



**MALAYSIA**

# **BANCI EKONOMI** *ECONOMIC CENSUS* **2016**

**STATISTIK TENAGA DAN UTILITI**  
*ENERGY AND UTILITIES STATISTICS*

**Pemakluman/ Announcement:**

Dimaklumkan bahawa kerajaan Malaysia telah mengisytiharkan Hari Statistik Negara (*MyStats Day*) pada 20 Oktober setiap tahun. Tema sambutan *MyStats Day* adalah "Data Berkualiti, Kehidupan Sejahtera".

*Please be informed that the Government of Malaysia has declared National Statistics Day (MyStats Day) on 20 October each year. MyStats Day theme is "Better Data, Better Lives".*

**JABATAN PERANGKAAN MALAYSIA**  
*DEPARTMENT OF STATISTICS, MALAYSIA*

Diterbitkan dan dicetak oleh:

**Jabatan Perangkaan Malaysia**

Blok C6, Kompleks C

Pusat Pentadbiran Kerajaan Persekutuan

62514 Putrajaya

**MALAYSIA**

Tel : 03-8885 7000

Faks : 03-8888 9248

Portal : <https://www.dosm.gov.my>

Facebook : [www.facebook.com/StatsMalaysia](http://www.facebook.com/StatsMalaysia)

Twitter : <https://twitter.com/StatsMalaysia>

Harga : RM40.00

Diterbitkan pada November 2018

**Hakcipta terpelihara.**

Tiada bahagian daripada terbitan ini boleh diterbitkan semula, disimpan untuk pengeluaran atau ditukar dalam apa-apa bentuk atau alat apa jua pun kecuali setelah mendapat kebenaran daripada Jabatan Perangkaan Malaysia.

Pengguna yang mengeluarkan sebarang maklumat dari terbitan ini sama ada yang asal atau diolah semula hendaklah meletakkan kenyataan berikut:

“Sumber: Jabatan Perangkaan Malaysia”.

*Published and printed by:*

**Department of Statistics, Malaysia**

*Block C6, Complex C*

*Federal Government Administrative Centre*

*62514 Putrajaya*

**MALAYSIA**

*Tel. : 03-8885 7000*

*Fax : 03-8888 9248*

*Portal : <https://www.dosm.gov.my>*

*Facebook : [www.facebook.com/StatsMalaysia](http://www.facebook.com/StatsMalaysia)*

*Twitter : <https://twitter.com/StatsMalaysia>*

*Price : RM40.00*

*Published on November 2018*

**All rights reserved.**

*No part of this publication may be reproduced or distributed in any form or by any means or stored in data base without the prior written permission from Department of Statistics, Malaysia.*

*Users reproducing content of this publication with or without adaptation should quote the following:*

*“Source: Department of Statistics, Malaysia.”*

**ISBN 978-967-2000-58-7**

Penerbitan Statistik Tenaga dan Utiliti, hasil daripada Banci Ekonomi 2016 ini julung kali dikeluarkan oleh Jabatan Perangkaan Malaysia. Inisiatif menerbitkan data parameter tambahan ini bertujuan untuk mengkaji penemuan Banci Ekonomi dari dimensi yang berbeza selari dengan usaha untuk merakmatkan statistik. Penerbitan ini menyediakan statistik tenaga dan utiliti mengikut sektor ekonomi utama, mengikut negeri dan industri tenaga bagi memenuhi keperluan agensi kerajaan, sektor swasta, ahli akademik serta individu bagi tujuan membuat perancangan dan penggubalan dasar, analisis ekonomi, unjuran dan membantu merancang program pembangunan perniagaan.

Industri tenaga meliputi semua industri berkaitan tenaga seperti yang disyorkan dalam *International Recommendation for Energy Statistics (IRES)* dan *Energy Statistics Compilers Manual (ESCM)* yang meliputi Seksyen B, C, dan D manakala industri utiliti di Seksyen E yang dikelaskan di bawah Piawaian Klasifikasi Industri Malaysia (MSIC) 2008 Ver. 1.0, selaras dengan Piawaian Klasifikasi Industri Antarabangsa bagi Semua Aktiviti Ekonomi (ISIC), Semakan Ke-4. Data utama bagi industri tenaga yang diterbitkan ialah nilai output kasar, nilai input perantara, nilai ditambah, bilangan pekerja, gaji & upah dan nilai harta tetap. Penerbitan ini juga membentangkan pelbagai statistik termasuk pengeluaran dan penggunaan tenaga & utiliti dan statistik berkaitan lain yang telah diterbitkan oleh Jabatan dan agensi kerajaan lain.

Penerbitan ini dibahagikan kepada tiga bahagian. Bahagian pertama memaparkan infografik penemuan utama dan ringkasan penemuan statistik tenaga dan utiliti. Bahagian kedua meliputi aspek teknikal seperti skop dan liputan, konsep dan definisi serta pembolehubah utama yang digunakan bagi memudahkan pengguna memahami statistik dalam penerbitan ini. Bahagian ketiga pula memaparkan jadual perangkaan secara terperinci.

Jabatan merakamkan setinggi-tinggi penghargaan atas kerjasama yang diberikan oleh responden dan juga semua pihak yang telah menyumbang secara langsung dan tidak langsung dalam menjayakan penerbitan ini. Setiap maklum balas dan cadangan untuk penambahbaikan laporan ini pada masa akan datang amat dihargai.

**DATO' SRI DR. MOHD UZIR MAHIDIN**

Ketua Perangkawan Malaysia

**November 2018**

# PREFACE

*The Energy and Utilities Statistics publication which provides information based on the data obtained from the Economic Census 2016 is the first attempt undertaken by the Department of Statistics, Malaysia. The initiative for publishing additional parameter data is to serve analysis the findings of the Economic Census in different dimensions in line with efforts to give exposure to the community about statistics. This publication provides the energy and utilities statistics by main economic sector, by state and energy industry to meet the needs of government agencies, economists, academicians, private sector and individual for planning and formulation policies, economic analysis, projections and to assist in business development planning.*

*Energy industry encompasses all energy-related industries as recommended by the International Recommendation for Energy Statistics (IRES) dan Energy Statistics Compilers Manual (ESCM) covering Section B, C and D, while utilities industry in Section E is classified under the Malaysia Standard Industrial Classification (MSIC) 2008 Ver. 1.0, in accordance with the International Standard Industrial Classification of All Economic Activities (ISIC), Revision 4. Key data for the energy industry consists of value of gross output, intermediate input, value added, number of persons engaged, salaries & wages and value of fixed assets are reported in this publication. This publication also presents various statistics include production and consumption of energy & utilities and other related statistics that have been published by the Department and other government agencies.*

*This publication is divided into three sections. The first section presents the infographics of the main findings and a summary of findings for energy and utilities statistics. While, the second section covers the technical aspects such as scope and coverage, concepts and definitions as well as the key variables used to facilitate users to understand statistics in this publication. The third section presents the detailed statistical tables.*

*The Department gratefully acknowledges the co-operation rendered by the respondents as well as all parties who have contributed directly and indirectly to the success of this publication. Every feedback and suggestion towards improving future reports is highly appreciated.*

**DATO' SRI DR. MOHD UZIR MAHIDIN**

*Chief Statistician Malaysia*

**November 2018**

	Muka surat <i>Pages</i>
<b>Kata pengantar</b> <i>Preface</i>	i
<b>Kandungan</b> <i>Contents</i>	iii
<b>BAHAGIAN 1</b> : <b>Penemuan utama</b> <i>PART 1</i> : <i>Main findings</i>	3
: <b>Ringkasan penemuan</b> : <i>Summary of findings</i>	7
<b>BAHAGIAN 2</b> : <b>Nota teknikal</b> <i>PART 2</i> : <i>Technical notes</i>	41
<b>BAHAGIAN 3</b> : <b>Jadual</b> <i>PART 3</i> : <i>Tables</i>	
<b>Jadual Utama</b> <i>Main table</i>	
<b>1 Perangkaan utama tenaga dan utiliti, 2015</b> <i>Principal statistics of energy and utilities, 2015</i>	111
<b>2 Pengeluaran produk tenaga dan utiliti mengikut sektor ekonomi, 2015</b> <i>Production of energy and utilities products by economic sector, 2015</i>	113
<b>3 Pengeluaran produk pembuatan petroleum bertapis, 2015</b> <i>Production of manufacture of refined petroleum products, 2015</i>	114
<b>4 Nilai penggunaan produk tenaga dan utiliti mengikut sektor ekonomi, 2015</b> <i>Consumption of energy and utilities products by economic sector, 2015</i>	115
<b>4a Nilai penggunaan bahan pembakar, pelincir dan gas mengikut sektor ekonomi, 2015</b> <i>Consumption of fuel, lubricants and gas by economic sector, 2015</i>	116
<b>5 Nilai penggunaan produk tenaga dan utiliti mengikut negeri, 2015</b> <i>Consumption of energy and utilities products by state, 2015</i>	117
<b>5a Nilai penggunaan bahan pembakar, pelincir dan gas mengikut negeri, 2015</b> <i>Consumption of fuel, lubricants and gas by state, 2015</i>	118
<b>5b Nilai penggunaan tenaga elektrik mengikut negeri, 2015</b> <i>Consumption of electrical energy by state, 2015</i>	119
<b>5c Nilai penggunaan bekalan air mengikut negeri, 2015</b> <i>Consumption of water by state, 2015</i>	120
<b>6 Intensiti tenaga mengikut sektor ekonomi, 2015</b> <i>Energy intensity by economic sector, 2015</i>	121

	Muka surat <i>Pages</i>
<b>7 Eksport dan import produk tenaga dan utiliti, 2015</b> <i>Exports and imports of energy and utilities products, 2015</i>	<b>122</b>
<b>8 Bekalan dan permintaan produk tenaga dan utiliti, 2015</b> <i>Supply and demand of energy and utilities products, 2015</i>	<b>123</b>
<b>9 Nilai penggunaan produk tenaga dan utiliti mengikut sektor ekonomi dan PKS, 2015</b> <i>Consumption of energy and utilities products by economic sector and SMEs, 2015</i>	<b>125</b>
<b>10 Komposisi nilai penggunaan produk tenaga dan utiliti mengikut negeri, 2015</b> <i>Composition of energy and utilities products consumption by state, 2015</i>	<b>127</b>
<b>10a Komposisi nilai penggunaan bahan pembakar, pelincir dan gas mengikut negeri, 2015</b> <i>Composition of fuel, lubricants and gas consumption by state, 2015</i>	<b>128</b>
<b>10b Komposisi nilai penggunaan tenaga elektrik mengikut negeri, 2015</b> <i>Composition of electrical energy consumption by state, 2015</i>	<b>129</b>
<b>10c Komposisi nilai penggunaan bekalan air mengikut negeri, 2015</b> <i>Composition of water consumption by state, 2015</i>	<b>130</b>
 <b>Jadual Tambahan</b> <i>Additional Tables</i>	
<b>A Penjanaan tenaga elektrik</b> <i>Electrical energy generation</i>	<b>133</b>
<b>B Penggunaan tenaga elektrik</b> <i>Electrical energy consumption</i>	<b>134</b>
<b>C Indeks asal dan indeks pelarasan musim, sektor elektrik (2015=100)</b> <i>Original index and seasonally adjusted index, electricity sector (2015=100)</i>	<b>135</b>
<b>D Purata harga jualan tenaga elektrik</b> <i>Average selling prices of electrical energy</i>	<b>136</b>
<b>E Eksport, import, jumlah dagangan dan imbalan dagangan produk tenaga</b> <i>Exports, imports, total trade and balance of trade energy products</i>	<b>137</b>
<b>F Pengeluaran produk petroleum bertapis</b> <i>Production of refined petroleum products</i>	<b>139</b>

**Lampiran**  
*Appendix*



**BANCI EKONOMI 2016**  
*ECONOMIC CENSUS*

# **PENEMUAN UTAMA** *MAIN FINDINGS*

**1**  
**Bahagian**  
*Part*

**STATISTIK TENAGA DAN UTILITI**  
*ENERGY AND UTILITIES STATISTICS*

**JABATAN PERANGKAAN MALAYSIA**  
*DEPARTMENT OF STATISTICS, MALAYSIA*





# BANCI EKONOMI 2016



## PENEMUAN UTAMA TENAGA DAN UTILITI

### Pengeluaran RM371.4 bilion

#### PRODUK TENAGA DAN UTILITI

	<b>Pembuatan</b>	<b>RM123.6b</b>	<b>33.3%</b>
	<b>Perkhidmatan</b>	<b>RM123.6b</b>	
	<b>Perlombongan &amp; Pengkuarian</b>	<b>RM98.2b</b>	<b>26.5%</b>
	<b>OIL</b>	<b>RM49.5b</b>	
		<b>RM48.3b</b>	
		<b>RM0.4b</b>	
	<b>Perkhidmatan</b>	<b>RM60.6b</b>	<b>16.3%</b>
		<b>RM53.1b</b>	
		<b>RM7.5b</b>	

#### IMPORT

**RM85.2b**

**22.9%**



**Tenaga Elektrik Dijana & Guna Sendiri**

**1.0%**  
**RM3.8b**



**3.2%**

Peningkatan nilai penggunaan tenaga dan utiliti setahun



**10.0%**

Peningkatan nilai penggunaan tenaga elektrik setahun

#### INTENSITI TENAGA

**RM74.66**

bagi setiap RM1,000 penghasilan output

### Penggunaan RM371.4 bilion

	<b>Pembuatan</b>	<b>34.9%</b>	<b>RM125.9b</b>
	<b>Perkhidmatan</b>	<b>14.0%</b>	<b>RM50.5b</b>
	<b>Pembinaan</b>	<b>1.3%</b>	<b>RM4.7b</b>
	<b>Pertanian</b>	<b>1.1%</b>	<b>RM3.9b</b>
	<b>Perlombongan &amp; Pengkuarian</b>	<b>0.9%</b>	<b>RM3.2b</b>

#### EKSPORT

**RM125.9b**

**34.9%**



**Tenaga Elektrik Dijana & Guna Sendiri**

**0.8%**  
**RM2.8b**



**45.8%**

Sumbangan biomas kepada tenaga boleh baharu



**34.9%**

Penggunaan tertinggi adalah daripada sektor Pembuatan



**34.9%**

Nilai eksport meningkat kepada RM125.9b

#### PENGUNAAN ISI RUMAH DAN KERAJAAN

**11.1%**  
**RM40.3b**

**1.0%**  
**RM3.5b**





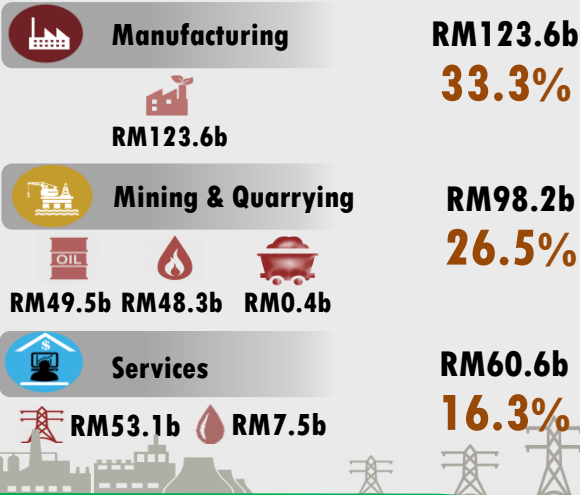
# ECONOMIC CENSUS 2016



## MAIN FINDINGS OF ENERGY AND UTILITIES

### Production RM371.4 billion

#### ENERGY AND UTILITIES PRODUCTS



#### IMPORTS

RM85.2b

**22.9%**



Self-generation & Self-Consumption of Electrical Energy

**1.0%**  
RM3.8b



**3.2%**

Increase of value in energy and utilities consumption per year



**10.0%**

Increase of value in electrical energy usage per year

#### INTENSITY OF ENERGY

**RM74.66**

for every RM1,000 output



**45.8%**

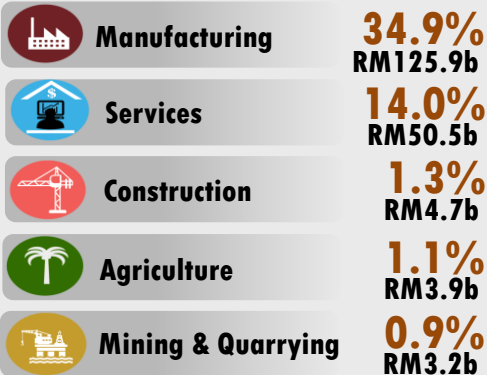
Biomass contribution to renewable energy



**34.9%**

The highest use is from Manufacturing sector

### Consumption RM371.4 billion



#### EXPORTS

RM125.9b

**34.9%**



Self-generation & Self-Consumption of Electrical Energy

**0.8%**  
RM2.8b

#### HOUSEHOLD AND GOVERNMENT CONSUMPTION

**11.1%**  
RM40.3b

**1.0%**  
RM3.5b



**34.9%**

Exports value increased to RM125.9b



**BANCI EKONOMI** 2016  
*ECONOMIC CENSUS*

# **RINGKASAN PENEMUAN** *SUMMARY OF FINDINGS*

**STATISTIK TENAGA DAN UTILITI**  
*ENERGY AND UTILITIES STATISTICS*

**JABATAN PERANGKAAAN MALAYSIA**  
*DEPARTMENT OF STATISTICS, MALAYSIA*



## 1. PENGENALAN

Penerbitan ini membentangkan statistik tenaga dan utiliti yang meliputi pengeluaran daripada industri tenaga & utiliti dan penggunaan oleh lima sektor ekonomi iaitu Pertanian, Perlombongan & pengkuarian, Pembuatan, Pembinaan dan Perkhidmatan. Industri tenaga ditakrifkan sebagai unit ekonomi yang menjalankan aktiviti utama berkaitan pengeluaran, penghantaran dan pengagihan produk tenaga. Statistik ini disusun berpandukan garis panduan dan saranan yang disyorkan dalam *International Recommendations for Energy Statistics* (IRES), 2016. Manakala, statistik utiliti yang digunakan dalam penerbitan ini adalah berdasarkan kepada Piawaian Klasifikasi Industri Malaysia (MSIC), 2008 versi 1.0. Industri utiliti meliputi aktiviti penakungan, perawatan dan pengagihan air untuk keperluan domestik dan industri, dikelaskan dalam sektor Perkhidmatan.

Statistik yang dibentang adalah hasil daripada Banci Ekonomi yang dijalankan pada tahun 2016 bagi tahun rujukan 2015 merangkumi data perangkaan utama dan pengeluaran produk tenaga dan utiliti oleh industri tenaga dan utiliti serta nilai penggunaannya mengikut lima sektor ekonomi. Statistik mengikut negeri turut dimuatkan dalam penerbitan ini.

Berbanding statistik tenaga dan utiliti sedia ada, statistik yang dibentangkan dalam penerbitan ini tidak diukur menggunakan jisim atau berat, sebaliknya menggunakan nilai dalam Ringgit Malaysia (RM).

## 2. PRESTASI KESELURUHAN

Industri tenaga diliputi dalam sektor Perlombongan & pengkuarian, Pembuatan dan Perkhidmatan. Perincian bagi setiap sektor adalah seperti di **Jadual 1**.

**Jadual 1: Klasifikasi industri tenaga mengikut sektor ekonomi**

Sektor Ekonomi	Aktiviti Ekonomi (MSIC 2008)	Industri Tenaga (IRES 2016)
<b>Perlombongan &amp; pengkuarian</b>	Bahagian 05: Perlombongan batu arang dan lignit	<i>Coal mines</i>
	Bahagian 06: Pengekstrakan petroleum mentah dan gas asli	<i>Oil and gas extraction</i>
		<i>Gas separation plants</i>
	Kelas 0721: Perlombongan bijih uranium dan torium	<i>Nuclear fuel extraction and fuel processing</i>

# RINGKASAN PENEMUAN

Sektor Ekonomi	Aktiviti Ekonomi (MSIC 2008)	Industri Tenaga (IRES 2016)
	Kelas 0892: Pengekstrakan tanah gambut	<i>Other energy industry not elsewhere specified</i>
	Kumpulan 091: Aktiviti sokongan pengekstrakan petroleum dan gas asli	<i>LNG plants / regasification plants</i>
		<i>Oil and gas extraction</i>
<b>Pembuatan</b>	Kumpulan 191: Pembuatan produk ketuhar kok	<i>Coke ovens</i>
	Kumpulan 192: Pembuatan produk petroleum bertapis	<i>Coal liquefaction plants</i>
		<i>Patent fuel plants</i>
		<i>Brown coal briquette plants</i>
		<i>Oil refineries</i>
	Kelas 2011: Pembuatan kimia asas	<i>Gas-to-liquids (GTL) plants</i>
		<i>Charcoal plants</i>
	<i>Nuclear fuel extraction and fuel processing</i>	
Kumpulan 241: Pembuatan besi asas dan keluli	<i>Blast furnaces</i>	
<b>Perkhidmatan</b>	Bahagian 35: Bekalan elektrik, gas, wap dan pendinginan udara	<i>Electricity, CHP and heat plants</i>
	Kumpulan 352: Pembuatan gas, pengagihan bahan api berunsur gas melalui saluran utama	<i>Gas works (and other conversion to gases)</i>
		<i>Biogas production plants</i>
Kelas 5221: Aktiviti perkhidmatan berkaitan pengangkutan darat	<i>LNG plants / regasification plants</i>	

Keluaran Dalam Negeri Kasar (KDNK) bagi semua subsektor utama berkaitan pengeluaran produk tenaga dan utiliti meningkat iaitu subsektor perlombongan petroleum & gas asli berkembang 0.7 peratus setahun, subsektor pembuatan produk petroleum bertapis meningkat 1.7 peratus setahun, subsektor bekalan elektrik, gas, wap dan pendinginan udara meningkat 4.0 peratus setahun dan subsektor penakungan, perawatan dan bekalan air meningkat 4.0 peratus setahun bagi tempoh 2010-2015.

