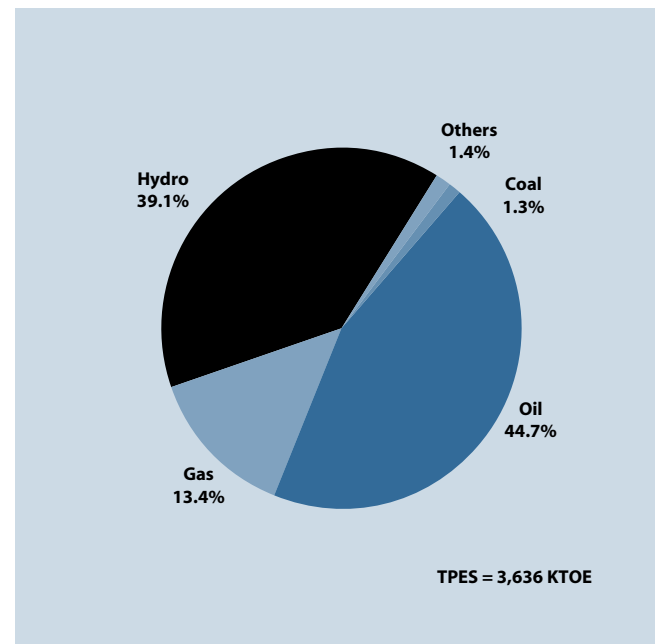
Gas consumption declined from 0.73 MTOE in 1990 to 0.27 MTOE in 2006, at an annual average rate of 6%. All of the gas consumption was categorized under the Others sector, while the real consumption decline should have occurred across all sectors.

Primary Energy Supply

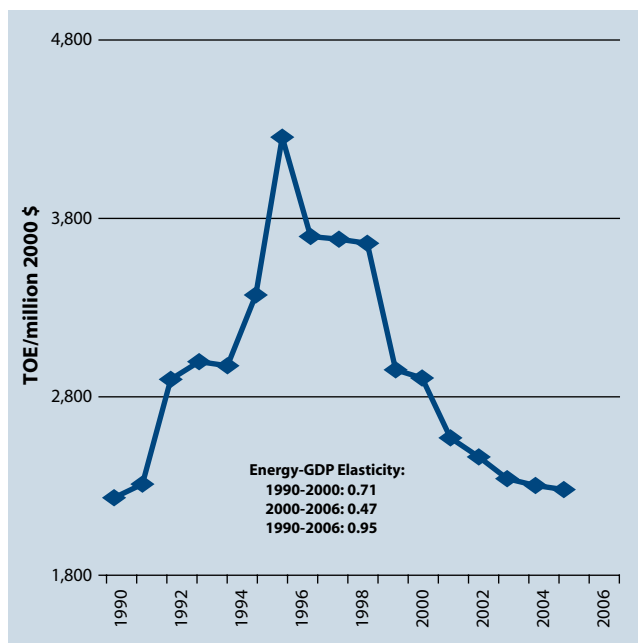
Tajikistan's primary energy is supplied mainly by three energy Source: oil, natural gas, and hydro. In 2006, oil represented the largest share at 44.7%, followed by hydro at 39.1%, and natural gas at 13.4% (Figure 3.8.6). Hydro accounted for the largest share of power generation at 98%. As shown in Figure 3.8.5, the amount of hydro supply remained fairly constant from 1990 to 2006.

Figure 3.8.5: Primary Energy Supply by Source, 1990–2006

Source: IEA.

Figure 3.8.6: Primary Energy Supply by Source, 2006

Source: IEA.

Figure 3.8.7: Energy Intensity and Elasticity, 1990–2006

Source: APERC.

Tajikistan's TPES decreased in the early 1990s and then remained at about 3 MTOE level until the end of the 1990s. Since then, it gradually increased to 3.6 MTOE in 2006.

Energy Intensity and Elasticity

The energy intensity in Tajikistan rose rapidly, from 2,166 TOE/million \$ (constant 2000 prices) in 1990 to 4,247 TOE/million \$ in 1996 (Figure 3.8.7). From 1997 onwards, energy intensity began to fall, reaching 2,218 TOE/million \$ in 2006. The mountain-shaped curve of energy intensity stems largely from Tajikistan's decline in economic activity in the mid-1990s, while its TPES was less affected.

3.10 Uzbekistan

Background

Uzbekistan is a small country in terms of its gross domestic product (GDP) and land area. Its GDP ranked 13th and its land area was 20th among the Asian Development Bank's member countries in 2006. Its 2006 GDP registered at \$19.2 billion (at constant 2000 prices) (World Bank, 2008).

Table 3.10.1: Key Data and Economic Profile, 2006

Socioeconomic Data^a	
Land Area (square kilometer)	425,400
Population (thousand)	26,540
GDP (billion constant 2000 \$)	19.2
GDP (billion \$ at current PPP)	58.2
GDP per Capita (constant 2000 \$)	724
GDP per Capita (\$ at current PPP)	2,193
Electrification Rate (Percent)	
—	
Energy Reserves	
Coal (million ton) - Recoverable ^b	3,000
Gas (trillion cubic feet) - Proven ^c	65
Oil (billion barrel) - Proven ^c	0.59

— = data not available, GDP = gross domestic product, PPP = purchasing power parity.

Source: ^a World Bank.

^b World Energy Council (as of end-2005).

^c Oil and Gas Journal (as of 1 January 2009).

Like other countries in Central and West Asia, the dissolution of the Former Soviet Union negatively impacted Uzbekistan's economic activities. As a result of the economic downturn, energy consumption dropped in the early 1990s. Between 1990 and 1995, the country's GDP declined by 15%, while primary energy supply dropped by 8%. From 1995 to 2006, the country's GDP increased by 69%, while primary energy supply increased by only 14%.

In 2006, Uzbekistan produced 41.6 million tons of oil equivalent (MTOE) of natural gas, of which 9.7 MTOE was exported. Proven reserves of natural gas, as of 1 January 2009, in Uzbekistan were estimated at 65 trillion cubic feet—the 17th largest in the world. It also has 0.59 billion barrels of proven oil reserves (Oil and Gas Journal, 2009). Uzbekistan's energy transport infrastructure is connected to the Russian Federation, Kazakhstan, and Turkmenistan.

The country also has 3 billion tons of recoverable coal reserves (World Energy Council, 2007).

Energy Consumption and Supply

Overview

From 1990 to 2006, Uzbekistan's GDP increased at an average annual rate of 1.98%. While the country's GDP decreased at an annual rate of 4.1% from 1990 to 1995, it recovered to increase positively at an annual rate of 4.9% (2000–2006).

