



ASEAN ENERGY REVIEW AND STATISTICS 2013

ASEAN CENTRE FOR ENERGY

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FINAL DRAFT

ASEAN CENTRE FOR ENERGY

June 2014



PREFACE

The ASEAN Centre for Energy (ACE), an inter-governmental organisation, was established by the ASEAN Member Governments beginning on 01 January 1999 with the Agreement signed by the ASEAN Ministers of Foreign Affairs. The ACE is guided by the ACE Governing Council (GC) composed of the Senior Officials on Energy of the ASEAN Member States (AMSs). The ASEAN Centre for Energy (ACE) has its function to serve as a catalyst for the economic growth and development of the ASEAN region by initiating, coordinating and facilitating national as well as joint and collective activities on energy.

As stipulated in the APAEC 2010-2015 Program Area No. 6 “Regional Energy Policy and Planning”, ACE has been tasked to realize its key actions in which the development of ASEAN Energy Database and publication of ASEAN Energy Review and Statistics are the main parts in realizing Action No. 1.1: “Continue, update and expand the ASEAN energy database and strengthen IT infrastructure”, and Action No. 1.5: “Publish ASEAN Energy Review and Energy Indicators”, under Strategy No. 1: “Enhancing energy policy and supply security information sharing network”. This ASEAN Energy Review and Statistics 2013 publication initiative also has been endorsed by the Senior Officials Meeting on Energy of the 30th ASEAN Ministers on Energy Meeting (30th SOME) held on 2-3 July 2012, and the Joint Ministerial Statement of the 30th ASEAN Ministers on Energy Meeting (30th AMEM) on 12 September 2012 in Phnom Penh, Cambodia.

In collaboration with ASEAN REPP-SSN Focal Points, ACE is pleased to present the ASEAN Energy Review and Statistics 2013 which provides information on the energy profile in supply and demand sides, composition and trends in the period of 2002-2011 of the ASEAN region. In line with the above key issues, we hope that this publication can be used as a reference to support in conducting a cohesive and effective regional energy policies analysis and planning towards sustainable energy development which is an important deliverable of the APAEC 2010-2015.

We would like to express our appreciation and thanks to all the parties involved in the preparation of this ASEAN Energy Review and Statistics 2013.

ASEAN CENTRE FOR ENERGY (ACE)



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EXECUTIVE SUMMARY

In 2011, ASEAN total primary energy supply was about 620.37 MTOE, increased significantly from 323.21 MTOE in 2002 with compound annual growth rate (CAGR) about 7.5%. Its composition shows that oil (crude oil and products) dominated the share of total primary energy supply which contributed to 41.3% in 2011. Natural gas was the second largest share with 23.1% followed by coal with 16.1%, others energy with 15.5%, geothermal about 2.7%, and hydropower about 1.2%.

ASEAN total refinery product output recorded in 2011 about 116.53 MTOE, increased slightly from 107.15 MTOE in 2002, with CAGR about 0.9%. Its composition shows that diesel was about 43.8% of the total refinery product output. The second largest share was motor gasoline with 21.6% followed by non-energy and refinery gas about 14.5%.

ASEAN total gas processing plant output recorded in 2011 about 61.85 MTOE, increased slightly from 57.48 MTOE in 2002, with CAGR about 0.8%. As observed from 2002 to 2011, the growth pattern of the ASEAN total gas processing plant output was cyclical.

ASEAN total energy input equivalent for power generation was about 168.60 MTOE in 2011, increased slightly from 97.71 MTOE in 2002, with CAGR about 6.2%. This also included fuel consumption for self-generation use. Its composition shows natural gas dominated the share in the period of 2002-2011, in which natural gas share was about 40.4% in 2011. Coal was the second largest share about 33.0%, followed by oil products with 21.7%, and renewable energy about 16.6% of the ASEAN total energy input equivalent for power generation.

ASEAN total final energy consumption was about 390.32 MTOE in 2011, increased significantly from 213.03 MTOE in 2002, with CAGR about 7.0%. Its composition shows oil products was about 45.0% of ASEAN total final energy consumption. Others energy was the second largest share with about 21.6%, followed by electricity with 13.5%, coal about 10.3%, and gas and products about 9.5%.

ASEAN total installed capacity was about 145,884 MW in 2011, increased significantly from 81,718 MW in 2002 with CAGR about 6.7%. This also included installed capacity for self-generation uses. There was a significant increase of ASEAN total installed capacity in 2006. The composition of the ASEAN total installed capacity shows that gas fired power plants was about 41.2% of the total installed capacity. The second largest share was renewable energy power plants contributed about 26.4% in which the share of hydropower about 20.3%, geothermal about 2.1% and others energy power plants such as biomass, combustible waste, wind and photovoltaic about 4.0%. Coal fired power plants with about 25.0% followed by oil products fired power plants about 7.4%.

ASEAN total power generation was about 685,552 GWh in 2011, increased significantly from 286,454 GWh in 2002 with CAGR about 10.2%. This also included electricity for self-generation uses. Oil products fired power plants did not represent the biggest share in ASEAN total power generation anymore because shifting to coal fired power plants and also increased of gas fired power plants and hydropower. The composition of the ASEAN total power generation shows that gas fired power plants dominated the share in the period of 2002-2011 about 41.8% of the ASEAN total power generation in 2011. Coal fired power plants was the second largest share which was about 33.0% followed renewable energy power plants contributed about 14.9% in which the share of hydropower about 12.2% and geothermal about 2.7%. Oil products fired power plants about 10.2%.



INTRODUCTION

In collaboration with ASEAN Regional Energy Policy and Planning Sub-Sector Network (REPP-SSN), ACE collected and compiled ASEAN energy data from ten (10) AMS's and updates and maintains the ASEAN Energy Statistics database for the period 1990-2011 in line with Annual Energy Questionnaires. It covers production, transformation and final consumption (end-use) for a range of primary and secondary energy products derived from conventional and non-conventional or renewable energy sources. The activities also include collection and dissemination of energy data, including basic data as well as aggregated tables, energy balance and electricity profiles.

Considerable efforts have been made to ensure that the data presented in this publication adhere to the ASEAN definitions and these definitions which have been used by most international organizations. This 2013 edition covers ASEAN energy data from 2002 to 2011, and the calculation flow for the ASEAN energy balance is in line with the energy chain which is shown in Annex 1.

This ASEAN Energy Review and Statistics 2013 provides information on the energy situation in supply & demand sides, composition and trends in the period of 2002-11 of the ASEAN region which consists of ten (10) ASEAN Member States, namely Brunei Darussalam, Cambodia, Indonesia, Lao P.D.R., Malaysia, Myanmar, Philippines, Singapore, Thailand and Vietnam. The associated information and data collected are presented in various user friendly formats such as pie charts, bar charts and trends.

Chapter 1 shows the ASEAN energy balance of 2011.

Chapter 2 provides an overview of the regional energy situation in the period of 2002-11. It describes the regional primary energy supply in 2002 and 2011 which covers the indigenous energy production at the ASEAN levels, the energy imports and energy exports and include the average annual growth in the observed years.

Chapter 3 describes the regional energy transformation during 2002-11 including oil refinery output, gas processing plants and energy input equivalent for power generation, including the average annual growth within ten years.

Chapter 4 describes the final energy consumption from 2002 until 2011 in the various sectors, such as industrial, transport and other sector and overall regional demand.

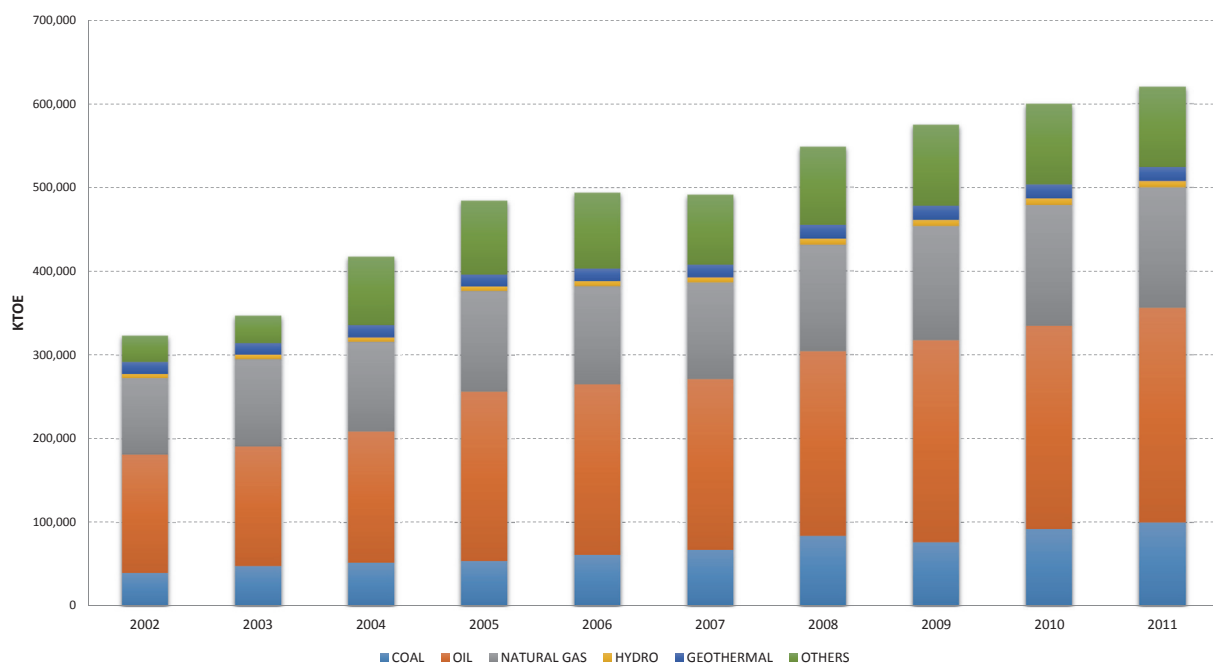
Chapter 5 describes the energy situation in the electricity sector including installed capacity and electricity generated at ASEAN from 2002 until 2011.

The Annexes provide information on conversion factors, glossary, methodology of analysis and socio-economic data.

CHAPTER 2. ASEAN PRIMARY ENERGY SUPPLY

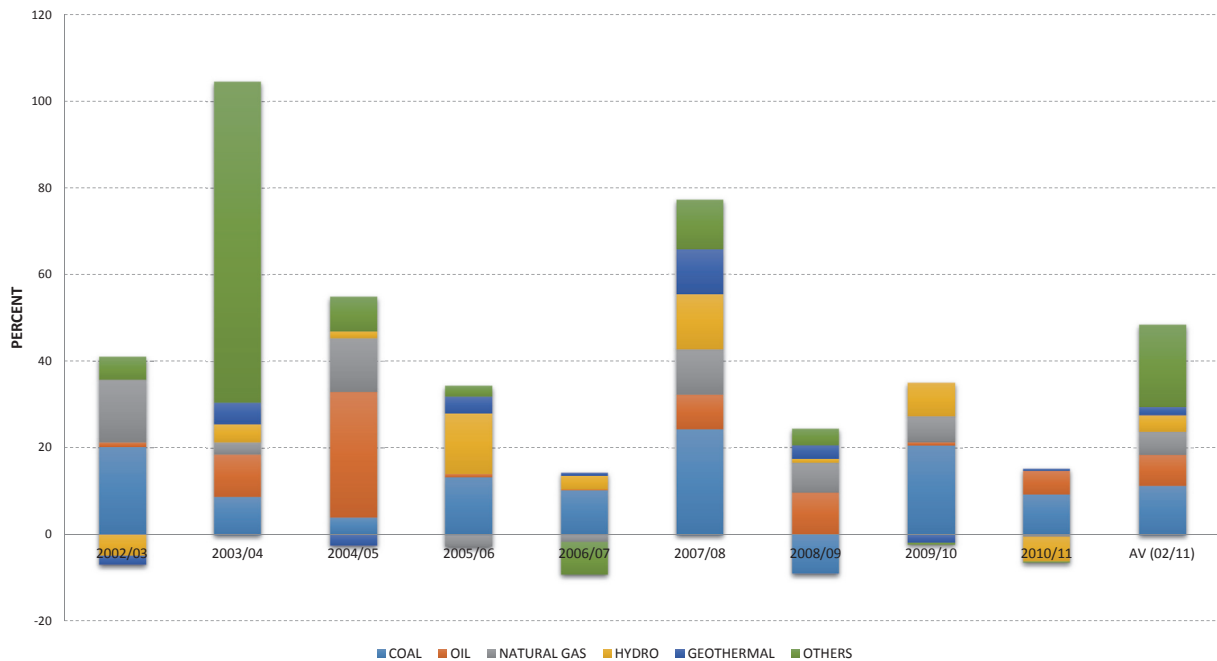
ASEAN total primary energy supply was about 620.37 MTOE in 2011, increased significantly from 323.21 MTOE in 2002 with CAGR about 7.5%. In the composition, the share of oil dominated from 2002 to 2011 with the biggest figure recorded approximately at 256.41 MTOE in 2011. As the second largest, natural gas were contributed about 143.55 MTOE in 2011. Coal and others energy interchangeably became the third largest on ASEAN total primary energy supply, coal for the period of 2002-03 and 2011 and others energy for the period of 2004-10. Coal was recorded at about 100.13 MTOE in 2011. In 2009, others energy and geothermal was recorded the biggest figure with 96.90 MTOE and 16.88 MTOE respectively. Hydropower was recorded the biggest with 7.96 MTOE in 2010. There were a significant increase in supply of others energy in 2004 and oil (crude oil and products) in 2005.

TOTAL PRIMARY ENERGY SUPPLY PER ENERGY TYPE 2002-2011



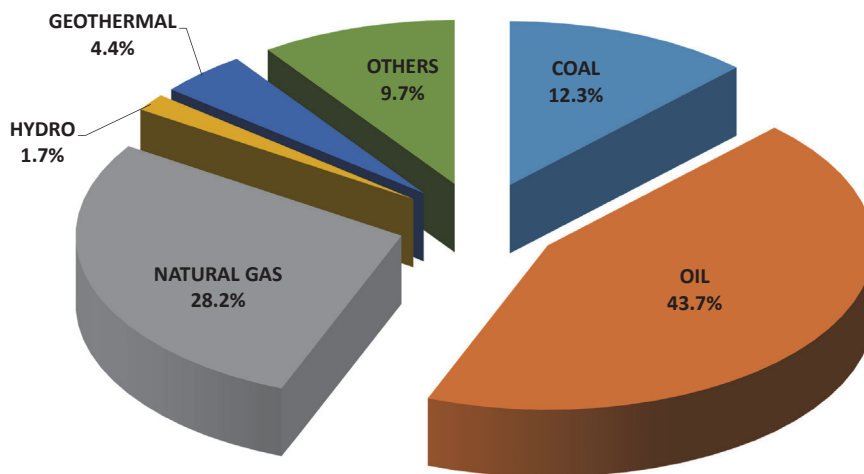
The total primary energy supply comparison based on year-on-year basis, shows that others energy has the biggest increased recorded in 2004 with a growth of 1.5 times than previous year. Oil (crude oil and products) supply increased most substantially with 28.9% in 2005. Coal supply has its biggest increased with 24.3% in 2008. Natural gas and hydropower has its biggest increased with 14.5% in 2003 and 13.9% in 2006 respectively. Geothermal reached biggest increased with 10.4% in 2008. Others energy has the most annual increased with 18.9%, followed by coal with 11.3%, oil (crude oil and products) with 7.2%. Natural gas and hydropower annually increased with 5.3% and 3.7% respectively. Geothermal posted the least increased with 1.9%. The biggest average annual increased of total primary energy supply was recorded with 29.7% in 2004.

TOTAL PRIMARY ENERGY SUPPLY ANNUAL GROWTH PER ENERGY TYPE



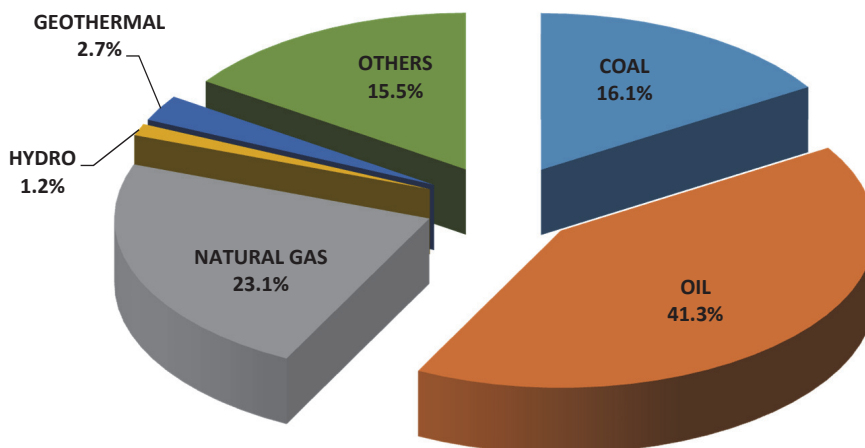
In 2002, oil (crude oil and products) contributed to 43.7% share of the total primary energy supply. Natural gas recorded as the second largest share with 28.2% followed by coal with 12.3% and others energy with 9.7%. The share of geothermal and hydropower was recorded less than 5% at about 4.4% and 1.7% respectively. Renewable energy supply share of total primary energy supply was recorded at about 15.8%.

TOTAL PRIMARY ENERGY SUPPLY BY ENERGY TYPE IN 2002



In 2011, oil (crude oil and products) still dominated the share which contributed to 41.3% of total primary energy supply. Natural gas has the second largest share with 23.1% followed by coal with 16.1% and others energy with 15.5%. The share of geothermal and hydropower was recorded less than 5% at about 2.7% and 1.2% respectively. Renewable energy supply share of total primary energy supply was recorded at about 19.4%.