Hasil daripada Banci Ekonomi 2016 mendapati pertumbuhan tahunan nilai ditambah industri berkaitan tenaga dan utiliti keseluruhannya meningkat 3.9 peratus setahun kepada RM189.4 bilion berbanding RM156.3 bilion pada tahun 2010. Sektor Perlombongan & pengkuarian mencatatkan nilai ditambah tertinggi sebanyak RM98.9 bilion dengan peratus

# RINGKASAN PENEMUAN

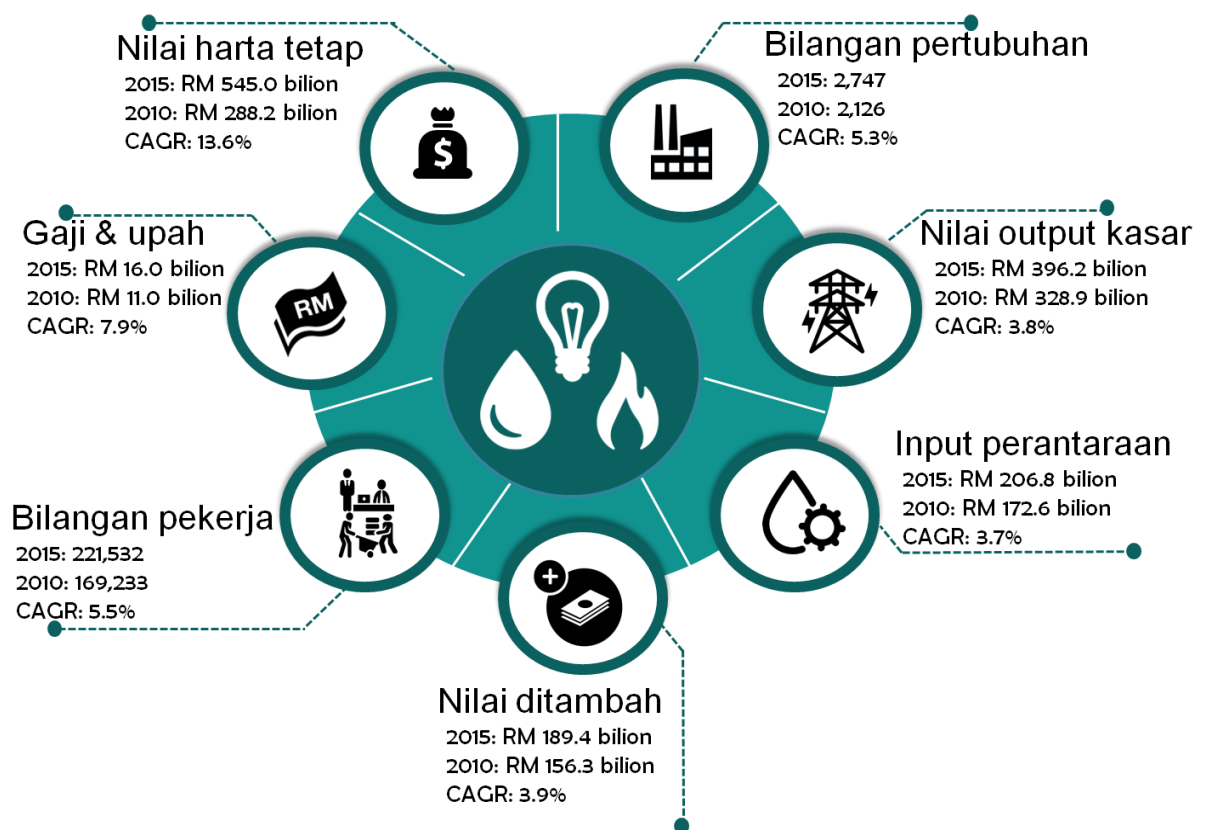
sumbangan 52.2 peratus yang disumbangkan oleh subsektor pengekstrakan petroleum mentah & gas asli (RM92.4 bilion). Seterusnya, sektor Pembuatan merekodkan nilai ditambah RM53.6 bilion (28.3%) yang disumbangkan oleh industri pembuatan dan produk petroleum bertapis, RM35.2 bilion.

Penemuan banci menunjukkan bilangan pertubuhan bagi industri berkaitan tenaga & utiliti meningkat kepada 2,747 berbanding 2,126 pertubuhan pada tahun 2010, merekodkan peningkatan pertumbuhan tahunan 5.3 peratus.

Nilai output kasar pada tahun 2015 berjumlah RM396.2 bilion berbanding RM328.9 bilion pada tahun 2010 dengan pertumbuhan tahunan sebanyak 3.8 peratus. Nilai input perantaraan turut meningkat kepada RM206.8 bilion berbanding RM172.6 bilion pada tahun 2010. Pada tahun 2015, industri ini mencatatkan jumlah pekerja seramai 221,532 orang dengan nilai gaji dan upah yang dibayar berjumlah RM16.0 bilion.

Prestasi keseluruhan industri berkaitan tenaga dan utiliti pada tahun 2010 dan 2015 adalah seperti di **Paparan 1**.

**Paparan 1: Perangkaan utama tenaga dan utiliti, 2010 dan 2015**



### 3. PENGELUARAN PRODUK TENAGA DAN UTILITI MENGIKUT SEKTOR EKONOMI

Pengeluaran produk tenaga ditakrifkan sebagai pengekstrakan atau pembuatan bahan api atau tenaga dalam bentuk yang sedia untuk kegunaan am. Dalam statistik tenaga, terdapat dua jenis pengeluaran iaitu pengeluaran utama (atau primer) dan pengeluaran sekunder.

Pengeluaran utama adalah pengekstrakan bahan api atau tenaga dari aliran tenaga semula jadi, biosfera dan rizab semula jadi fosil bahan api dalam negara dalam bentuk yang sesuai untuk digunakan. Produk yang dihasilkan adalah dirujuk sebagai produk "utama".

Sumber utama pengeluaran tenaga yang tidak boleh diperbaharui adalah seperti berikut:

- Bahan api fosil - Minyak mentah, arang batu dan gas asli:
  - Minyak mentah atau petroleum adalah sejenis sebatian hidrokarbon cecair yang berwarna gelap dan pekat yang biasanya didapati di bahagian atas kerak bumi;
  - Arang batu adalah pepejal hitam semula jadi dan digunakan sebagai bahan bakar secara meluas; dan
  - Gas asli adalah sejenis sebatian hidrokarbon dalam bentuk gas dan terbentuk di lapisan magma bumi.
  
- Bahan api mineral – Uranium semula jadi seperti Uranium-234, Uranium-235 dan Uranium-238.
  - Uranium adalah unsur logam radioaktif yang berwarna kelabu atau keperakan.

Pengeluaran sekunder merujuk kepada pembuatan produk tenaga melalui proses transformasi bahan api utama atau tenaga. Kuantiti bahan api sekunder dilaporkan sebagai pengeluaran termasuk kuantiti yang hilang melalui pembuangan dan pembakaran semasa dan selepas pengeluaran bahan api. Melalui kaedah ini, jisim, tenaga dan karbon di dalam sumber utama di mana bahan api dihasilkan boleh diimbangi dengan bahan api sekunder yang dihasilkan. Bahan api, elektrik dan haba yang dihasilkan biasanya dijual tetapi kemungkinan sebahagiannya atau keseluruhannya digunakan oleh pengeluar.

Sumber tenaga pengeluaran sekunder merupakan sumber tenaga yang telah berubah bentuk daripada sumber tenaga utama melalui proses penukaran tenaga. Penukaran

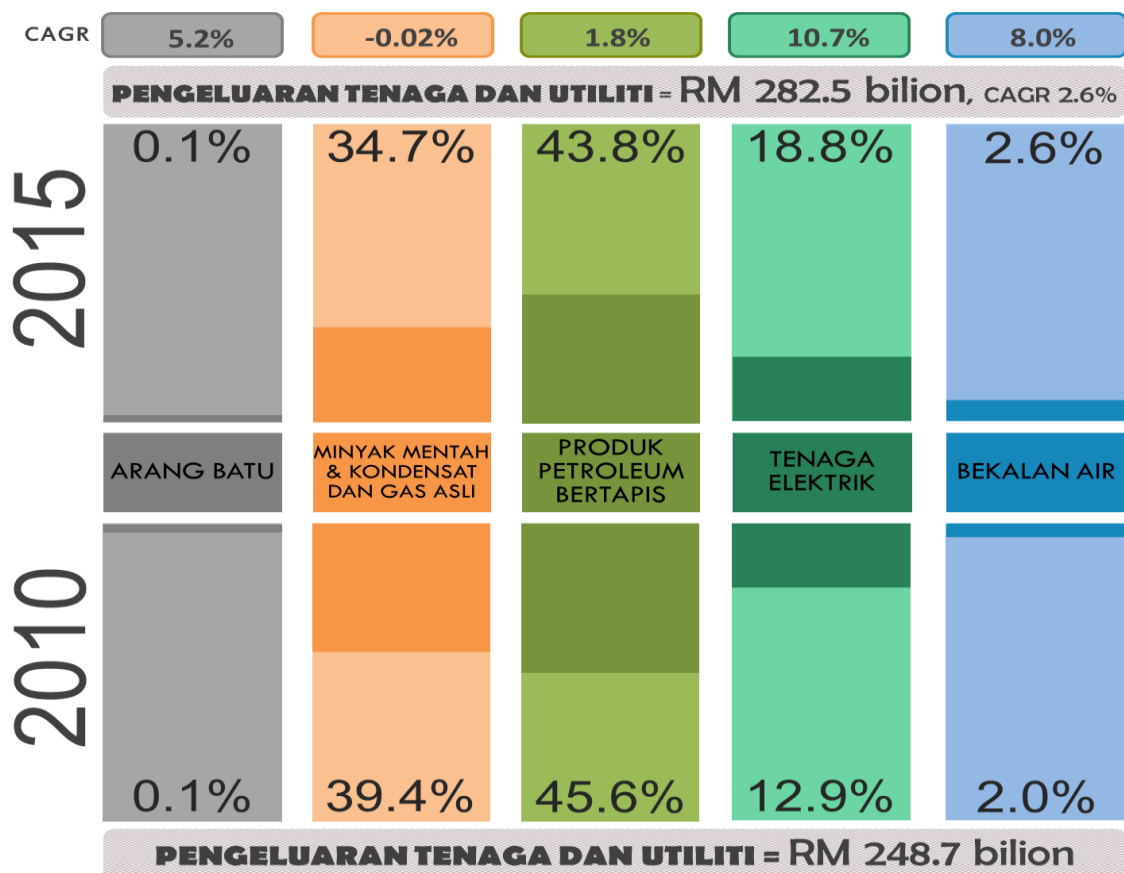
# RINGKASAN PENEMUAN

sumber tenaga daripada sumber tenaga utama kepada sumber tenaga sekunder adalah penting untuk penggunaan yang lebih mudah dan memberi manfaat kepada aktiviti-aktiviti pengguna. Contoh tenaga sekunder adalah tenaga elektrik yang mana kegunaannya adalah pelbagai, misalnya untuk menjanakan perkakasan dan peralatan elektrik seperti penyaman udara, peti sejuk, pemanas ruang serta air, lampu dan lain-lain. Tenaga sekunder yang lain ialah bahan pembakar hidrogen yang mana penggunaannya masih terhad dan dijangka bertambah pada masa hadapan.

Pengeluaran utiliti merupakan aktiviti penakungan, perawatan dan pengagihan air untuk tujuan bekalan air bagi memenuhi keperluan domestik dan industri.

Hasil daripada Banci Ekonomi 2016, sebanyak RM282.5 bilion pengeluaran produk tenaga dan utiliti dicatatkan pada tahun 2015 berbanding RM248.7 bilion pada tahun 2010 dengan kadar pertumbuhan tahunan 2.6 peratus. Sektor Pembuatan mencatatkan nilai pengeluaran produk tenaga dan utiliti tertinggi iaitu RM123.6 bilion dengan sumbangan 43.8 peratus seperti di **Paparan 2**.

**Paparan 2: Pengeluaran produk tenaga dan utiliti, 2010 dan 2015**



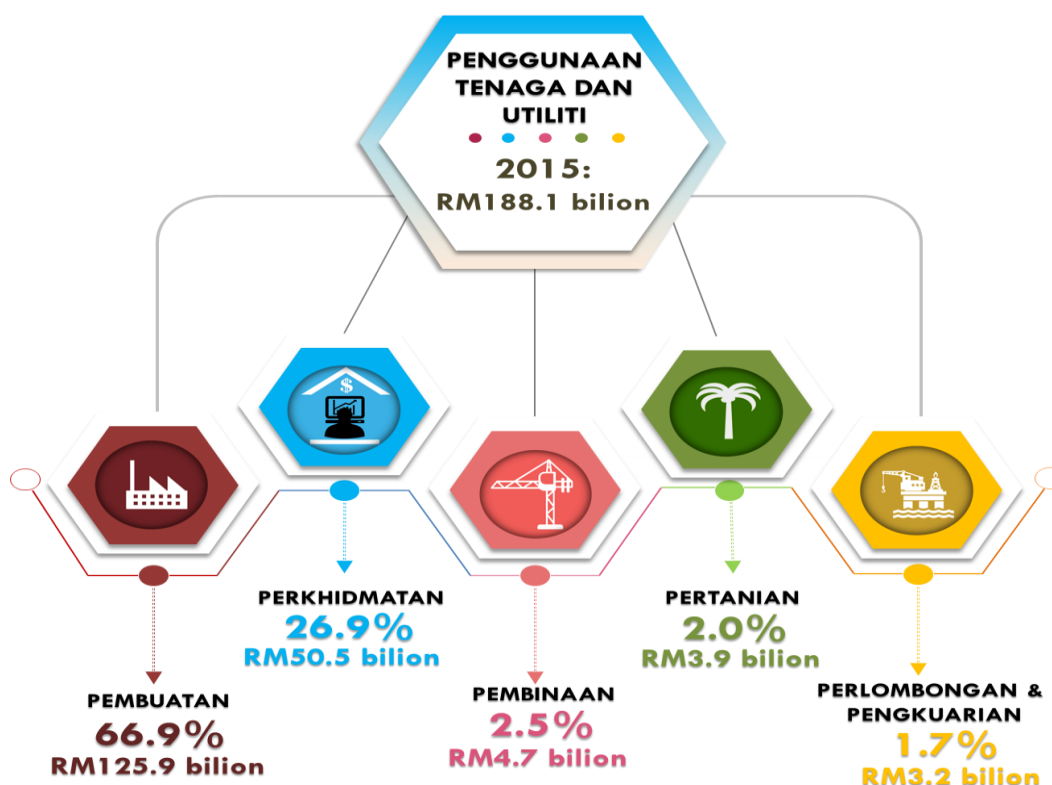
Pengeluaran produk tenaga meningkat 2.5 peratus setahun dalam tempoh 2010 hingga 2015, mencatatkan RM275.0 bilion pada tahun 2015, berbanding RM243.6 bilion pada tahun 2010. Bahan pembakar, pelincir dan gas menyumbang 80.7 peratus kepada jumlah pengeluaran produk tenaga.

Pengeluaran produk utiliti pada tahun 2015 berjumlah RM7.5 bilion, berbanding RM5.1 bilion pada tahun 2010, merekodkan purata pertumbuhan tahunan sebanyak 8.0 peratus. Pengeluaran produk utiliti menyumbang 2.6 peratus kepada jumlah bekalan tenaga dan utiliti pada tahun 2015.

#### 4. PENGGUNAAN PRODUK TENAGA DAN UTILITI MENGIKUT SEKTOR EKONOMI

Penggunaan produk tenaga dan utiliti adalah merujuk kepada penggunaan akhir lima sektor ekonomi iaitu Pertanian, Perlombongan & pengkuarian, Pembuatan, Pembinaan dan Perkhidmatan, manakala sektor isi rumah dan kerajaan tidak diliputi. Penggunaan produk tenaga dan utiliti pada tahun 2015 berjumlah RM188.1 bilion, di mana sektor Pembuatan merekodkan jumlah penggunaan tertinggi iaitu RM125.9 bilion dengan sumbangan 66.9 peratus seperti di **Paparan 3**.

**Paparan 3: Penggunaan tenaga dan utiliti mengikut sektor ekonomi, 2015**



# RINGKASAN PENEMUAN

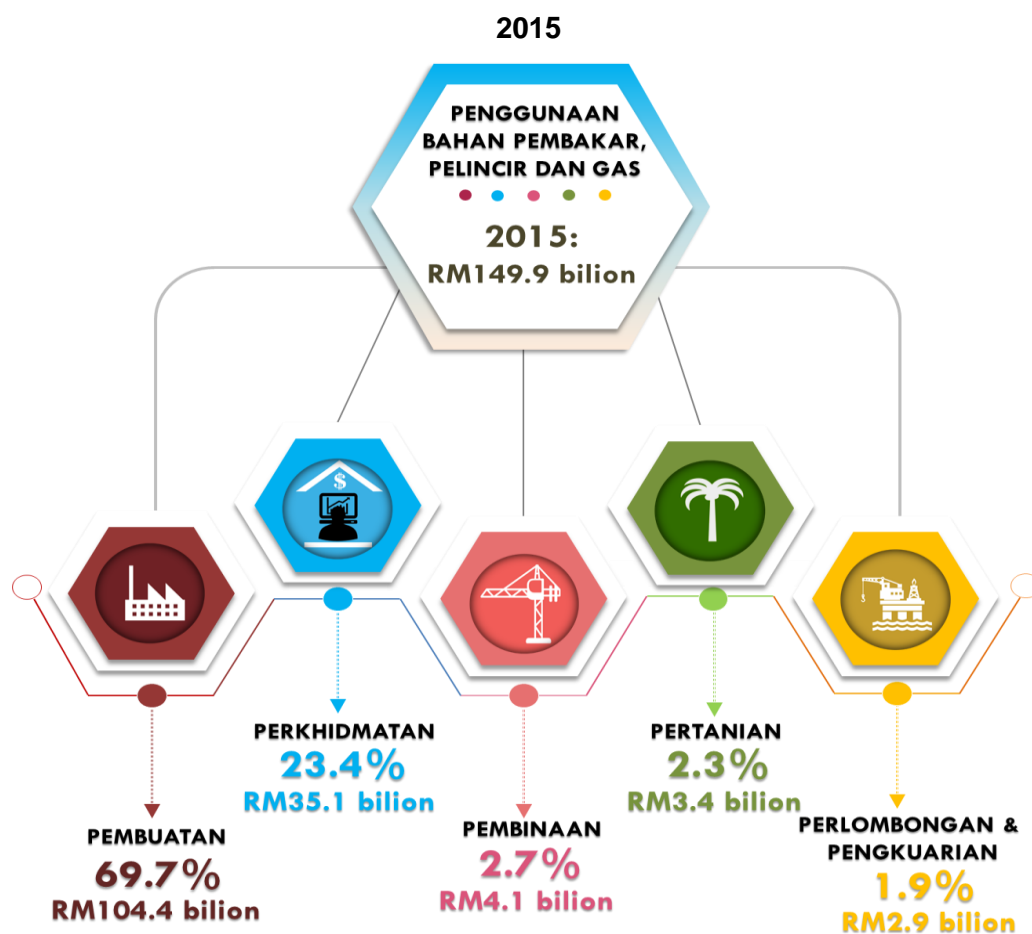
Pada tahun 2015, penggunaan produk tenaga mencatatkan RM185.9 bilion iaitu 80.7 peratus (RM159.4 bilion) disumbangkan oleh penggunaan bahan pembakar, pelincir dan gas. Penggunaan produk utiliti mencatatkan pertumbuhan tahunan 8.5 peratus dan merekodkan RM2.3 bilion pada tahun 2015. Sektor Perkhidmatan merekodkan penggunaan tertinggi, sebanyak RM1.4 bilion atau 59.7 peratus daripada jumlah bekalan air.

Penggunaan produk tenaga dan utiliti dibahagikan kepada tiga, iaitu bahan pembakar, pelincir & gas; tenaga elektrik; dan bekalan air.

## i. Bahan pembakar, pelincir & gas

Penggunaan bahan pembakar, pelincir & gas dalam lima sektor ekonomi pada tahun 2015 berjumlah RM149.9 bilion. Sektor Pembuatan merekodkan nilai terbesar iaitu RM104.4 bilion dengan sumbangan 69.7 peratus, diikuti sektor Perkhidmatan RM35.1 bilion (23.4%) seperti di **Paparan 4**.