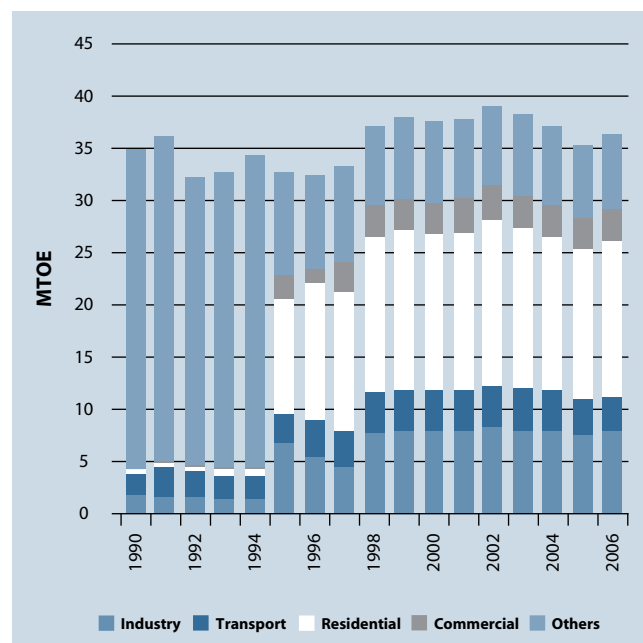
Although GDP recovered to increase from 2000 to 2006, both the total primary energy supply (TPES) and total final energy consumption (TFEC) remained almost flat during the same period (Figure 3.10.1).

Table 3.10.2: Energy Supply and Demand, 2006

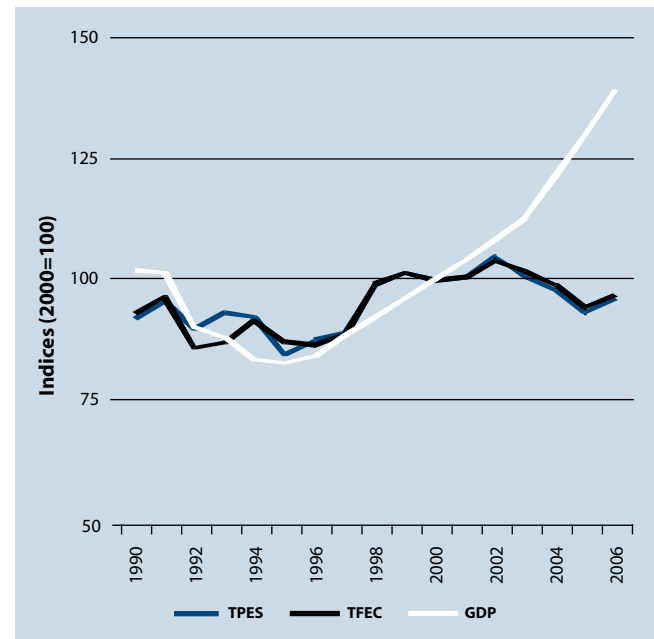
Primary Energy Supply (KTOE)	
Indigenous Production	58,167
Net Imports	-9,687
Total PES	48,454
Coal	1,068
Oil	5,278
Gas	41,571
Others	538
TPES/Capita (TOE/person)	1.8
TPES/GDP (TOE/million \$ at current PPP)	833
Final Energy Consumption (KTOE)	
Industry	7,933
Transport	3,345
Other Sectors	25,160
Total FEC	36,437
Coal	184
Oil	3,562
Gas	26,620
Electricity	3,497
Others	2,574

FEC = final energy consumption, GDP = gross domestic product, KTOE = thousand tons of oil equivalent, PES = primary energy supply, PPP = purchasing power parity, TOE = tons of oil equivalent, TPES = total primary energy supply.

Source: International Energy Agency (IEA).

Figure 3.10.2: Final Energy Consumption by Sector, 1990–2006

Source: IEA.

Figure 3.10.1: Growth in GDP, TPES, and TFEC, 1990–2006

GDP = gross domestic product, TFEC = total final energy consumption, TPES = total primary energy supply.

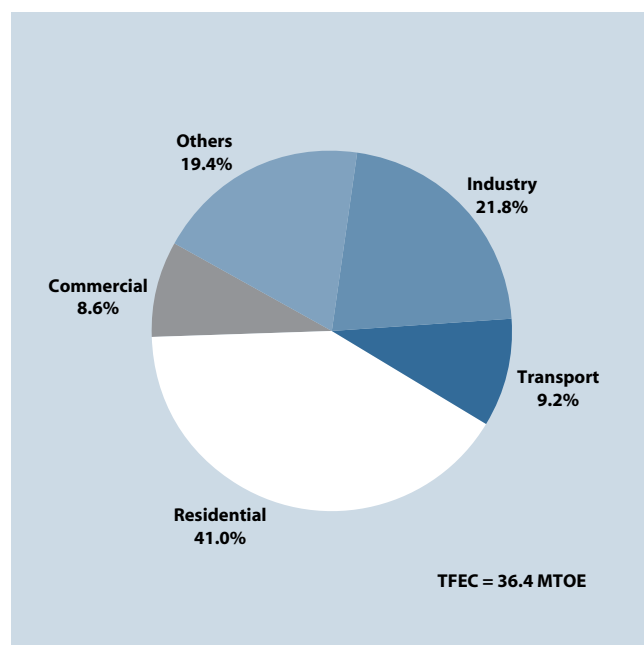
Source: Asia Pacific Energy Research Centre (APERC).

Final Energy Consumption

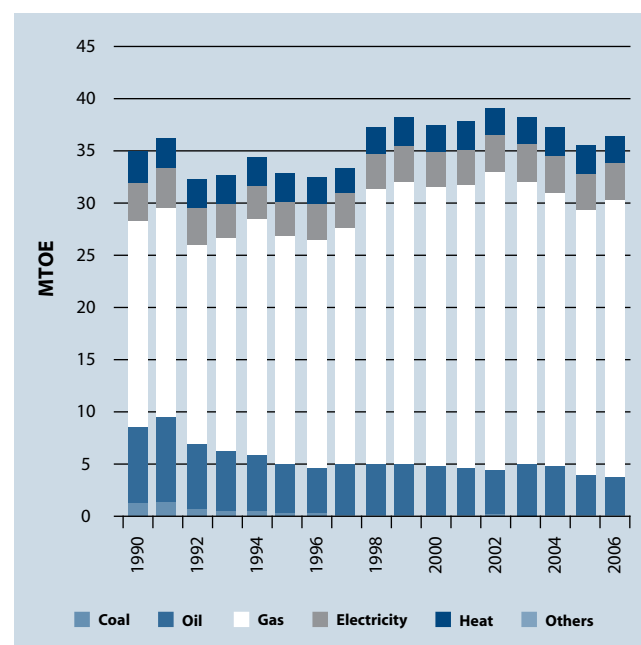
TFEC in Uzbekistan grew only at an average annual growth rate of 0.3%, from 35.0 MTOE in 1990 to 36.4 MTOE in 2006 (Figure 3.10.2). Due to a statistical problem from 1990 to 1994, the sectoral details are not clear. Between 1990 and 1994, for example, more than 85% of TFEC is categorized under the Others sector.

In terms of the sectoral share, the residential sector accounted for the largest share of TFEC, at 41% in 2006, followed by industry at 22%, Others at 19%, and transport and commercial, both at 9% (Figure 3.10.3).