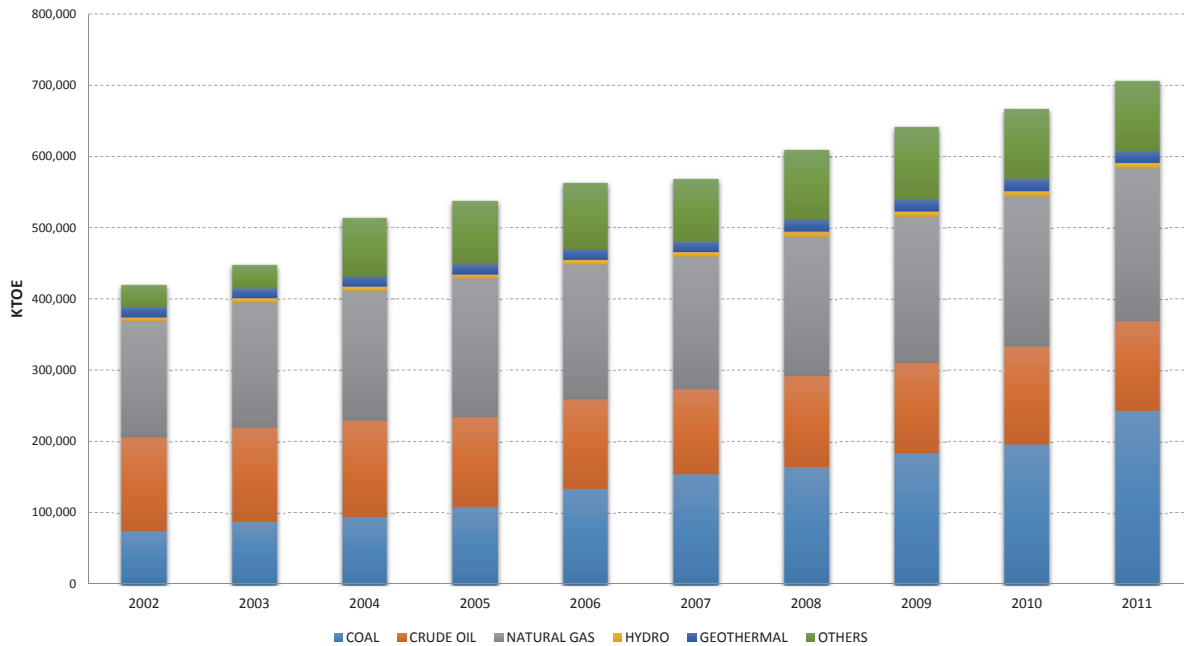
TOTAL PRIMARY ENERGY SUPPLY BY ENERGY TYPE IN 2011



2.1 PRIMARY ENERGY PRODUCTION

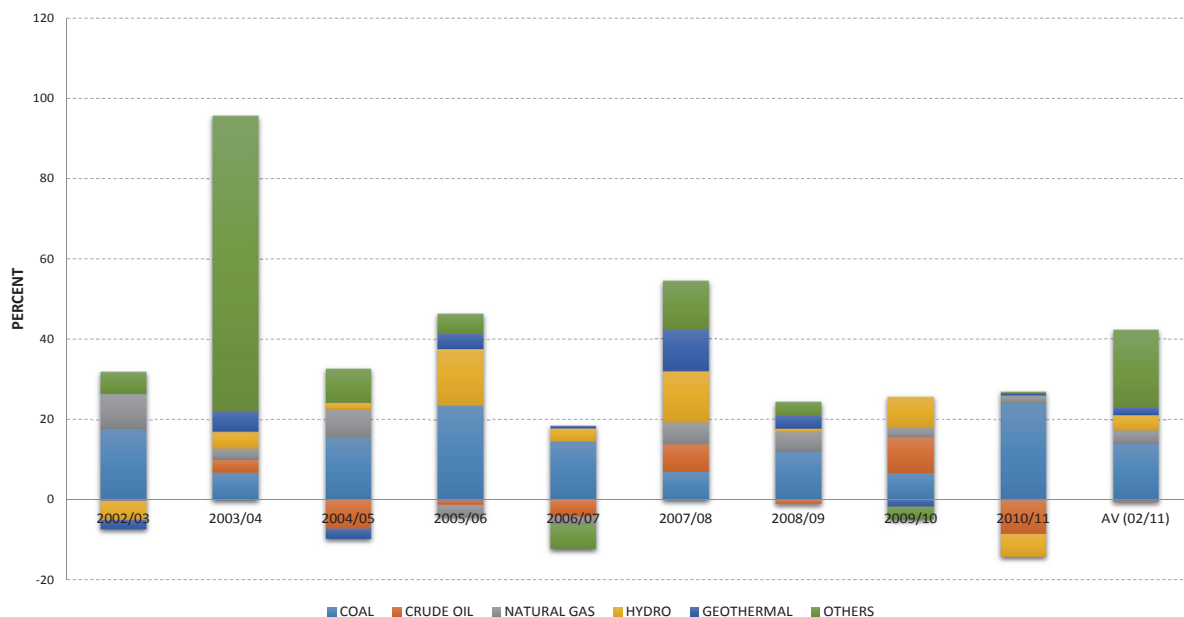
ASEAN primary energy production was about 706.83 MTOE in 2011, increased significantly from 419.66 MTOE in 2002 with CAGR about 6.0%. In the composition, natural gas dominated the share from 2002 to 2010 with the biggest figure recorded approximately at 214.10 MTOE in 2011, but overweighed by coal in 2011. As the second largest, coal overweighed crude oil in 2006 contributed about 134.61 MTOE and also natural gas in 2011 contributed about 243.73 MTOE. Crude oil became the third largest from 2006 to 2011 contributed at about 125.96 MTOE and was recorded the biggest figure with 137.50 MTOE in 2010. Others energy contributed at about 98.84 MTOE but recorded the biggest with 101.57 MTOE in 2009. Geothermal contributed about 16.68 MTOE and recorded the biggest with 16.88 MTOE in 2009. Hydropower was recorded the biggest with 7.51 MTOE.

PRIMARY ENERGY PRODUCTION PER ENERGY TYPE 2002-2011



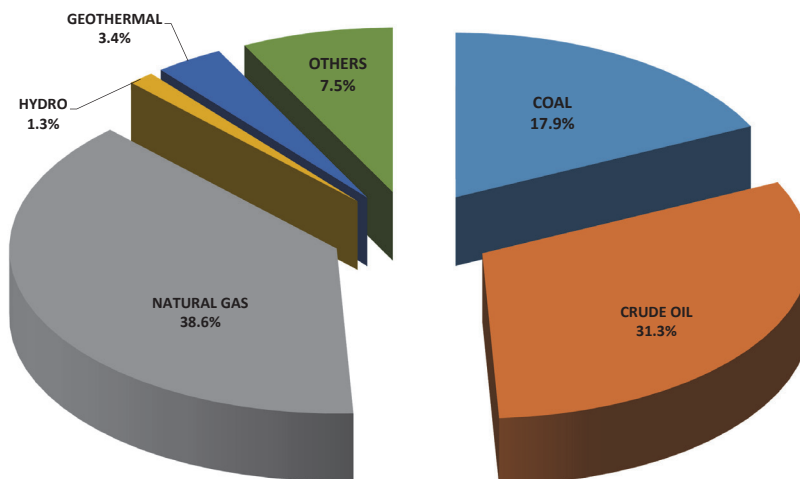
The primary energy production comparison based on year-on-year basis, shows that others energy increased significantly in 2004 with a growth of almost 1.5 times and recorded figure of almost 2.5 times from the previous year. Coal production increased most substantially with 23.9% in 2011. Hydropower production has its biggest increased with 13.9% in 2006. Geothermal and natural gas has its biggest increased with 10.4% in 2008 and 8.7% in 2002 respectively. Crude oil reached biggest increased 6.8% in 2008. Others energy has the most annual increased with 19.2%, followed by coal with 14.1% and hydropower with 3.7%. Natural gas and geothermal annually increased with 3.2% and 1.9% respectively. Crude oil recorded annual reduced at about 0.3%. the biggest average annual increased of total energy production was recorded with 28.2% in 2004.

PRIMARY ENERGY PRODUCTION ANNUAL GROWTH PER ENERGY TYPE



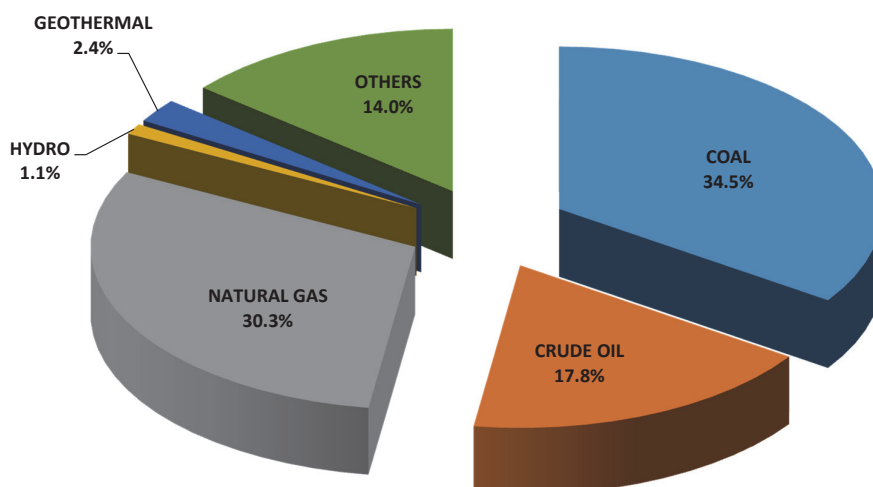
In 2002, natural gas contributed to 38.7% share of the total primary energy production. Crude oil recorded as the second largest share with 31.3% followed by coal with 17.9% and others energy with 7.5%. The share of geothermal and hydropower was recorded at about 3.4% and 1.1% respectively. Renewable energy production share of total primary energy production was recorded at about 12.0%.

PRIMARY ENERGY PRODUCTION BY ENERGY TYPE IN 2002



In 2011, natural gas still dominated the share which contributed to 30.3% of total primary energy production. Coal had the second largest share with 34.5% followed by crude oil with 17.8% and others energy with 14.0%. The share of geothermal and hydropower was recorded less than 5% at about 2.4% and 1.1% respectively. Renewable energy production share of total primary energy production was recorded at about 17.5%.

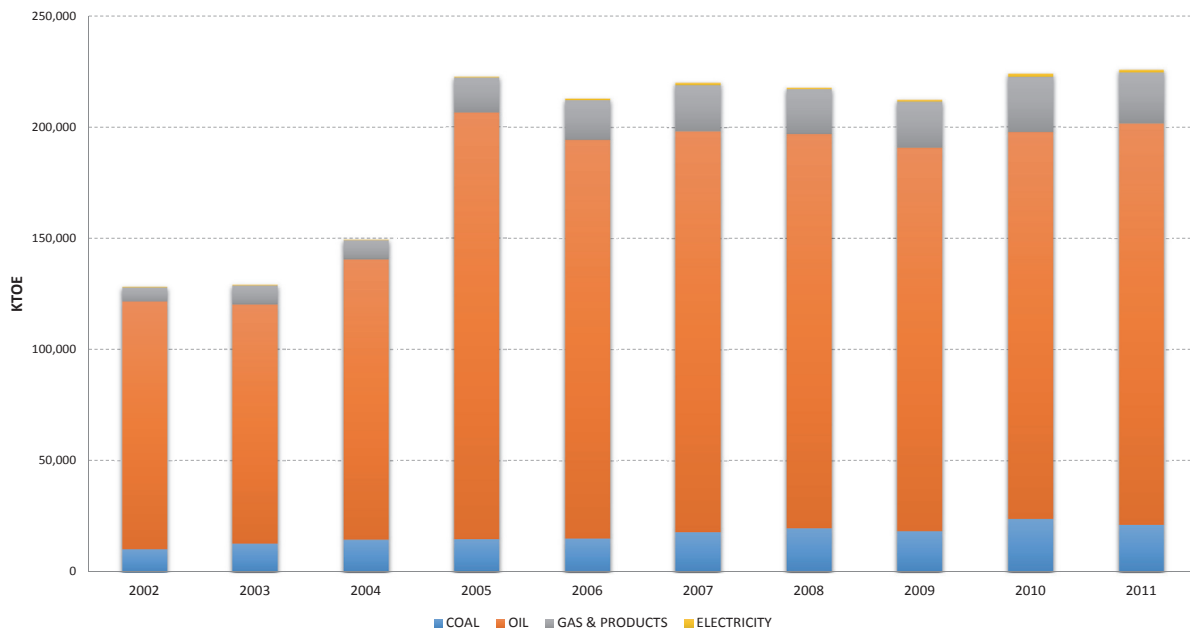
PRIMARY ENERGY PRODUCTION PER ENERGY TYPE IN 2011



2.2 ENERGY IMPORTS

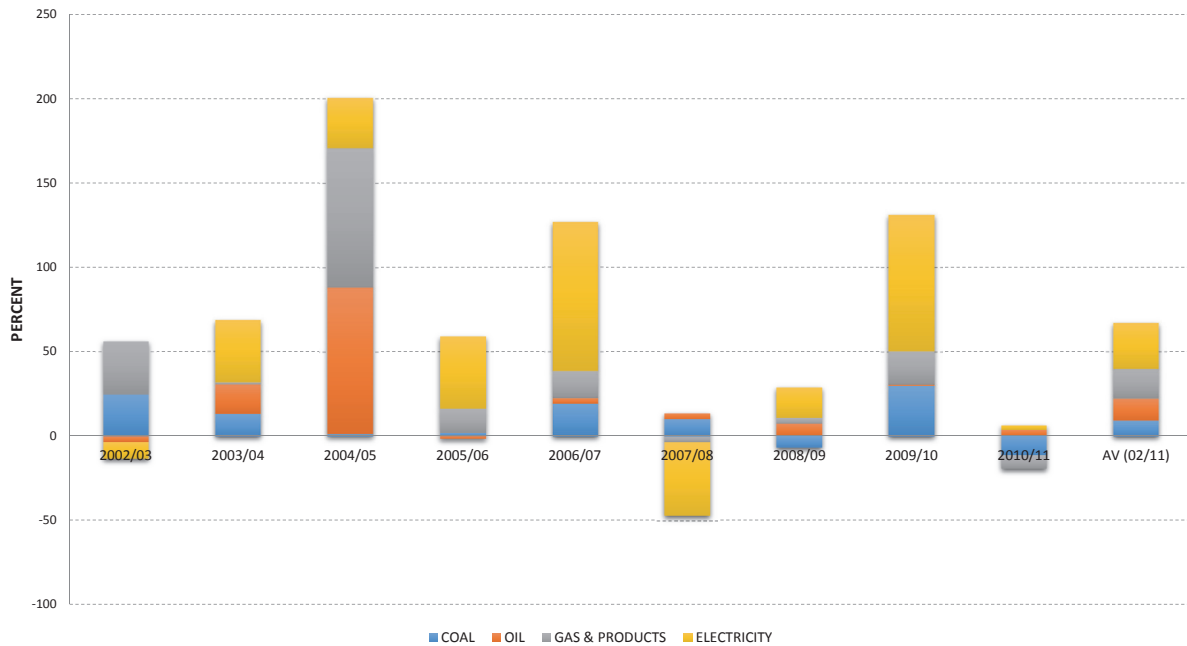
ASEAN total energy imports almost increase every year. It was recorded at 226.05 MTOE in 2011, increased significantly from 128.07 MTOE in 2002, with CAGR about 6.5%. In the composition, the share of oil (crude oil and products) dominated in the period of 2002-11 with the biggest figure recorded approximately at 180.53 MTOE in 2011. Gas and products and coal interchangeably became the second largest on imported energy, gas and products for the period of 2005-11 and coal for the period of 2002-04. In 2010, gas and products and coal was recorded the biggest figure with 24.83 MTOE and 23.96 MTOE respectively. Electricity was recorded the biggest with 1.36 MTOE in 2011. In 2005, imports of oil (crude oil and products), increase significantly compared with previous year. In the period of 2005-11, ASEAN total energy imports did not show significant fluctuations.

ENERGY IMPORTS PER ENERGY TYPE 2002-2011



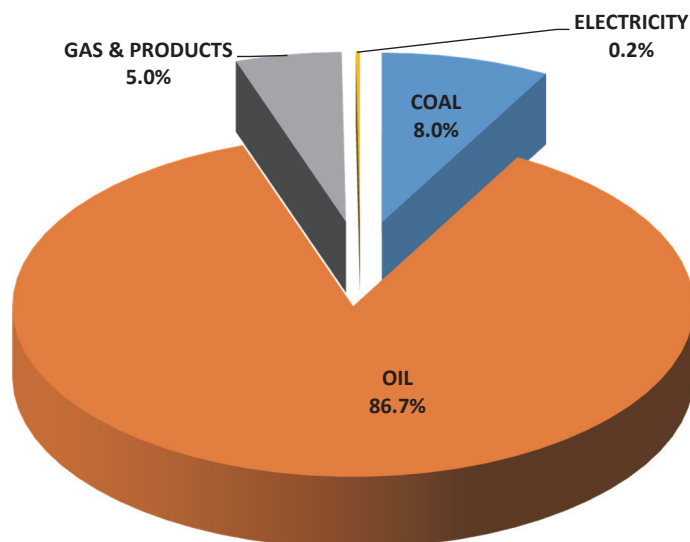
The energy imports comparison based on year-on-year basis, shows that electricity increased significantly in 2007 with a growth of almost 2 times and recorded at about 87.8% from the previous year. Oil (crude oil and products) and gas and products increased most substantially with 86.8% and 82.7% respectively in 2005. Coal has its biggest increased with 30.0% in 2010. Electricity has the most annual increased with 27.2% followed by gas and products with 17.5%. Oil (crude oil and products) and coal annually increased with 13.1% and 9.2% respectively. The biggest average annual increase of total energy imports was recorded with 50.1% in 2005.

AVERAGE ANNUAL ENERGY IMPORTS GROWTH 2002-11



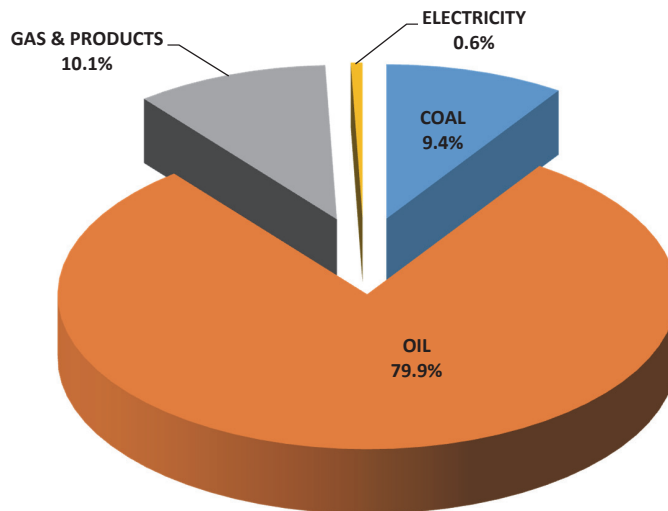
In 2002, oil (crude oil and products) contributed to 86.7% share of the total energy imports. Coal recorded as second largest share with 8.0% followed by gas and products with 5.0%. The share of electricity was recorded far less than 1% approximately about 0.2%.