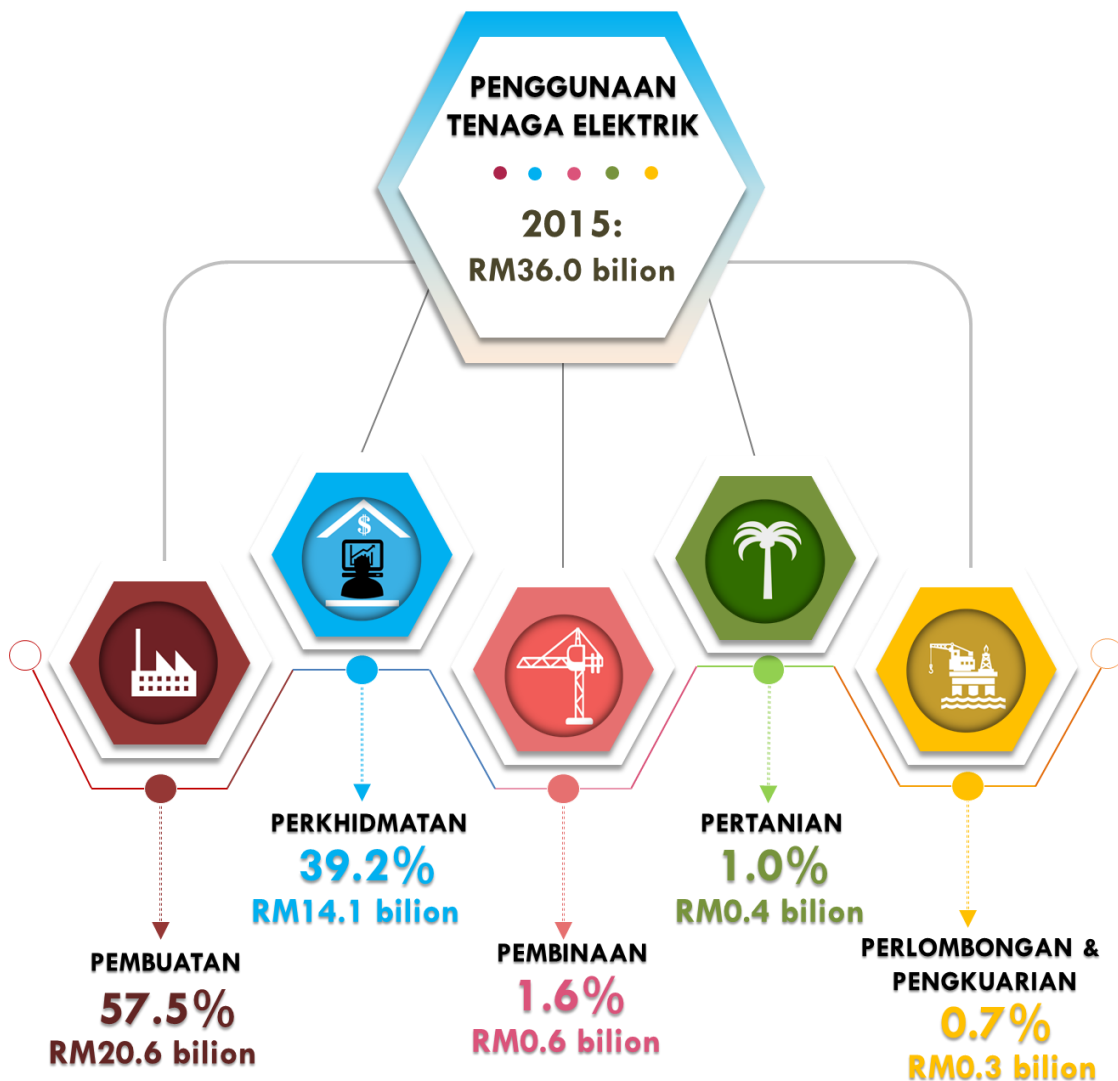
**Paparan 4: Penggunaan bahan pembakar, pelincir & gas mengikut sektor ekonomi,**



## ii. Tenaga elektrik

Jumlah penggunaan tenaga elektrik dalam lima sektor ekonomi pada tahun 2015 meningkat kepada RM36.0 bilion. Sektor Pembuatan merekodkan nilai penggunaan tenaga elektrik tertinggi iaitu RM20.6 bilion (57.5%), diikuti sektor Perkhidmatan RM14.1 bilion (39.2%) seperti di **Paparan 5**.

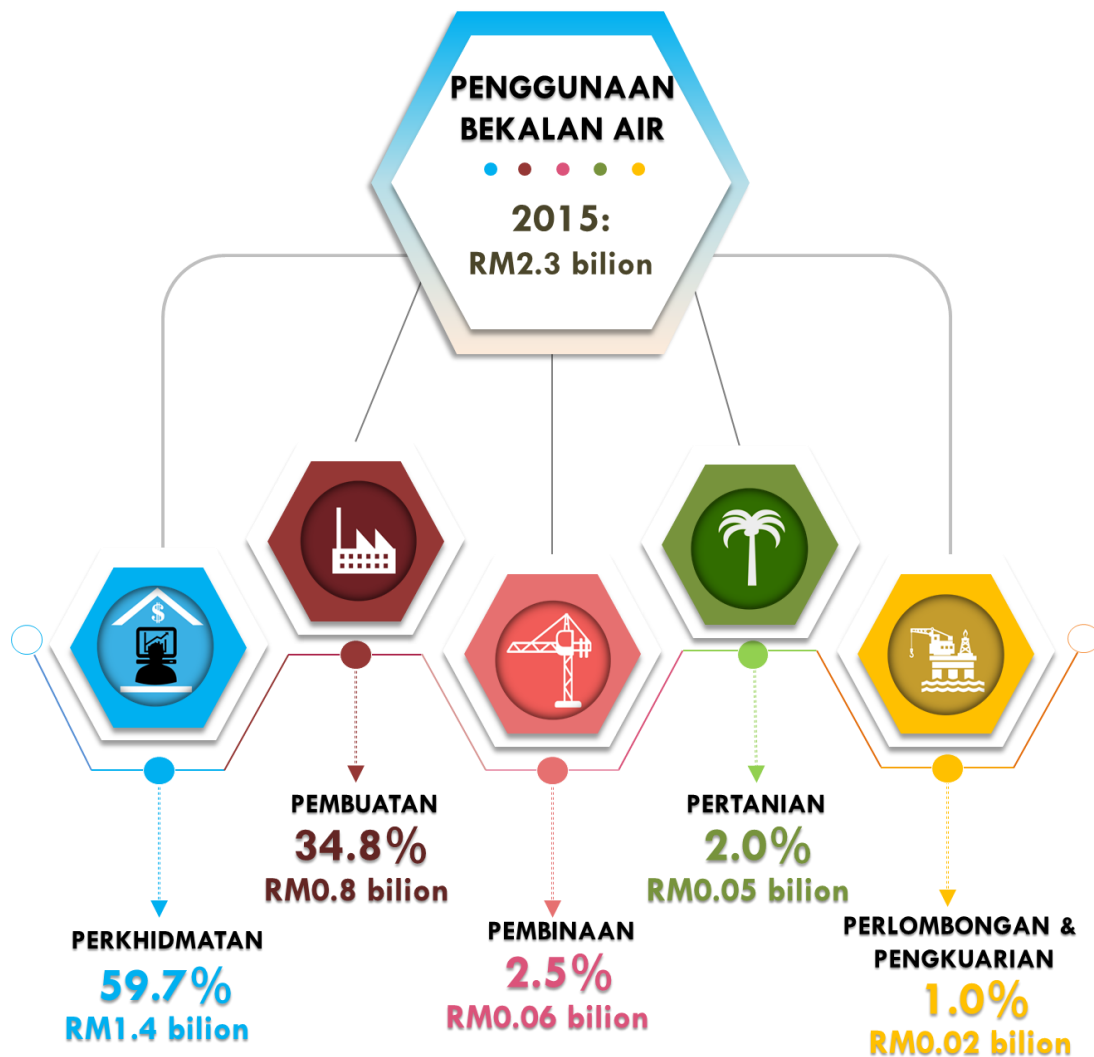
**Paparan 5: Penggunaan tenaga elektrik mengikut sektor ekonomi, 2015**



## iii. Bekalan air

Jumlah penggunaan bekalan air dalam lima sektor ekonomi pada tahun 2015 merekodkan RM2.3 bilion. Sektor Perkhidmatan mencatatkan penggunaan terbesar iaitu RM1.4 bilion dengan sumbangan 59.7 peratus, diikuti sektor Pembuatan, RM0.8 bilion (34.8%) seperti di **Paparan 6**.







**Paparan 6: Penggunaan bekalan air mengikut sektor ekonomi, 2015**



## 5. EKSPORT DAN IMPORT PRODUK TENAGA DAN UTILITI

Pada tahun 2015, jumlah eksport produk tenaga dan utiliti meningkat kepada RM125.9 bilion berbanding RM102.0 bilion pada tahun 2010 dengan pertumbuhan tahunan 4.3 peratus. Nilai import turut mencatatkan peningkatan kepada RM85.2 bilion dengan pertumbuhan tahunan 10.1 peratus seperti di **Paparan 7**. Pada tahun 2015, jumlah perdagangan produk tenaga mencatatkan lebih RM40.7 bilion, manakala perdagangan produk utiliti merekodkan defisit sebanyak RM1 juta.

**Paparan 7: Eksport dan import produk tenaga dan utiliti, 2010 dan 2015**

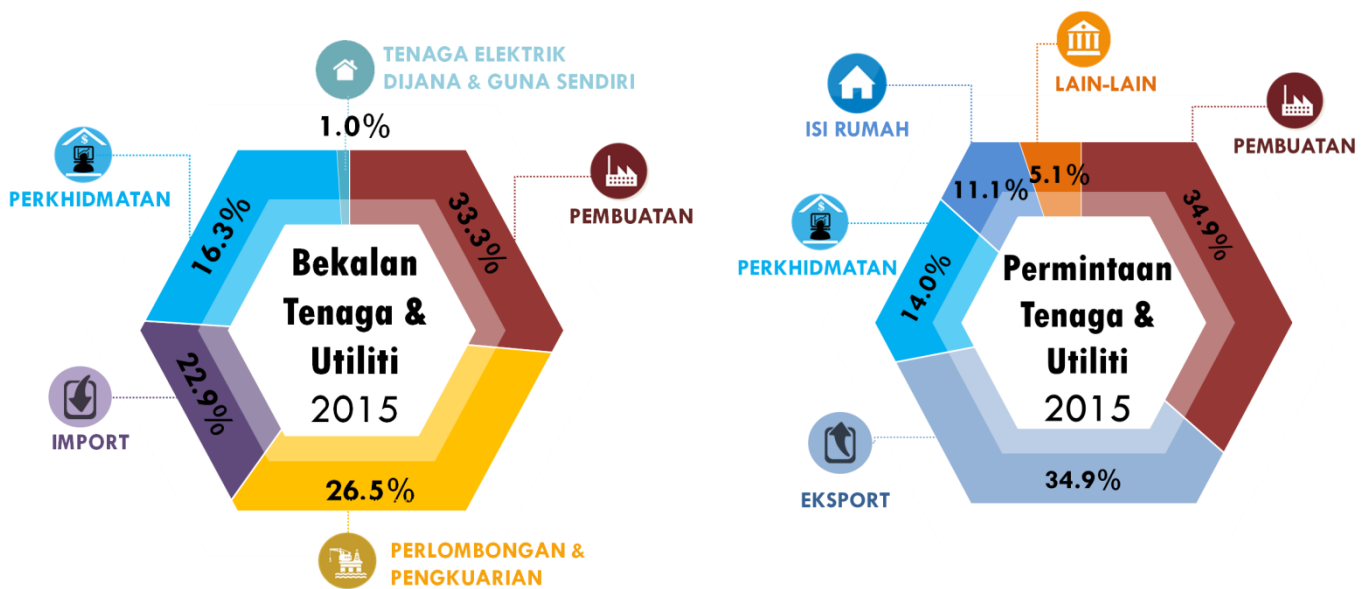
							
		ARANG BATU, ARANG KOK & BRIKUET	PETROLEUM	GAS, ASLI & BUATAN	TENAGA ELEKTRIK	BEKALAN AIR	JUMLAH
EKSPORT (RM juta)	2015	45 0.0%	78,750 62.6%	47,078 37.4%	2 0.0%	2 0.0%	125,877
	2010	71 0.1%	58,188 57.1%	43,652 42.8%	48 0.0%	2 0.0%	101,961
	CAGR	-8.4%	6.2%	1.5%	-45.6%	-2.8%	4.3%
IMPORT (RM juta)	2015	5,542 6.5%	74,085 87.0%	5,515 6.5%	6 0.0%	3 0.0%	85,151
	2010	5,341 10.1%	44,646 84.7%	2,704 5.2%	-	5 0.0%	52,696
	CAGR	0.7%	10.7%	15.3%	-	-8.8%	10.1%

## 6. IMBANGAN TENAGA DAN UTILITI

Bekalan tenaga dan utiliti ditakrifkan sebagai pengeluaran produk tenaga dan utiliti ditambah import produk tenaga dan utiliti dan ditolakkan dengan eksport produk tenaga dan utiliti, bunker laut antarabangsa, bunker penerbangan antarabangsa, kemudian ditambah/ditolak perubahan stok. Pengeluaran boleh merujuk kepada sama ada pengeluaran utama, sekunder, atau kedua-dua pengeluaran utama dan sekunder.

Pada tahun 2015, bekalan produk tenaga dan utiliti berjumlah RM371.4 bilion yang mana sektor Pembuatan merekodkan sumbangan tertinggi iaitu 33.3 peratus, diikuti oleh sektor Perlombongan & pengkuarian (26.5%), Import (22.9%), sektor Perkhidmatan (16.3%) dan tenaga elektrik dijana & guna sendiri (1.0%). Manakala permintaan produk tenaga dan utiliti bagi eksport mencatatkan RM125.9 bilion (34.9%), sektor Pembuatan (34.9%), sektor Perkhidmatan (14.0%), sektor Isi rumah (11.1%) dan lain-lain permintaan (5.1%) yang meliputi sektor Pertanian, Perlombongan & pengkuarian, Pembinaan, Kerajaan dan tenaga elektrik dijana & guna sendiri seperti di **Paparan 8**.

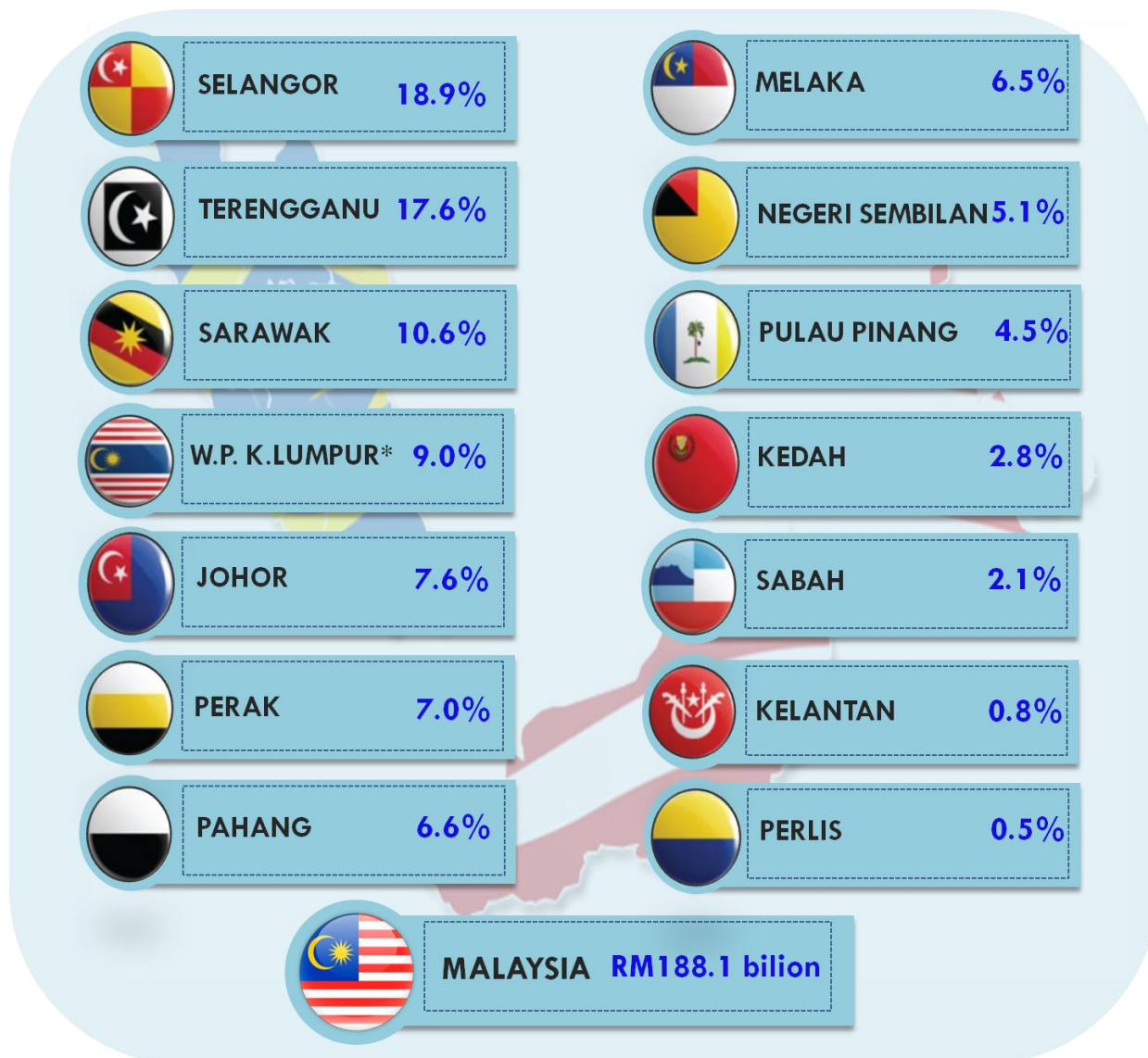
**Paparan 8: Bekalan dan permintaan produk tenaga dan utiliti, 2015**



## 7. PENGGUNAAN PRODUK TENAGA DAN UTILITI MENGIKUT NEGERI

Selangor mencatatkan penggunaan produk tenaga dan utiliti tertinggi pada tahun 2015 iaitu RM35.5 bilion dengan peratus sumbangan 18.9 peratus diikuti oleh Terengganu (17.6%) dan Sarawak (10.6%) seperti di **Paparan 9**.

**Paparan 9: Penggunaan tenaga dan utiliti mengikut negeri, 2015**



**Nota:**

\*Termasuk W.P. PUTRAJAYA dan W.P. LABUAN

Penjumlahan peratusan tidak bersamaan 100 disebabkan oleh pengecualian *Supra State*

## 8. INTENSITI TENAGA

Intensiti Tenaga ditakrifkan sebagai jumlah tenaga yang digunakan untuk menghasilkan RM1,000 output. Perubahan dari masa ke masa mencerminkan pengaruh pelbagai faktor, termasuk peningkatan kecekapan tenaga dan juga perubahan dalam aktiviti ekonomi. Pada tahun 2015, secara keseluruhannya, penggunaan tenaga dilaporkan sebanyak RM74.66 bagi setiap RM1,000 penghasilan output.

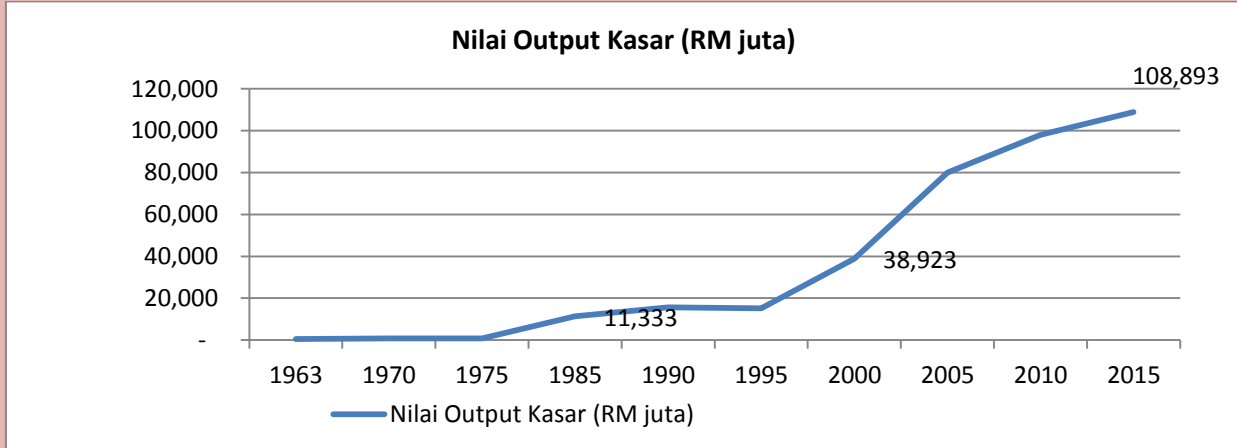
Setiap sektor ekonomi menggunakan tenaga dan sektor Pembuatan merupakan pengguna tenaga terbesar dengan intensiti tenaga sebanyak RM109.52 bagi setiap RM1,000 penghasilan output. Manakala, sektor Perlombongan & pengkuarian adalah sektor yang kurang menggunakan tenaga secara intensif iaitu RM24.03 bagi setiap RM1,000 penghasilan output seperti di **Paparan 10**.

**Paparan 10: Intensiti tenaga mengikut sektor ekonomi, 2015**



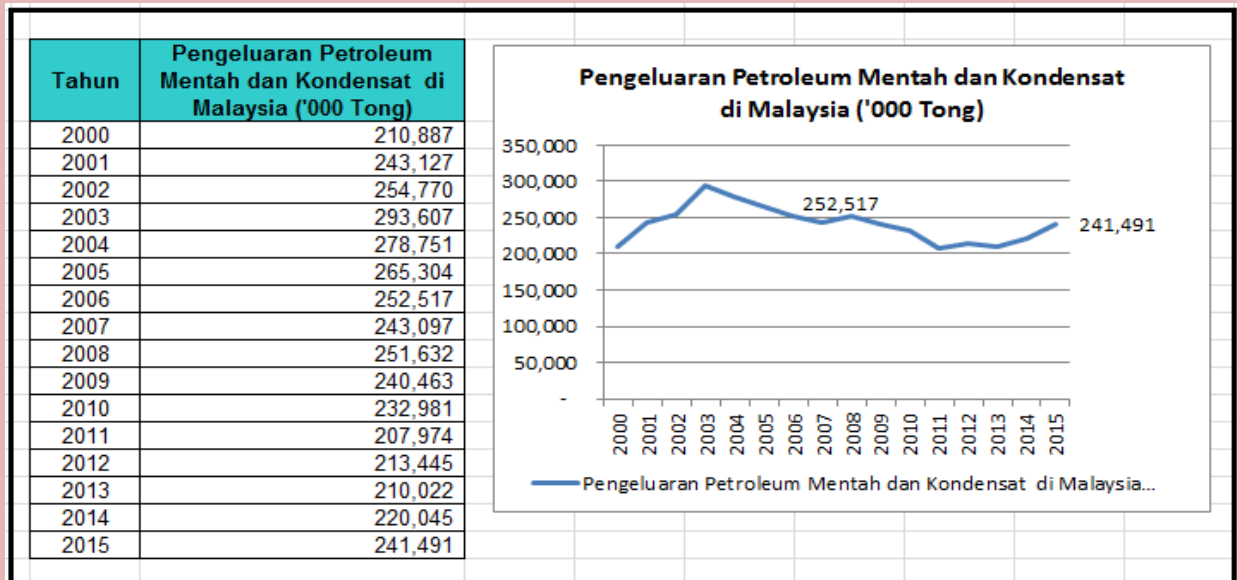
## Kotak 1: Perkembangan industri petroleum dan gas asli di Malaysia

Industri petroleum di Malaysia bermula pada awal tahun 1910 dengan penemuan telaga komersial pertama di Miri, Sarawak<sup>1</sup>. Industri ini terus berkembang dan merupakan antara penyumbang utama ekonomi negara di mana pada tahun 1987, ia menyumbang sebanyak 11.8% pada harga malar. Pada tahun 2015, industri ini menyumbang sebanyak 8.4% kepada KDNK berbanding 10.4% pada tahun 2010<sup>2</sup>.