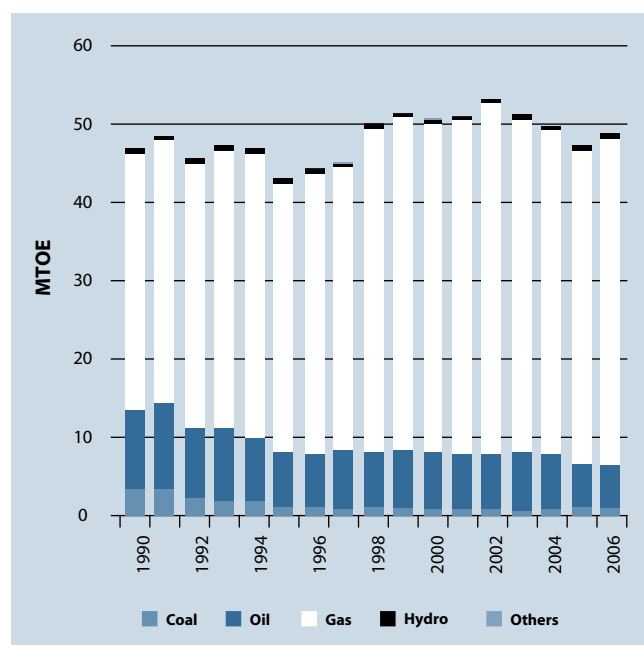
Looking at the data between 2000 and 2006, TFEC decreased slightly at an average annual rate of 0.5%. The largest consumption decrease took place in the transport sector at an annual rate of 2.5%. This is followed by the Others sector, declining at an annual rate of 1.2% (2000–2006).

Figure 3.10.3: Final Energy Consumption by Sector, 2006

Source: IEA.

Figure 3.10.4: Final Energy Consumption by Type, 1990–2006

Source: IEA.

Figure 3.10.5: Primary Energy Supply by Source, 1990–2006

Source: IEA.

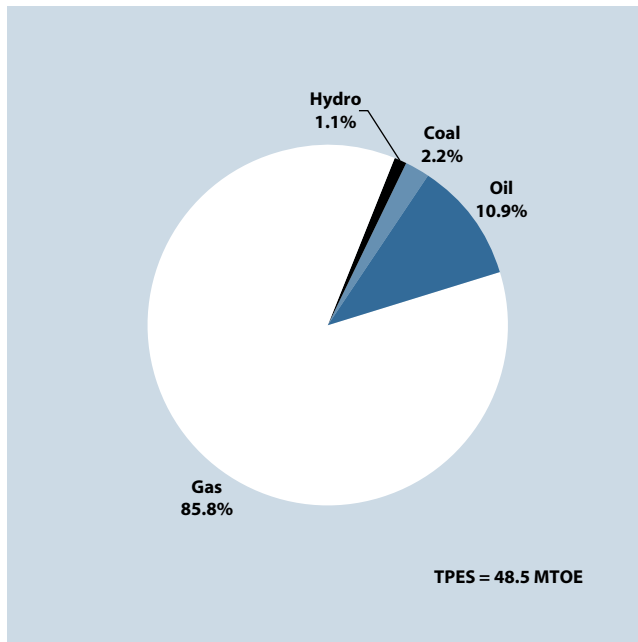
The historical trends of T FEC by energy type are shown in Figure 3.10.4. Natural gas formed the bulk of energy consumed in the final consumption. Since natural gas consumption grew at an annual rate of 1.9% (1990–2006)—faster than the average growth rate of T FEC of 0.3%—the share of natural gas expanded from 56% in 1990 to 73% in 2006.

With consumption declining at an annual rate of 4.4%, oil's share of T FEC dropped from 21% in 1990 to 10% in 2006.

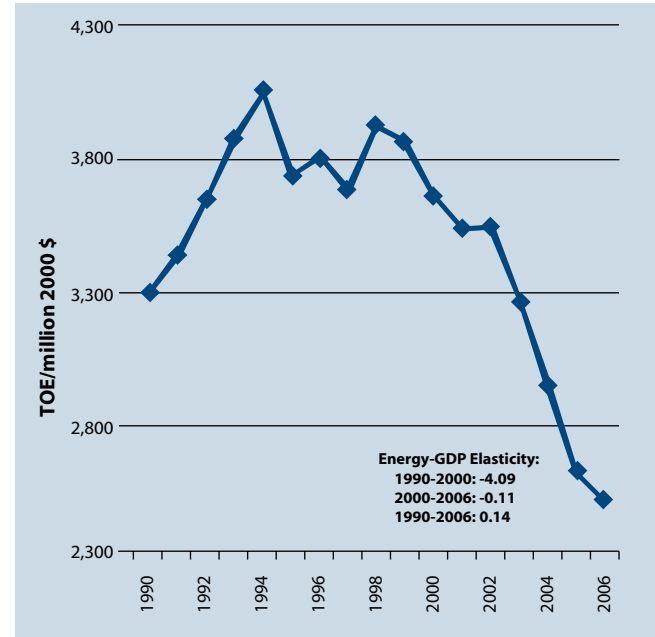
Electricity consumption maintained a flat level, declining at an annual rate of 0.3% (1990–2006), making its share of T FEC almost unchanged, from 11% in 1990 to 10% in 2006.

Primary Energy Supply

The historical trends of T PES in Uzbekistan by energy source are shown in Figure 3.10.5. From 1990 to 2006, its T PES grew slightly at an average annual rate of 0.3% (1990–2006).

Figure 3.10.6: Primary Energy Supply by Source, 2006

Source: IEA.

Figure 3.10.7: Energy Intensity and Elasticity, 1990–2006

Source: APERC.

Uzbekistan's TPES was dominated by natural gas, which accounted for 85.8% of TPES in 2006 (Figure 3.10.6). Natural gas supply increased from 32.5 MTOE in 1990 to 41.6 MTOE in 2006, at an annual rate of 1.6%.

As oil supply declined at an annual rate of 4.0%, from 10.1 MTOE in 1990 to 5.3 MTOE in 2006, its share of TPES decreased from 22% to 11%.

Coal supply also decreased by 51.6%, from 3.4 MTOE in 1990 to 1.1 MTOE in 2006 at an annual rate of 7%. The largest decrease in coal's supply stemmed from the power sector's shift toward domestically produced natural gas.

Energy Intensity and Elasticity

The historical trends in energy intensity from 1990 to 2006 are shown in Figure 3.10.7. Energy intensity increased from 3,331 TOE/million \$ (constant 2000 prices) in 1990 to 4,045 TOE/million \$ in 1994. Between 1995 and 1997, energy intensity maintained a relatively flat level at about 3,700 TOE/million \$. After increasing to 3,921 TOE/million \$ in 1998, energy intensity declined at an annual rate of 5.4% (1998–2006). During this period, energy supply declined slowly at an annual rate of 0.4%, in contrast to the growth in GDP at an annual rate of 5.3%.

At 2,522 TOE/million \$, Uzbekistan's 2006 energy intensity represents more than double that of the People's Republic of China. This high energy intensity level resulted from a relatively low GDP as expressed in US dollars.

3.13 Mongolia

Background

Mongolia's economy declined in the early 1990s along with the collapse of the Soviet Union, which had provided the country with significant assistance—up to one-third of Mongolia's gross domestic product (GDP) at one time. Mongolia recovered from the economic downturn in 1994, after which its economy grew at an annual rate of 5.1% until 2006. In 2006, the country's GDP reached \$1.6 billion (constant 2000 prices). With a population of 2.6 million, Mongolia's GDP per capita was \$626 (constant 2000 prices)—the lowest in East Asia.