ENERGY IMPORTS BY ENERGY TYPE IN 2002



In 2011, for all countries, oil (crude oil and products) represented the largest part of ASEAN energy imports which was about 79.9% of total 226.05 MTOE. Gas and products has the second largest share with 10.1% followed by coal with 9.4%. The share of electricity was recorded at about 0.6%.

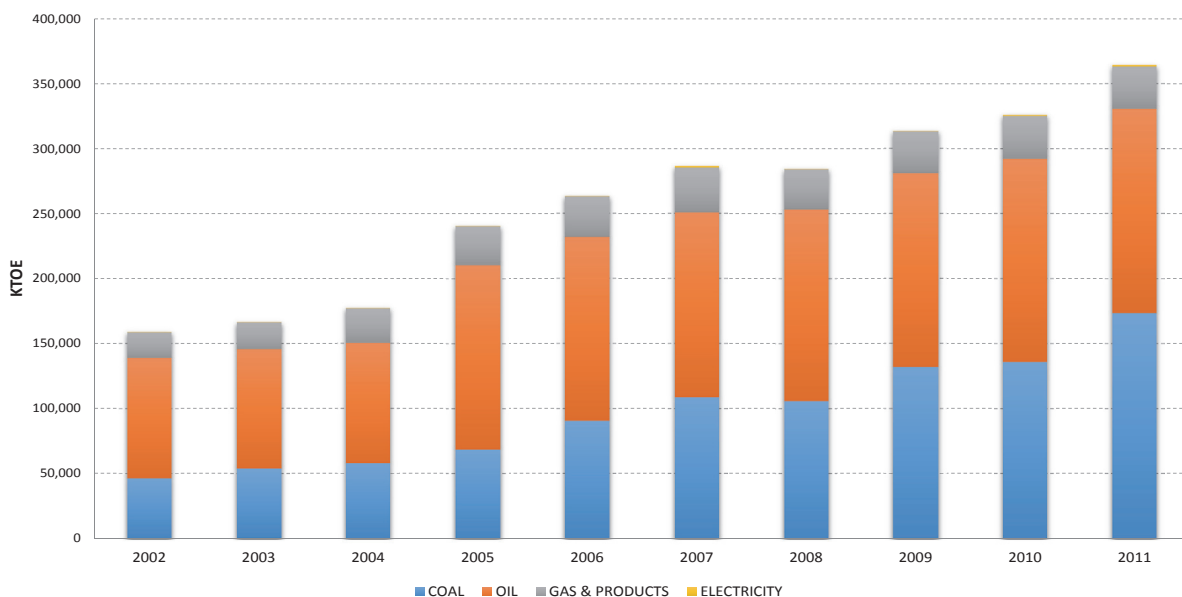
ENERGY IMPORTS BY ENERGY TYPE IN 2011



2.3 ENERGY EXPORTS

In the period of 2002-11, ASEAN total energy exports increased every year. It was recorded at 364.28 MTOE in 2011, increased significantly from 158.98 MTOE in 2002, with CAGR about 9.7%. In the composition, the share of oil (crude oil and products) dominated in the period of 2002-10 with the biggest figure recorded approximately at 157.26 MTOE in 2011. As the second largest, coal overweighed oil (crude oil and products) in 2011 contributed about 173.32 MTOE. Gas and products became the third largest on exported energy in the period of 2002-11 and in 2007 was recorded the biggest figure with 34.33 MTOE. Electricity was recorded the biggest with 1.14 MTOE in 2007 and 2011.

ENERGY EXPORTS PER ENERGY TYPE 2002-2011



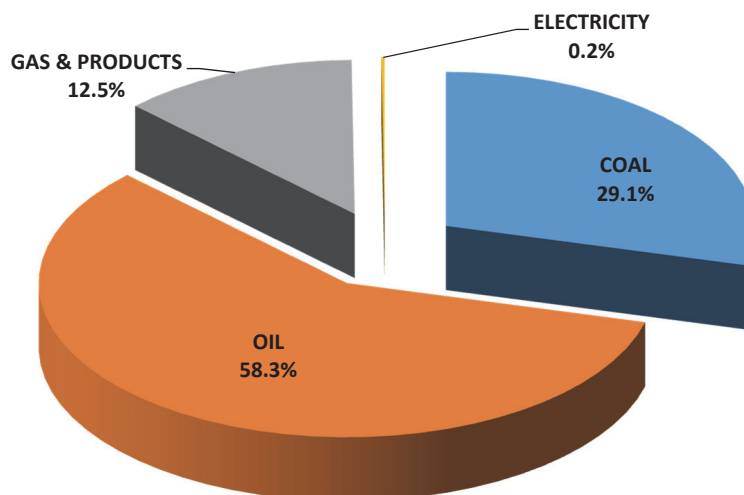
The energy exports comparison based on year-on-year basis, shows that electricity increased significantly in 2007 with a growth of almost 2.5 times and recorded at about 1.4 times from the previous year. Oil (crude oil and products) and coal increased most substantially with 53.5% in 2005 and 32.5% in 2006 respectively. Gas and products has its biggest increased with 28.1% in 2004. Electricity has the most annual increased with 33.8% followed by coal with 16.4%. Oil (crude oil and products) and gas and products annually increased with 7.1% and 6.1% respectively. The biggest average annual increase of total energy exports was recorded with 42.4% in 2007.

AVERAGE ANNUAL ENERGY EXPORTS GROWTH 2002-2011



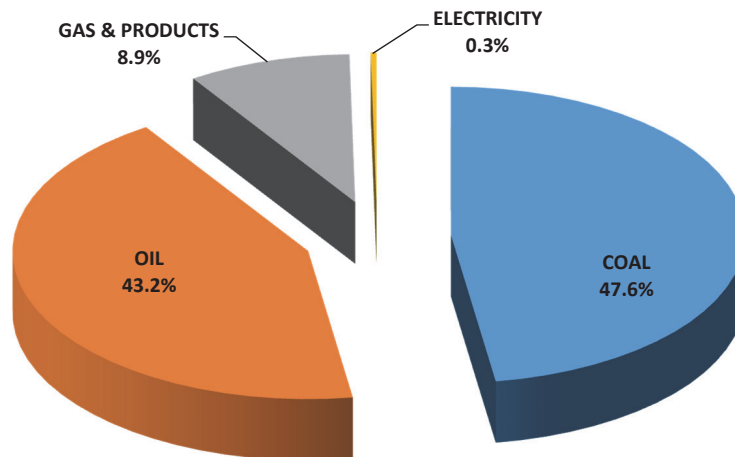
In 2002, oil (crude oil and products) contributed to 58.3% share of the total energy exports. Coal recorded as second largest share with 29.1% followed by gas and products with 12.5%. The share of electricity was recorded far less than 1% approximately about 0.2%.

ENERGY EXPORTS BY ENERGY TYPE IN 2002



In 2011, coal was the largest part of ASEAN energy exports, about 47.6% of total 364.28 MTOE. Oil (crude oil and products) has the second largest share with 43.2% followed by gas and products with 8.9%. The share of electricity was recorded far less than 1% at about 0.3%.

ENERGY EXPORTS BY ENERGY TYPE IN 2011

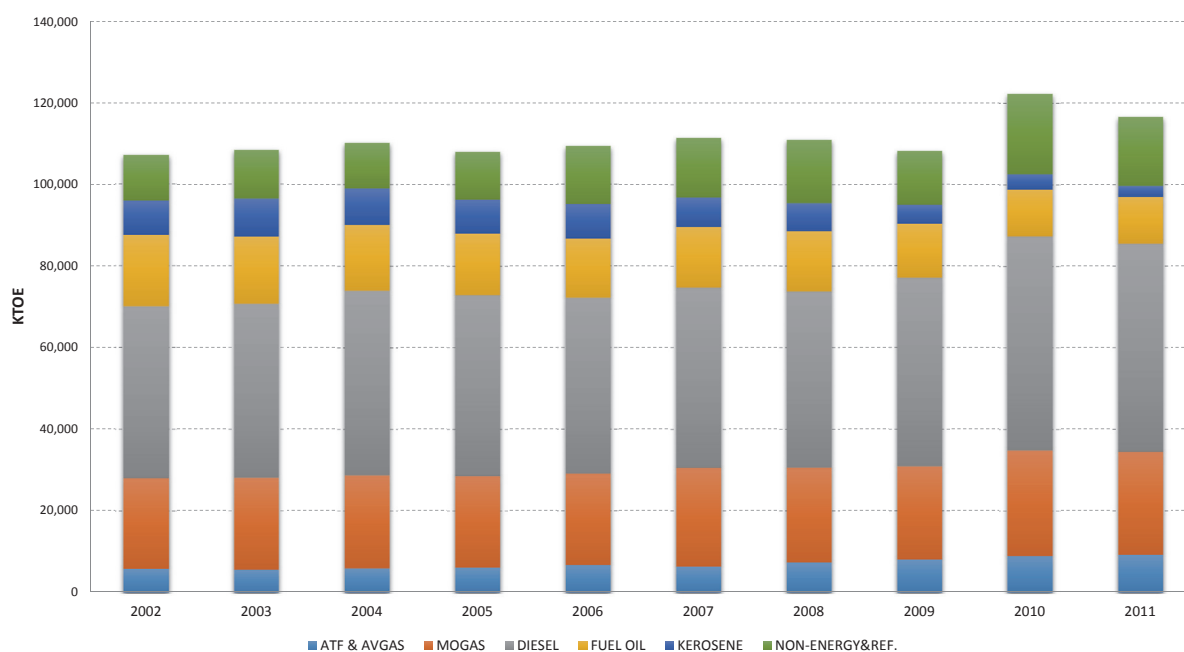


CHAPTER 3. ENERGY TRANSFORMATION

3.1 TOTAL REFINERY PRODUCT OUTPUT

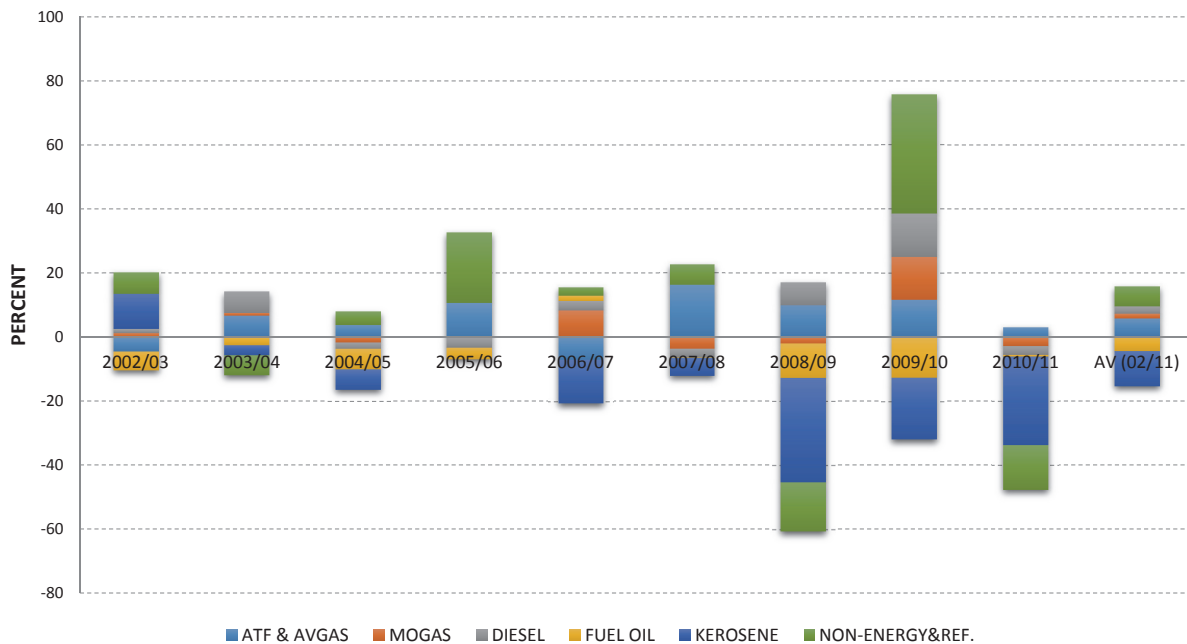
ASEAN total product refinery output recorded at about 116.53 MTOE in 2011, increased slightly from 107.15 MTOE in 2002, with CAGR at about 0.9%. Its composition describes that diesel dominated the share in the period of 2002-11 with the biggest figure recorded approximately at 52.51 MTOE in 2010. As the second largest, motor gasoline contributed about 25.16 MTOE in 2011 and recorded the biggest with 25.87 MTOE in 2010. Non-energy & refinery gas and fuel oil interchangeably became the third largest of refinery output, non-energy & refinery gas for the period of 2008-11 and fuel oil for the period of 2002-07. Non-energy & refinery gas and fuel oil was recorded the biggest figure with 19.68 MOTE in 2010 and 17.51 MTOE in 2002 respectively. Total avtur and avgas was recorded the biggest with 9.25 MTOE in 2011 and overweighed kerosene in 2008. Kerosene was recorded the biggest with 9.27 MTOE in 2003.

TOTAL REFINERY OUTPUT BY PRODUCT TYPE 2002-2011



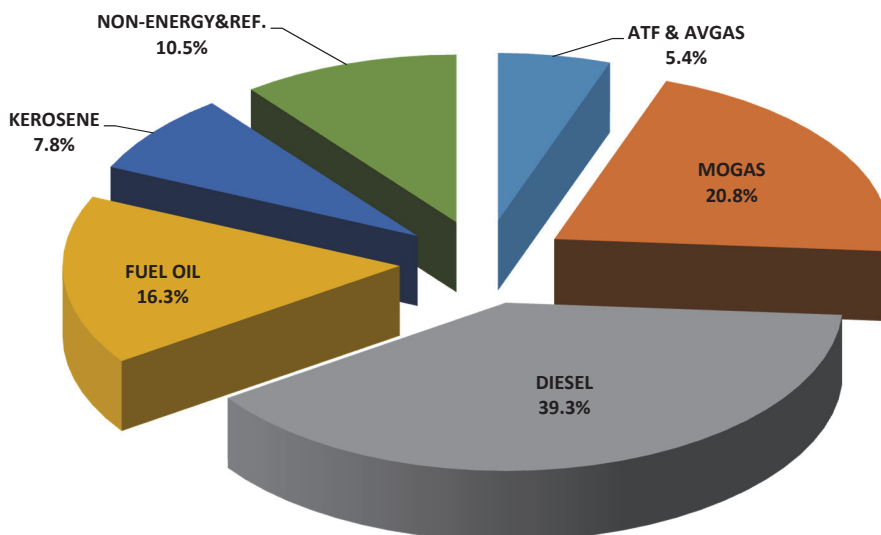
The total refinery product output comparison based on year-on-year basis, shows that non-energy & refinery gas increased in 2010 recorded about 49.6% from the previous year. Total avtur and avgas increased most substantially with 16.2% in 2008. Diesel and motor gasoline has its biggest increased with 13.5% and 13.3% respectively in 2010. Fuel oil and kerosene production had decreased during 2002-11 with its biggest decreased at about 12.5% in 2010 and 27.6% in 2011 respectively. Non-energy & refinery gas has the most annual increased with CAGR about 6.2%, followed by total avtur and avgas with 5.6%. Diesel and motor gasoline annually increased with 2.3% and 1.5% respectively. Fuel oil and kerosene recorded annual reduced at about 4.5% and 10.8% respectively. The biggest average annual increased of total refinery output was recorded about 9.4% in 2010.

AVERAGE ANNUAL GROWTH OF TOTAL REFINERY OUTPUT BY PRODUCT TYPE



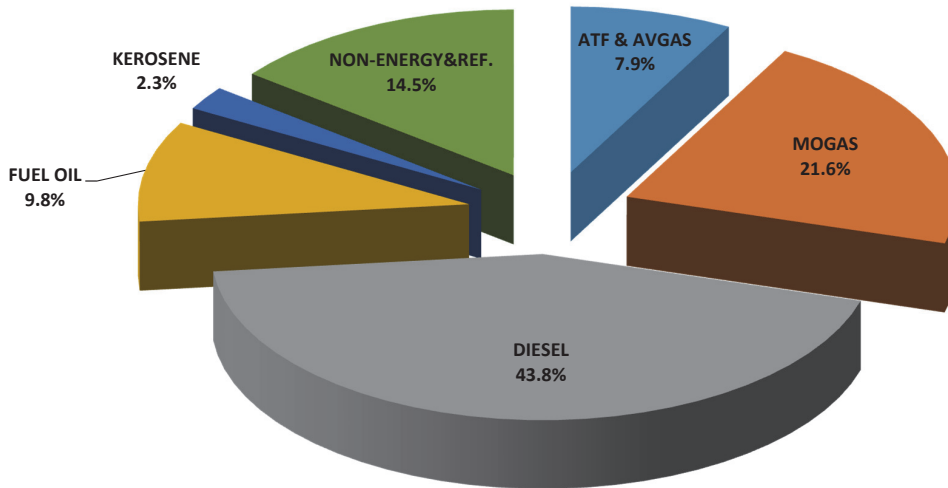
In 2002, diesel contributed to 39.3% share of the total refinery product output. Motor gasoline recorded as the second largest share with 20.8% followed by fuel oil with 16.3% and non-energy & refinery gas with 10.5%. The share of kerosene and total avtur and avgas was recorded at about 7.8% and 5.4% respectively.

REFINERY PRODUCT OUTPUT BY PRODUCT TYPE IN 2002



In 2011, diesel still dominated the share which contributed to 43.8% of total refinery product output. Motor gasoline had the second largest share with 21.6% followed by non-energy & refinery gas with 14.5%. The share of fuel oil and total avtur and avgas was recorded at about 9.8% and 7.9% respectively. Kerosene was the least share with 2.3% of total refinery product output.