Sumber: Jabatan Perangkaan Malaysia

Dari segi pengeluaran, pengeluaran petroleum mentah dan kondensat mencatatkan pengeluaran tertinggi pada tahun 2015 dengan 241,491 ribu tong, iaitu tertinggi sejak tahun 2009<sup>3</sup>. Peningkatan ini disumbangkan oleh pengeluaran baharu daripada medan minyak laut dalam Gumusut Kakap di luar pesisir Sabah yang telah memulakan operasi pada suku keempat 2014<sup>4</sup>.



Sumber: NEB, Suruhanjaya Tenaga

<sup>1</sup> Laman Web Majlis Bandaraya Miri

<sup>2</sup> Jabatan Perangkaan Malaysia

<sup>3</sup> Suruhanjaya Tenaga

<sup>4</sup> Laporan Tahunan Bank Negara Malaysia, 2015

## **Pengurangan subsidi**

Pada 2 Oktober 2014 pengurangan subsidi petrol dan diesel sebanyak 20 sen telah berkuat kuasa bagi mengelak berlakunya ketirisan dan penyelewengan bahan subsidi ini. Berikutan trend harga minyak mentah dunia yang semakin merudum, kerajaan Malaysia memutuskan untuk menghentikan subsidi minyak dan memperkenalkan sistem pengapungan terkawal berkuatkuasa 1 Disember 2014. Subsidi bagi RON95 akan dihapuskan dan harga minyak akan bergantung kepada harga pasaran dunia. KPDNKK memaklumkan harga runcit produk petroleum di Malaysia ditentukan melalui kaedah Mekanisme Harga Automatik (APM) sejak 1983.

(Kenyataan oleh Datuk Hamzah Zainuddin, Menteri Perdagangan Dalam Negeri, Koperasi dan Kepenggunaan)

## Kotak 2: Inisiatif Hijau - Sumber Tenaga Boleh Baharu (TBB)

- Permintaan tenaga semakin meningkat seiring pertumbuhan populasi global. *World Population Prospects: The 2017 Revision* melaporkan populasi dunia kini adalah 7.6 bilion dan dijangka meningkat kepada 9.8 bilion pada 2050. Selain itu, kadar pembangunan ekonomi yang rancak dan peningkatan taraf hidup masyarakat di negara membangun turut menyebabkan peningkatan tinggi terhadap permintaan tenaga.
- Kadar peningkatan purata permintaan maksimum terhadap tenaga elektrik di Semenanjung Malaysia adalah sebanyak tiga peratus sejak tahun 2008 (Suruhanjaya Tenaga, 2014). Sumber tenaga yang digunakan untuk menjana tenaga elektrik adalah merupakan sumber tenaga campuran yang terdiri daripada bahan api fosil seperti gas asli, arang batu, dan minyak serta sumber yang boleh diperbaharui iaitu hidro. Penggunaan bahan api fosil di dalam penjanaan tenaga elektrik menyumbang kepada pengeluaran gas rumah hijau seperti gas karbon dioksida (CO<sub>2</sub>) yang memberi kesan terhadap perubahan iklim.
- Sejalan dengan itu, kerajaan telah memperkenalkan dasar pelaksanaan sumber Tenaga Boleh Baharu (TBB) sebagai sumber tenaga kelima di dalam penjanaan tenaga elektrik sejak Rancangan Malaysia Kelapan (RMK-8) dan Dasar Tenaga Boleh Diperbaharui Nasional & Pelan Tindakan 2008 yang dijangka memainkan peranan sangat penting dalam menjamin keselamatan dan ketahanan sumber tenaga di masa hadapan di samping dapat mengurangkan pengeluaran CO<sub>2</sub>. Dalam Rancangan Malaysia Kesebelas (RMK-11), sasaran TBB dijangka membekalkan 2080 MW pada tahun 2020 iaitu menyumbang sebanyak 7.8% kepada penjanaan tenaga elektrik keseluruhan.
- Kelebihan TBB berbanding dengan tenaga konvensional adalah :-
  - i. Sumber tenaga yang bersih dan memberi kesan yang minimal terhadap pencemaran udara dan alam sekitar;
  - ii. Sumber tenaga yang berkekalan dan berterusan untuk generasi akan datang;
  - iii. Kaedah penghasilan tenaga yang tidak berpusat dan dijangka akan merangsangkan pembangunan ekonomi sesebuah negara; dan
  - iv. Sebagai industri tenaga diperbaharui yang dijangka meningkatkan peluang pekerjaan kepada generasi masa depan.

**Jadual 1: Penjanaan Tenaga dari Projek TBB yang telah Mencapai Operasi Komersil (2012-2015)**

Sumber TBB	Penjanaan Tenaga (GWh)					Jumlah (%)
	2012	2013	2014	2015	Jumlah	
<b>Biogas</b>	-	29.26	47.48	54.40	131.14	<b>8.65%</b>
<b>Biomass</b>	96.30	228.80	197.33	171.50	693.93	<b>45.75%</b>
<b>Kuasa Hidro</b>	7.23	91.43	64.45	52.63	215.74	<b>14.22%</b>
<b>Solar</b>	1.34	53.92	177.36	243.42	476.04	<b>31.38%</b>
<b>Jumlah</b>	<b>104.87</b>	<b>403.41</b>	<b>486.62</b>	<b>521.95</b>	<b>1,516.85</b>	<b>100.00%</b>

Sumber: Sustainable Energy Development Authority (SEDA)

## 1. INTRODUCTION

This publication presents energy and utilities statistics, including production from energy & utilities industries and consumption by five major economic sectors, namely Agriculture, Mining & quarrying, Manufacturing, Construction and Services. The energy industry is defined as an economic unit that carries out principle activities related to produce, tranmise and distribute of energy products. The statistics are compiled based on guidelines and recommendations in the International Recommendations for Energy Statistics (IRES), 2016. Whereas utilities statistics presented are based on the Malaysian Industrial Classification Standard (MSIC), 2008 version 1.0. Utilities industries include water collection, treatment and supply activities for domestic and industrial needs, classified in the Services sector.

The statistics presented are the result of the Economic Census conducted in 2016 for the reference year 2015 which includes principal statistics and production of energy and utilities products by the industries, and their consumption in five economic sectors. Statistics by state are also included in this publication.

As compared to existing energy and utilities statistics, the statistics presented in this publication are not measured using mass or weight, but instead using values in Ringgit Malaysia (RM).

## 2. OVERALL PERFORMANCE

The energy industry is covered in the Mining & quarrying, Manufacturing and Services sectors. Details are shown in **Table 1**.

**Table 1: Classification of energy industry by economic sectors**

<b>Economic Sector</b>	<b>Economic Activities (MSIC 2008)</b>	<b>Energy industry (IRES 2016)</b>
<b>Mining &amp; Quarrying</b>	<i>Division 05: Mining of coal and lignite</i>	Coal mines
	<i>Division 06: Extraction of crude petroleum and natural gas</i>	Oil and gas extraction
		Gas separation plants
	<i>Class 0721: Mining of uranium and thorium ores</i>	Nuclear fuel extraction and fuel processing
	<i>Class 0892: Extraction of peat</i>	Other energy industry not elsewhere specified

## SUMMARY OF FINDINGS

<b>Economic Sector</b>	<b>Economic Activities (MSIC 2008)</b>	<b>Energy industry (IRES 2016)</b>
	Group 091: Support activities for petroleum and natural gas extraction	LNG plants / regasification plants Oil and gas extraction
<b>Manufacturing</b>	Group 191: Manufacture of coke oven products	Coke ovens
	Group 192: Manufacture of refined petroleum products	Coal liquefaction plants
		Patent fuel plants
		Brown coal briquette plants
		Oil refineries
		Gas-to-liquids (GTL) plants
	Class 2011: Manufacture of basic chemicals	Charcoal plants
Nuclear fuel extraction and fuel processing		
Group 241: Manufacture of basic iron and steel	Blast furnaces	
<b>Services</b>	Division 35: Electricity, gas, steam and air conditioning supply	Electricity, CHP and heat plants
	Group 352: Manufacture of gas; distribution of gaseous fuels through mains	Gas works (and other conversion to gases)
		Biogas production plants
Class 5221: Service activities incidental to land transportation	LNG plants / regasification plants	

The Gross Domestic Product (GDP) for all industries related to energy and utilities production registered an increase with the petroleum & natural gas subsector expanded by 0.7 per cent, manufacture of refined petroleum products subsector increased by 1.7 per cent, generation, transmission & distribution of electricity subsector increased by 4.0 per cent and water collection, treatment and supply subsector increased by 4.0 per cent during 2010 to 2015.

Based on the Economic Census 2016, value added for all industry related to energy and utilities production increased 3.9 per cent annually to RM189.4 billion as compared to RM156.3 billion in 2010. The Mining & quarrying sector recorded the highest value added RM98.9 billion with a contribution 52.2 per cent, which contributed by the extraction of crude petroleum & natural gas subsector (RM92.4 billion). Meanwhile, the Manufacturing sector recorded a value added RM53.6 billion (28.3%) which contributed by manufacture of refined petroleum products industry, RM35.2 billion.

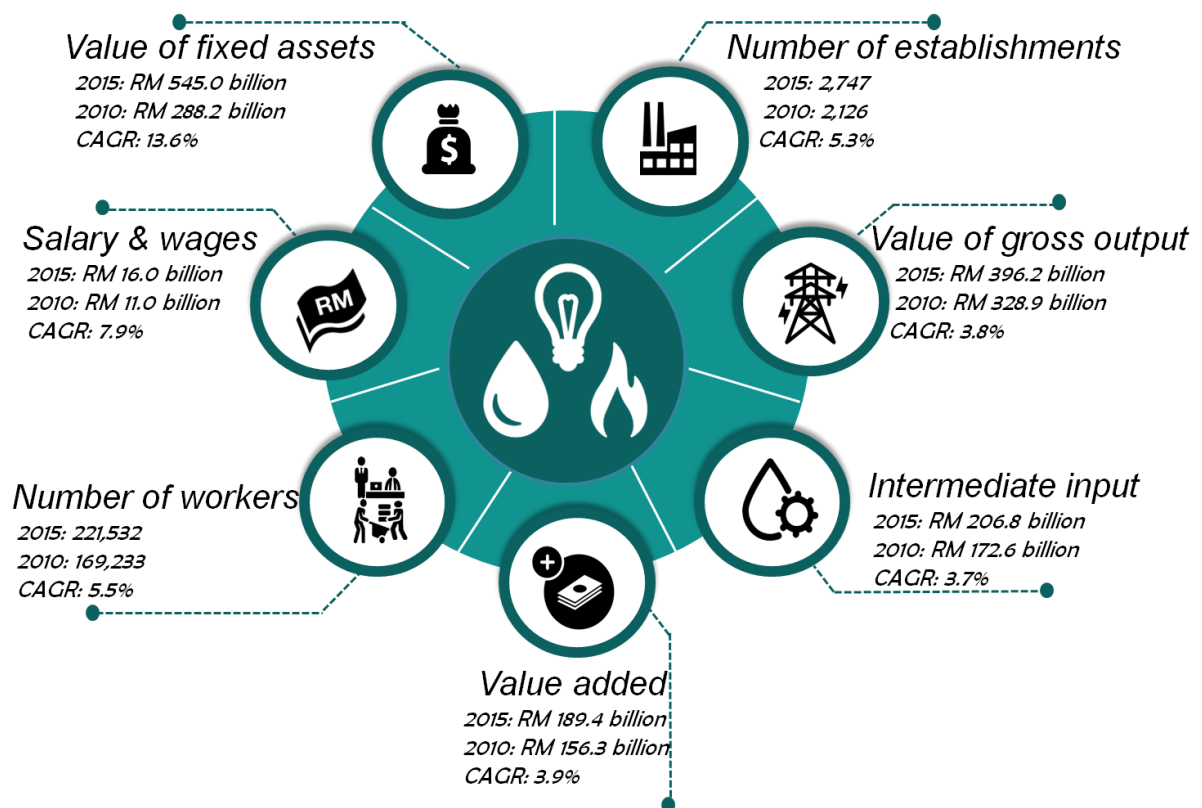
# SUMMARY OF FINDINGS

The census revealed that the number of establishments for this industry increased to 2,747 in 2015 compared to 2,126 establishments in 2010, which recorded an annual growth of 5.3 per cent per annum during the period.

The value of gross output in 2015 amounted RM396.2 billion as compared to RM328.9 billion in 2010 with an annual growth of 3.8 per cent. Value of intermediate input also increased to RM206.8 billion as compared to RM172.6 billion in 2010. In 2015, the industry recorded a total of 221,532 employees with salaries and wages paid amounting to RM16.0 billion.

The overall performance of energy and utilities industries in 2010 and 2015 is shown in **Exhibit 1**.

**Exhibit 1: Principle statistics of energy and utilities, 2010 and 2015**



### 3. PRODUCTION OF ENERGY AND UTILITIES PRODUCTS BY ECONOMIC SECTOR

*Production of energy products is defined as extraction or manufacture of fuel or energy in the form available for general use. In energy statistics, there are two types of production, namely main or primary production and secondary production.*

*Primer production is the extraction of fuel or energy from natural energy flows, biosphere and natural fossil fuel reserves within the country in the form suitable for use. The resulting product is referred to as the "primary" product.*

*Main sources of non-renewable energy production are as follows:*

- *Fossil Fuels - Crude oil, coal and natural gas:*
  - *Crude oil or petroleum is a type of dark and concentrated liquid hydrocarbon compounds normally found in the basic part of the crust;*
  - *Coal is a natural black solid and widely used as fuel;and*
  - *Natural Gas is a type of hydrocarbon compound in the form of gas and is formed in the magma layer of the earth.*
- *Mineral Fuels - Natural Uranium such as Uranium-234, Uranium-235 and Uranium-238.*
  - *Uranium is a radioactive metal element that is grey or silvery.*

*Secondary production refers to the manufacture of energy products through the transformation of fuel or energy. Secondary fuel quantities are reported as production including quantities lost through the disposal and combustion during and after fuel production. Through this method, mass, energy and carbon in the primary source where the fuel is produced can be offset by the secondary fuel produced. Fuel, electrical energy and heat generated are usually sold but may be partially or wholly used by producers.*

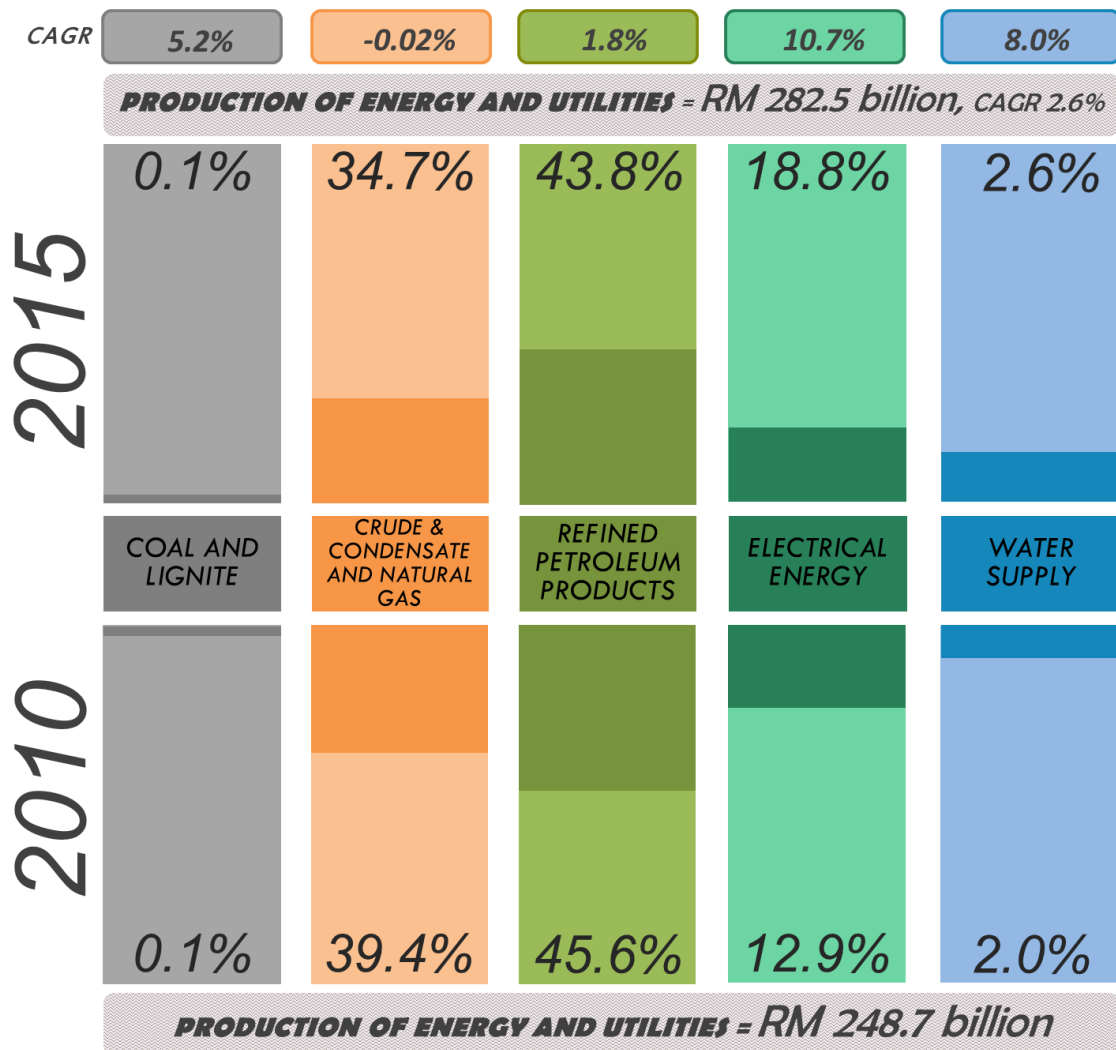
*Secondary production is the sources of energy that have been transformed from major energy sources through energy conversion processes. Conversion of energy sources from primary sources to secondary energy sources is important for easier use and benefits to user activities. Examples of secondary energy are electrical energy where its use is diverse, for instance to generate power of electrical appliances such as air conditioning, refrigerators, space heaters and water, lamps and others. Another secondary energy is hydrogen, the usage is still limited and expected to increase in the future.*

# SUMMARY OF FINDINGS

Utilities production is referring to water collection, treatment and distribution activity to meet domestic and industrial needs.

Based on the Economic Census 2016, a total RM282.5 billion energy and utilities products were produced as compared to RM248.7 billion in 2010, recorded an annual growth rate of 2.6 per cent. The Manufacturing sector recorded the highest production of energy and utilities products, valued at RM123.6 billion with a contribution of 43.8 per cent as shown on **Exhibit 2**.

**Exhibit 2: Production of energy and utilities products, 2010 and 2015**



Production of energy products increased by 2.5 per cent per annum during 2010 to 2015, registered RM275.0 billion in 2015 as compared to RM243.6 billion in 2010. Fuel, lubricants and gas contributed 80.7 per cent to the total energy production.

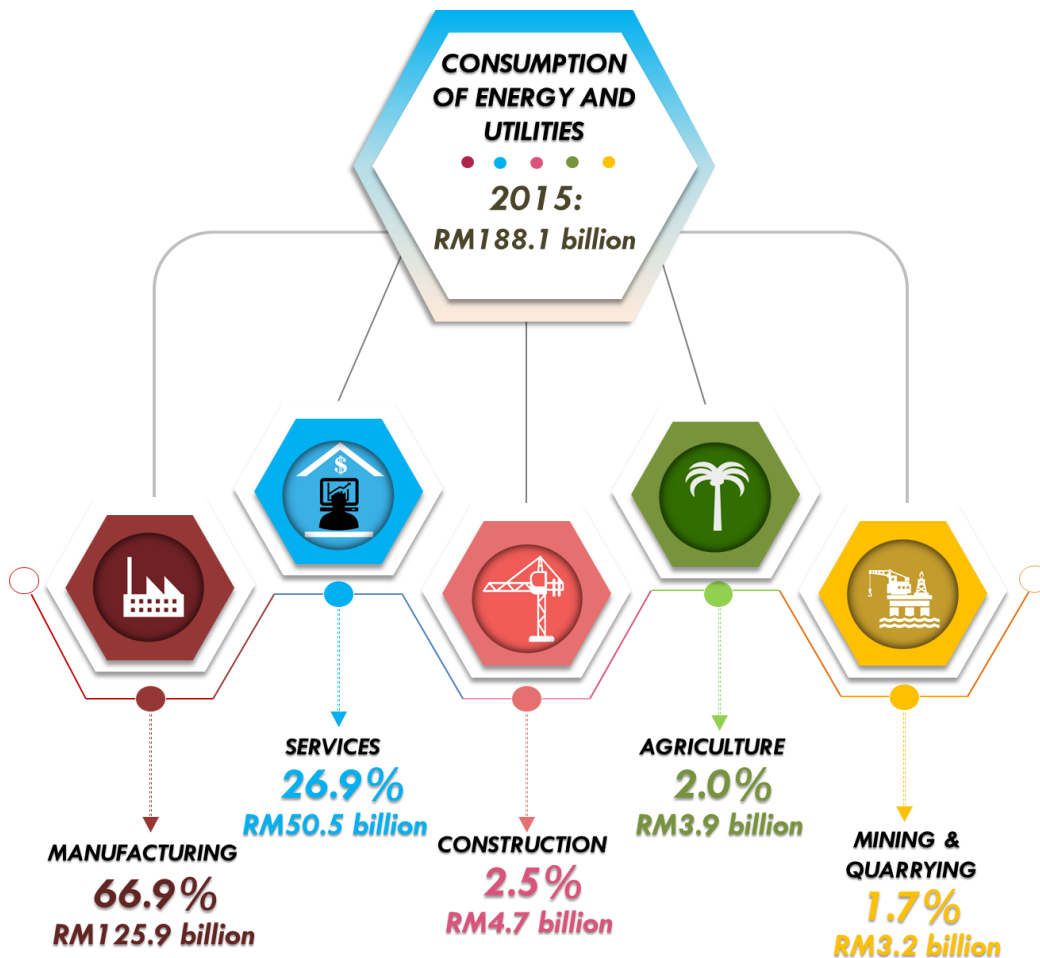
# SUMMARY OF FINDINGS

The production of utilities products in 2015 amounted RM7.5 billion as compared to RM5.1 billion in 2010, recorded an annual growth of 8.0 per cent. The production of utilities products accounted for 2.6 per cent of total energy and utilities supplies in 2015.