Table 3.13.1: Key Data and Economic Profile, 2006

Socioeconomic Data^a	
Land Area (square kilometer)	1,566,500
Population (thousand)	2,585
GDP (billion constant 2000 \$)	1.6
GDP (billion \$ at current PPP)	7.5
GDP per Capita (constant 2000 \$)	626
GDP per Capita (\$ at current PPP)	2,902
Electrification Rate (Percent)^b	
	65
Energy Reserves	
Coal (billion ton) - Recoverable ^c	100
Gas (trillion cubic feet) - Proven ^d	0
Oil (billion barrel) - Proven ^d	0

GDP = gross domestic product, PPP = purchasing power parity.

Source: ^a World Bank.

^b United Nations Development Programme.

^c International Press Services, 2005.

^d Oil and Gas Journal (as of 1 January 2009).

Due to the economic downturn in the early 1990s, Mongolia's total primary energy supply (TPES) decreased sharply, from 3.4 million tons of oil equivalent (MTOE) in 1990 to 2.3 MTOE in 1997—a 34% decline. From 1997 to 2006, primary energy supply increased relatively slow (2.4% per year) compared with GDP growth during the same period at 5.3%.

Mongolia possesses vast amounts of coal reserves at an estimated potential of 100 billion tons.¹⁴ This could be the reason why coal accounted for the largest share of TPES at 71.7%, followed by oil at 24%, and biomass at 4% in 2006.

Energy Consumption and Supply

Overview

Mongolia's economic activity has traditionally relied on herding and agriculture. Prior to 1990, Soviet assistance accounted for up to one-third of its GDP. With the dismantlement of the Former Soviet Union, Mongolia's GDP declined at an annual rate of 7% between 1990 and 1993.

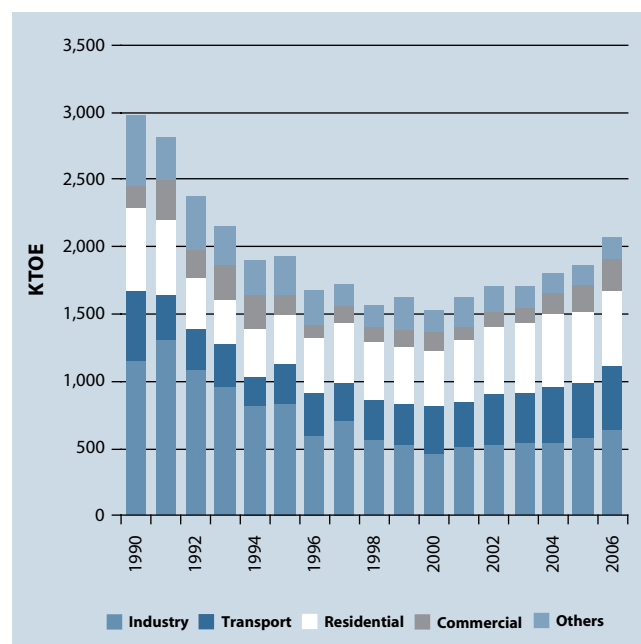
¹⁴ International Press Services (IPS). 2005. *Mongolia Business Opportunities for 2005, An Investment Perspective*.

Table 3.13.2: Energy Supply and Demand, 2006

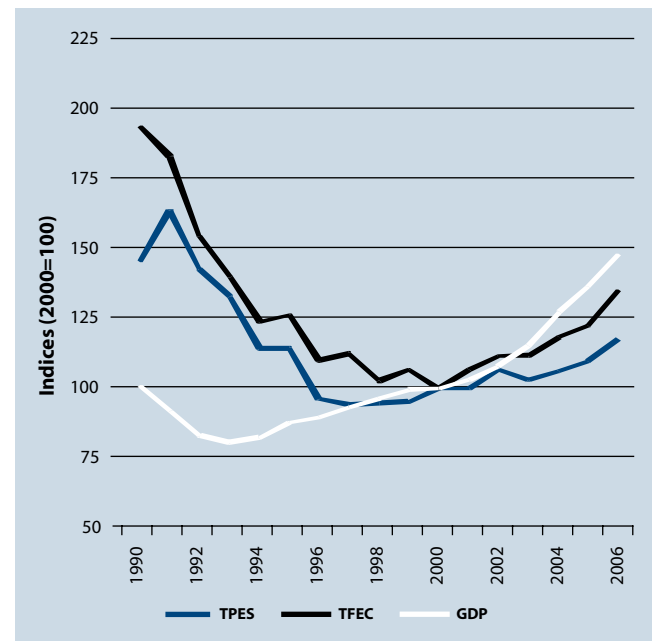
Primary Energy Supply (KTOE)	
Indigenous Production	2,979
Net Imports	-213
Total PES	2,791
Coal	2,001
Oil	671
Gas	0
Others	120
TPES/Capita (TOE/person)	1.08
TPES/GDP (TOE/million \$ at current PPP)	372
Final Energy Consumption (KTOE)	
Industry	638
Transport	482
Other Sectors	950
Total FEC	2,069
Coal	421
Oil	630
Gas	0
Electricity	234
Others	784

FEC = final energy consumption, GDP = gross domestic product, KTOE = thousand tons of oil equivalent, PES = primary energy supply, PPP= purchasing power parity, TOE = tons of oil equivalent, TPES = total primary energy supply.

Source: International Energy Agency (IEA).

Figure 3.13.2: Final Energy Consumption by Sector, 1990–2006

Source: IEA.

Figure 3.13.1: Growth in GDP, TPES, and TFEC, 1990–2006

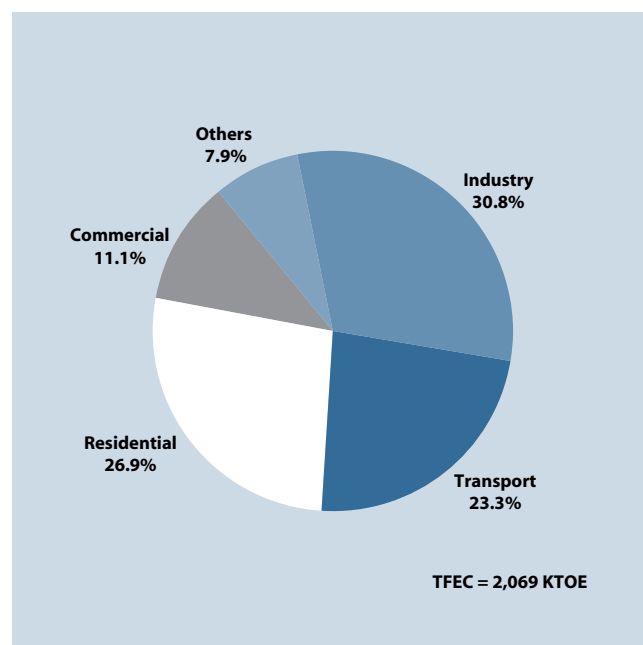
GDP = gross domestic product, TFEC = total final energy consumption, TPES = total primary energy supply.

Source: Asia Pacific Energy Research Centre (APEREC).