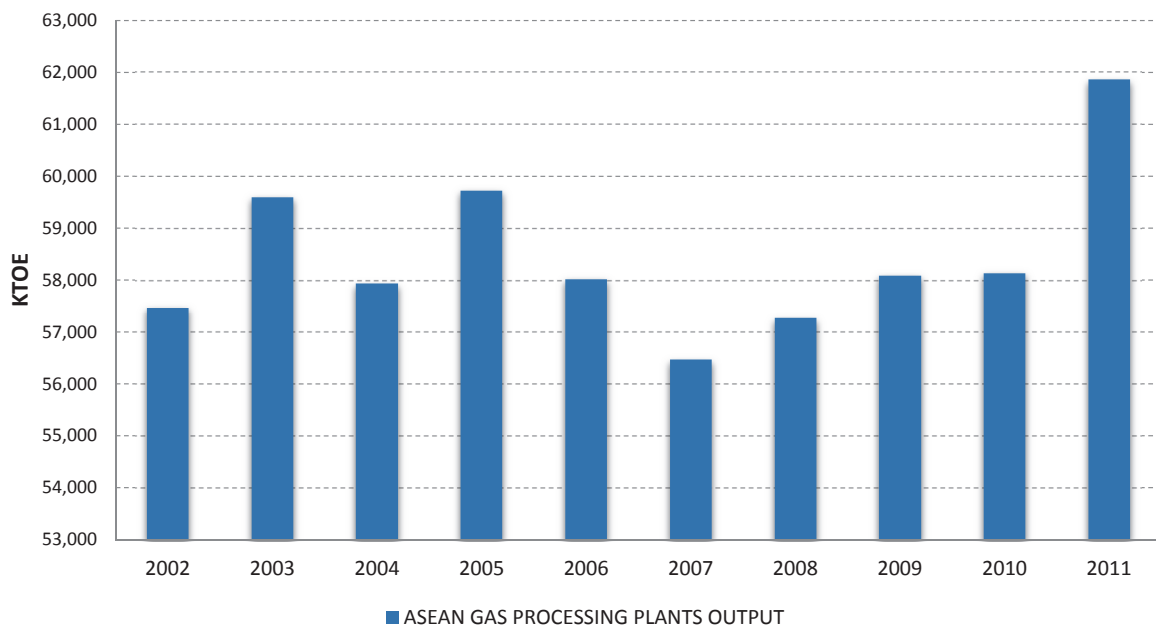
REFINERY PRODUCT OUTPUT BY PRODUCT TYPE IN 2011



3.2 GAS PROCESSING PLANT OUTPUT

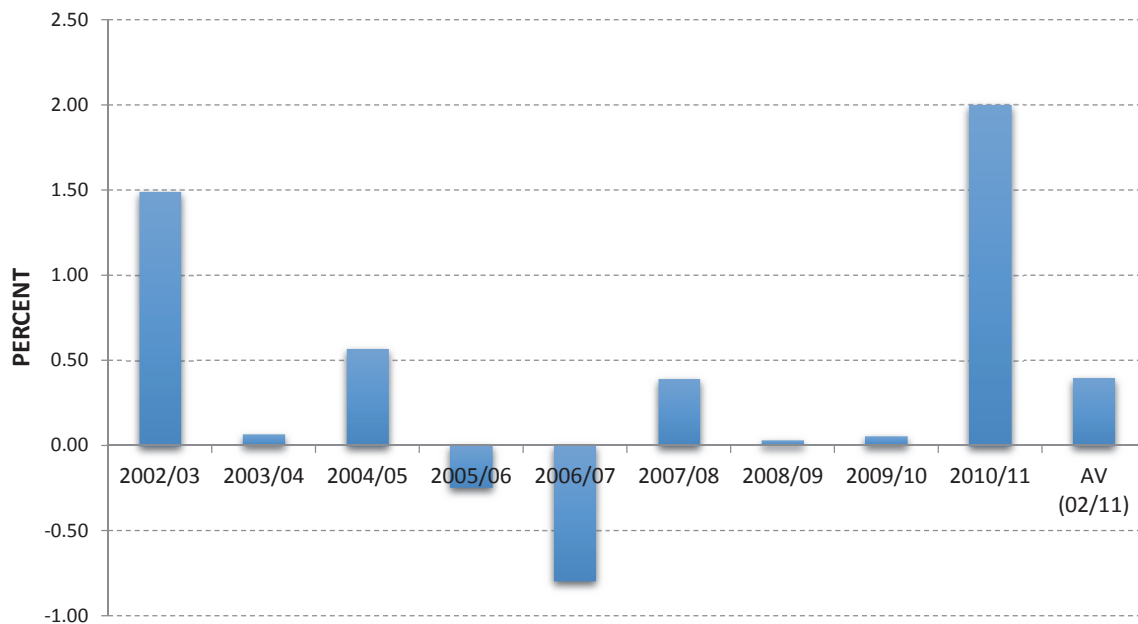
ASEAN total gas processing plant output recorded at about 61.85 MTOE in 2011, increased slightly from 57.48 MTOE in 2002, with CAGR about 0.8%. The major part of the gas processing went to LNG production. As observed from 2002 to 2011, the growth of the ASEAN gas processing plant output underwent a cyclical pattern with the biggest figure recorded at 61.85 MTOE in 2011 and the lowest recorded at 56.47 MTOE in 2007. Three countries recorded actively in gas processing, namely: Brunei Darussalam, Indonesia and Malaysia.

ASEAN GAS PROCESSING PLANTS OUTPUT 2002-2011



The gas processing plant output comparison based on year-on-year basis, shows that the biggest increased was in 2011 with a growth of 2% followed with 1.5% in 2003. A cyclical growth shows for the average growth and also for countries per year in the period of 2002-11. Malaysia was recorded the major increased in gas processing with annual average of 4.2% and had the biggest increased with 21.0% in 2003 and with 10.2% in 2009. Brunei Darussalam was recorded with annual average of 0.5% and increased with 7.4% in 2003, 6.5% in 2006 and 5.7% in 2011 respectively. Indonesia posted a decreased in gas processing with annual average of 0.8%, although it was increased with 17.9% in 2011 but also decreased with 17.2% in 2004.

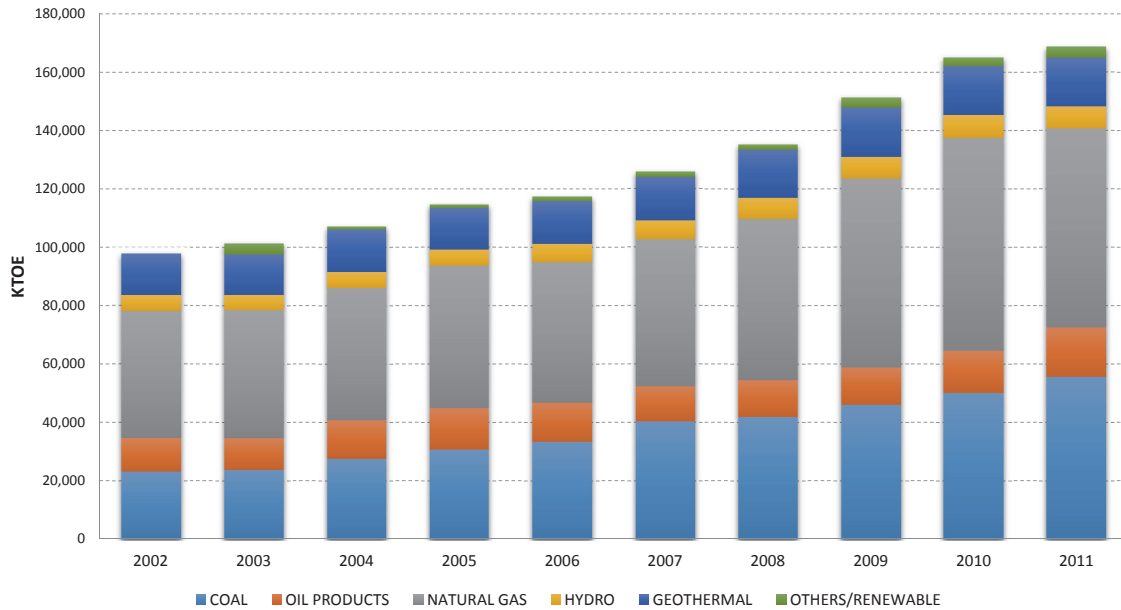
ASEAN AVERAGE ANNUAL GAS PROCESSING PLANTS OUTPUT GROWTH 2002-2011



3.3 ENERGY INPUT EQUIVALENT FOR POWER GENERATION

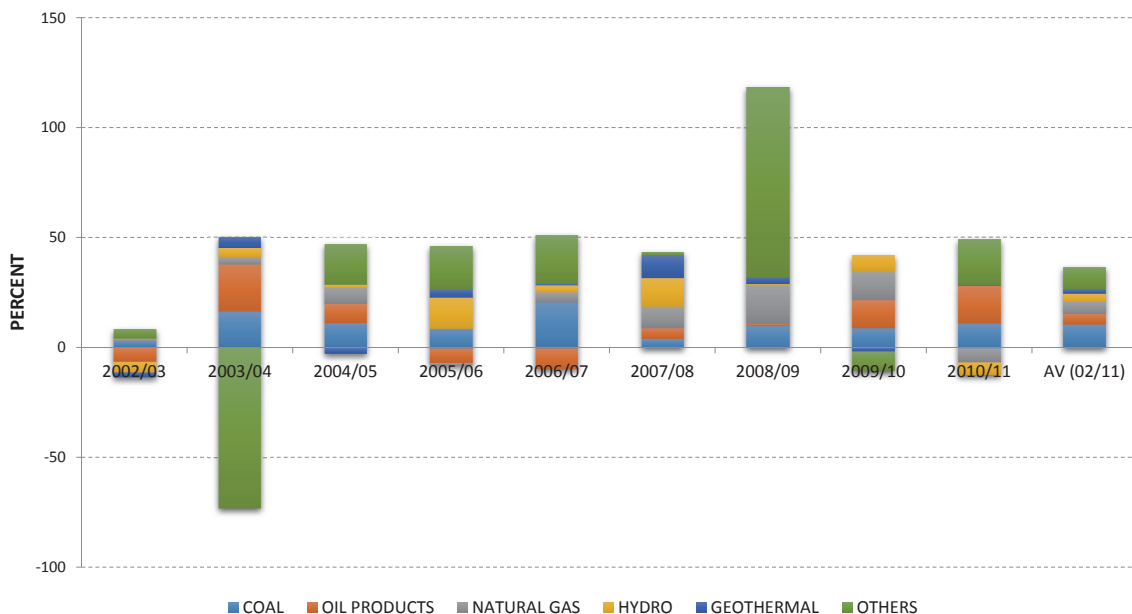
ASEAN total energy input equivalent for power generation in 2011 was about 168.60 MTOE, increased slightly from 97.71 MTOE in 2002, with CAGR about 6.2%. This also includes fuel consumption for self-generation purposes. In the composition, the share of natural gas dominated in the period of 2002-11 with the biggest figure recorded approximately at 72.88 MTOE in 2010. As the second largest, coal contributed about 55.63 MTOE in 2011. Oil products and became the third largest of energy consumption for power generation and was recorded the biggest figure with 16.89 MTOE in 2011. Others energy was recorded the biggest with 3.84 MTOE in 2003.

ENERGY INPUT EQUIVALENT FOR POWER GENERATION 2002-2011



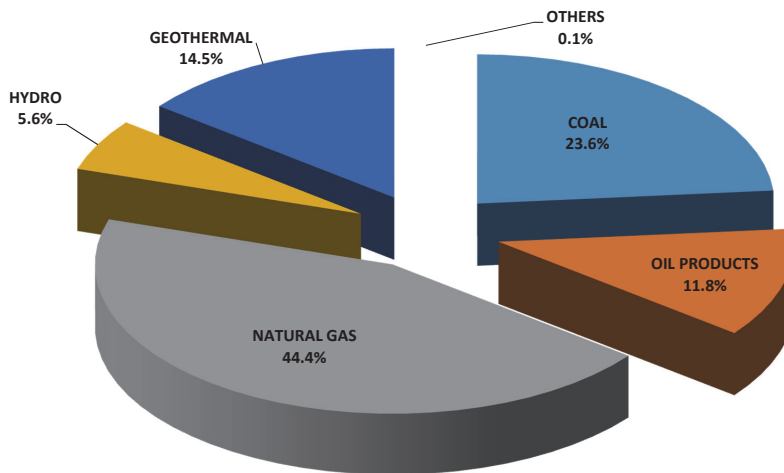
The total energy input equivalent for power generation comparison based on year-on-year basis, shows that others energy increased in 2009 recorded about 86.4% from the previous year, but reduced significantly about 73.0% in 2004. Oil products increased most substantially with 21.4% in 2004 followed by coal with 20.6% in 2007. Natural gas reached biggest increased with 17.3% in 2009. Hydropower and geothermal has its biggest increased with 13.9% in 2006 and 10.4% in 2008 respectively. Coal has the most annual increased with 10.4% followed by others energy with 10.1%. Natural gas and oil products annually increased with 5.4% and 4.8% respectively. Hydropower annually increased with 3.7%. Geothermal posted the least increased with 1.9%. The biggest average annual increased of total energy input equivalent for power generation was recorded with 19.7% in 2009.

AVERAGE ANNUAL ENERGY INPUT EQUIVALENT FOR POWER GENERATION GROWTH 2002-2011



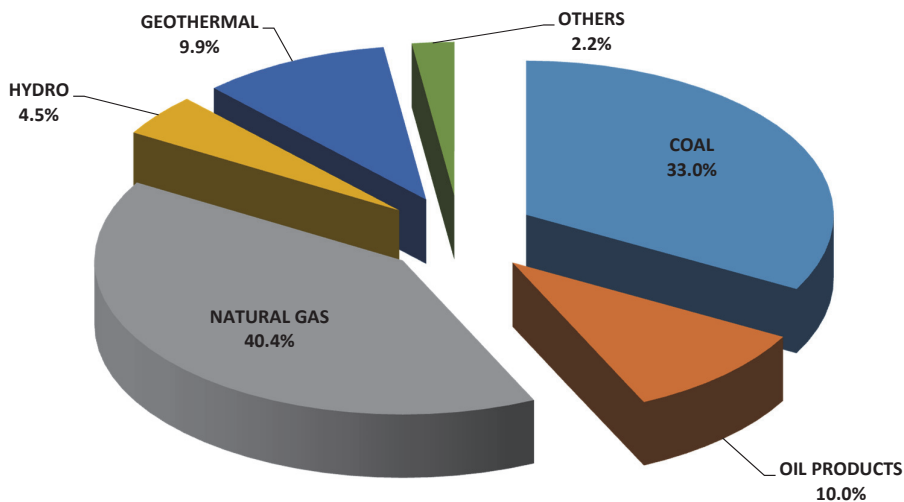
In 2002, natural gas contributed to 44.4% share of the total energy input equivalent for power generation. Coal recorded as the second largest share with 23.6%. Renewable energy input equivalent for power generation share was about 20.2% of the ASEAN total energy input equivalent for power generation in which geothermal about 14.5%, hydropower about 5.6% and others energy about 0.1%. The share of oil products was about 11.8%.

ENERGY INPUT EQUIVALENT FOR POWER GENERATION BY ENERGY TYPE IN 2002



In 2011, the share of natural gas still dominated which contributed to 40.4% of total energy input equivalent for power generation. Coal had the second largest share with 33.0% followed by renewable energy at about 16.6% of the ASEAN total energy input equivalent for power generation, with geothermal about 9.9%, hydropower about 4.5% and others energy about 2.2%. The share of oil products was about 10.0%.

ENERGY INPUT EQUIVALENT FOR POWER GENERATION BY ENERGY TYPE IN 2011

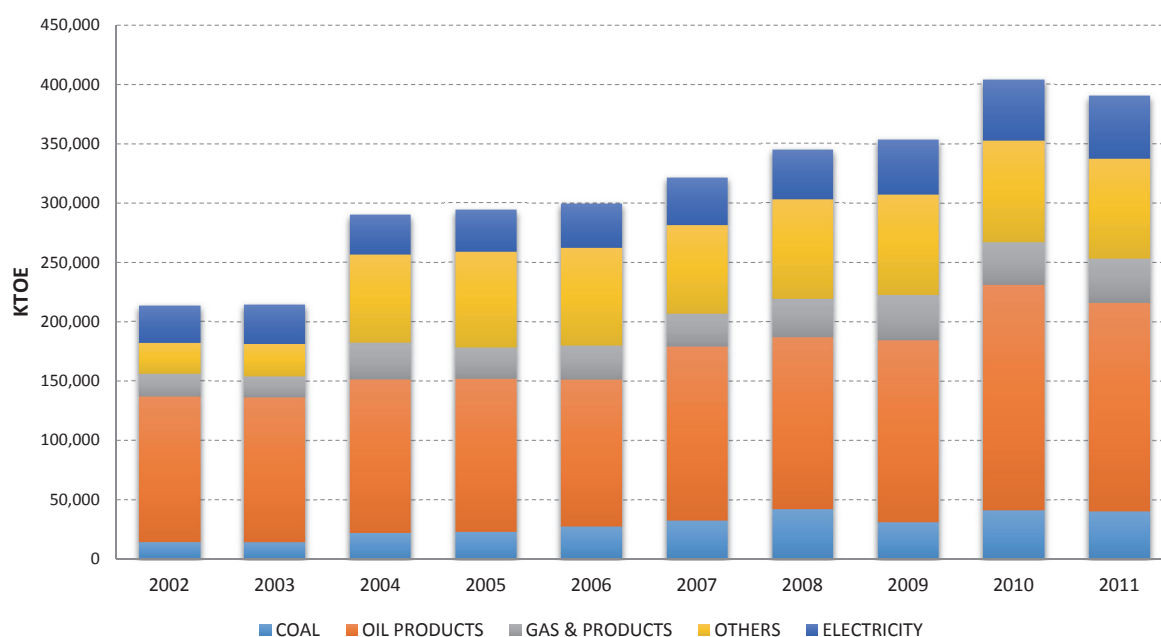


CHAPTER 4. ASEAN FINAL ENERGY CONSUMPTION

4.1 ASEAN TOTAL FINAL ENERGY CONSUMPTION

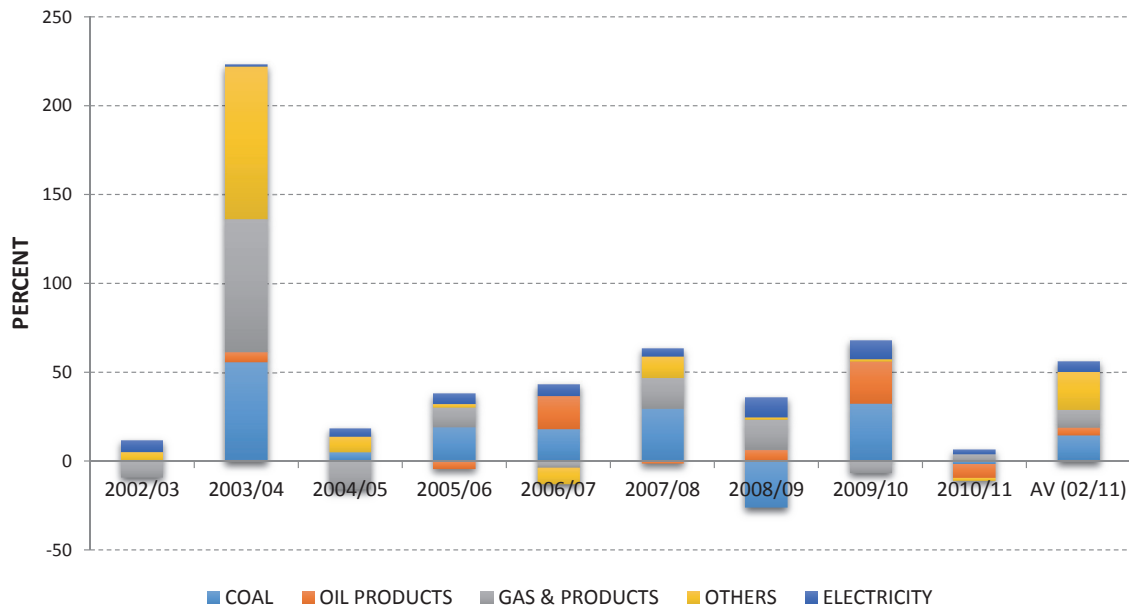
ASEAN total final energy consumption was about 390.32 MTOE in 2011, increased significantly from 213.03 MTOE in 2002 with about 7.0%. In the composition, oil products dominated the share from 2002 to 2011 with the biggest figure recorded approximately at 189.88 MTOE in 2010. As the second largest, others energy contributed the biggest at about 85.70 MTOE in 2010. Electricity became the third largest of total energy consumption and was recorded the biggest figure with 52.84 MTOE in 2011. Coal and gas and products interchangeably followed and was recorded the biggest figure with 42.01 MTOE in 2008 and 38.27 MTOE respectively in 2009.