## 4. CONSUMPTION OF ENERGY AND UTILITIES PRODUCTS BY ECONOMIC SECTOR

Consumption of energy and utilities products referring to the final consumption of five economic sectors namely Agriculture, Mining & quarrying, Manufacturing, Construction and Services, while the Household and Government sectors are not covered. The total energy and utilities products consumption in 2015 amounted at RM188.1 billion. The Manufacturing sector recorded the highest consumption (RM125.9 billion), with a contribution of 66.9 per cent as shown in **Exhibit 3**.

**Exhibit 3: Consumption of energy and utilities products by economic sector, 2015**



# SUMMARY OF FINDINGS

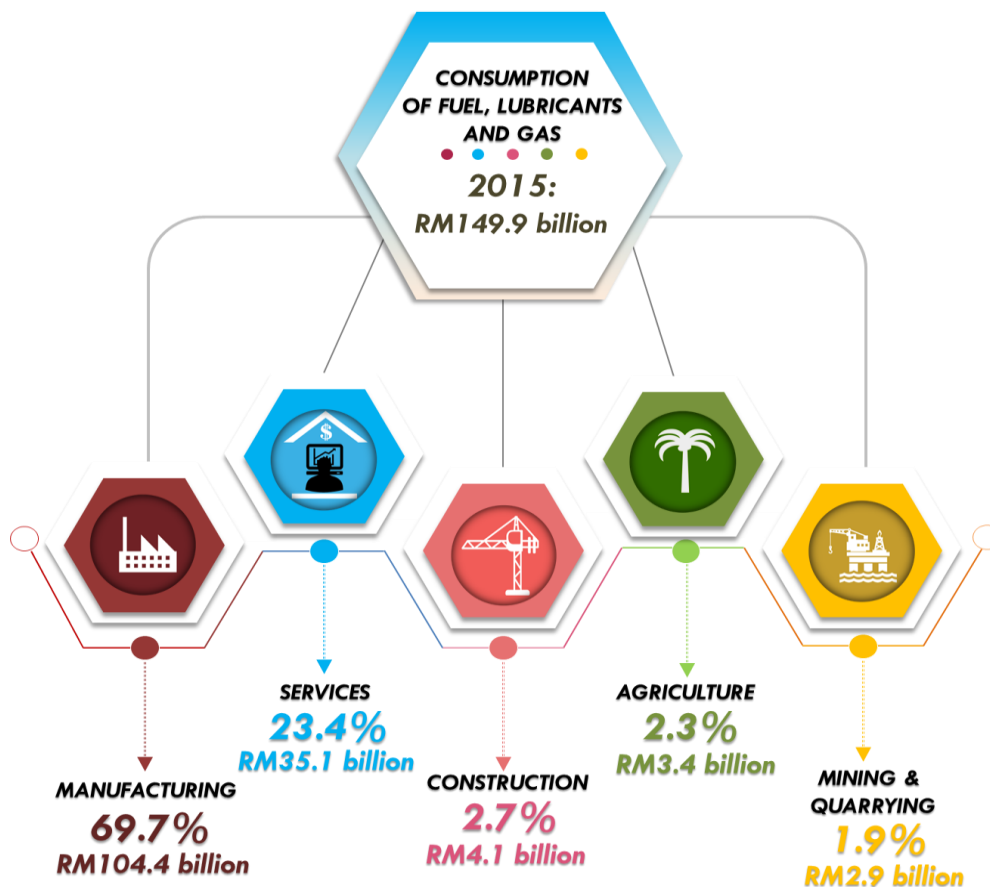
In 2015, consumption of energy products registered RM185.9 billion, which fuels, lubricants and gas contributed 80.7 per cent (RM159.4 billion) of the total consumption. The consumption of utilities products recorded an annual growth of 8.5 per cent and recorded RM2.3 billion in 2015. The Services sector consumed RM1.4 billion or 59.7 per cent of total water supply in the economic sectors.

Consumption of energy and utilities products is divided into three, namely, Fuel, Lubricants & gas; Electrical energy; and Water supply.

## i. Fuel, lubricants & gas

The consumption of fuel, lubricants & gas by the five economic sector in 2015 amounted to RM149.9 billion. The Manufacturing sector recorded the largest value, RM104.4 billion with a contribution of 69.7 per cent, followed by the Services sector, RM35.1 billion (23.4%) as shown in **Exhibit 4**.

**Exhibit 4: Consumption of fuel, lubricants & gas by economic sector, 2015**

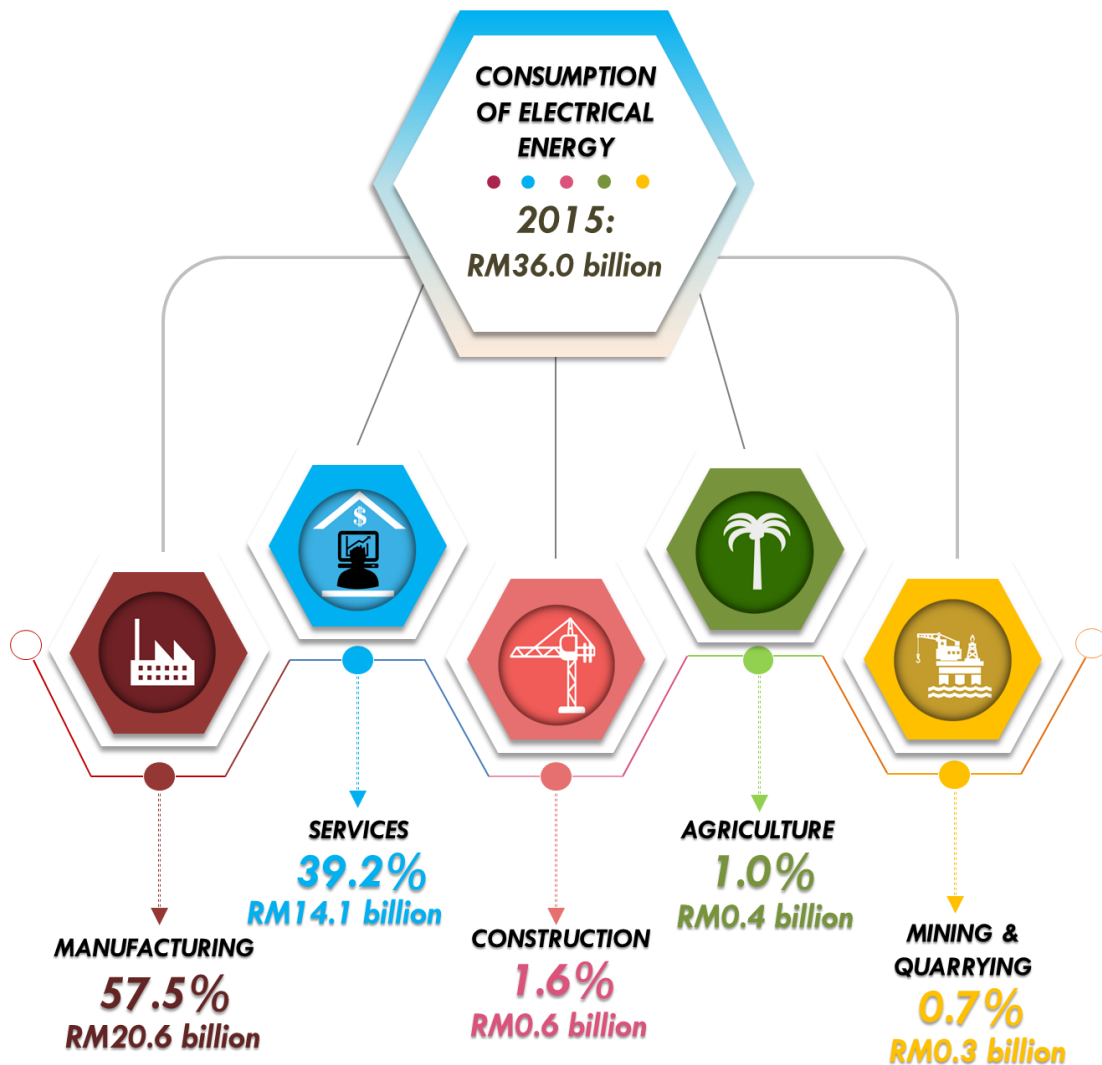


# SUMMARY OF FINDINGS

## ii. Electrical energy

Total electrical energy consumption by the five economic sector in 2015 increased to RM36.0 billion. The Manufacturing sector recorded the highest electrical energy consumption, RM20.6 billion (57.5%), followed by the Services sector, RM14.1 billion (39.2%) as shown in **Exhibit 5**.

**Exhibit 5: Consumption of electrical energy by economic sector, 2015**

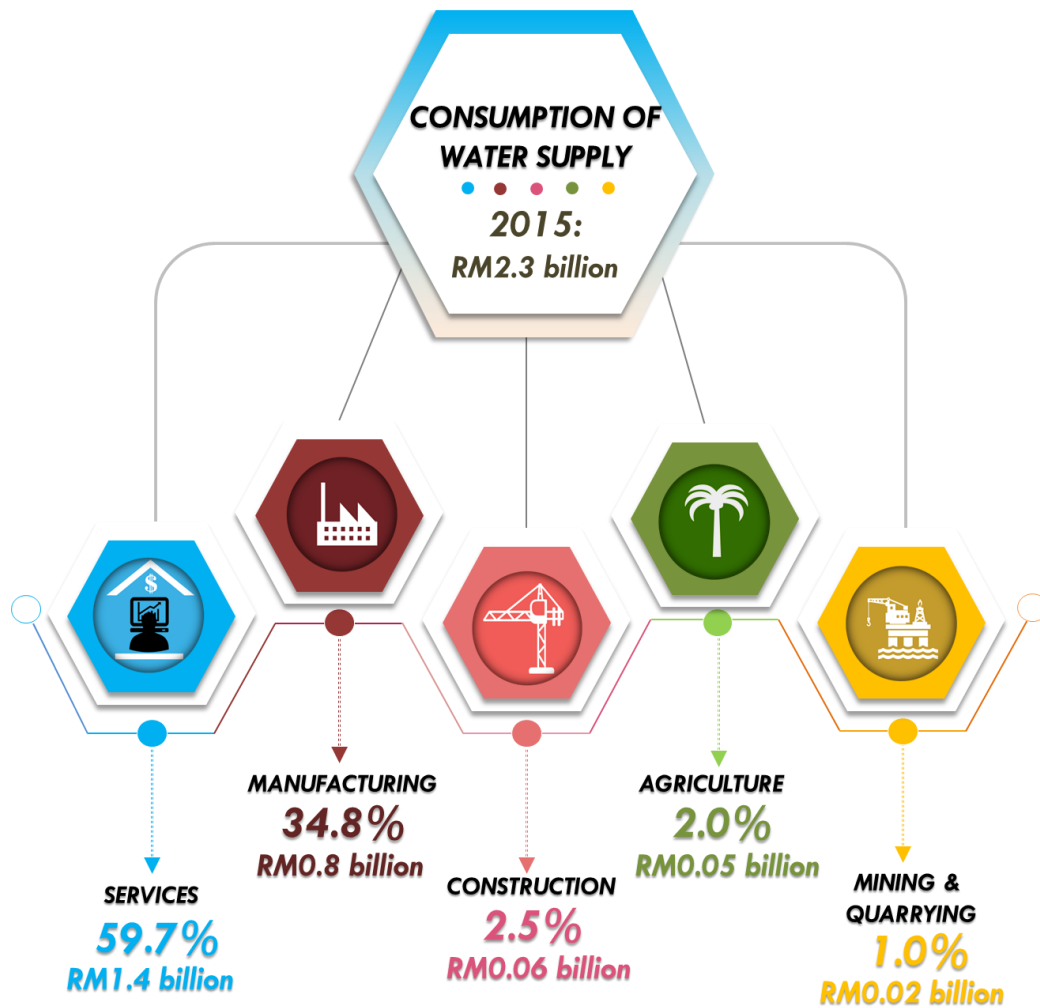


# SUMMARY OF FINDINGS

## iii. Water supply

Total water consumption by the five economic sector in 2015 recorded an increase to RM2.3 billion. The increase was contributed by the Services sector, RM1.4 billion with a contribution of 59.7 per cent, followed by the Manufacturing sector, RM0.8 billion (34.8%) as shown in **Exhibit 6**.

**Exhibit 6: Consumption of water supply by economic sector, 2015**









# SUMMARY OF FINDINGS

## 5. EXPORTS AND IMPORTS OF ENERGY AND UTILITIES PRODUCTS

Exports of energy and utilities products increased to RM125.9 billion in 2015 as compared to RM102.0 billion in 2010 with an annual growth of 4.3 per cent. Imports also increased to RM85.2 billion with an annual growth of 10.1 per cent as shown in **Exhibit 7**. In 2015, total trade of energy products recorded a surplus of RM40.7 billion, while trade of utilities products recorded a deficit of RM1 million.

**Exhibit 7: Exports and imports of energy and utilities products, 2010 and 2015**

							
		COAL, COKE & BRIQUETTES	PETROLEUM	NATURAL AND MANUFACTURED GAS	ELECTRICAL ENERGY	WATER SUPPLY	TOTAL
EXPORTS (RM million)	2015	45 0.0%	78,750 62.6%	47,078 37.4%	2 0.0%	2 0.0%	125,877
	2010	71 0.1%	58,188 57.1%	43,652 42.8%	48 0.0%	2 0.0%	101,961
	CAGR	-8.4%	6.2%	1.5%	-45.6%	-2.8%	4.3%
IMPORTS (RM million)	2015	5,542 6.5%	74,085 87.0%	5,515 6.5%	6 0.0%	3 0.0%	85,151
	2010	5,341 10.1%	44,646 84.7%	2,704 5.2%	-	5 0.0%	52,696
	CAGR	0.7%	10.7%	15.3%	-	-8.8%	10.1%

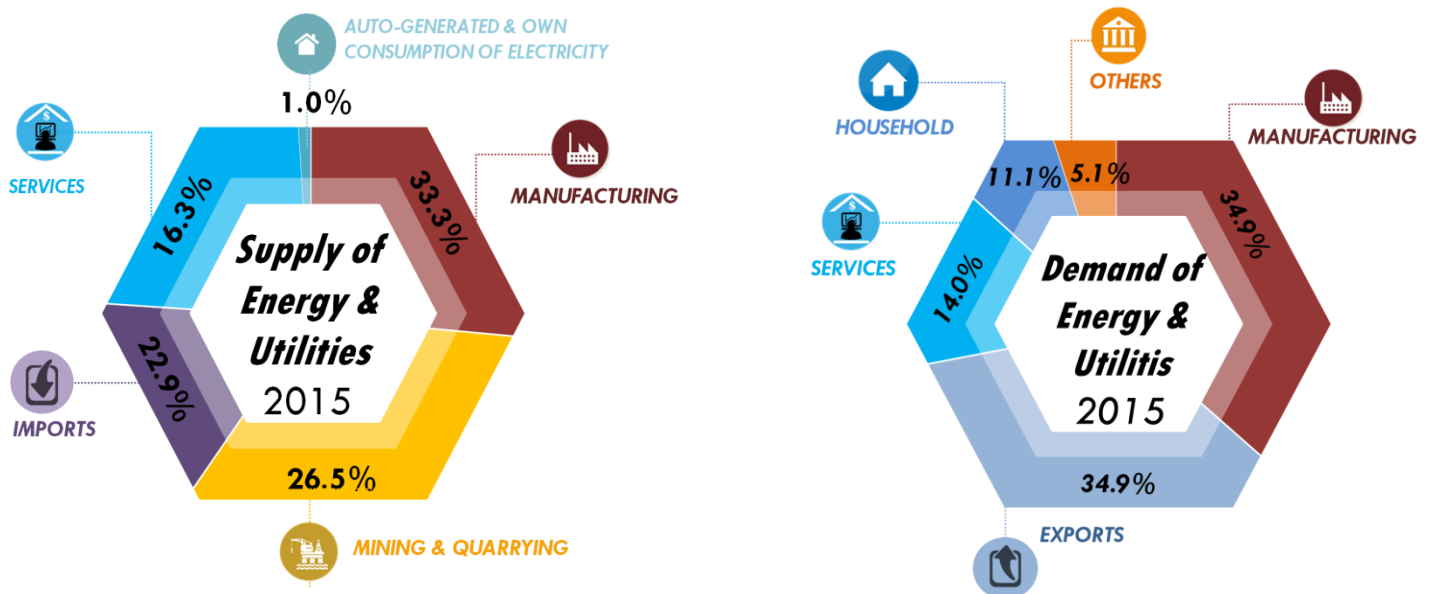
# SUMMARY OF FINDINGS

## 6. ENERGY AND UTILITIES BALANCE

Energy and utilities supply are defined as production of energy and utilities products plus imports of energy and utilities products, minus exports of energy and utilities products, international sea bunkers, international aviation bunkers, then plus/minus change in stocks. Supply can refer to either primary, secondary, or both primary and secondary production.

In 2015, the supply of energy and utilities products amounted to RM371.4 billion, Manufacturing sector recorded the highest contribution of 33.3 per cent, followed by Mining & quarrying sector (26.5%), Imports (22.9%), Services sector (16.3%) and self-generation & self-consumption of electrical energy (1.0%). Meanwhile, demand of energy and utilities products for exports amounted to RM125.9 billion (34.9%), Manufacturing sector (34.9%), Services sector (14.0%), Households sector (11.1%) and other demand (5.1%) which includes Agriculture, Mining & quarrying, Construction, Government sector and self-generation & self-consumption of electrical energy as shown in **Exhibit 8**.

**Exhibit 8: Supply and demand of energy and utilities products, 2015**

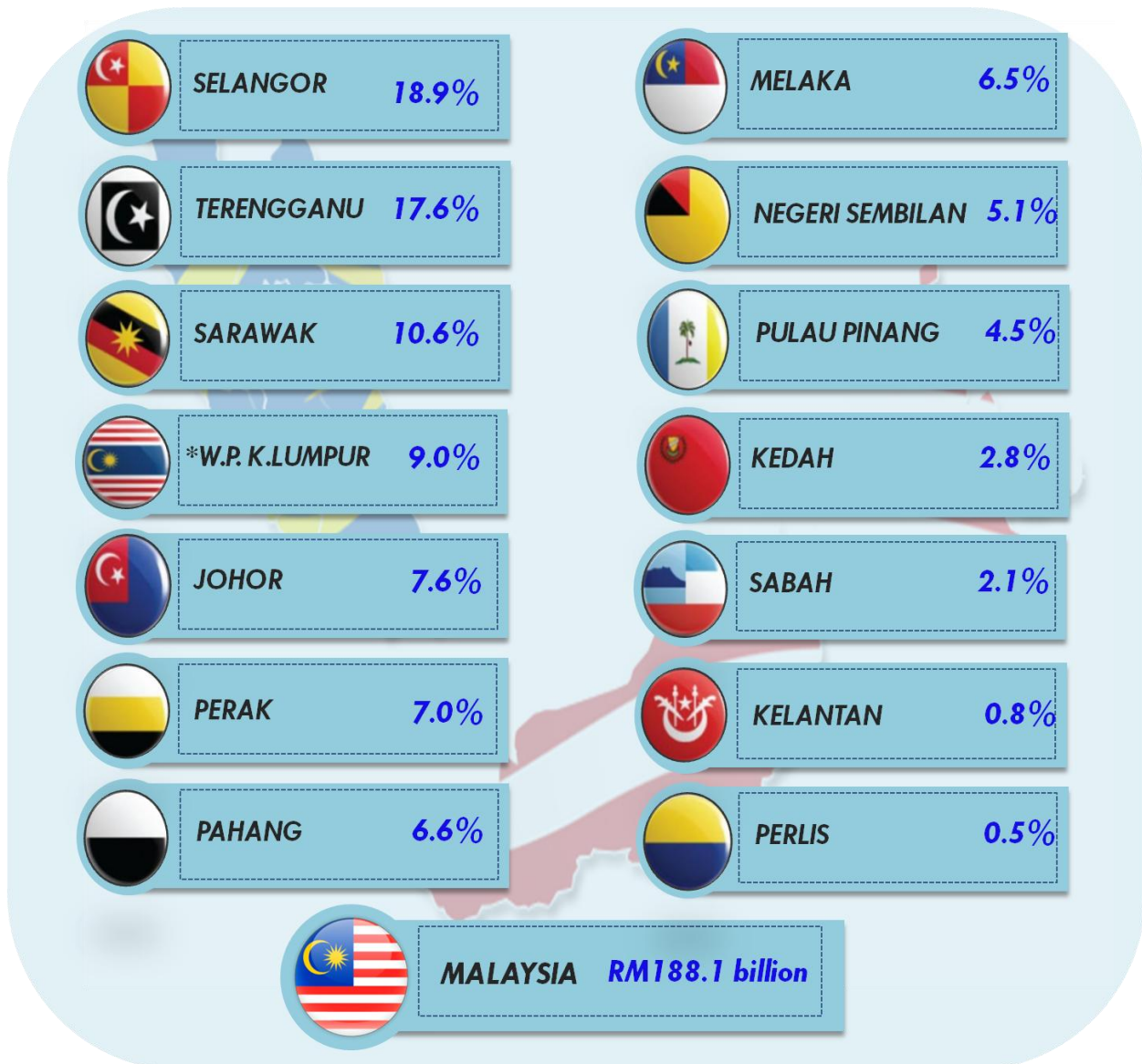


# SUMMARY OF FINDINGS

## 7. CONSUMPTION OF ENERGY AND UTILITIES PRODUCTS BY STATE

Selangor recorded the highest consumption of energy and utilities products in 2015 (RM35.5 billion or 18.9 per cent), followed by Terengganu (17.6%) and Sarawak (10.6%) as shown in **Exhibit 9**.