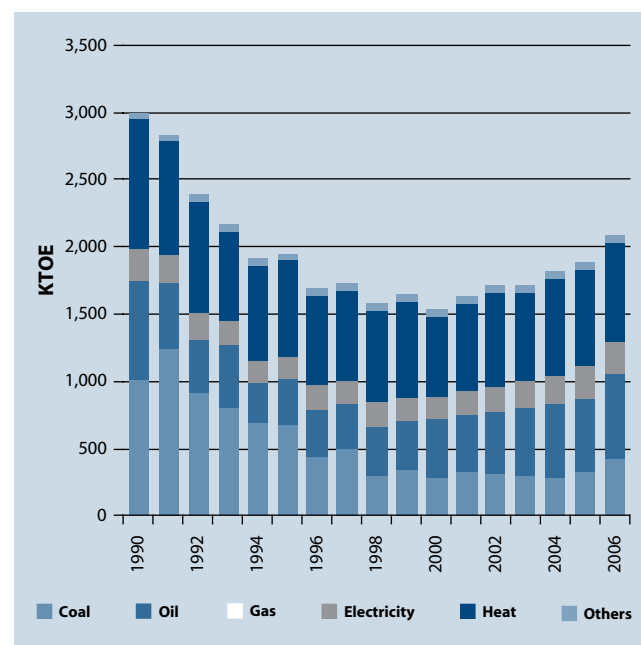
The economic downturn affected Mongolia's energy consumption. Along with the decline in GDP from 1990 to 1993, both TPES and total final energy consumption (TFEC) declined by 8% and 28%, respectively. Economic reforms undertaken since 1992 to privatize the former state-owned companies slowed industrial activities, which affected both TPES and TFEC. TPES and TFEC continued to decline, reaching their lowest levels in 1997 and 1998, respectively. From 1997 to 2006, TPES grew at an annual rate of 2.4%, while TFEC grew at an annual rate of 3.5%. Figure 3.13.1 describes these trends.

Final Energy Consumption

The historical trends in the TFEC by sector are shown in Figure 3.13.2. Until the lowest level was registered in 1998, TFEC declined at an annual rate of 7.7% from 1990. From 1998 to 2006, TFEC increased at an annual rate of 3.5%. Aside from this overall consumption trend, the growth trend of TFEC varied substantially by sector and by time period.

Figure 3.13.3: Final Energy Consumption by Sector, 2006

Source: IEA.

Figure 3.13.4: Final Energy Consumption by Type, 1990–2006

Source: IEA.

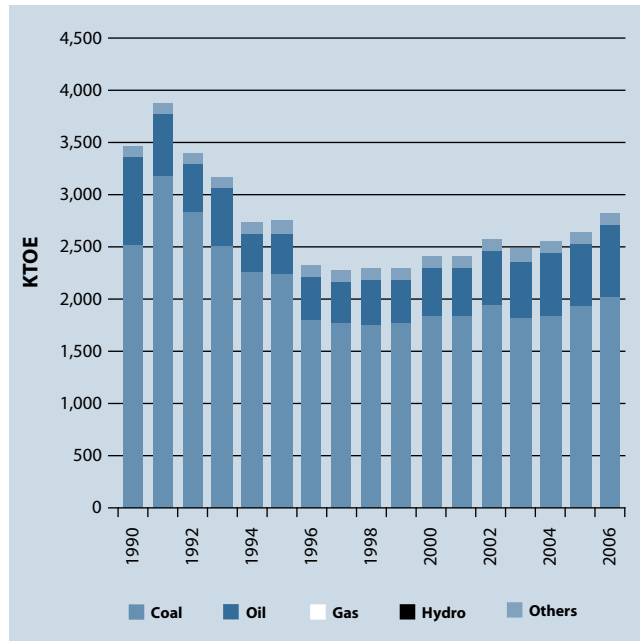
The industry sector's energy consumption reached its lowest level in 2000 at 0.47 MTOE—from 1.15 MTOE in 1990. Because of the privatization of former state-owned companies, industrial activities remained low, thereby making the sector's energy consumption almost flat from 2001 to 2006. However, the sector's energy consumption was still the largest in 2006, accounting for 30.8% of the TFEC (Figure 3.13.3).

The residential energy consumption nearly halved, from 0.61 MTOE in 1990 to 0.34 in 1993, as a result of the economic downturn. From 1993 onwards, the residential energy consumption grew at an annual rate of 3.9%—driven by the increased heat consumption and coal consumption.

Similar to the other sectors, the transport sector's energy consumption was much affected by the economic downturn. The transport sector's energy consumption reached its lowest level, at 0.23 MTOE, in 1994—down from 0.53 MTOE in 1990. Economic recovery from 1993 translated into increased transport energy consumption. Between 1993 and 2006, the sector's energy consumption grew at an annual rate of 3.2%. Gasoline was responsible for nearly 70% of incremental growth between 1993 and 2006.

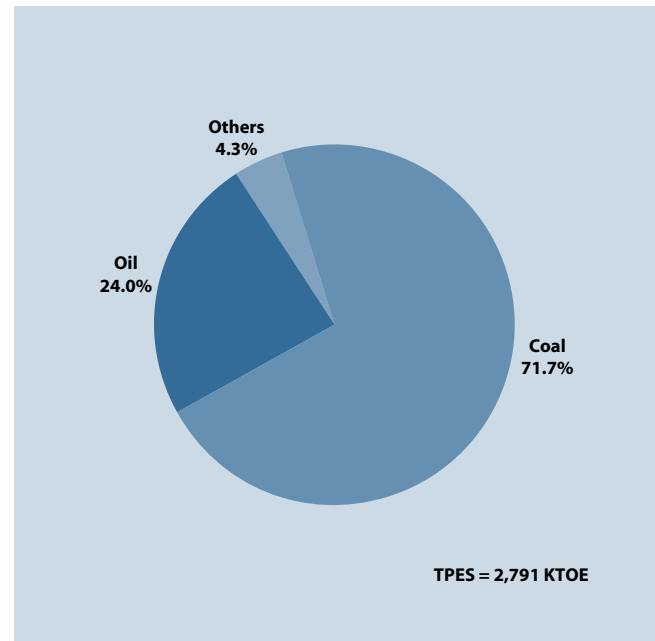
Figure 3.13.4 shows the historical trends in TFEC by type of energy. In 2006, heat accounted for the largest share of Mongolia's TFEC at 35%, followed by oil at 30%, coal at 20%, electricity at 11%, and others (mainly biomass) at 3%. In comparison with the energy mix in 1990, the share of oil, electricity, and heat increased at the expense of decreased coal share. The reduced coal share of TFEC reflects the reduction in the industry sector's consumption. In Mongolia, coal is utilized across all the sectors, and coal's consumption by the residential, commercial, and transport sectors remained relatively flat from 1993, while industry's consumption declined by 74% from 1993 to 2006.