ASEAN TOTAL FINAL ENERGY CONSUMPTION BY ENERGY TYPE 2002-2011



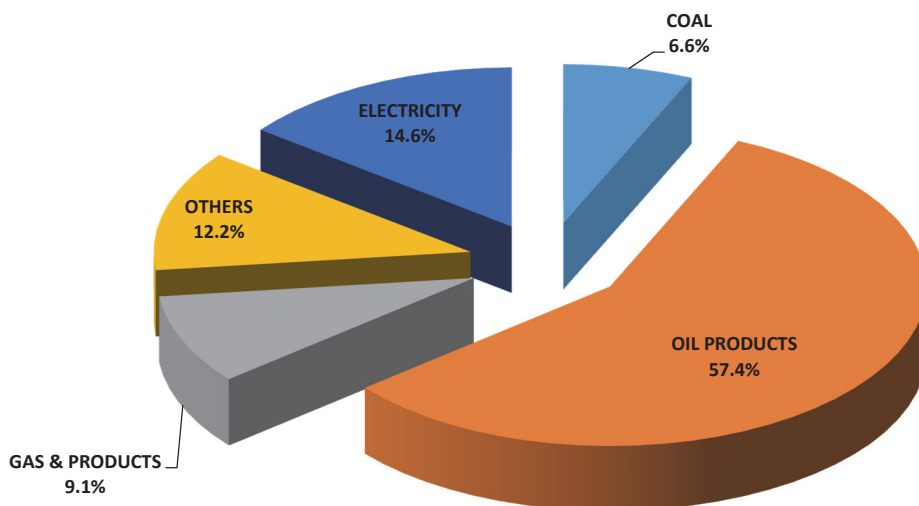
The ASEAN total final energy consumption comparison based on year-on-year basis, shows that others energy has the biggest increased recorded in 2004 with a growth of 1.7 times than previous year. Gas and products consumption increased most substantially with 74.7% in 2004. Coal has its biggest increased with 29.5% in 2008. Oil products and electricity has its biggest increased with 23.9% in 2010 and 11.4% in 2009 respectively. Others energy has the most annual increased with 21.1% followed by coal with 14.6% and gas and products with 9.9%. Electricity and oil products annually increased with 6.1% and 4.6% respectively. The biggest average annual growth of ASEAN total final energy consumption was recorded about 61.7% in 2004.

ASEAN AVERAGE ANNUAL GROWTH OF TOTAL FINAL ENERGY CONSUMPTION PER ENERGY TYPE



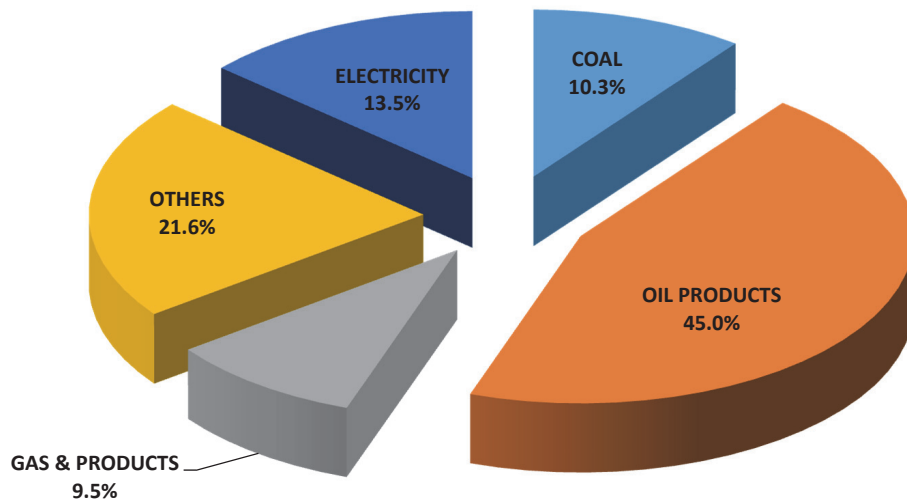
As the case of consumption in 2002, oil products contributed to 57.4% share of the ASEAN total final energy consumption. Electricity recorded as the second largest share with 14.6% followed by others energy with 12.2%. The share of gas and products and coal was recorded with 9.1% and 6.6% respectively.

ASEAN TOTAL FINAL ENERGY CONSUMPTION BY ENERGY TYPE IN 2002



In 2011, oil products still dominated the share which contributed to 45.0% of ASEAN total final energy consumption. Others energy had the second largest share with 21.6% followed by electricity with 13.5%. The share of coal and gas and products was recorded at about 10.3% and 9.5% respectively.

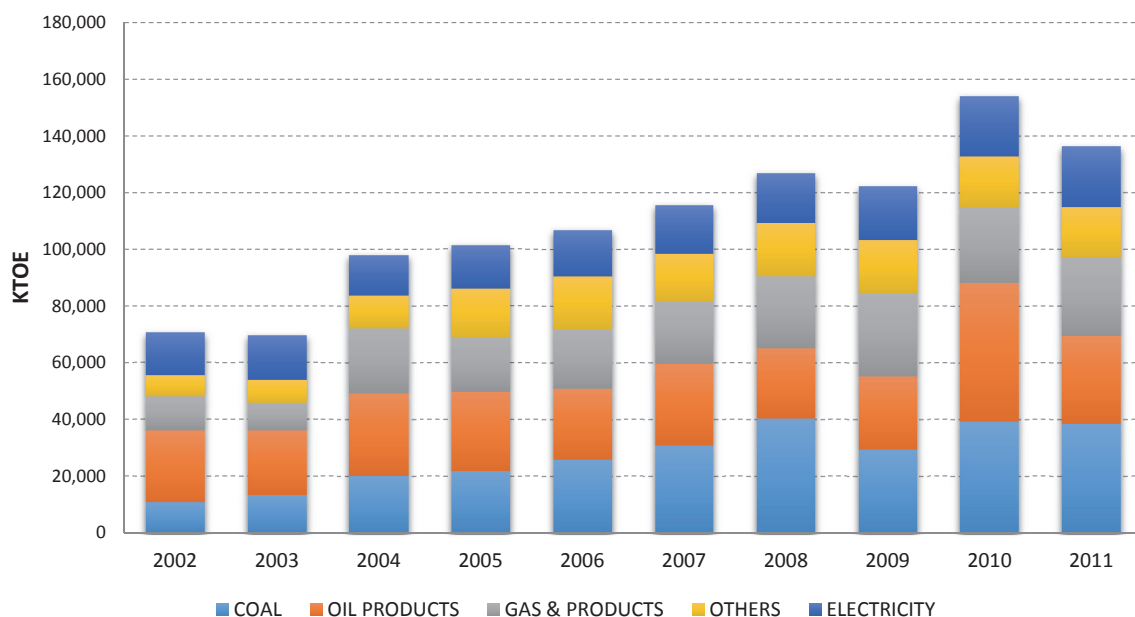
ASEAN TOTAL FINAL ENERGY CONSUMPTION BY ENERGY TYPE IN 2011



4.2 INDUSTRIAL SECTOR

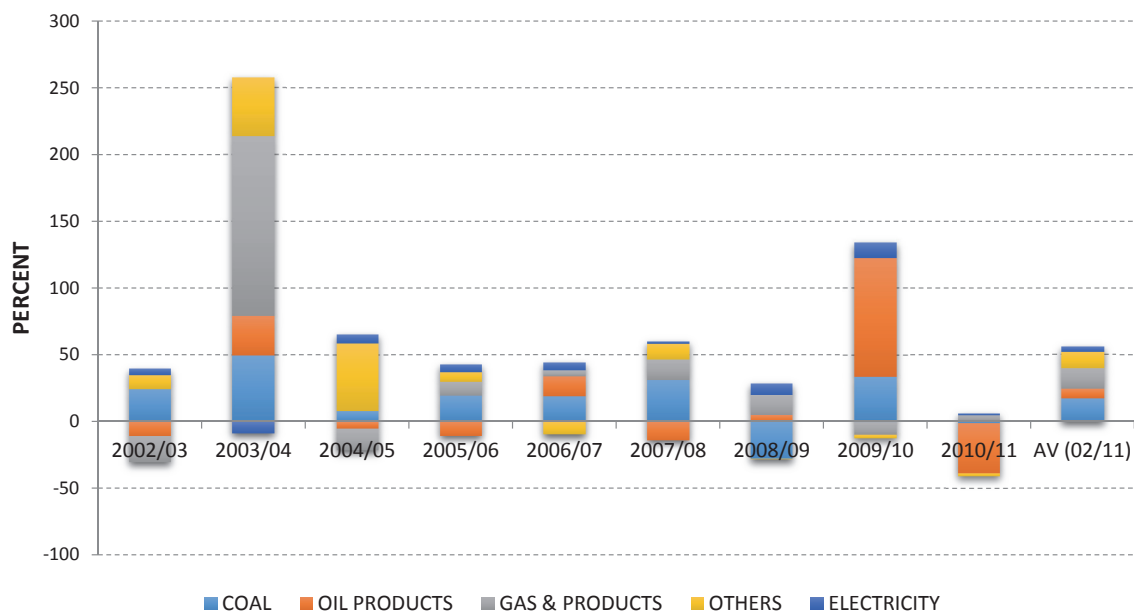
Energy consumption in industrial sector was about 136.25 MTOE in 2011, increased significantly from 70.39 MTOE in 2002 with CAGR at about 7.6%, but decreased from previous year that recorded at about 154.01 MTOE. In the composition, coal and oil products interchangeably dominated the share of energy consumption in industrial sector and were recorded with 38.60 MTOE and 30.78 MTOE respectively in 2011. Coal was recorded the biggest figure with 40.40 MTOE in 2008 and oil products with 48.86 MTOE in 2010. Gas and products was recorded with 27.66 MTOE followed by electricity with 21.44 MTOE in 2011. Others energy was recorded with 17.77 MTOE in 2011 and has the biggest figure with 18.86 MTOE in 2007.

ENERGY CONSUMPTION IN INDUSTRIAL SECTOR PER ENERGY TYPE 2002-2011



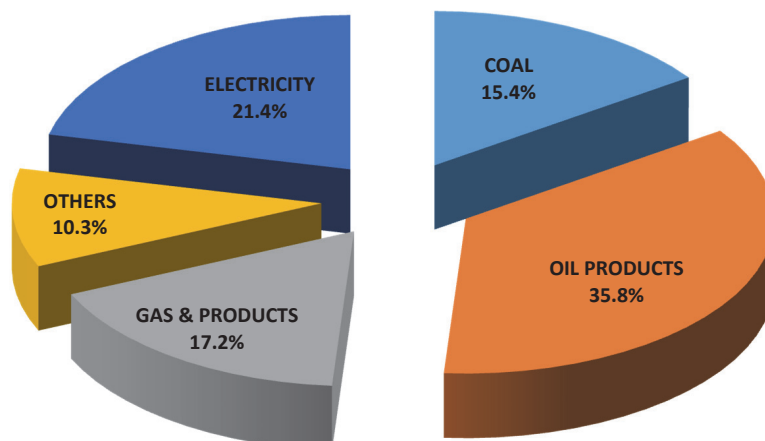
The energy consumption in industrial sector comparison based on year-on-year basis, shows that gas and products have the biggest increased recorded in 2004 with a growth of almost 1.4 times than previous year. Oil products consumption increased most substantially with 88.4% in 2010. Others energy has its biggest increased with 50.3% in 2005. Coal and electricity has its biggest increased with 49.5% in 2004 and 11.5% in 2010 respectively. Coal has the most annual increased with 17.3% followed by gas and products with 15.4%. Others energy and oil products annually increased with 12.1% and 6.8% respectively. Electricity posted the least increased with 4.2%. The biggest average annual increased of industrial consumption was recorded with 49.8% in 2004.

ANNUAL AVERAGE GROWTH OF ENERGY CONSUMPTION IN INDUSTRIAL SECTOR PER ENERGY TYPE



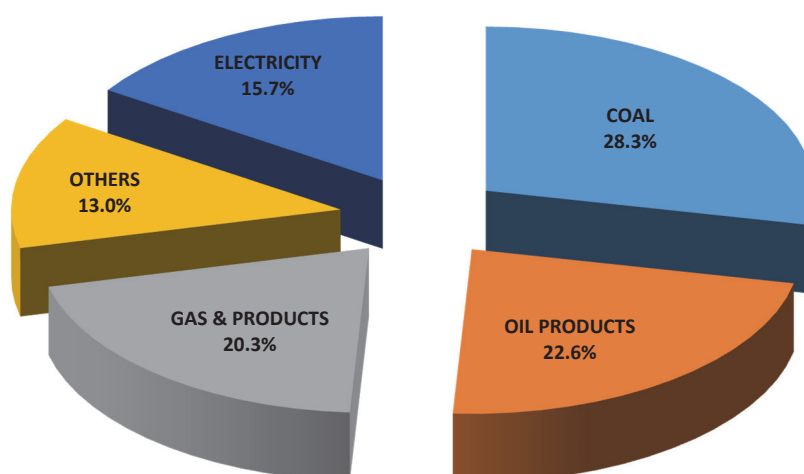
In 2002, oil products contributed to 35.8% share of the energy consumption in industrial sector. Electricity recorded as the second largest share with 21.4% followed by gas and products with 17.2%. The share of coal and others energy was recorded with 15.4% and 10.3% respectively.

ENERGY CONSUMPTION IN INDUSTRIAL SECTOR BY ENERGY TYPE IN 2002



In 2011, coal dominated the share which contributed to 28.3% of energy consumption in industrial sector. Oil products had the second largest share with 22.6% followed by gas and products with 20.3%. The share of electricity and others energy was recorded at about 15.7% and 13.0% respectively.