**Exhibit 9: Consumption of energy and utilities products by state, 2015**



**Notes:**

\*Include W.P. PUTRAJAYA and W.P. LABUAN

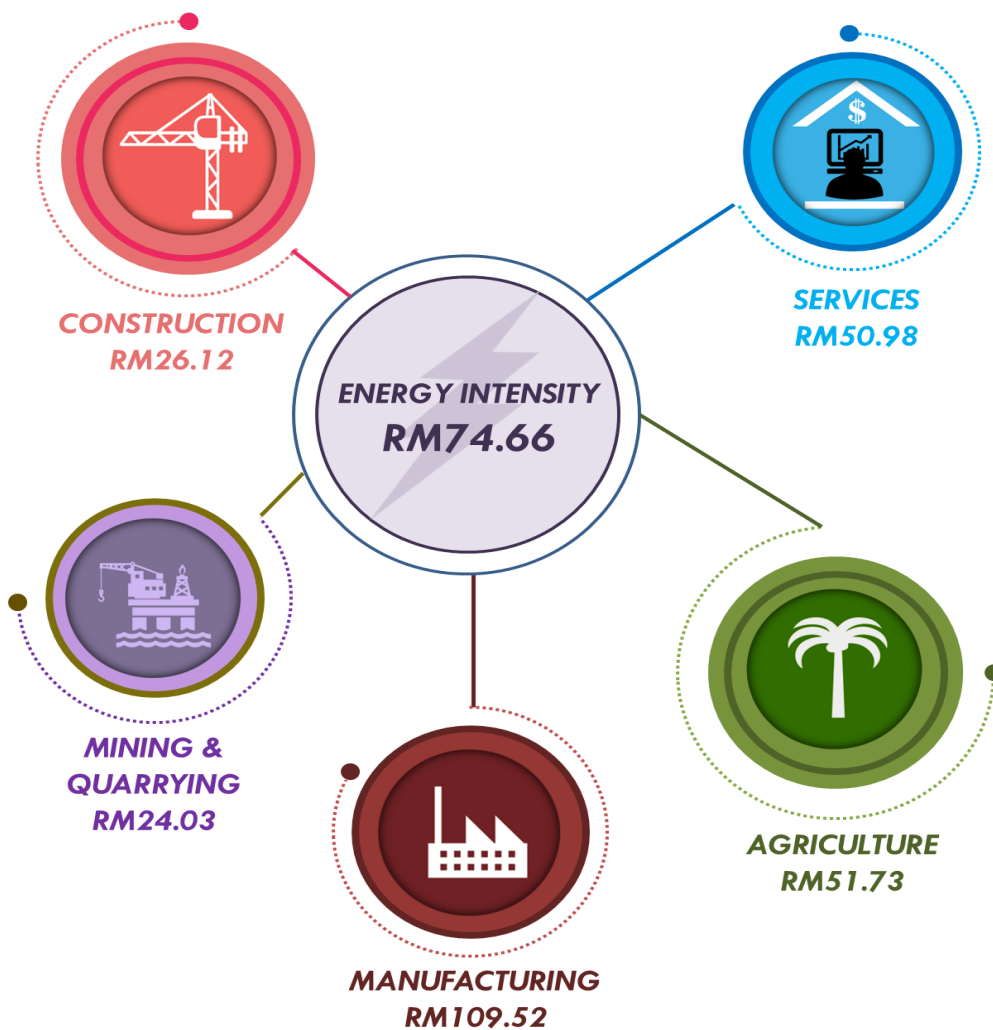
The sum of percentage is not equal to 100 due to the exclusion of Supra State

## 8. ENERGY INTENSITY

Energy Intensity is defined as the amount of energy consumed to generate RM1,000 outputs. Its variation over time reflects the influence of various factors, which include energy efficiency improvements, and changes in the nature of the economic activity. In 2015, consumption of energy was accounted for RM74.66 per RM1,000 outputs.

Every economic sector consumes energy and Manufacturing sector was the most energy intensive sector, where RM109.52 is required for every RM1,000 output. Meanwhile, the Mining & quarrying sector is less energy intensive sector with RM24.03 for every RM1,000 outputs as shown in **Exhibit 10**.

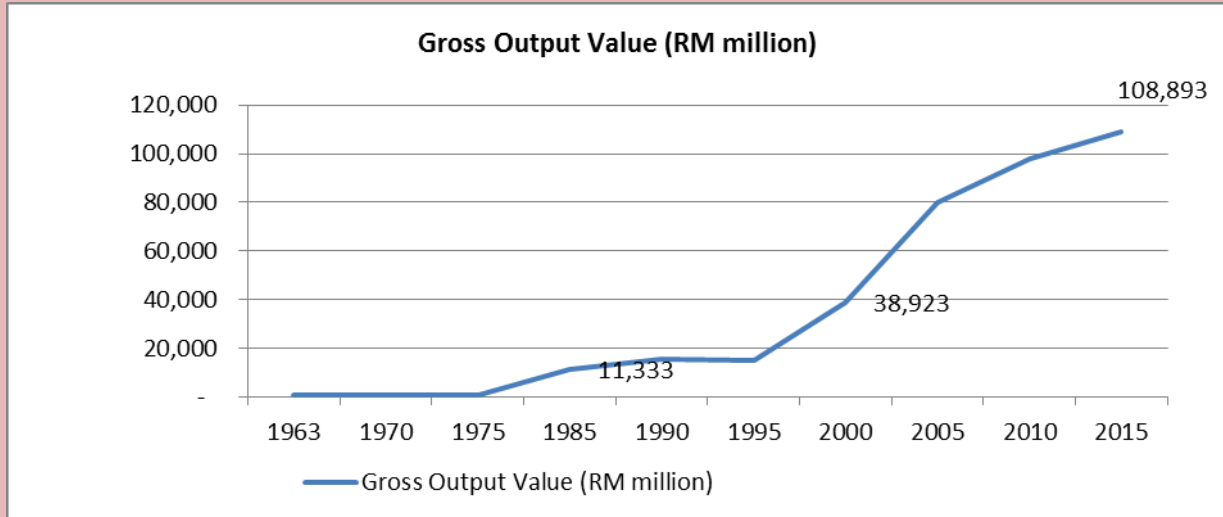
**Exhibit 10: Energy intensity by economic sector, 2015**



# SUMMARY OF FINDINGS

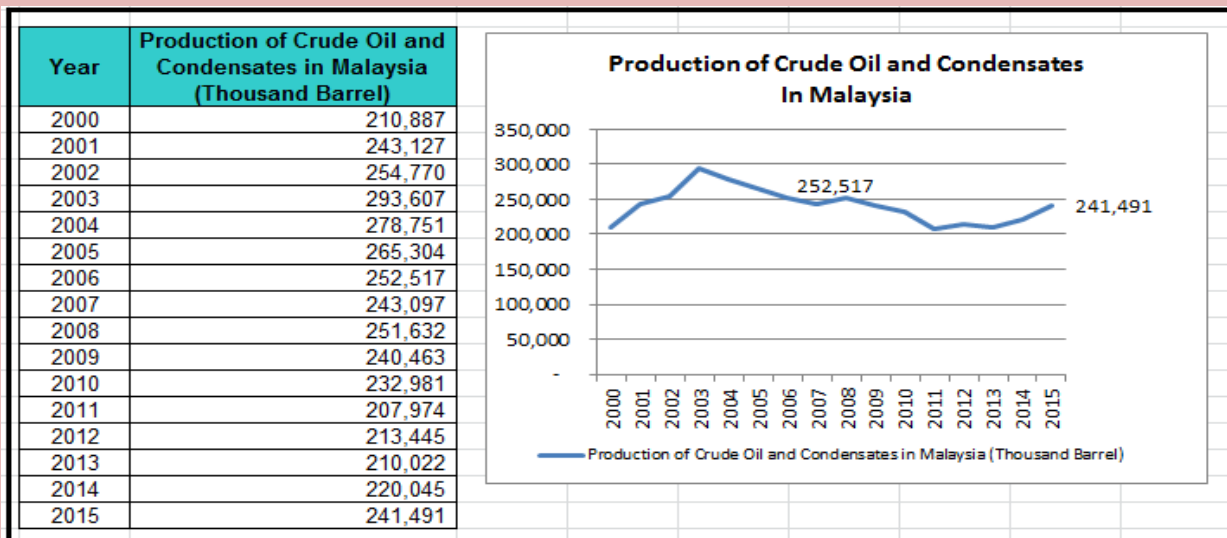
## Box 1: Development of petroleum and natural gas industries in Malaysia

The petroleum industry in Malaysia began in early 1910 with the discovery of the first commercial well in Miri, Sarawak<sup>1</sup>. The industry continues to grow as one of the major contributors of the country's economy where in 1987 it contributed 11.8% at constant prices. In 2015, the industry contributed 8.4% to GDP compared to 10.4% in 2010<sup>2</sup>.



Source: Department of Statistics, Malaysia

In terms of production, crude oil and condensate registered 241,491 thousand barrels in 2015, the highest since 2009<sup>3</sup>. This increase was contributed by new production from the Sabah offshore oilfields Gumusut Kakap which started operations in the fourth quarter of 2014<sup>4</sup>.



Source: NEB, Energy Commission

<sup>1</sup>Official Website of Miri City Council

<sup>2</sup>Department of Statistics Malaysia

<sup>3</sup>Energy Commission

<sup>4</sup>Bank Negara Malaysia Annual Report 2015

### ***Reduction of subsidies***

*On 2 October 2014, a reduction of 20 cent of petrol and diesel subsidies has been in force to prevent the leakage and misappropriation of these subsidised materials. Following the downturn in world crude oil prices, the Malaysian government has decided to halt oil subsidies with a regulated flotation system effective 1 December 2014. Subsidies for RON95 will be abolished and oil prices will depend on world market prices. KPDNKK has informed that the retail price of petroleum products in Malaysia is determined by the Automatic Price Mechanism (APM) method since 1983.*

*(Statement by Datuk Hamzah Zainuddin, Minister of Domestic Trade, Co-operatives and Consumerism)*

# SUMMARY OF FINDINGS

## Box 2: Green Initiative - Renewable Energy Sources (RES)

- Demand for energy is increasing as global population growth. World Population Prospects: The 2017 Revision reports that the world's population is now 7.6 billion and is expected to increase to 9.8 billion by 2050. In addition, the pace of economic development and the improvement of the living standards of the developing nations also resulted in high increases in energy demand
- The average rate of increase of maximum demand for electricity in Peninsular Malaysia is 3 per cent since 2008 (Energy Commission, 2014). Energy sources used to generate electricity are mixed energy sources comprising fossil fuels such as natural gas, coal, and oil as well as renewable sources of hydro. The use of fossil fuels in electricity generation contributes to the production of greenhouse gases such as carbon dioxide (CO<sub>2</sub>) which affects climate change.
- In line with that, the government has introduced the Renewable Energy Sources (RES) implementation policy as the fifth energy source in electricity generation since the Eighth Malaysia Plan (8MP) and the National Renewable Energy Policy & Action Plan 2008 which are expected to play a very important role in ensuring the safety and durability of future energy sources as well as reducing CO<sub>2</sub> emissions. In the 11th Malaysia Plan (11MP), the target of RES is expected to supply 2080 MW by 2020, accounting for 7.8% of total electricity generation.
- The advantages of RES compared to conventional energy are:-
  - i. A clean source of energy and a minimal impact on pollution air and environment;
  - ii. Sustainable and sustainable energy sources for future generations;
  - iii. The method of producing energy that is not centered and expected to stimulate economic development of a country; and
  - iv. As the renewable energy industry which expected to increase employment opportunities to future generations

**Table 1: Energy Generation from the RES Project that has Acquired Commercial Operations (2012-2015)**

RES source	Power Generation (GWh)					Total %
	2012	2013	2014	2015	Jumlah	
<b>Biogas</b>	-	29.26	47.48	54.40	131.14	<b>8.65%</b>
<b>Biomass</b>	96.30	228.80	197.33	171.50	693.93	<b>45.75%</b>
<b>Hydro Power</b>	7.23	91.43	64.45	52.63	215.74	<b>14.22%</b>
<b>Solar</b>	1.34	53.92	177.36	243.42	476.04	<b>31.38%</b>
<b>Total</b>	<b>104.87</b>	<b>403.41</b>	<b>486.62</b>	<b>521.95</b>	<b>1,516.85</b>	<b>100.00%</b>

Source: Sustainable Energy Development Authority (SEDA)



**BANCI EKONOMI** 2016  
*ECONOMIC CENSUS*

**2**

**Bahagian**  
*Part*

**NOTA TEKNIKAL**  
*TECHNICAL NOTES*

**STATISTIK TENAGA DAN UTILITI**  
*ENERGY AND UTILITIES STATISTICS*

JABATAN PERANGKAAN MALAYSIA  
DEPARTMENT OF STATISTICS, MALAYSIA



## 1. Skop dan liputan

Banci ini meliputi pertubuhan berdaftar yang terlibat dalam aktiviti pertanian, perlombongan dan pengkuarian, pembuatan, pembinaan dan perkhidmatan. Sumber utama rangka pertubuhan diperoleh daripada Suruhanjaya Syarikat Malaysia (SSM). Selain daripada SSM, maklumat rangka banci juga dikemaskini daripada sumber seperti Lembaga Kemajuan Perindustrian Malaysia (MIDA), Kementerian Pertanian dan Industri Asas Tani Malaysia (MOA), Lembaga Pembangunan Industri Pembinaan Malaysia (LPIPM), Jabatan Mineral & Geosains Malaysia (JMG), Suruhanjaya Tenaga Malaysia (ST), pelbagai persatuan perniagaan dan perdagangan, iklan surat khabar dan laman web.

Usahawan sektor Pertanian yang berdaftar dengan MOA atau agensi-agensi kerajaan yang lain bagi tujuan menerima bantuan TIDAK diliputi dalam banci ini.

Data Perdagangan borong, Perdagangan runcit dan Kenderaan bermotor telah dianggar menggunakan data Banci Perdagangan Edaran 2014 (tahun rujukan 2013). Anggaran dibuat dengan kadar pertumbuhan tahunan purata yang diperoleh daripada data Perdagangan Edaran Bulanan bagi tempoh 2010 hingga 2015.

## 2. Sumber rangka

Sumber utama rangka banci ialah syarikat yang berdaftar dengan Suruhanjaya Syarikat Malaysia dan pelbagai persatuan perniagaan dan perdagangan.

Rangka dikemaskini dengan pertubuhan baru dan perubahan pada pertubuhan sedia ada seperti tutup, tidak beroperasi, perubahan aktiviti utama dan lokasi/ alamat pos untuk memastikan maklumat dalam rangka adalah terkini.

## 3. Jenis aktiviti perniagaan

Jenis aktiviti perniagaan merujuk kepada aktiviti utama dan sekunder. Aktiviti utama merujuk kepada aktiviti yang mana pertubuhan menumpukan sebahagian besar sumbernya atau memperoleh sebahagian besar daripada pendapatannya. Aktiviti sekunder didefinisikan sebagai aktiviti sampingan kepada aktiviti utama. Klasifikasi industri bagi pertubuhan adalah merujuk kepada aktiviti utama dan dikelaskan mengikut **Piawaian Klasifikasi Industri Malaysia** (MSIC), 2008 Versi 1.0 yang dibangunkan berasaskan *International Standard Industrial Classification of All Economic Activities (ISIC), Revision 4*, diterbitkan *United Nations*.

## 4. Jenis aktiviti perniagaan

Definisi aktiviti ekonomi yang diguna pakai dalam penerbitan ini adalah berasaskan kepada MSIC 2008 versi 1.0. Aktiviti-aktiviti ekonomi termasuk:

### i. **Pertanian** ditakrifkan sebagai:

Aktiviti penanaman, pemeliharaan dan penternakan haiwan dan pengeluaran produk haiwan, penebangan kayu balak dan tanaman lain, serta penangkapan ikan dan akuakultur termasuk penggunaan sumber semulajadi tumbuh-tumbuhan dan haiwan.

**a. Tanaman** merujuk penanaman dan pengeluaran produk tanaman, ia juga termasuk pertanian organik dan penanaman yang dimodifikasikan secara genetik. Tanaman juga meliputi penanaman tanaman jangka panjang dan tanaman jangka pendek, pembiakan tumbuhan dan pertanian campur;

**b. Ternakan** ialah binatang-binatang atau unggas yang dipelihara untuk tujuan komersil, sara diri, pembiakbakaan dan rekreasi. Pengeluaran ternakan termasuk penternakan (ladang) dan pembiakan semua haiwan, kecuali haiwan akuatik;

**c. Perhutanan dan pembalakan** termasuk pengeluaran kayu balak untuk industri berasas kayu, meliputi pengestrakan dan pengumpulan produk hutan bukan kayu yang tumbuh liar. Selain pengeluaran kayu balak, aktiviti perhutanan yang menghasilkan produk melalui proses minima seperti kayu api, kayu arang, raja kayu dan kayu balak yang digunakan dalam bentuk yang belum diproses. Aktiviti ini boleh dijalankan dalam hutan asli dan ladang hutan. Ia juga termasuk sebahagian daripada aktiviti operasi perhutanan berdasarkan bayaran atau secara kontrak; dan

**d. Perikanan** ialah penangkapan, pemungutan dan pembiakan hidupan laut daripada lautan, pinggir pantai, perairan pedalaman dan kuala atas dasar komersil dan untuk kegunaan sendiri, tetapi bukan untuk bersukan. Akuakultur ialah proses pengeluaran yang melibatkan pengkulturan (termasuk tuaian) organisma akuatik dengan menggunakan teknik yang direka bentuk untuk meningkatkan pengeluaran organisma tersebut melebihi kapasiti persekitaran semulajadinya.

- ii. **Perlombongan & pengkuarian** termasuk pengekstrakan mineral yang terjadi secara semulajadi seperti pepejal (batu arang dan bijih), cecair (petroleum) atau gas (gas asli). Pengekstrakan boleh dijalankan melalui pelbagai kaedah seperti perlombongan bawah tanah atau dedah, pengoperasian telaga, perlombongan dasar laut dan lain-lain.
- a. **Perlombongan** adalah ditakrif sebagai pengestrakan, pembersihan dan pemanfaatan mineral-mineral semulajadi, berbentuk pepejal seperti arang batu dan bijih; cecair seperti minyak mentah; atau berbentuk gas seperti gas asli. Perlombongan termasuk lombong bawah tanah dan lombong permukaan, kuari dan telaga-telaga dan semua kegiatan tambahan untuk pembersihan dan pemanfaatan bijih dan mineral mentah lain seperti pemecahan, penapisan, pembasuhan, pembersihan, penggredan, pengilangan, pengapungan, peleburan, penggentelan, pengkacipan dan persiapan-persiapan lain yang diperlukan bagi menyediakan memasarkan bahan-bahan tersebut ini untuk membolehkannya dipasarkan. Aktiviti perlombongan juga dikelaskan kepada kumpulan-kumpulan berdasarkan mineral utama yang dikeluarkan.
- b. **Pengkuarian** merujuk kepada aktiviti pengekstrakan dari lombong atau kuari dan pengorekan mendapan lanar (aluvium), pemecahan batu dan penggunaan garam paya. Produk ini digunakan dengan meluas dalam sektor pembinaan (cth. pasir, batu, dll.), pembuatan bahan mentah (cth. tanah liat, gipsum, kalsium, dll.), pembuatan bahan kimia, dll. Ia termasuk pengkuarian, pemotongan kasar bongkah batu dan batu bangunan seperti marmar, granit, batu pasir, dll, pengkuarian, pemecahan dan pemotongan batu kapur, perlombongan gipsum dan anhidrit, perlombongan kapur dan dolomit, pengekstrakan dan pengorekan pasir industri, pasir untuk pembinaan dan kerikil, memecah dan menghancurkan batu dan kerikil, pengkuarian pasir dan perlombongan tanah liat, refraktori tanah liat dan kaolin. Ia juga termasuk perlombongan mineral kimia dan baja, pengekstrakan tanah gambut, pengekstrakan garam dan lain-lain.
- c. **Petroleum dan gas asli** merujuk kepada pengeluaran petroleum mentah, perlombongan dan pengekstrakan minyak daripada minyak batu syal dan pasir minyak dan pengeluaran gas asli dan perolehan semula cecair hidrokarbon. Ia termasuk keseluruhan aktiviti pengoperasian dan/atau pembangunan kelengkapan lapangan minyak dan gas, termasuklah aktiviti seperti penggerudian, penyiapan dan melengkapkan telaga, operasi pengasingan,

pemisahan emulsi, peralatan penyahkelodak dan penyambungan aktiviti lapangan untuk petroleum mentah dan semua aktiviti dalam penyediaan minyak dan gas sehingga ke tempat penghantaran daripada pusat pengeluaran. Ia juga termasuk aktiviti sokongan bagi pengekstrakan petroleum dan gas seperti perkhidmatan lapangan minyak dan gas, yang dibuat berdasarkan kontrak atau yuran, eksplorasi telaga minyak dan gas dan penggerudian ujian dan aktiviti penggerekkan (boring) yang baru diliputi dalam Banci Ekonomi 2016.