Figure 3.13.5: Primary Energy Supply by Source, 1990–2006



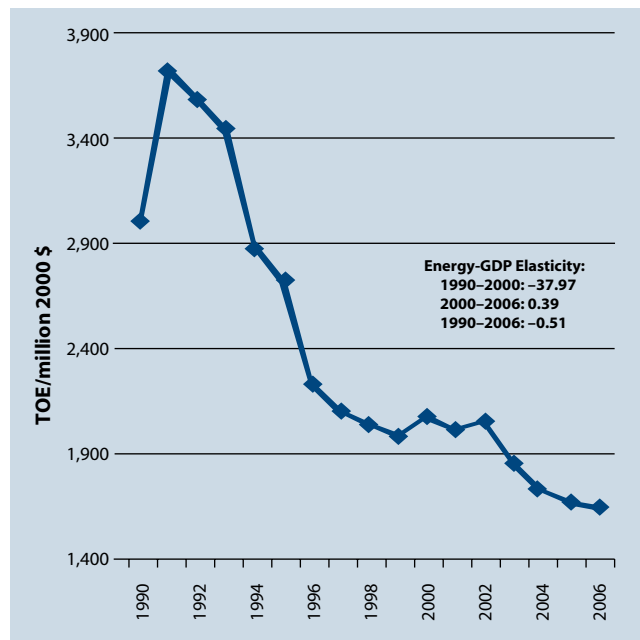
Source: IEA.

Figure 3.13.6: Primary Energy Supply by Source, 2006



Source: IEA.

Figure 3.13.7: Energy Intensity and Elasticity, 1990–2006



Source: APERC.

Primary Energy Supply

Mongolia's TPES by source is shown in Figure 3.13.5. After reaching the peak level of 3.8 MTOE in 1991, the country's TPES dropped to 2.26 MTOE in 1997. Thereafter, Mongolia's TPES increased at an annual rate of 2.3% to reach 2.8 MTOE in 2006.

Coal accounted for the largest share of TPES, at 71.7%, in 2006 (Figure 3.13.6). The power sector was the largest coal user, accounting for 79% of primary coal supply in the same year. Coal-fired generation accounted for 97% of total electricity output in 2006.

Oil represented the second largest share of TPES, at 24%, in 2006. Oil was mainly consumed by the transport sector, accounting for 64% of total oil supply in 2006.

Energy Intensity and Elasticity

After reaching its highest level at 3,832 TOE/million \$ (constant 2000 prices) in 1991, Mongolia's energy intensity decreased at an annual rate of 5.2%. Despite the declining trend, the country's energy intensity was relatively high compared with that of developed countries. This resulted from the relatively low GDP level (in US dollar terms) in view of the weakness of the Mongolian currency against the US dollar.

3.14 People's Republic of China

Background

The People's Republic of China (PRC) is the second largest economy in the world in terms of land area, and the fourth largest in terms of gross domestic product (GDP), with a 2006 GDP of \$2.1 trillion (constant 2000 prices). Since the PRC is the most populous country in the world, its per capita GDP, as of 2006, is low at \$1,598 (constant 2000 prices).

At current purchasing power parity, however, GDP—equivalent to \$6.1 trillion—is the second largest in the world, smaller only than that of the United States. Its corresponding per capita GDP represents \$4,644.

Table 3.14.1: Key Data and Economic Profile, 2006

Socioeconomic Data^a	
Land Area (square kilometer)	9,327,488
Population (thousand)	1,311,798
GDP (billion constant 2000 \$)	2,096
GDP (billion \$ at current PPP)	6,092
GDP per Capita (constant 2000 \$)	1,598
GDP per Capita (\$ at current PPP)	4,644
Electrification Rate (Percent)^b	
	99
Energy Reserves	
Coal (billion ton) - Recoverable ^c	115
Gas (trillion cubic feet) - Proven ^d	80
Oil (billion barrel) - Proven ^d	16

GDP = gross domestic product, PPP = purchasing power parity.

Source: ^a World Bank.

^b United Nations Development Programme.

^c World Energy Council (as of end-2005).

^d Oil and Gas Journal (as of 1 January 2009).

The PRC is also one of the world's major energy producers, but has become a net energy importer in recent years. In 2006, it imported 13% of its total energy requirements.

It has abundant energy resources, with 115 billion tons of recoverable coal reserves (World Energy Council, 2007), 80 trillion cubic feet of natural gas, and 16 billion barrels of oil (Oil and Gas Journal, 2009).

Energy Consumption and Supply

Overview

The evolution of the growth of GDP, total final energy consumption (TFEC), and total primary energy supply (TPES) from 1990 to

2006 is shown in Figure 3.14.1. The PRC's economy grew rapidly from 1990 to 2006 at an annual average rate of 10.2%. Its population, on the other hand, grew at an average annual rate of only 0.9%. These growth rates resulted in a fourfold increase in per capita income. During the same period, the country's TFEC and TPES grew at average annual rates of 4.4% and 6.1%, respectively.

Final Energy Consumption

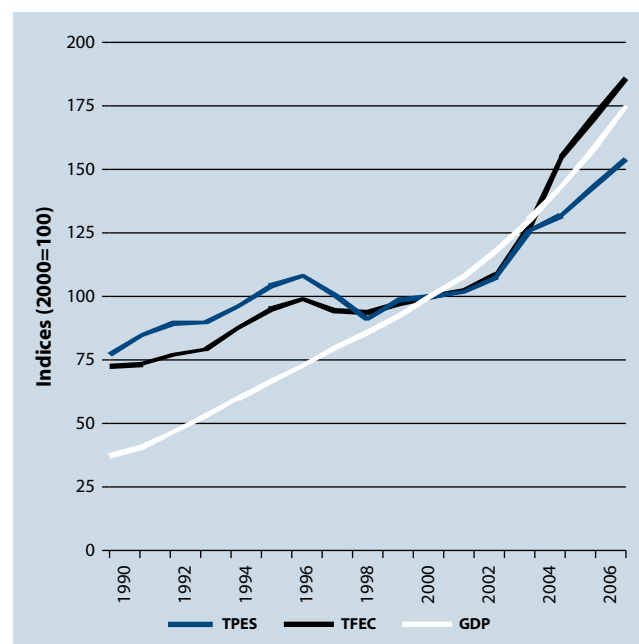
TFEC in the PRC grew at an average annual rate of 4.4%, from 489.9 million tons of oil equivalent (MTOE) in 1990 to 976.3 MTOE in 2006. The transport sector's consumption registered a high growth rate of 9.1%, increasing its share of the total consumption from 5.9% in 1990 to 11.9% in 2006. This is attributed to the rapid rate of motorization in the PRC as a result of greater economic prosperity.

Table 3.14.2: Energy Supply and Demand, 2006

Primary Energy Supply (KTOE)	
Indigenous Production	1,536,025
Net Imports	145,401
Total PES	1,681,044
Coal	1,222,426
Oil	349,864
Gas	51,903
Others	56,851
TPES/Capita (TOE/person)	1.28
TPES/GDP (TOE/million \$ at current PPP)	276
Final Energy Consumption (KTOE)	
Industry	544,123
Transport	116,023
Other Sectors	316,122
Total FEC	976,268
Coal	375,586
Oil	308,054
Gas	45,062
Electricity	199,419
Others	48,147

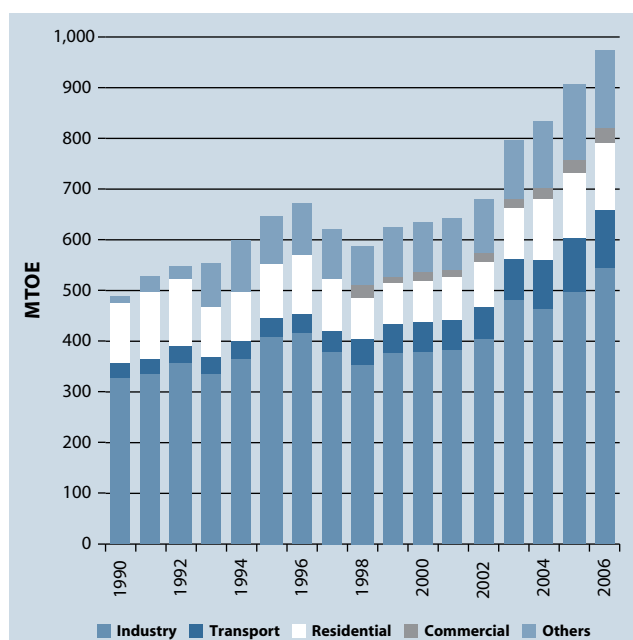
FEC = final energy consumption, GDP = gross domestic product, KTOE = thousand tons of oil equivalent, PES = primary energy supply, PPP= purchasing power parity, TOE = tons of oil equivalent, TPES = total primary energy supply.