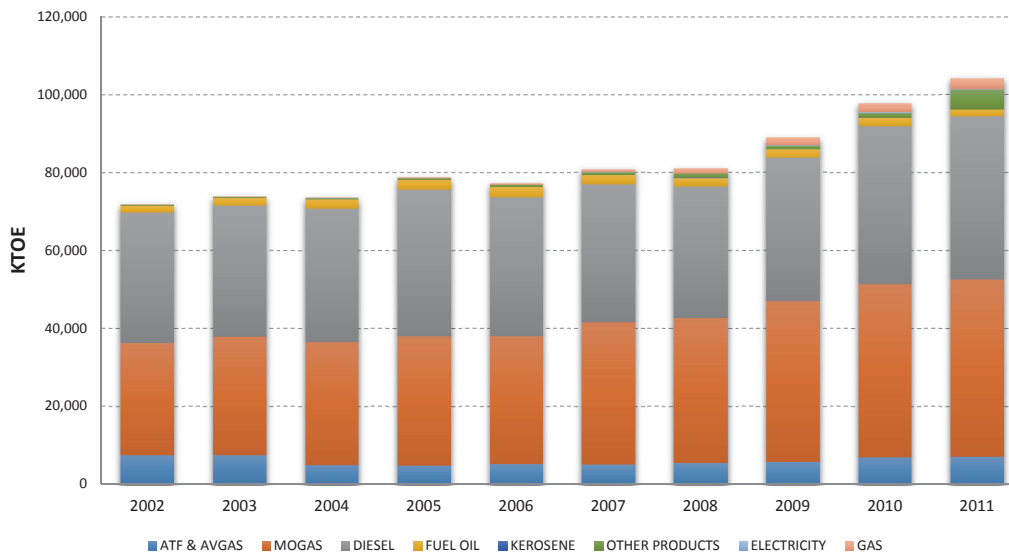
ENERGY CONSUMPTION IN INDUSTRIAL SECTOR BY ENERGY TYPE IN 2011



4.3 TRANSPORT SECTOR

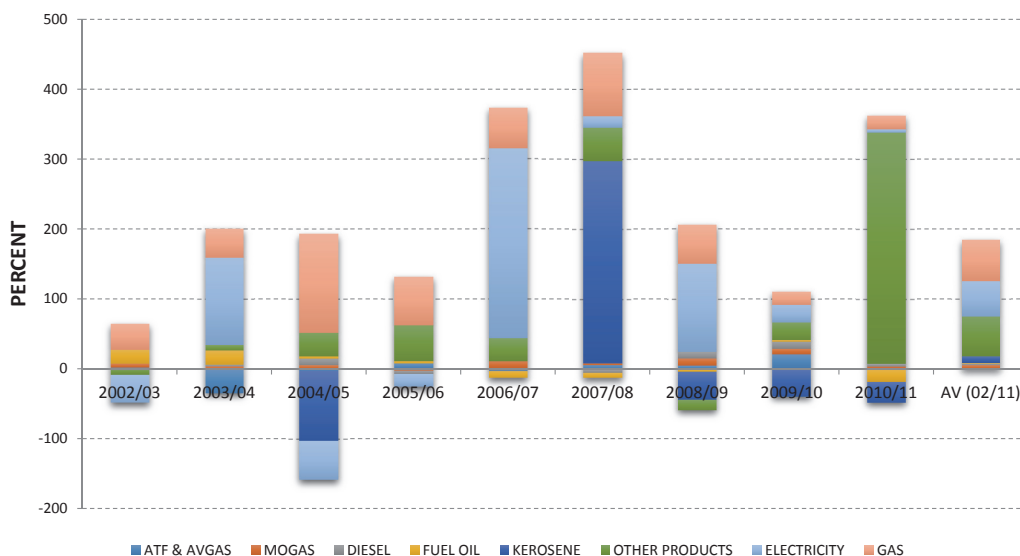
Energy consumption in transport sector was about 104.17 MTOE in 2011, increased significantly from 71.77 MTOE in 2002 with CAGR at about 4.2%. In the composition, motor gasoline and diesel interchangeably dominated the share of energy consumption in transport sector, motor gasoline for the period of 2007-11 and diesel for the period of 2002-06. Motor gasoline and diesel was recorded the biggest figure with 45.37 MTOE and 41.91 MTOE respectively in 2011. As the third largest, total avtur and avgas contributed about 7.13 MTOE in 2011 and recorded the biggest with 7.57 MTOE in 2003. Other products was recorded the biggest figure with 4.95 MTOE, and overweighed fuel oil in 2011. Gas was recorded the biggest consumption with 2.80 MTOE in 2011. Fuel oil was recorded with 1.77 MTOE in 2011 and has the biggest figure with 2.52 MTOE in 2005. Electricity and kerosene was recorded about 237.33 KTOE and 640 TOE respectively.

ENERGY CONSUMPTION IN TRANSPORT SECTOR PER ENERGY TYPE 2002-2011



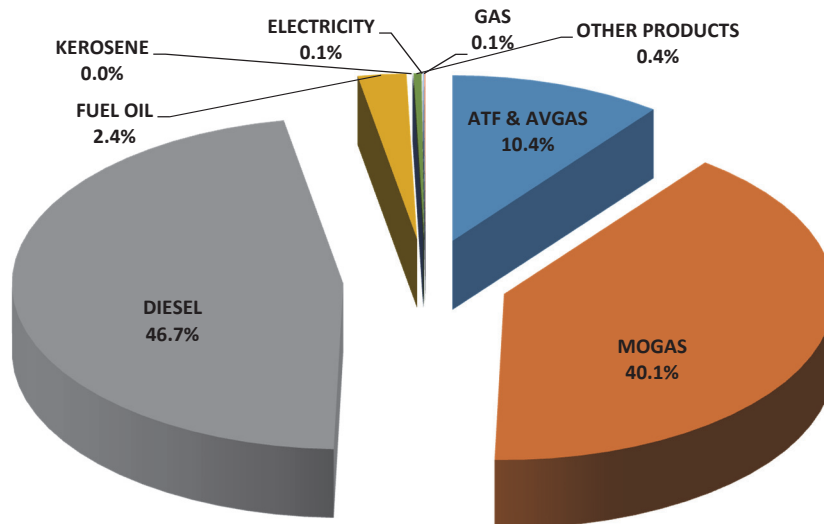
The energy consumption in transport sector comparison based on year-on-year basis, shows that other products increased significantly in 2011 with a growth of almost 3.3 times and recorded figure of almost 4.3 times from the previous year. Kerosene consumption increased most substantially of almost 3 times in 2008 but also decreased at the rest of years. Electricity has its biggest increased with almost 2.7 times in 2007, but also decreased in previous years. Gas has its biggest increased with 141.2% in 2005. Total avtur and avgas and fuel oil has its biggest increased with 21.3% in 2010 and 20.1% in 2004, but also decreased with 34.1% in 2004 and 17.6% in 2001 respectively. Motor gasoline and diesel has its biggest increased with 11.3% in 2007 and 10.1% in 2010 respectively. Gas has the most annual increased with 59.1% followed by other products with 56.1%, electricity with 50.4%, kerosene with 8.9%, and motor gasoline with 5.3%. Diesel and fuel oil annually increased with 2.7% and 1.2% respectively. Total avtur and avgas annually increased with 0.6%. The biggest average annual growth of energy consumption in transport sector was recorded about 55.0% in 2008.

AVERAGE ANNUAL GROWTH OF ENERGY CONSUMPTION IN TRANSPORT SECTOR PER ENERGY TYPE



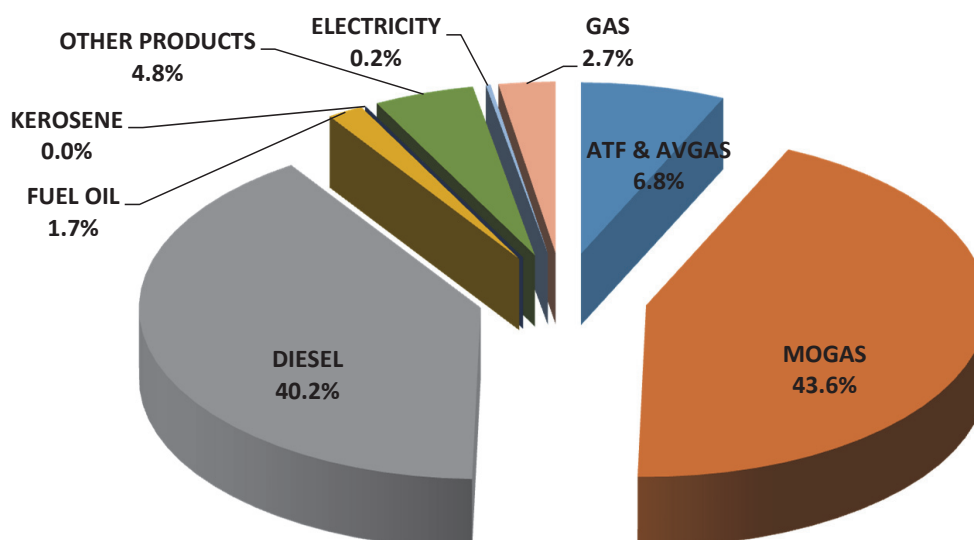
In 2002, diesel contributed to 46.7% share of the energy consumption in transport sector. Motor gasoline recorded as the second largest share with 40.1% followed by total avtur and avgas with 10.4%. The share of fuel oil was recorded with 2.4%. Other products, electricity, gas and kerosene have a similar share at about nearly 0.

ENERGY CONSUMPTION IN TRANSPORT SECTOR BY ENERGY TYPE IN 2002



In 2011, the share of motor gasoline was dominant in which contributed to 43.6% of energy consumption in transport sector. Diesel has the second largest share with 40.2% followed by total avtur and avgas with 6.8%. The share of other products, gas, fuel oil and electricity were recorded less than 5% at about 4.8%, 2.7%, 1.7% and 0.2% respectively. Kerosene was the least share of energy consumption in transport sector with nearly 0.

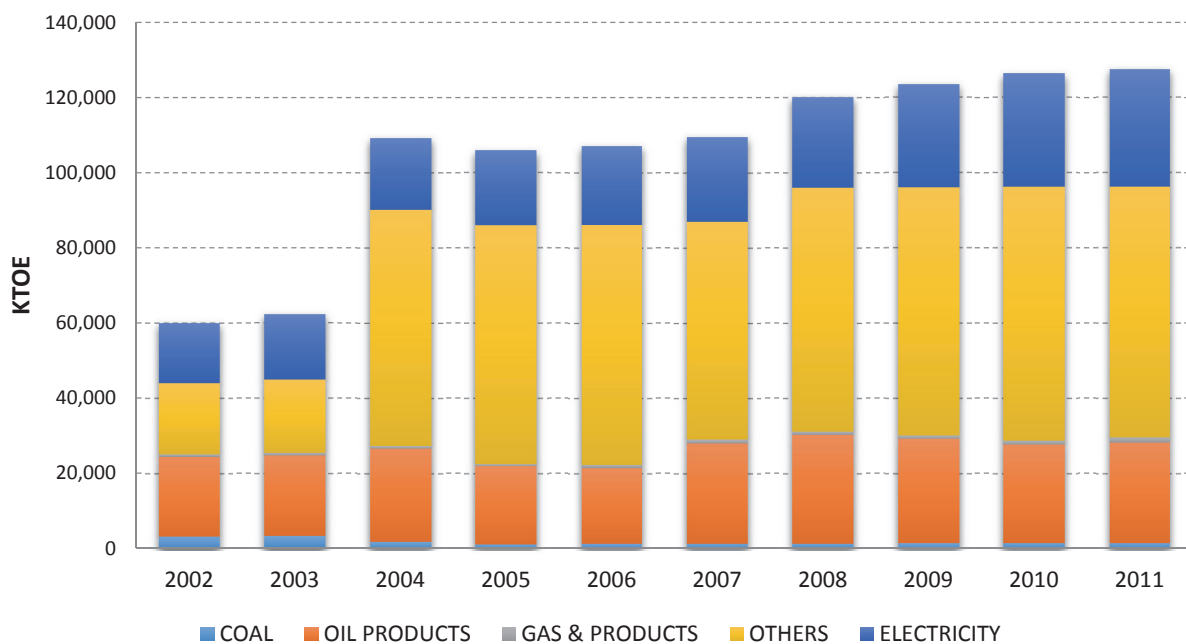
ENERGY CONSUMPTION IN TRANSPORT SECTOR BY ENERGY TYPE IN 2011



4.4 OTHER SECTOR

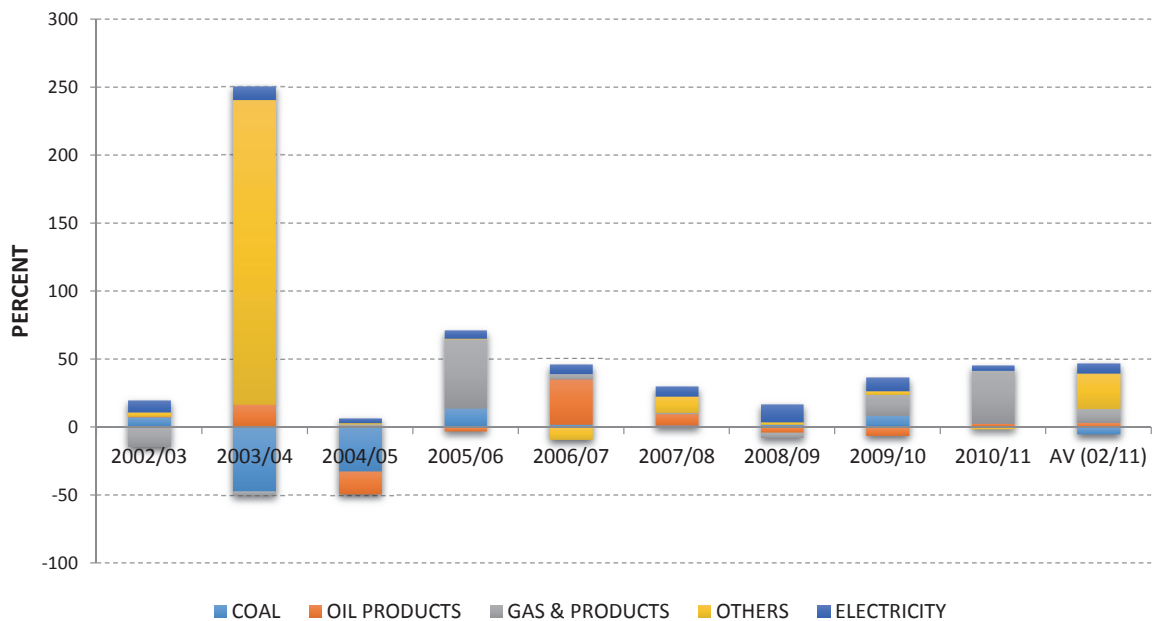
Energy consumption in other sector was about 127.34 MTOE in 2011, increased significantly from 59.76 MTOE in 2002 with CAGR at about 8.8%. In the composition, the share of others energy dominated the energy consumption in other sector from 2004 to 2011, was recorded with 66.54 MTOE in 2011 and has the biggest figure recorded about 67.50 MTOE in 2010. As the second largest, oil products contributed about 26.66 MTOE in 2011, overweighed by others energy. Electricity was recorded the biggest consumption with 31.13 MTOE in 2011. Coal was recorded with 1.62 MTOE in 2001 and has the biggest figure with 3.47 MTOE in 2003. Gas and products was recorded the biggest figure with 1.39 MTOE in 2011.

ENERGY CONSUMPTION IN OTHER SECTOR PER ENERGY TYPE 2002-2011



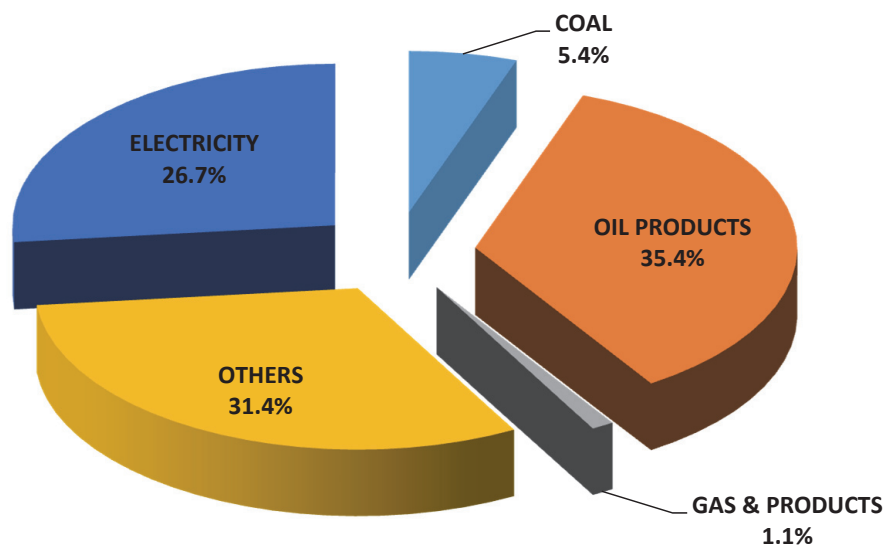
The energy consumption in other sector comparison based on year-on-year basis, shows that others energy increased significantly in 2004 with a growth of almost 2.3 times and recorded figure of almost 3.3 times from the previous year. This is in line with the energy policy of ASEAN Member States regarding the program to accelerate the use of renewable energy. Gas and products consumption increased most substantially with 50.7% in 2006. Oil products has its biggest increased with 15.6% in 2004 but decreased with 16.0% in 2005. Coal and electricity has its biggest increased with 13.5% in 2006 and 13.0% in 2009 respectively. Others energy has the most annual increased with 25.9% followed by gas and products with 10.0%. Electricity and oil products annually increased with 7.7% and 3.1% respectively. Coal recorded annual reduced with 4.9%. The biggest average annual growth of energy consumption in other sector was about 42.7% in 2004.

AVERAGE ANNUAL GROWTH OF ENERGY CONSUMPTION IN OTHER SECTOR PER ENERGY TYPE



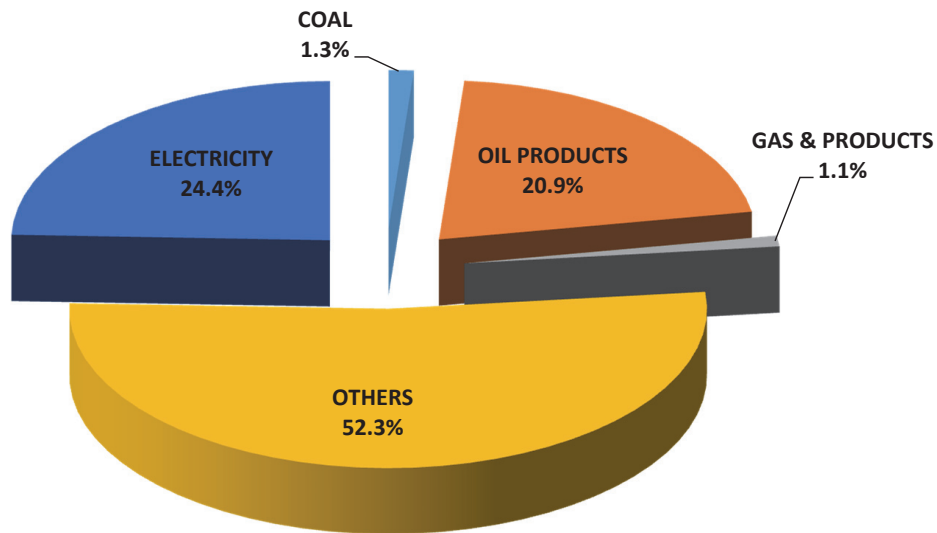
In 2002, the share of oil products was about 35.2% of the energy consumption in other sector. Others energy recorded as the second largest share with 31.5% followed by electricity with 26.8%. The share of coal and gas and products was recorded with 5.4% and 1.1% respectively.

ENERGY CONSUMPTION IN OTHER SECTOR BY ENERGY TYPE IN 2002



In 2011, the share of others energy contributed to energy consumption in other sector was about 52.3%. Electricity has the second largest share with 24.4% followed by oil products with 20.9%. The share of coal and gas and products was recorded less than 5% at about 1.3% and 1.1% respectively.