- iii. **Pembuatan** ditakrifkan sebagai perubahan fizikal atau kimia ke atas bahan atau komponen yang akan menjadi produk baru sama ada kerja itu dilakukan oleh jentera atau yang dijalankan dengan tangan, sama ada dijalankan dalam kilang atau di rumah pekerja dan sama ada barang keluaran dijual secara borong atau runcit.
- iv. **Pembinaan** ditakrifkan sebagai pembinaan baru, pengubahsuaian, pembaikan dan perobohan. Pemasangan sebarang jenis jentera atau peralatan yang dipasang ketika pembinaan asal adalah diambil kira, demikian juga bagi pemasangan jentera atau peralatan selepas pembinaan asal tetapi memerlukan perubahan struktur bagi pemasangannya.
- v. **Perkhidmatan** termasuk Bekalan elektrik, gas, wap & pendinginan udara; Bekalan air; pembentungan, pengurusan sisa & aktiviti pemulihan; Perdagangan borong dan runcit, Pengangkutan dan penyimpanan; Maklumat dan komunikasi, Penginapan; Makanan dan minuman; Kewangan; Hartanah; Profesional, saintifik & teknikal; Pentadbiran dan khidmat sokongan; Pendidikan; Kesihatan dan kerja sosial; Kesenian, hiburan & rekreasi dan Perkhidmatan persendirian & lain-lain aktiviti;
  - a. **Bekalan air, pembentungan, pengurusan sisa & aktiviti pemulihan** meliputi aktiviti yang berkaitan dengan pengurusan sisa (termasuk pungutan, perawatan dan pelupusan) seperti sisa terjadual, sisa pepejal dan air sisa daripada perindustrian dan isi rumah, termasuk juga pemulihan bahan dan tapak yang tercemar. Hasil sisa daripada proses perawatan boleh dilupus atau menjadi input kepada proses pengeluaran yang lain. Aktiviti yang berkaitan dengan perawatan dan bekalan air juga dimasukkan dalam sektor ini.
  - b. **Perdagangan borong dan runcit** merujuk kepada perdagangan borong, perdagangan runcit dan kenderaan bermotor merujuk kepada aktiviti “penjualan semula (tanpa pengubahsuaian) barangan baru dan barangan yang telah

digunakan". Perdagangan borong merujuk kepada aktiviti penjualan semula (tanpa pengubahsuaian) barangan baru dan terpakai kepada peruncit, pengguna perindustrian, perdagangan, institusi atau profesional; atau kepada pemborong lain; atau bertindak sebagai agen atau broker dalam pembelian barang dagangan, atau menjual barang dagangan kepada orang atau syarikat berkenaan. Perdagangan runcit merujuk kepada penjualan semula (tanpa pengubahsuaian) barang baru dan terpakai kepada orang awam untuk kegunaan persendirian atau isi rumah. Kenderaan bermotor merujuk kepada jualan secara borong dan runcit kenderaan bermotor dan motorsikal, sama ada baru atau terpakai, jualan alat-alat ganti dan aksesori kenderaan, penyelenggaraan dan pembaikan kenderaan bermotor dan motorsikal termasuk mencuci, mengilap dan menunda kenderaan serta jualan oleh agen berkomisen.

- c. **Pengangkutan dan penyimpanan** meliputi pertubuhan terlibat dalam menyediakan perkhidmatan darat, pengangkutan muatan melalui jalan raya, pengangkutan darat lain, pengangkutan air, penggudangan & aktiviti sokongan seperti pengoperasian terminal, tempat letak kereta, pengoperasian lebuh raya, pengoperasian pelabuhan, pengendalian kargo/pemunggahan, agensi perkapalan & penghantaran serta lain-lain aktiviti sokongan perkhidmatan pengangkutan;
- d. **Maklumat dan komunikasi** terdiri daripada aktiviti penerbitan wayang gambar, video dan program televisyen, rakaman bunyi dan penerbitan muzik, aktiviti pemrograman dan penyiaran, perkhidmatan telekomunikasi, pengaturcaraan komputer, perundingan dan aktiviti yang berkaitan dan aktiviti perkhidmatan maklumat;
- e. **Perkhidmatan penginapan** merujuk kepada penyediaan tempat penginapan jangka pendek berbayar, sama ada dibuka kepada orang awam atau terhad kepada ahli sebuah pertubuhan tertentu;
- f. **Perkhidmatan makanan dan minuman** termasuk perkhidmatan makanan dan minuman yang menyediakan hidangan atau minuman lengkap untuk penggunaan segera, sama ada di restoran tradisional, restoran layan diri atau bawa pulang, yang didirikan secara kekal atau sementara, dengan atau tiada kemudahan tempat duduk;

- g. Perkhidmatan kewangan** adalah meliputi aktiviti perantaraan kewangan; aktiviti perkhidmatan kewangan lain dan aktiviti sokongan kepada perkhidmatan kewangan; aktiviti insurans/ takaful, insurans/ takaful semula dan tabungan pencen & hemat; dan aktiviti sokongan kepada insurans/ takaful dan tabungan pencen;
- h. Perkhidmatan hartanah** termasuk tindakan seperti pemberi pajak, agen dan/atau broker di dalam satu atau lebih daripada yang berikut: penjualan atau pembelian hartanah, penyewaan hartanah, penyediaan perkhidmatan hartanah lain seperti penilaian hartanah, pengurusan hartanah atau bertindak sebagai agen hartanah eskrow. Aktiviti dalam bahagian ini mungkin dijalankan di atas hartanah milikan sendiri atau pajakan dan mungkin berlaku atas dasar bayaran atau kontrak. Termasuk juga pembangunan struktur, berserta mengekalkan hak milik atau pajakan bagi struktur tersebut;
- i. Perkhidmatan profesional, saintifik dan teknikal** termasuk aktiviti profesional khusus, saintifik dan teknikal di mana ianya memerlukan tahap latihan yang tinggi dan menjadikan pengetahuan dan kemahiran khusus tersedia kepada pengguna. Aktiviti yang dijalankan termasuk aktiviti guaman dan perakaunan, aktiviti ibu pejabat, aktiviti perundingan pengurusan, aktiviti arkitek dan kejuruteraan, ujian dan analisis teknikal, penyelidikan dan pembangunan saintifik, pengiklanan dan penyelidikan pasaran, profesional lain, aktiviti saintifik dan teknikal dan veterinar;
- j. Perkhidmatan pentadbiran dan khidmat sokongan** termasuk pelbagai aktiviti yang menyokong operasi am perniagaan meliputi aktiviti sewaan dan pajakan, aktiviti pekerjaan, agensi pengembaraan, operator pelancongan dan aktiviti perkhidmatan penempahan lain, aktiviti keselamatan dan penyiasatan, aktiviti perkhidmatan kepada bangunan dan lanskap dan pentadbiran pejabat, aktiviti sokongan pejabat dan perniagaan lain;
- k. Perkhidmatan pendidikan** merujuk kepada pertubuhan yang berdaftar dengan Kementerian Pendidikan Malaysia dan Kementerian Pengajian Tinggi yang menyediakan Perkhidmatan pelajaran akademik, vokasional dan perdagangan. Termasuk dalam kumpulan ini ialah pra sekolah, sekolah rendah, sekolah menengah, sekolah teknik dan vokasional serta kolej dan universiti (termasuk sekolah kejururawatan serta institut perdagangan dan teknik lain). Juga

termasuk ialah pendidikan sukan dan rekreasi, pendidikan kebudayaan, pusat tuisyen, sekolah memandu yang membekalkan perkhidmatan pelajaran automobil, sekolah agama, sekolah komputer dan sekolah atau institusi lain serta perkhidmatan sokongan pendidikan;

- l. Perkhidmatan kesihatan dan kerja sosial** meliputi perkhidmatan hospital, perkhidmatan perubatan am dan pakar, perkhidmatan rumah bersalin, perkhidmatan pergigian, pusat dialisis, makmal perubatan, pusat akupunktur, perkhidmatan ahli herba dan homeopati serta perkhidmatan kesihatan kemanusiaan lain;
- m. Perkhidmatan kesenian, hiburan dan rekreasi** termasuk pelbagai aktiviti bagi memenuhi minat orang awam dalam aktiviti kebudayaan, hiburan dan rekreasi meliputi persembahan secara langsung, operasi muzium, perjudian, sukan dan aktiviti rekreasi; dan
- n. Perkhidmatan persendirian & lain-lain aktiviti** termasuk aktiviti keahlian organisasi, aktiviti organisasi keahlian perniagaan, majikan dan profesional, aktiviti kesatuan buruh, aktiviti keahlian organisasi lain, pembaikan komputer dan barangan persendirian dan isi rumah dan aktiviti perkhidmatan persendirian lain seperti perkhidmatan basuhan dan cucian kering tekstil dan produk berbulu; dandan rambut dan penjagaan kecantikan lain; dan pengebumian dan aktiviti perkhidmatan lain.

## 5. Definisi produk tenaga

Definisi yang digunakan dalam penerbitan ini adalah berdasarkan syor **Standard Klasifikasi Produk Tenaga Antarabangsa (SIEC)**. Pengelasan terkini produk tenaga adalah seperti berikut

### ***i. Solid fossil fuels***

#### ***a. Hard coal***

*Coals with a gross calorific value (moist, ash-free basis) which is not less than 24MJ/kg or which is less than 24 MJ/kg provided that the coal has a vitrinite mean random reflectance greater than or equal to 0.6 per cent. Hard coal comprises anthracite and bituminous coals.*

**b. Brown coal**

*Coals with a gross calorific value (moist, ash-free basis) less than 24 MJ/ kg and a vitrinite mean random reflectance less than 0.6 per cent. Brown coal comprises subbituminous coal and lignite.*

**c. Peat**

*A solid fuel formed from the partial decomposition of dead vegetation under conditions of high humidity and limited air access (initial stage of coalification). It is available in two forms for use as a fuel, sod peat and milled peat. Only peat used as fuel is included.*

**d. Patent fuel**

*A composition fuel made by moulding hard coal fines into briquette shapes with the addition of a binding agent such as pitch.*

**e. Brown coal briquettes**

*A composition fuel made of brown coal produced by briquetting under high pressure with or without the addition of a binding agent. Either sub-bituminous coal or lignite may be used, including dried lignite fines and dust.*

**f. Peat product**

*This includes products such as peat briquettes derived directly or indirectly from sod peat and milled peat.*

**g. Coal coke**

*This group includes the solid, cellular, infusible material remaining after the carbonisation of certain coals. Various cokes are defined according to the type of coal carbonised and their conditions of carbonisation or use: coke oven coke, gas coke, coke breeze and semi cokes. For collection purposes, coke breeze and semi cokes are included with coke oven coke.*

**h. Coal tar**

*The liquid by-product of the carbonization of coal in coke ovens. Coal tar may be separated by distillation into several liquid products which may be used for pharmaceutical or wood preservative purposes.*

**i. Other coal products**

*Coal products not elsewhere specified (if any).*

**j. Oil shale**

*A sedimentary rock which contains organic matter in the form of kerogen. Kerogen is a waxy hydrocarbon-rich material regarded as a precursor of petroleum. Oil shale may be burned directly or processed by heating to extract shale oil.*

*Note that this product was formerly included under Lignite by the IEA.*

**ii. Liquid fossil fuels**

**a. Conventional crude oil**

*A mineral oil of fossil origin extracted by conventional means from underground reservoirs, and comprises liquid or near-liquid hydrocarbons and associated impurities such as sulphur and metals. Conventional crude oil exists in the liquid phase under normal surface temperature and pressure, and usually flows to the surface under the pressure of the reservoir. This is termed “conventional” extraction.*

*Crude oil includes condensate from condensate fields, and “field” or “lease” condensate extracted with the crude oil. The various crude oils may be classified according to their sulphur content (“sweet” or “sour”) and API gravity (“heavy” or “light”). There are no rigorous specifications for the classifications but a heavy crude oil may be assumed to have an API gravity of less than 20° and a sweet crude oil may be assumed to have less than 0.5% sulphur content. For simplicity this publication refers to conventional crude oil as simply crude oil.*

**b. Natural gas liquids (NGL)**

*Natural gas liquids are a mixture of ethane, propane, butane (normal and iso), (iso) pentane and a few higher alkanes collectively referred to as pentanes plus. NGL are produced in association with oil or natural gas. They are removed in field facilities or gas separation plants before sale of the gas. All of the components of NGL except ethane are either liquid at the surface or are liquefied for disposal. The definition given above is the most commonly used. However, there is some use of terms based on the vapour pressure of the components which are liquid at the surface or can be easily liquefied.*

The three resulting groups are in order of increasing vapour pressure: condensates, natural gasoline and liquefied petroleum gas. NGL may be distilled with crude oil in refineries, blended with refined oil products or used directly. NGL differs from LNG (liquefied natural gas) which is obtained by liquefying natural gas from which the NGL has been removed.

### **c. Additives and oxygenates**

Compounds added to or blended with oil products to modify their properties (octane, cetane, cold properties, etc.). Examples are:

- Oxygenates such as alcohols (methanol, ethanol) and ethers [MTBE (methyl tertiary butyl ether), ETBE (ethyl tertiary butyl ether), TAME (tertiary amyl methyl ether)];
- Esters (e.g., rapeseed or dimethylester, etc.); and
- Chemical compounds (such as TML, TEL and detergents). Some additives/oxygenates may be derived from biomass while others may be of fossil hydrocarbon origin.

### **d. Other hydrocarbons**

This includes nonconventional oils and hydrogen. Nonconventional oils refer to oils obtained by nonconventional production techniques, that is oils which are extracted from reservoirs containing extra heavy oils or oil sands which need heating or treatment (e.g., emulsification) in situ before they can be brought to the surface for refining/ processing. It also include the oils extracted from oil sands, extra heavy oils, coal and oil shale which are at, or can be brought to, the surface without treatment and require processing after mining (ex situ processing). Nonconventional oils may also be produced from natural gas. The oils may be divided into two groups:

- Oils for transformation (e.g., synthetic crudes extracted from extra heavy oils, oil sands, coal and oil shale); and
- Oils for direct use (e.g. emulsified oils such as orimulsion and GTL liquids).

## **e. Oil products**

*Products obtained from crude oil, non-conventional oils or gases from oil and gas fields. It may be produced through the refining of conventional crude and nonconventional oils or during the separation of natural gas from gases extracted from oil or gas fields.*

*This category includes Aviation gasoline, Motor gasoline, Gasoline-type jet fuel, Kerosene type jet fuel, Other kerosene, Gas/diesel oil, Fuel oil, LPG, Feedstocks, Naphtha, White spirit and SBP, Lubricants, Bitumen, Paraffin waxes, Petroleum coke, Refinery gas, Ethane, and other oil products.*

## **f. Aviation gasoline**

*Gasoline prepared especially for aviation piston engines with additives which assure performance under flight conditions. Aviation gasolines are predominantly alkylates (obtained by combining C<sub>4</sub> and C<sub>5</sub> isoparaffins with C<sub>3</sub>, C<sub>4</sub> and C<sub>5</sub> olefins) with the possible addition of more aromatic components including toluene. The distillation range is 25°C to 170°C.*

## **g. Motor gasoline**

*A mixture of some aromatics (e.g., benzene and toluene) and aliphatic hydrocarbons in the C<sub>5</sub> to C<sub>12</sub> range. The distillation range is 25°C to 220°C. Additives are blended to improve octane rating, improve combustion performance, reduce oxidation during storage, maintain cleanliness of the engine and improve capture of pollutants by catalytic converters in the exhaust system. Motor gasoline may also contain biogasoline products when blended.*

## **h. Gasoline-type jet fuel**

*Light hydrocarbons for use in aviation turbine power units, distilling between 100°C and 250°C. They are obtained by blending kerosene and gasoline or naphtha in such a way that the aromatic content does not exceed 25 per cent in volume and the vapour pressure is between 13.7 kPa and 20.6 kPa. Gasoline-type jet fuel is also known as "aviation turbine fuel".*

## **i. Kerosene**

Mixtures of hydrocarbons in the range C<sub>9</sub> to C<sub>16</sub> and distilling over the temperature interval 145°C to 300°C, but not usually above 250°C and with a flash point above 38°C.

The chemical compositions of kerosenes depend on the nature of the crude oils from which they are derived and the refinery processes that they have undergone. Kerosenes obtained from crude oil by atmospheric distillation are known as straight-run kerosenes. Such streams may be treated by a variety of processes to produce kerosenes that are acceptable for blending as jet fuels.

Kerosenes are primarily used as jet fuels. They are also used as domestic heating and cooking fuels, and as solvents. Kerosenes may include components or additives derived from biomass when blended.

- **Kerosene-type jet fuel**

A blend of kerosenes suited to flight conditions with particular specifications, such as freezing point. The specifications are set down by a small number of national standards committees, most notably ASTM (U.S.), MOD (UK), GOST (Russia).

- **Other kerosene**

Kerosene which is used for heating, cooking, lighting, solvents and internal combustion engines. Other names for this product are burning oil, vaporizing oil, power kerosene and illuminating oil.

## **j. Gas oil / diesel oil**

Gas oils are middle distillates, predominantly of carbon number range C<sub>11</sub> to C<sub>25</sub> and with a distillation range of 160°C to 420°C. The principal marketed products are fuels for diesel engines (diesel oil), heating oils and marine fuel. Gas oils are also used as middle distillate feedstock for the petrochemical industry and as solvents. Also included here is heavy gas oil, which is a mixture of predominantly gas oil and fuel oil which distils in the range of approximately 380°C to 540°C.

## **k. Fuel oil**

*Comprises residual fuel oil and heavy fuel oil. Residual fuel oils have a distillation range of 350°C to 650°C and a kinematic viscosity in the range 6 to 55 cSt at 100°C. Their flash point is always above 60°C and their specific gravity is above 0.95. Heavy fuel oil is a general term describing a blended product based on the residues from various refinery processes.*

*Other names commonly used to describe fuel oil include: bunker fuel, bunker C, fuel oil No. 6, industrial fuel oil, marine fuel oil and black oil.*

*Residual and heavy fuel oil are used in medium to large industrial plants, marine applications and power stations in combustion equipment such as boilers, furnaces and diesel engines. Residual fuel oil is also used as fuel within the refinery.*

## **l. Liquefied petroleum gases (LPG)**

*LPG refers to liquefied propane (C<sub>3</sub>H<sub>8</sub>) and butane (C<sub>4</sub>H<sub>10</sub>) or mixtures of both. Commercial grades are usually mixtures of the gases with small amounts of propylene, butylene, isobutene and isobutylene stored under pressure in containers. The mixture of propane and butane used varies according to purpose and season of the year. The gases may be extracted from natural gas at gas separation plants or at plants regasifying imported liquefied natural gas. They are also obtained during the refining of crude oil. LPG may be used for heating and as a vehicle fuel. See also the definition for natural gas liquids. Certain oil field practices also use the term LPG to describe the high vapour pressure components of natural gas liquids.*

## **m. Ethane**

*A naturally straight-chain hydrocarbon (C<sub>2</sub>H<sub>6</sub>). Ethane is obtained at gas separation plants or from the refining of crude oil. It is a valuable feedstock for petrochemical manufacture.*

**n. Refinery gas**

*Includes a mixture of noncondensable gases mainly consisting of hydrogen, methane, ethane and olefins obtained during distillation of crude oil or treatment of oil products (e.g., cracking) in refineries or from nearby petrochemical plants. It is used mainly as a fuel within the refinery.*

**o. Feedstocks**

*This includes refinery feedstocks, i.e. oils or gases from crude oil refining or the processing of hydrocarbons in the petrochemical industry which are destined for further processing in the refinery excluding blending. Typical feedstocks include naphthas, middle distillates, pyrolysis gasoline and heavy oils from vacuum distillation and petrochemical plants.*

**p. Naphtha**

*Light or medium oils distilling between 30°C and 210°C which do not meet the specification for motor gasoline. Different naphthas are distinguished by their density and the content of paraffins, isoparaffins, olefins, naphthenes and aromatics. The main uses for naphthas are as feedstock for high octane gasolines and the manufacture of olefins in the petrochemical industry.*

**q. White spirit and SBP industrial spirits**

*White spirit and special boiling point industrial spirits (SBP) are refined distillate intermediates with a distillation in the naphtha/ kerosene range. They are mainly used for non-fuel purposes and sub-divided as:*

- *White spirit - an industrial spirit with a flash point above 30°C and a distillation range of 135°C to 200°C; and*
- *Industrial spirit (SBP) - light oils distilling between 30°C and 200°C.*

*There are 7 or 8 grades of industrial spirits, depending on the position of the cut in the distillation range. The grades are defined according to the temperature difference between the 5 per cent and 90 per cent volume distillation points (which is not more than 60°C). White spirit and Industrial spirits are mostly used as thinners and solvents.*

**r. Lubricants**

*Oils, produced from crude oil, for which the principal use is to reduce friction between sliding surfaces and during metal cutting operations. Lubricant base stocks are obtained from vacuum distillates which result from further distillation of the residue from atmospheric distillation of crude oil. The lubricant base stocks are then further processed to produce lubricants with the desired properties.*

**s. Bitumen**

*A solid, semi-solid or viscous hydrocarbon with a colloidal structure, being brown to black in colour. It is obtained as a residue in the distillation of crude oil and by vacuum distillation of oil residues from atmospheric distillation. It should not be confused with the nonconventional primary extra heavy oils which may also be referred to as bitumen.*

*In addition to its major use for road pavements, bitumen is also used as an adhesive, a waterproofing agent for roof coverings and as a binder in the manufacture of patent fuel. It may also be used for electricity generation in specially designed power plants.*

*Bitumen is also known in some countries as asphalt but in others asphalt describes the mixture of bitumen and stone aggregate used for road pavements.*

**t. Paraffin waxes**

*Residues extracted when dewaxing lubricant oils. The waxes have a crystalline structure which varies in fineness according to the grade, and are colourless, odourless and translucent, with a melting point above 45°C. Paraffin waxes are also known as "petroleum waxes".*

**u. Petroleum coke**

*Petroleum coke is a black solid obtained mainly by cracking and carbonizing heavy hydrocarbon oils, tars and pitches. It consists mainly of carbon (90 to 95 per cent) and has low ash content.*

*The two most important categories are "green coke" and "calcined coke". Green coke (raw coke) is the primary solid carbonization product from high boiling hydrocarbon fractions obtained at temperatures below 630°C. It contains 4-15*

*per cent by weight of matter that can be released as volatiles during subsequent heat treatment at temperatures up to approximately 1,330°C. Calcined coke is a petroleum coke or coal derived pitch coke obtained by heat treatment of green coke to about 1,330°C. It will normally have a hydrogen content of less than 0.1 per cent by weight. In many catalytic operations (e.g., catalytic cracking) carbon or catalytic coke is deposited on the catalyst, thus deactivating it. The catalyst is reactivated by burning off the coke which is used as a fuel in the refining process. The coke is not recoverable in a concentrated form.*

## **v. Other oil products**

*Products (including partly refined products) from the refining of crude oil and feedstocks which are not specified above. These products will include basic chemicals and organic chemicals destined for use within the refinery or for sale to or processing in the chemical industry such as propylene, benzene, toluene and xylene.*