Source: Asia Pacific Energy Research Centre (APERC).

Figure 3.14.1: Growth in GDP, TPES, and TFEC, 1990–2006

GDP = gross domestic product, TFEC = total final energy consumption, TPES = total primary energy supply.

Source: APERC.

Figure 3.14.2: Final Energy Consumption by Sector, 1990–2006

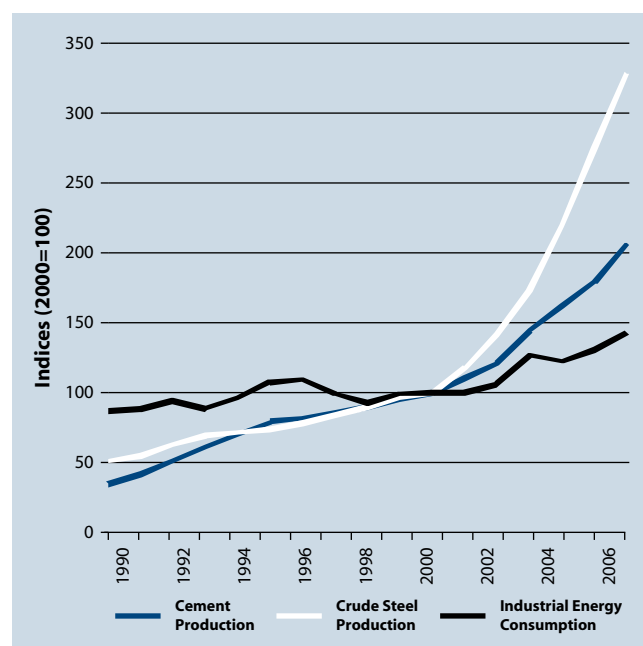
Source: APERC.

The energy consumption of the industry sector grew at 3.2% per year, a rate slower than that of TFEC growth, at 4.4%. This sector is the largest energy consumer in TFEC. Its share of the total decreased from 67.3% in 1990 to 55.7% in 2006.

On the other hand, energy consumption of the residential sector increased at a slow rate of 0.8% per annum. Its share of the total decreased from 24.2% in 1990 to 13.7% in 2006. Figure 3.14.2 shows the evolution of TFEC, which was dominated by the industry sector.

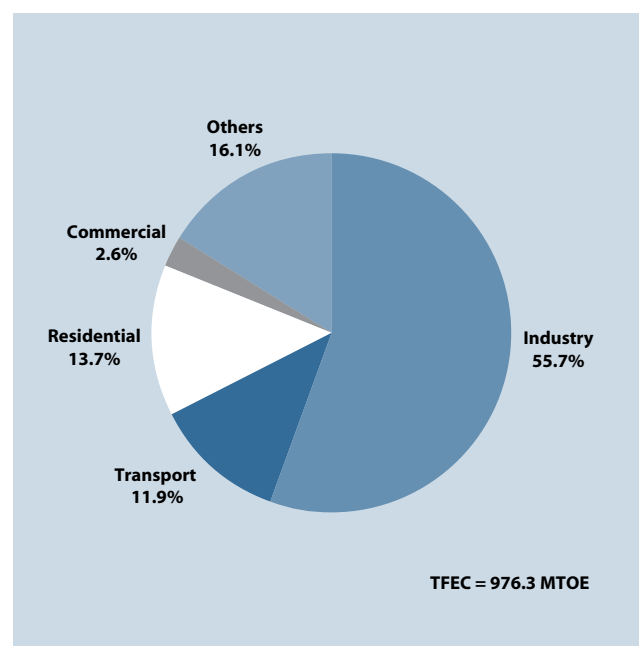
Incidentally, TFEC from 1990 to 2000 grew at a slow rate of 2.6% per annum. This, however, increased to 7.4% from 2000 to 2006—driven by the growth in energy consumption of the industry sector, particularly from energy-intensive industries. During this period, the growth rates of production of crude steel

Figure 3.14.3: Indices of Industrial Energy Consumption, Cement Production, and Steel Production, 1990–2006



Source: APERC.

Figure 3.14.4: Final Energy Consumption by Sector, 2006



Source: APERC.

and cement were at average annual rates of 21.9% and 12.9%, respectively.¹⁵

Figure 3.14.3 shows the evolution of the indices of industrial energy consumption along with the production of crude steel and cement in the PRC. From 1990 to 2000, the average annual growth rates of production were only 6.8% for crude steel and 11.0% for cement. The rapid increase in the production of crude steel and cement coincided with a period of infrastructure investment and property boom following a rapid privatization of urban housing triggered by major reforms in the urban housing sector.

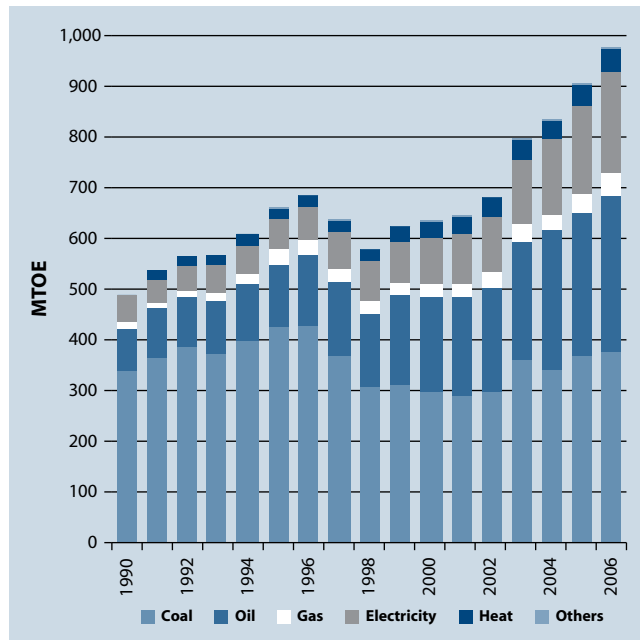
In terms of consumption by type of energy, coal formerly comprised the bulk of energy consumed in the final consumption sector. In 1990, coal's share of the TFEC was 69.0%. This dropped to 38.5% in 2006. Despite the decrease in share, coal grew by 0.7% per year over the period 1990–2006.

Oil consumption, on the other hand, increased its share from 17.2% in 1990 to 31.6% in 2006. This is due to its 8.5% average annual growth rate—driven by the growth of the industry and transport sectors.