ENERGY CONSUMPTION IN OTHER SECTOR BY ENERGY TYPE IN 2011

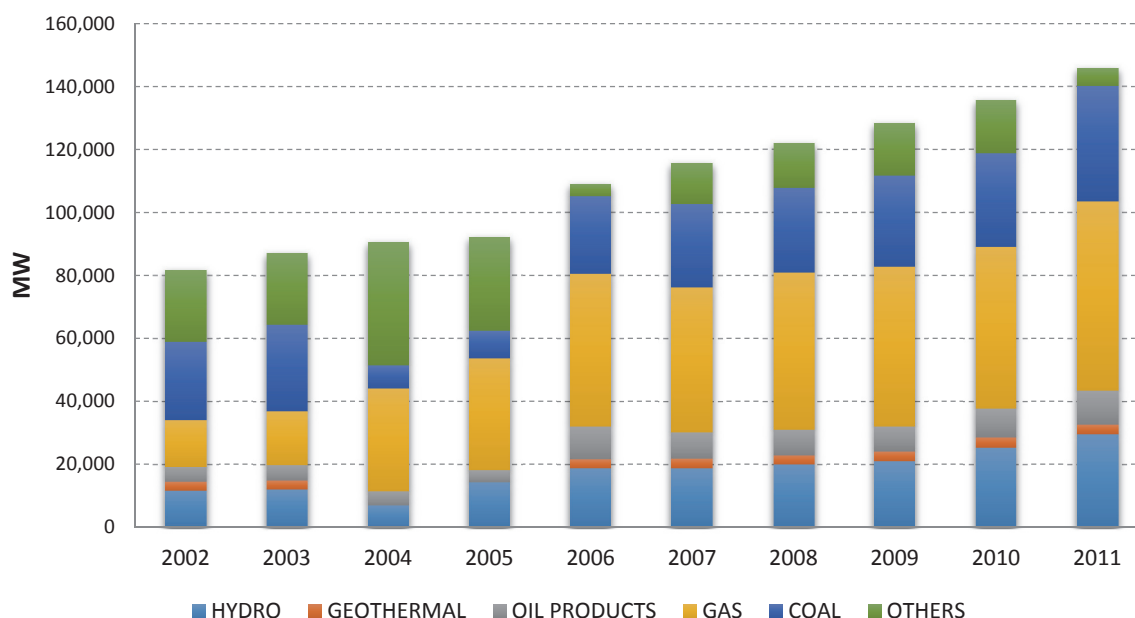


CHAPTER 5. ELECTRICITY

5.1 INSTALLED CAPACITY

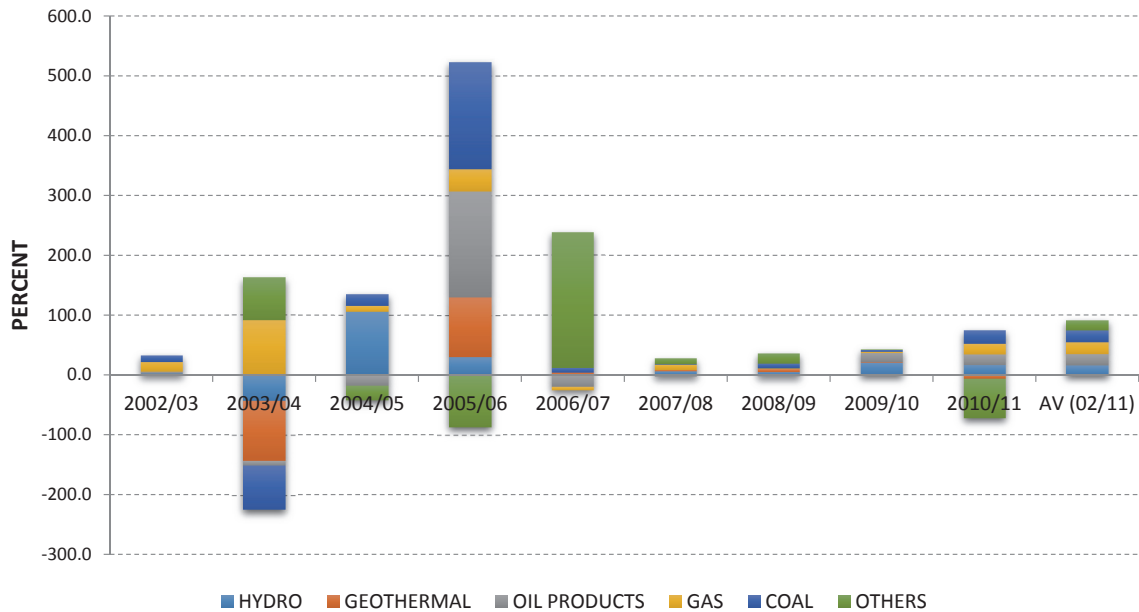
ASEAN total installed capacity was at 145,884 MW in 2011, increased significantly from 81,718 MW in 2002 with CAGR at about 6.7%. The figure includes installed capacity for self-generation purposes. Gas fired power plants accounted for the major part of ASEAN total installed capacity at 60,068 MW in 2011. The second largest was coal fired power plants at 36,509 MW. Renewable energy power plants contributed at 38,534 which consists of hydropower at 29,678 MW, other energy power plants such as biomass, combustible waste, photovoltaic and wind at 5,864 MW and geothermal at 2,992 MW. Oil products fired power plants were recorded at 10,772 MW. There was a significant increase in ASEAN total installed capacity in 2006.

ASEAN TOTAL INSTALLED CAPACITY 2002-2011



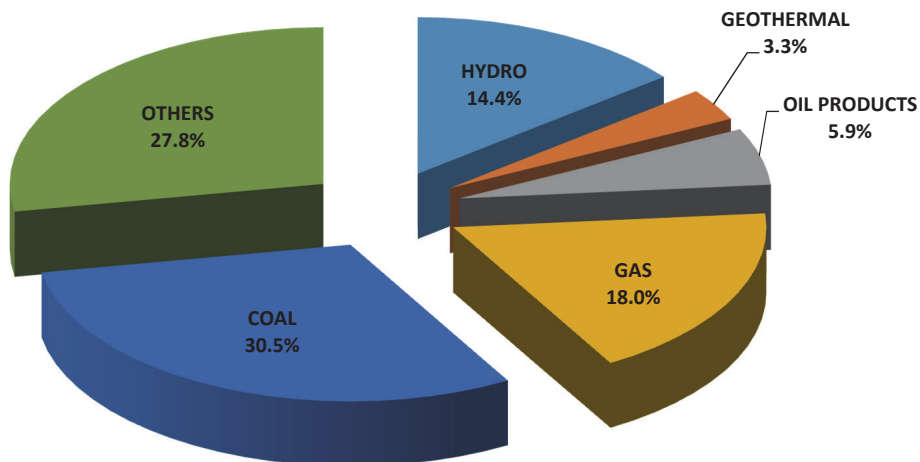
The ASEAN total installed capacity comparison based on year-on-year basis, shows that others energy power plants increased significantly in 2007 with growth of almost 2.3 times from the previous year, but in 2006 reduced about 86.4% and about 65.4% in 2011 respectively. Coal fired power plants and oil products fired power plants also increased significantly in 2006 with growth of almost 1.8 times from previous year. Coal fired power plants reduced about 73.4% in 2004 and oil products fired power plants reduced about 19.7% in 2007 and 17.4% in 2005 respectively. Installed capacity of hydropower in 2005, geothermal in 2006 and gas generated power plants in 2004 was doubled compared to the previous year. Hydropower reduced at about 42.6% in 2004 and geothermal also reduced by half capacity in 2004. Gas fired power plants increased at about 36.6% in 2006 and 17.3% in 2011 respectively. Coal fired power plants has the most annual increased with 19.9%, followed by gas fired power plants with 19.5% and oil products fired power plants with 18.0%. Others energy power plants and hydropower annually increased at similar figure with 16.5% and 16.3% respectively. Geothermal posted the least annual increased with 0.7%. In 2006, the biggest average annual increased of total installed capacity was recorded at 72.7%.

ASEAN ANNUAL AVERAGE INSTALLED CAPACITY GROWTH 2002-2011



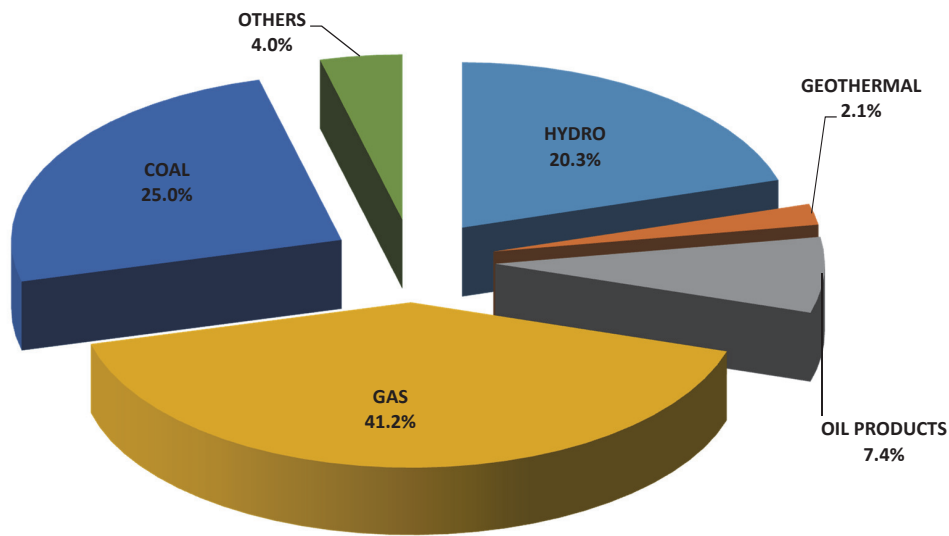
In 2002, the share of coal fired power plants was about 30.5% of the ASEAN total installed capacity. Others energy power plants recorded as the second largest with 27.8% followed by gas fired power plants with 18.0%. Hydropower was recorded about 14.4%. The share of oil products fired power plants and geothermal was recorded with 5.9% and 3.3% respectively. The share of renewable energy power plants was about 45.5% of the ASEAN total installed capacity.

ASEAN INSTALLED CAPACITY BY PLANT TYPE IN 2002



In 2011, gas fired power plants still dominated which contributed about 41.2% of the ASEAN total installed capacity. Coal fired power plants recorded as the second largest with 25.0% followed by hydropower with 20.3%. Oil products fired power plants were recorded at about 7.4%. The share of others energy power plants and geothermal was recorded with 4.0% and 2.1% respectively. Renewable energy power plants contributed about 26.4% of the ASEAN total installed capacity.

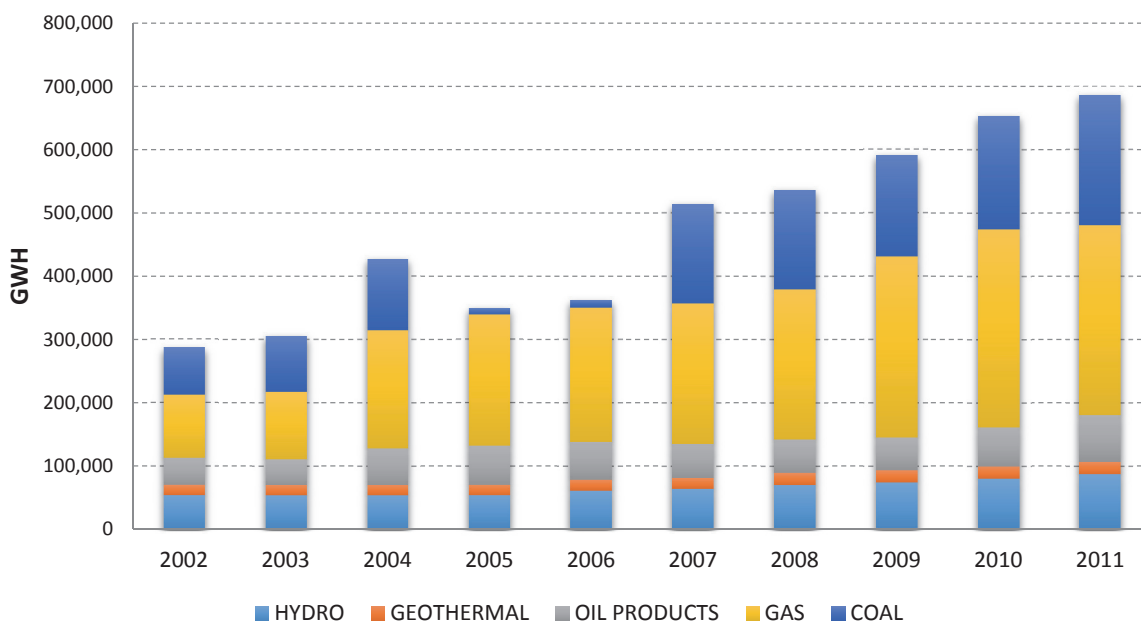
ASEAN INSTALLED CAPACITY BY PLANT TYPE IN 2011



5.2 POWER GENERATION

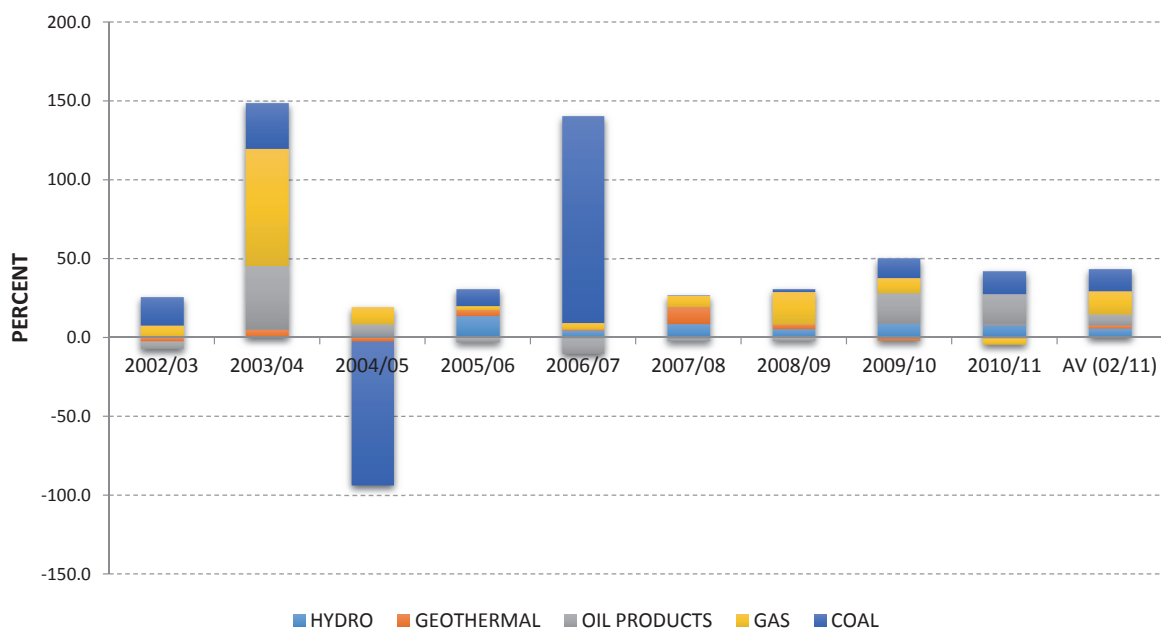
ASEAN total power generation was about 685,552 GWh in 2011, which increased significantly from 286,454 GWh in 2002 with CAGR at about 10.2%. The figure also includes electricity for self-generation purposes. In the composition, gas fired power plants dominated the share of 2002-11 at about 299,858 GWh in 2011 and the biggest figure at about 312,442 GWh in 2010. The second largest was coal fired power plants contributed about 205,615 GWh in 2011. Hydropower was recorded with the biggest contribution at about 87,325 GWh. Oil products fired power plants and geothermal was recorded with 73,436 GWh and 19,315 GWh respectively in 2011.

ASEAN TOTAL POWER GENERATION 2002-2011



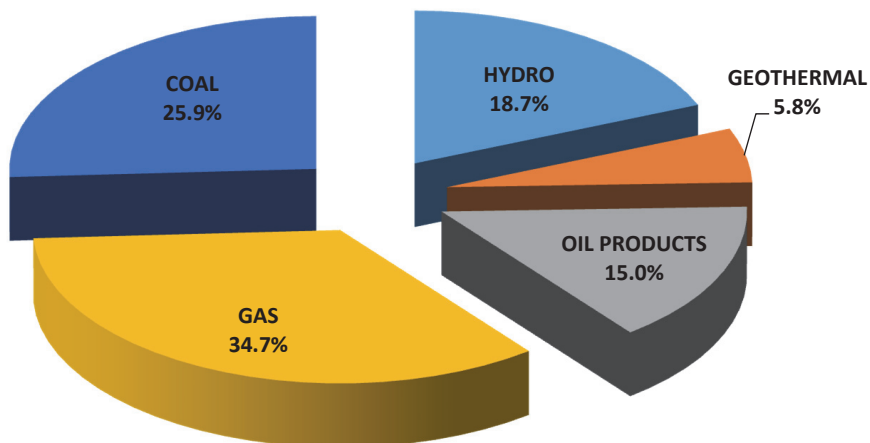
The ASEAN total power generation comparison based on year-on-year basis, shows that coal fired power plants increased in 2007 with a growth of almost 1.5 times from the previous year, but also reduced about 91.0% in 2005. Gas fired power plants was recorded the biggest increased with 74.2% in 2004. Oil products fired power plants has its significant increased with 40.4% in 2004 but decreased with 10.0% in 2007. Hydropower and geothermal have the biggest increased with 13.5% in 2006 and 10.4% in 2008 respectively. Gas fired power plants have the most annual increased with 14.8% followed by coal fired power plants with 13.9%. Oil products fired power plants and hydropower annually increased with 7.2% and 5.6% respectively. Geothermal posted the least annual increased with 1.9%. The biggest average annual increased of ASEAN total power generation was recorded at 42.1% in 2007.

ASEAN ANNUAL AVERAGE POWER GENERATION GROWTH 2002-2011



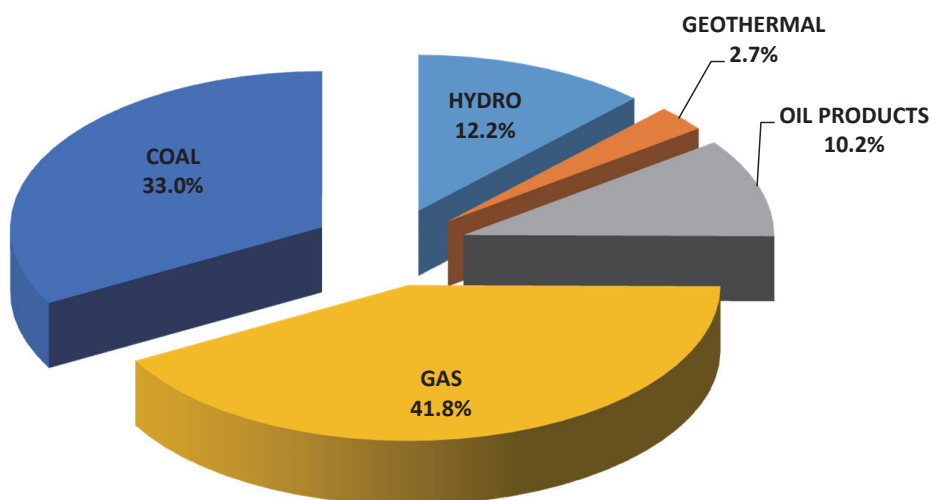
In 2002, gas fired power plants contributed about 34.7% of the ASEAN total generation. Coal fired power plants recorded as the second largest with 25.9% followed by hydropower about 18.7%. The share of oil products fired power plants and geothermal were recorded with 15.0% and 5.8% respectively.

ASEAN POWER GENERATION BY PLANT TYPE IN 2002



In 2011, gas fired power plants still dominated which contributed about 41.8% of the ASEAN total generation. Coal fired power plants recorded as the second largest with 33.0% followed by hydropower with 12.2%. The share of oil products fired power plants and geothermal were recorded with 10.2% and 2.7% respectively.

ASEAN POWER GENERATION BY PLANT TYPE IN 2011



CONVERSION FACTOR

Units of Volume

The unit of length underlies the unit of volume (meter, centimeter, etc.). Gallons and liter were originally standards of liquid measure but are now formally defined in terms of the cubic meter. Stere and cord are used exclusively for fuelwood measurement and represent 1 cubic meter and 128 cubic feet of stacked fuelwood, respectively. The actual volume of solid wood in each of the units is, therefore, ill-defined as the density of stacking and shape of the pieces of wood used can vary considerably.

Table 1. Conversion Equivalents between Units of Volume

To:	gal U.S.	gal U.K.	bbbl	ft ³	l	m ³
From:	multiply by:					
<i>U.S. gallon (gal)</i>	1	0.8327	0.02381	0.1337	3.785	0.0038
<i>U.K. gallon (gal)</i>	1.201	1	0.02859	0.1605	4.546	0.0045
<i>Barrel (bbl)</i>	42.0	34.97	1	5.615	159.0	0.159
<i>Cubic foot (ft³)</i>	7.48	6.229	0.1781	1	28.3	0.0283
<i>Litre (l)</i>	0.2642	0.220	0.0063	0.0353	1	0.001
<i>Cubic metre (m³)</i>	264.2	220.0	6.289	35.3147	1000.0	1

Unit of mass

The SI unit of mass is the kilogramme (kg); the tonne (metric ton), equal to 1,000 kilogrammes, is widely used as the smallest unit in energy statistics. For most countries, the national commodity balances will use the kilotonne (1,000 tonnes) as the unit for presentation of commodities expressed in mass terms.

Table 2. Conversion Equivalents between Units of Mass

To:	kg	t	lt	st	lb
From:	multiply by:				
<i>Kilogramme (kg)</i>	1	0.001	9.84 x 10 ⁻⁴	1.102 x 10 ⁻³	2.2046
<i>Tonne (t)</i>	1000	1	0.984	1.1023	2204.6
<i>Long ton (lt)</i>	1016	1.016	1	1.120	2240.0
<i>Short ton (st)</i>	907.2	0.9072	0.893	1	2000
<i>Pound (lb)</i>	0.454	4.54 x 10 ⁻⁴	4.46 x 10 ⁻⁴	5.0 x 10 ⁻⁴	1

Energy units

The SI unit of energy is the joule (J). Many other units for energy are in use for the practical expression of energy quantities partly for historical reasons and partly because the small size of the joule demands the use of unfamiliar (for non-scientists) decimal prefixes.

There are several definitions of the calorie in use. The conversion equivalent between the calorie and the joule given here is the International Steam Table (IT) value for the British thermal unit (Btu) is now 1,055.06 joules. The Btu is the basis for the quad (10^{15} Btu) and the therm (10^5 Btu).

Table 3. Conversion Equivalents between Units of Energy

To:	TJ	Gcal	Mtoe	MBtu	GWh
From:	multiply by:				
<i>Terajoule (TJ)</i>	1	238.8	2.388×10^{-5}	947.8	0.2778
<i>Gigacalorie (Gcal)</i>	4.1868×10^{-3}	1	10^{-7}	3.968	1.163×10^{-3}
<i>Mtoe*</i>	4.1868×10^{-4}	10^7	1	3.968×10^7	11630
<i>Million Btu</i>	1.0551×10^{-3}	0.252	2.52×10^{-8}	1	2.931×10^{-4}
<i>Gigawatt-hour</i>	3.6	860	8.6×10^{-5}	3412	1

*Million tonnes of oil equivalent.

Typical Calorific Values

Coals

Table 4. Calorific Values of Selected Coals for ASEAN Member States

Coals	Brunei Darussalam	Cambodia	Indonesia	Lao P.D.R.	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
<i>Coking Coal</i>	-	-	-	-	-	-	-	-	-	5600
<i>Anthracite</i>	-	-	-	4500	-	-	-	-	7483.62	5600
<i>Other bituminous</i>	-	-	-	-	-	-	-	-	6285.54	5530
<i>Sub-bituminous</i>	-	4750	5880	-	5984.99	5609.7	5277.77	-	-	5600
<i>Lignite</i>	-	-	-	4500	-	4565.7	-	-	2849.98	4160
<i>Peat</i>	-	-	-	-	-	-	-	-	-	5600
<i>Coke oven coke</i>	-	-	-	-	-	-	-	-	6584.71	5600
<i>BKB/PB</i>	-	-	4739.85	-	-	-	-	-	6285.53	-

*unit is in kcal/kg.

Oil (Crude oil and Oil Products)

Table 5. Calorific Values of Selected Oil for ASEAN Member States

Oil	Brunei Darussalam	Cambodia	Indonesia	Lao P.D.R.	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
Crude oil	11312	-	10442.3	-	10311.15	10088.68	9844.12	-	10070.05	10180.01
Natural Gas Liquids	11312	-	9865.05	-	10580.87	-	8896.55	-	10144.94	10538.92
Refinery feedstocks	-	-	-	-	10349	10349	-	-	-	-
Additives/Oxygenates	-	-	9707.27	-	6000	-	8368.39	-	10125.39	-
Other hydrocarbons	11021	-	8879.53	-	10349	-	-	-	10020.86	-
Refinery gas (not liq.)	11367	-	-	-	10148.56	-	-	-	-	-
LPG	11021	11799.63	11077.52	11020.62	10877.04	11777.78	10687.05	-	11723.47	10788.03
Naphtha	-	-	10497.8	-	-	9910	10640.01	10829.27	-	10246
Motor gasoline	10686	10148.45	10780.31	10686.3	10499.66	10450.24	10254.26	10688.35	10303.92	10412.73
Aviation gasoline	-	-	10040.39	-	-	10315.75	10477.37	-	11150.67	-
Gasoline type Jet Fuel	-	-	-	-	-	-	-	-	11602.23	-
Kerosene type Jet Fuel	10646	10273.97	9958.78	10488.1	10315.75	11674.58	10048.49	10490.11	11620.31	10232.42
Other kerosene	-	10185.19	9866.36	-	10150	10310.36	9896.46	-	10964.58	10235.49
Gas/Diesel oil	10359	10308.06	9735.18	10359.14	10150	10236.42	9798.85	10361.13	10080.88	10065.48
Fuel oil	9714	10000	9772.96	10072.58	9912.01	10105.25	9667.61	9928.82	10058.15	9827.54
White spirit SBP	-	-	-	-	-	9910	-	-	-	-
Lubricants	9982	9808.34	9074.4	9926.92	-	9910	9120	-	-	9910
Bitumen	9522	-	-	-	-	9910	9174.81	-	-	9910
Paraffin waxes	-	-	9790.8	-	-	9910	-	-	-	-
Petroleum coke	-	-	-	-	-	9910	-	-	-	9910
Other products	-	-	10501.59	-	10150	9910	9753.71	9601.61	9939.63	9711.5

*unit is in kcal/kg.

Renewable Energy

Table 6. Calorific Values of Selected Renewable Energy for ASEAN Member States

Renewable	Brunei Darussalam	Cambodia	Indonesia	Lao P.D.R.	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
Fuelwood & wood-waste	-	3820	3056	3820	4456	953.8	3455.21	-	3815.57	-
Bagasse	-	-	-	-	-	-	3773.88	-	1797.9	-
Charcoal	-	6900	-	6900	-	1742.79	6313.26	-	6898.69	-
Other biomass	-	3550	3702	-	4456	-	3164.67	-	3200.35	3275.35
Biogas	-	-	-	-	-	117	-	-	6666.67	-
Municipal solid waste	-	-	-	-	4456	-	3343.84	3343.84	1141.45	-
Liquid biofuels ethanol	-	-	10335.92	-	6400	-	6256.45	-	10393.08	-
Liquid biofuels biodiesel	-	-	9251.54	-	6400	-	8954.9	-	9743.98	-

*unit is in kcal/kg.

Natural Gas

Table 7. Conversion Equivalents between Standard Cubic Metres (Scm) and Normal Cubic Metres (Ncm)

From:	To:	Standard cm	Normal cm
	multiply by:		
Standard cm*		1	0.948
Normal cm**		1.055	1

*1 Scm measured at 15oC and 760 mm Hg.

**1 Ncm measured at 0oC and 760 mm Hg.

Table 8. Conversion Equivalents between LNG and Natural Gas Units

From:	To:	Metric ton of LNG	Cm of LNG	Standard cm*
	multiply by:			
Metric ton of LNG		1	0.948	1360
Cubic metre (cm) of LNG		0.45	1	615
Standard cm*		7.35×10^{-4}	1.626×10^{-3}	1

*1 Scm = 40 MJ.

Table 9. Gross versus Net Calorific Value of Natural Gas

$$1 \text{ NCV}^* = 0.9 \text{ GCV}^{**}$$

*NCV = Net Calorific Value.

**GCV = Gross Calorific Value.

Table 10. Calorific Values of Natural Gas for ASEAN Member States

ASEAN Member States	Natural Gas
Brunei Darussalam	9290
Cambodia	-
Indonesia	8483.63
Lao P.D.R.	-
Malaysia	8385
Myanmar	6336
Philippines	8297.64
Singapore	8106.19
Thailand	8473.85
Vietnam	8850

*1 Scm = 40 MJ.

GLOSSARY

Others	<i>Others</i> include solar, wind, and tide/wave/ocean energy. For solar, wind and tide/wave/ocean energy, the quantities entering electricity generation are equal to the electrical energy generated. Direct use of solar heat is also included. Electricity is accounted for at the same heat value as electricity in final consumption (i.e. 1 GWh = 0.000086 MTOE). Heat includes heat that is produced for sale and is accounted for in the transformation sector.
Geothermal	Unless the actual efficiency of the geothermal process is known, the quantity of geothermal energy entering electricity generation is inferred from the electricity production at geothermal plants assuming an average thermal efficiency of 10%.
Hydropower	<i>Hydro</i> shows the energy content of the electricity produced in hydro power plants. Hydro output excludes output from pumped storage plants.
Production	<i>Production</i> is the production of primary energy, i.e. hard coal, lignite, peat, crude oil, NGLs, natural gas, biofuels and waste, nuclear, hydro, geothermal, solar and the heat from heat pumps that is extracted from the ambient environment. Production is calculated after removal of impurities (e.g. sulphur from natural gas).
Imports and exports	<p><i>Imports</i> and <i>exports</i> comprise amounts having crossed the national territorial boundaries of the country, whether or not customs clearance has taken place.</p> <p>a) Oil and natural gas</p> <p>Quantities of crude oil and oil products imported or exported under processing agreements (i.e. refining on account) are included. Quantities of oil in transit are excluded. Crude oil, NGL and natural gas are reported as coming from the country of origin; refinery feedstocks and oil products are reported as coming from the country of last consignment. Re-exports of oil imported for processing within bonded area are shown as export of product from the processing country to the final destination.</p> <p>b) Coal</p> <p><i>Imports</i> and <i>exports</i> comprise the amount of fuels obtained from or supplied to other countries, whether or not there is an economic or customs union between the relevant countries. Coal in transit is not included.</p> <p>c) Electricity</p> <p>Amounts are considered as imported or exported when they have crossed the national territorial boundaries of the country.</p>
Total primary energy supply (TPES)	<i>Total primary energy supply (TPES)</i> is made up of production + imports – exports – international marine bunkers – international aviation bunkers ± stock changes.
Total final energy consumption (TFEC)	<i>Total final energy consumption (TFEC)</i> is the sum of consumption by the different end use sectors. Backflows from the petrochemical industry are not included in final consumption.

Transport

Transport includes all fuels used for transport [ISIC Division 49 to 51]. It includes transport in industry and covers domestic aviation, road, rail, pipeline transport, domestic navigation and non-specified transport. Fuel used for ocean, coastal and inland fishing (included under fishing) and military consumption (included in other non-specified) are excluded from transport.

Other (sector)

Other covers residential, commercial and public services [ISIC Division 33, 36-39, 45-47, 52, 53, 55, 58-66, 68-75, 77-82, 84 (excluding Class 8422), 85-88, 90-99], agriculture/forestry [ISIC Divisions 01 and 02], fishing [ISIC Division 03] and non-specified consumption.

Non-energy use

Non-energy use covers those fuels that are used as raw materials in the different sectors and are not consumed as a fuel or transformed into another fuel. Non-energy use also includes petrochemical feedstocks. Non-energy use is shown separately in final consumption under the heading *non-energy use*.

Compound Annual Growth Rate (CAGR)

Compounded Annual Growth Rate (CAGR) is a business and investing specific term for the geometric mean that provides a constant rate of return over the time period. CAGR is not an accounting term, but it is often used to describe some element of the business, for example revenue, units delivered, registered users, etc. CAGR dampens the effect of volatility of periodic returns that can render arithmetic means irrelevant. It is particularly useful to compare growth rates from different data sets.

$$\text{Formula: } CAGR(t_o, t_n) = \left(\frac{V(t_n)}{V(t_o)} \right)^{\frac{1}{t_n - t_o}} - 1$$

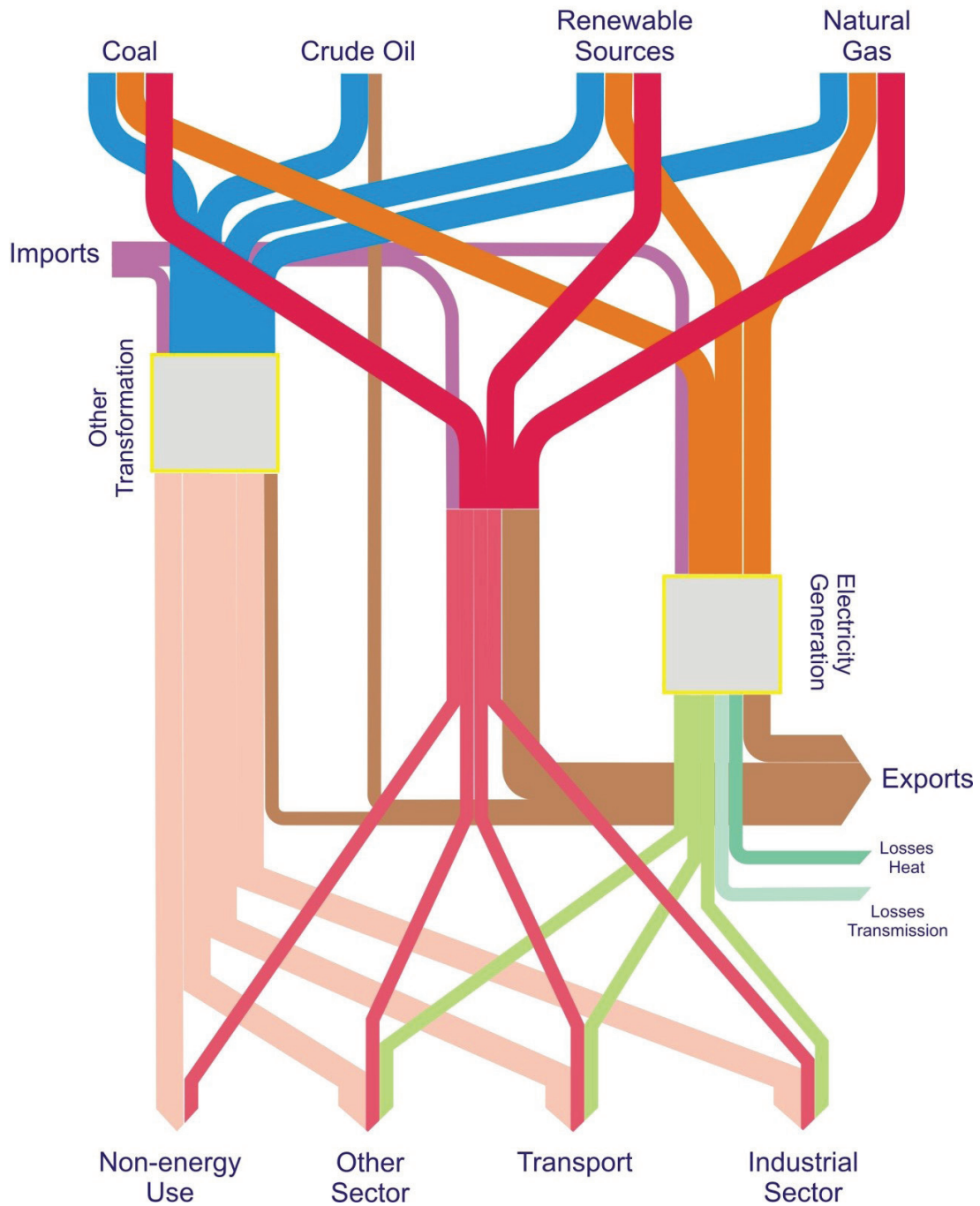
$V(t_o)$: start value , $V(t_n)$: finish value , $t_n - t_o$: number of years

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ANNEXES

ANNEX 1. ENERGY CHAIN



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INDONESIA