The fastest-growing energy source is electricity. Driven by the rapid industrialization, electricity consumption increased at an annual rate of 8.7%.

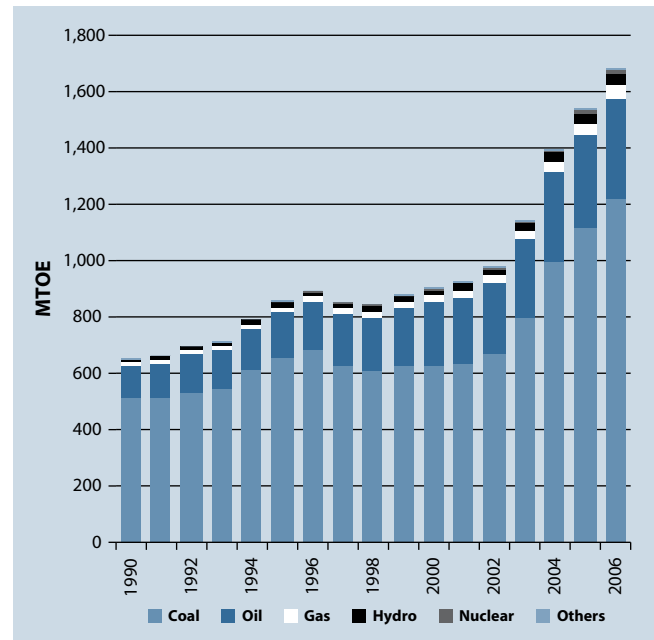
¹⁵ Data on cement and crude steel production are obtained from Asian Development Bank. 2008. *Key Indicators 2008*. Available: www.adb.org/Documents/Books/Key_Indicators/2008/Country.asp

Figure 3.14.5: Final Energy Consumption by Type, 1990–2006



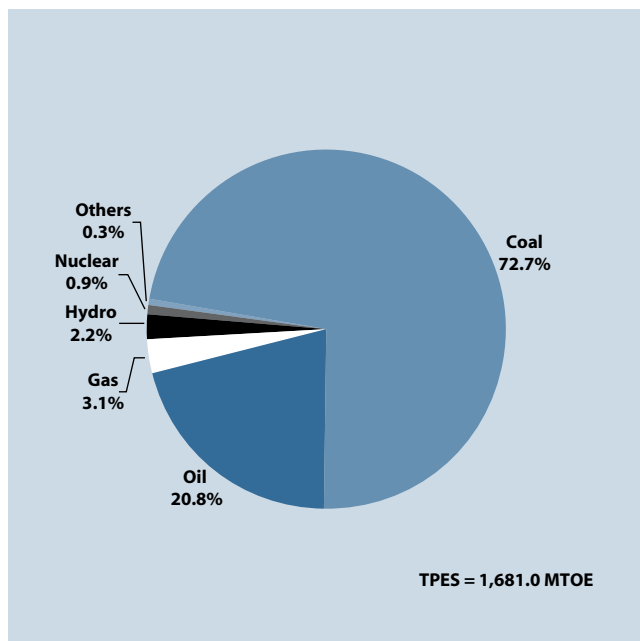
Source: APERC.

Figure 3.14.6: Primary Energy Supply by Source, 1990–2006



Source: APERC.

Figure 3.14.7: Primary Energy Supply by Source, 2006



Source: APERC.

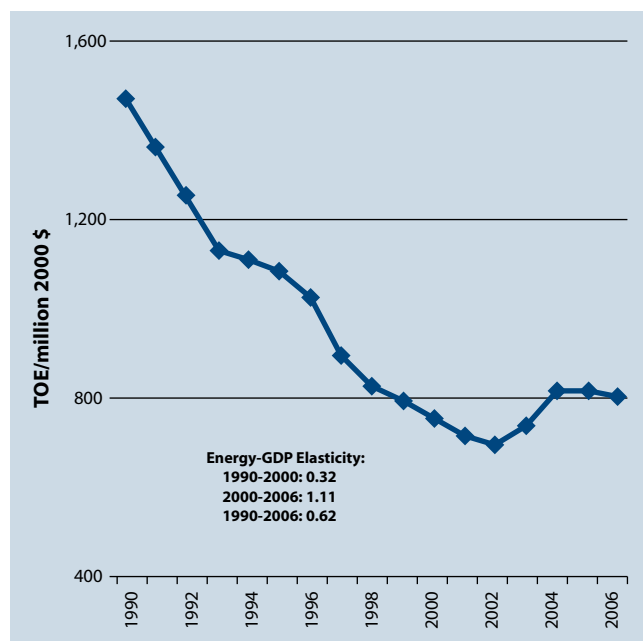
Natural gas consumption also increased substantially during the period, with an average annual escalation of 8.0%. Figure 3.14.5 shows TFEC by type of energy.

Primary Energy Supply

From 1990 to 2006, the PRC's TPES grew at an average annual rate of 6.1% (Figure 3.14.6). The annual growth rate of 3.3% observed from 1990 to 2000 more than tripled (to 10.9%) from 2000 to 2006.

Coal dominated the PRC's TPES, which accounted for 72.7% of the total in 2006 (Figure 3.14.7). Due to the slower growth rate at 5.6% (1990–2006) than that of TPES at 6.1%, the share of coal to TPES declined from 78% in 1990 to 73% in 2006. In contrast to the average growth registered between 1990 and 2006, coal supply increased at a faster rate of 11.6% (2000–2006). This could be attributed to the increased production from energy-intensive industries, such as iron and steel, as well as cement. Also, coal-fired generation increased substantially during this period to meet a double-digit

growth in electricity demand. In 2006, coal-fired generation accounted for 80% of total electricity generation.

Figure 3.14.8: Energy Intensity and Elasticity, 1990–2006

Source: APERC.

Natural gas had the fastest average annual growth rate of 8.4%, having started from a relatively low level. In fact, its share of TPES in 2006 reached only 3.1%, from 2.2% in 1990. Hydro posted the second highest growth rate of 8.0%, which could be attributed to the PRC's continuous efforts in developing hydro power, including the Three Gorges project. Oil represented the third highest growth rate, of 7.2% per annum, which could be explained by the 16.6% annual growth in vehicle ownership from 2002 to 2005.¹⁶

Energy Intensity and Elasticity

Data shows that energy intensity in the PRC declined substantially from 1,471 TOE/million \$ (constant 2000 prices) in 1990 to 694 TOE/million \$ in 2002. From 2002 onwards, energy intensity slowly increased, reaching 816 TOE/million \$ in 2004 and decreasing slightly to 802 TOE/million \$ in 2006 (Figure 3.14.8).

This decreasing energy intensity is very evident in the energy-GDP elasticity ratio. This is an indicator of the percentage increase in energy consumption for every 1% growth in GDP. From 1990 to 2000, elasticity was calculated at 0.32, indicating that for every 1% growth in GDP, energy consumption only grew by 0.32%. From 2000 to 2006, elasticity was calculated at 1.11, showing that energy consumption grew faster than GDP.

¹⁶ World Bank. 2008. *World Development Indicators 2008*. Data on vehicle ownership is available only from 2002 to 2005. The average annual growth rate was calculated during that period.