## **iii. Gaseous fossil fuels**

### **a. Natural gas**

*A mixture of gaseous hydrocarbons, primarily methane, but generally also including ethane, propane and higher hydrocarbons in much smaller amounts and some non-combustible gases such as nitrogen and carbon dioxide.*

*The majority of natural gas is separated from both "non-associated" gases originating from fields producing hydrocarbons only in gaseous form, and "associated" gas produced in association with crude oil.*

*The separation process produces natural gas by removing or reducing the hydrocarbons other than methane to levels which are acceptable in the marketable gas. The natural gas liquids (NGL) removed in the process are distributed separately.*

*Natural gas also includes methane recovered from coal mines (colliery gas) or from coal seams (coal seam gas) and shale gas. When distributed it may also contain methane from anaerobic fermentation or the methanation of biomass. Natural gas may be liquefied (LNG) by reducing its temperature in order to*

*simplify storage and transportation when production sites are remote from centres of consumption and pipeline transportation is not economically practicable.*

**b. Gas works gas (and other manufactured gases for distribution)**

*This includes gases obtained from the carbonisation or gasification of carbonaceous material of fossil or biomass origins in Gas Works. The gases comprise:*

- *Gases obtained from carbonisation or gasification of coals, cokes, biomass or waste;*
- *Substitute natural gas (a methane-rich gas) made from synthesis gas. Synthesis gas is a mixture of mainly hydrogen and carbon monoxide obtained by cracking hydrocarbons with high temperature steam.*

**c. Coke oven gas**

*A gas produced from coke ovens during the manufacture of coke oven coke.*

**d. Blast furnace gas**

*The by-product gas of blast furnace operation consisting mainly of nitrogen, carbon dioxide and carbon monoxide. The gas is recovered as it leaves the furnace. Its calorific value arises mainly from the carbon monoxide produced by the partial combustion of coke and other carbon bearing products in the blast furnace. It is used to heat blast air and as a fuel in the iron and steel industry. It may also be used by other nearby industrial plants. Note that where carbonised biomass (e.g., charcoal or animal meal) is used in blast furnaces, part of the carbon supply may be considered renewable.*

**e. Other recovered gases**

*Combustible gases of solid carbonaceous origin recovered from manufacturing and chemical processes not elsewhere defined. Examples of fuel gas production from metals and chemicals processing are in the production of zinc, tin, lead, ferroalloys, phosphorus and silicon carbide.*

## iv. **Biofuels and waste**

### a. **Fuelwood, wood residues and by products**

*Fuelwood or firewood (in log, brushwood, pellet or chip form) obtained from natural or managed forests or isolated trees. Also included are wood residues used as fuel and in which the original composition of wood is retained. Charcoal and black liquor are excluded.*

### b. **Bagasse**

*The fuel obtained from the fibre which remains after juice extraction in sugar cane processing. It is often used as a fuel within the sugar milling industry.*

### c. **Charcoal**

*The solid residue from the carbonisation of wood or other vegetal matter through slow pyrolysis.*

### d. **Animal waste**

*Excreta of animals, meat and fish residues which, when dry, are used directly as a fuel. This excludes waste used in anaerobic fermentation plants. Fuel gases from these plants are included under biogases.*

### e. **Vegetal waste**

*Refers to SIEC's 'Other vegetal materials and residues', which are solid primary biofuels not specified elsewhere, including straw, vegetable husks, ground nut shells, pruning brushwood, olive pomace and other wastes arising from the maintenance, cropping and processing of plants.*

### f. **Municipal waste**

*Household waste and waste from companies and public services that resembles household waste and which is collected at installations specifically designed for the disposal of mixed wastes with recovery of combustible liquids, gases or heat. Municipal wastes can be divided into renewable and non-renewable fractions.*

### g. **Industrial waste**

*Non-renewable waste which is combusted with heat recovery in plants other than those used for the incineration of municipal waste. Examples are used tires,*

*specific residues from the chemical industry and hazardous wastes from health care. Combustion includes co-firing with other fuels. The renewable portions of industrial waste combusted with heat recovery are classified according to the biofuels which best describe them.*

**h. Black liquor**

*The alkaline-spent liquor obtained from the digesters during the production of sulphate or soda pulp required for paper manufacture. The lignin contained in the liquor burns to release heat when the concentrated liquor is sprayed into a recovery furnace and heated with hot gases at 900°C. Black liquor is used as a fuel in the pulping process.*

**i. Biogasoline**

*Liquid fuels derived from biomass and used in spark-ignition internal combustion engines. Common examples are: bioethanol (including both hydrous and anhydrous ethanol); biomethanol; biobutanol; bio ETBE (ethyl-tertiobutyl-ether); and bio MTBE (methyl-tertio-butylether). Biogasoline may be blended with petroleum gasoline or used directly in engines. The blending may take place in refineries or at or near the point of sale.*

**j. Biodiesels**

*Liquid biofuels derived from biomass and used in diesel engines. Biodiesels obtained by chemical modification are a linear alkyl ester made by transesterification of vegetable oils or animal fats with methanol. The transesterification distinguishes biodiesel from straight vegetable and waste oils. Biodiesel has a flash point of around 150°C and a density of about 0.88 kg/litre. Biological sources of biodiesel include, but are not limited to, vegetable oils made from canola (rapeseed), soybeans, corn, oil palm, peanut or sunflower. Some liquid biofuels (straight vegetable oils) may be used without chemical modification and their use usually requires modification of the engine. A further category of diesel fuels can be produced by a range of thermal processes (including for example gasification followed by Fischer Tropsch synthesis, pyrolysis followed by hydrogenation, or conversion of sugar to hydrocarbons using microorganisms (e.g. yeast)). A wide range of biomass feedstocks, including cellulosic materials and algal biomass could be used in such processes. Biodiesels may be blended with petroleum diesel or used directly in diesel engines.*

## **k. Bio jet kerosene**

*Liquid biofuels derived from biomass and blended with or replacing jet kerosene. Bio jet kerosene can be produced by a range of thermal processes (including for example gasification followed by Fischer-Tropsch synthesis, pyrolysis followed by hydrogenation, or conversion of sugar to hydrocarbons using microorganisms (e.g. yeast). A wide range of biomass feedstocks, including cellulosic materials and algal biomass could be used in such processes.*

## **l. Other liquid biofuels**

*Includes liquid biofuels not elsewhere specified.*

## **m. Biogases**

*Gases arising from the anaerobic fermentation of biomass and the gasification of solid biomass (including biomass in wastes). The biogases from anaerobic fermentation are composed principally of methane and carbon dioxide and comprise landfill gas, sewage sludge gas and other biogases from anaerobic fermentation. Biogases can also be produced from thermal processes (by gasification or pyrolysis) of biomass and are mixtures containing hydrogen and carbon monoxide (usually known as syngas) along with other components. These gases may be further processed to modify their composition and can be further processed to produce substitute natural gas. The gases are divided into two groups according to their production: biogases from anaerobic fermentation and biogases from thermal processes. Biogases are used mainly as a fuel but can be used as a chemical feedstock.*

## **v. Electricity and heat**

### **a. Electricity**

*The transfer of energy through the physical phenomena involving electric charges and their effects when at rest and in motion.*

*Electricity can be generated through different processes such as: the conversion of energy contained in falling or streaming water, wind or waves; the direct conversion of solar radiation through photovoltaic processes in semiconductor devices (solar cells); or by the combustion of fuels. Electricity production refers to gross production, which is the sum of the electrical energy production by all the*

*generating units/installations concerned (including pumped storage) measured at the output terminals of the main generators.*

**b. Primary electricity** *refers to electrical energy from hydro, solar photovoltaics, wind, tide, wave and ocean sources.*

**c. Secondary electricity** *is defined as electricity derived from a product already accounted for within energy statistics. This includes electricity generated from combustible fuels, in addition to electricity coming from solar heat, nuclear heat, geothermal heat and heat from chemical sources.*

**d. Main activity producers**

*These are enterprises which produce electricity or heat as their principal activity. Formerly known as public utilities, these enterprises may be privately or publicly owned companies.*

**e. Autoproducers (electricity)**

*These are enterprises which produce electricity but for whom the production is not their principal activity.*

**f. Autoproducers (heat)**

*These are enterprises which produce heat for sale but for whom the production is not their principal activity. Deliveries of fuels for heat generated by an establishment for its own purposes are classified within the part of final consumption where they are consumed, and not as transformation inputs.*

**g. Heat**

*The energy obtained from the translational, rotational and vibrational motion of the constituents of matter, as well as changes in its physical state.*

*Heat can be produced by different production processes, both primary and secondary. It is usually sold in the form of steam or hot water, and for the purposes of energy statistics it is important to note that heat only represents quantities of energy for sale (or generated and consumed directly by direct use of solar thermal or geothermal). This means that any quantities “generated” at an end-use site (for example through the combustion of coal to power a boiler, or an*

*electric filament heating a kettle) are not considered within the scope of heat production.*

## **h. Uranium production**

*Comprises the U content of uranium ores and concentrates intended for treatment for uranium recovery.*

## **vi. Energy flow definitions**

**a. Production** *is defined as the capture, extraction or manufacture of fuels or energy in forms which are ready for general use. In energy statistics, two types of production are distinguished, primary and secondary.*

- **Primary production** *is the capture or extraction of fuels or energy from natural energy flows, the biosphere and natural reserves of fossil fuels within the national territory in a form suitable for use. Inert matter removed from the extracted fuels and quantities reinjected, flared or vented are not included. The resulting products are referred to as “primary” products.*

- **Secondary production** *is the manufacture of energy products through the process of transformation of primary fuels or energy. The quantities of secondary fuels reported as production include quantities lost through venting and flaring during and after production. In this manner, the mass, energy and carbon within the primary source(s) from which the fuels are manufactured may be balanced against the secondary fuels produced. Fuels, electricity and heat produced are usually sold but may be partly or entirely consumed by the producer (but see the definition of autoproducer heat plants for an important exception.)*

**b. Imports** *of energy products comprise all fuel and other energy products entering the national territory. Goods simply being transported through a country (goods in transit) and goods temporarily admitted are excluded but re-imports, which are domestic goods exported but subsequently readmitted, are included. The bunkering of fuel outside the reference territory by national merchant ships and civil aircraft engaged in international travel is excluded from imports.*

*Fuels delivered to national merchant ships and civil aircraft which are outside of the national territory and are engaged in international travel should be classified as “International Marine” or “Aviation Bunkers”, respectively, in the country where such bunkering is carried out. Note that the “country of origin” of energy products should be recorded as a country from which goods were imported.*

- c. Exports** of energy products comprise all fuel and other energy products leaving the national territory with the exception that exports exclude quantities of fuels delivered for use by merchant (including passenger) ships and civil aircraft, of all nationalities, during international transport of goods and passengers. Goods simply being transported through a country (goods in transit) and goods temporarily withdrawn are excluded but re-exports, foreign goods exported in the same state as previously imported, are included.

*Fuels delivered to foreign merchant ships and civil aircraft engaged in international travel are classified as “International Marine” or “Aviation Bunkers”, respectively. Note that “country of destination” of energy products (that is country of the last known destination as it is known at the time of exportation) should be recorded as a country to which these products are exported to.*

*For electricity, trade data include “goods in transit”, i.e. electricity transmitted through the country from one neighbour to another, as there is no practical way of discerning which quantities are re-exported and which are consumed by the transit country.*

- d. International Marine Bunkers** are quantities of fuels delivered to merchant (including passenger) ships, of any nationality, for consumption during international voyages transporting goods or passengers. International voyages take place when the ports of departure and arrival are in different national territories. Fuels delivered for consumption by ships during domestic transportation, fishing or military uses are not included here. For the purposes of energy statistics International Marine Bunkers are not included in exports.
- e. International Aviation Bunkers** are quantities of fuels delivered to civil aircraft, of any nationality, for consumption during international flights transporting goods or passengers. International flights take place when the ports of departure and

arrival are in different national territories. Fuels delivered for consumption by aircraft undertaking domestic or military flights are not included here. For the purposes of energy statistics International Aviation Bunkers are not included in exports.

**f. Stocks**

For the purposes of energy statistics, stocks are quantities of energy products that are held on the national territory and can be used to:

- maintain service under conditions where supply and demand are variable in their timing or amount due to normal market fluctuations
- supplement supply in the case of a supply disruption. Stocks used to manage a supply disruption may be called "strategic" or "emergency" stocks and are often held separately from stocks designed to meet normal market fluctuations. Stock changes are defined as the increase (stock build) or decrease (stock draw) in the quantity of stock over the reporting period and are thus calculated as the difference between the closing and opening stocks.

**g. Energy supply** is defined as energy production plus imports minus exports minus international marine bunkers minus international aviation bunkers minus stock changes. Production can refer to either primary, secondary, or both primary and secondary production (see the note under production above).

**h. Energy industries own use** refers to consumption of fuels and energy for the direct support of the production, and preparation for use of fuels and energy. Quantities of fuels which are transformed into other fuels or energy are not included here but within the transformation use. Neither are quantities which are used within parts of the energy industry not directly involved in the activities listed in the definition. These quantities are reported within final consumption.

**i. Final Consumption** refers to all fuel and energy that is delivered to users for both their energy and non-energy uses which do not involve a transformation process.

## vii. Capacities

- a. **Refinery capacity** is the theoretical maximum capacity of crude oil refineries available for operation at the end of the reference year.
- b. **Net maximum** electrical capacity is the maximum active power that can be supplied continuously, with all plants running, at the point of outlet (i.e., after taking the power supplies for the station auxiliaries and allowing for the losses in those transformers considered integral to the station). This assumes no restriction of interconnection to the network. Does not include overload capacity that can only be sustained for a short period of time (e.g., internal combustion engines momentarily running above their rated capacity). The net maximum electricity-generating capacity represents the sum of all individual plants' maximum capacities available to run continuously throughout a prolonged period of operation in a day.

## viii. Energy resources and reserves

### a. **Hard Coal, Brown coal and Peat**

*Proved amount in place is the resource remaining in known deposits that has been carefully measured and assessed as exploitable under present and expected local economic conditions with existing available technology.*

*Proved recoverable reserves are the tonnage within the proved amount in place that can be recovered in the future under present and expected local economic conditions with existing available technology.*

*Estimated additional amount in place is the indicated and inferred tonnage additional to the proved amount in place that is of foreseeable economic interest. It includes estimates of amounts which could exist in unexplored extensions of known deposits or in undiscovered deposits in known coal-bearing areas, as well as amounts inferred through knowledge of favourable geological conditions. Speculative amounts are not included.*

## **b. Crude Oil and Natural Gas Liquids**

*Proved recoverable reserves are the quantity within the proved amount in place that can be recovered in the future under present and expected local economic conditions with existing available technology. Proved amount in place is the resource remaining in known natural reservoirs that has been carefully measured and assessed as exploitable under present and expected local economic conditions with existing available technology.*

*The ratio of crude oil reserves to production (R/P ratio) is used to show the length of time those reserves would last in years if production continued at the then-current level and there were no further increases in the proved recoverable reserves. The ratio is calculated by dividing the proved recoverable crude oil and NGL reserves (which for the most part refer to reserves at the end of 2014) by the production. These R/P ratios should be viewed with caution. The definition used for proved recoverable reserves is very restrictive and confined to those known reserves which can be recovered with reasonable certainty under existing economic conditions.*

*The R/P ratios, therefore, can frequently give a very pessimistic impression of the expected life of a country's reserves. In addition, for some of those countries whose R/P ratios appear very large, it can reasonably be assumed that the figures for proved recoverable reserves include some unproved reserves.*

## **c. Oil Shale and Bituminous Sands**

*Proved recoverable reserves are the amount, expressed as tonnage of recoverable synthetic oil that has been both carefully measured and has also been assessed as exploitable under present and expected local economic conditions with existing available technology.*

## **d. Natural Gas**

*Proved recoverable reserves are the volume within the proved amount in place that can be recovered in the future under present and expected local economic conditions with existing available technology.*

## **e. Uranium**

*Reasonably assured resources refer to recoverable uranium that occurs in known mineral deposits of delineated size, grade and configuration such that the quantities which could be recovered within the given production cost ranges with currently proven mining and processing technology can be specified. Estimates of tonnage and grade are based on specific sample data and measurements of the deposits and on knowledge of deposit characteristics.*

**f. Inferred Resources** refer to recoverable uranium (in addition to reasonably assured resources) that is inferred to occur, based on direct geological evidence, in extensions of well-explored deposits and in deposits in which geological continuity has been established, but where specific data and measurements of the deposits and knowledge of their characteristics are considered to be inadequate to classify the resource as reasonably assured resources.

## **g. Hydropower**

*Gross theoretical capability is the annual energy potentially available in the country if all natural flows were turbined down to sea level or to the water level of the border of the country (if the water course extends into another country) with 100% efficiency from the machinery and driving water-works. Unless otherwise stated, the figures have been estimated on the basis of atmospheric precipitation and water runoff.*

## **6. Unit pelapor**

Unit pelapor bagi banci ini ialah **pertubuhan**. Sesebuah pertubuhan ditakrifkan sebagai "satu unit ekonomi yang bergiat di bawah satu hak milik atau penguasaan tunggal, iaitu di bawah satu entiti yang sah. Ia menjalankan satu jenis aktiviti ekonomi utama di satu tempat/ lokasi fizikal". Setiap pertubuhan diberikan klasifikasi industri berdasarkan aktiviti utamanya.

Setiap cawangan daripada organisasi yang mempunyai beberapa cawangan di lokasi yang berbeza dari segi konsep dianggap sebagai pertubuhan yang berlainan. Pertubuhan berkenaan diminta memberikan penyata yang berasingan bagi setiap kegiatannya dari segi nilai. Walau bagaimanapun, dari segi praktis akaun biasanya disediakan secara berpusat kerana kesukaran untuk memperoleh data yang berasingan bagi setiap unit atau cawangan. Entiti atau "enterprise" ini akan dianggap sebagai satu unit pelapor dan dibenarkan mengemukakan soal selidik yang menggabungkan semua unit atau cawangannya.

## 7. Nilai output kasar

- i. Nilai output kasar **Pertanian** (tanaman, ternakan dan perikanan) dikirakan daripada item-item berikut:

### **Jualan daripada hasil pertanian**

- + Stok hasil pertanian (akhir)
- + Barangan dalam proses dan stok barangan siap (pembuatan sendiri) (akhir)
- + Jualan daripada hasil pertanian
- + Pendapatan daripada kerja pertanian yang dibuat untuk pihak lain
- + Pendapatan daripada hasil pertanian yang diproses
- + Nilai jualan daripada barangan/ bahan/ produk berkaitan pertanian yang dibeli untuk dijual semula tanpa proses selanjutnya
- + Pendapatan lain yang berkaitan dengan pertanian
- + Pendapatan daripada aktiviti pertanian lain
- + Kawasan perhutatan dikontrakkan kepada kontraktor (Perhutatan & Pembalakan sahaja)
- + Royalti, hakcipta, pelesenan dan yuran francais
- + Pendapatan daripada sewa
- + Pendapatan daripada agro pelancongan (Tanaman/ Ternakan/ Perikanan)
- + Nilai jualan barangan/ bahan bukan pertanian yang dibeli untuk dijual semula tanpa melalui proses selanjutnya
- + Semua nilai output lain
- + Perbelanjaan penyelidikan dan pembangunan (Dalam)
- Pendapatan daripada sewa: Tanah
- Stok hasil pertanian (awal)
- Barangan dalam proses dan stok barangan siap (pembuatan sendiri)(awal)
- Kos barangan/ bahan/ produk berkaitan dengan aktiviti pertanian yang dibeli untuk dijual semula tanpa melalui proses selanjutnya
- Kos barangan/ bahan (bukan Pertanian) yang dijual yang dibeli untuk dijual semula tanpa melalui proses selanjutnya

- ii. Nilai output kasar **Perlombongan & Pengkuarian, Pembuatan dan Pembinaan** ditakrifkan dengan elemen berikut:

**Nilai jualan mineral/ produk kuari/ produk pembuatan dan nilai kerja pembinaan**

- + Nilai barangan yang dijual dalam keadaan yang sama seperti dibeli
- Kos barangan yang dijual dalam keadaan yang sama seperti yang dibeli
- + Perbelanjaan modal ke atas binaan sendiri
- + Pendapatan daripada Perkhidmatan perindustrian yang diberikan kepada orang lain
- + Pendapatan daripada kerja perindustrian lain
- + Penerimaan bayaran daripada skrap, tenaga elektrik, produk sisa, dll. yang dijual kepada orang lain
- + Penerimaan komisen dan brokeraj
- + Semua nilai output lain (seperti penerimaan perkhidmatan bukan perindustrian, misalnya bayaran pengurusan, sewa harta, dll.)
- + Perbelanjaan penyelidikan dan Pembangunan (Dalam)
- + Stok akhir barangan siap
- Stok awal barangan siap
- + Stok akhir barangan sedang diproses
- Stok awal barangan sedang diproses

- iii. Nilai output kasar **Perkhidmatan** ditakrifkan dengan memasukkan perkara berikut:

**Pendapatan daripada perkhidmatan yang diberikan**

- + Nilai jualan barangan yang dibeli untuk dijual semula
- + Perkhidmatan pengurusan
- + Komisen dan pembrokeran yang diterima
- + Yuran yang diterima daripada keahlian
- + Pendapatan daripada sewa yang diterima kecuali tanah
- + Pendapatan operasi lain
- + Cukai perkhidmatan dan caj perkhidmatan
- Nilai barang yang dibeli untuk dijual semula dalam keadaan sama seperti dibeli
- + Stok akhir
- Stok awal

## 8. Nilai input perantaraan

i. Nilai input perantaraan **Pertanian** (tanaman, ternakan, perhutanan & pembalakan dan perikanan) dikirakan daripada item-item berikut:

- + Kos bahan langsung yang digunakan dalam aktiviti pertanian
- + Jumlah bayaran ke atas kerja-kerja pertanian yang dibuat oleh pihak lain
- + Kos biji/ benih tanaman jangka pendek/ anak ternakan bukan baka
- + Perbelanjaan untuk aktiviti pertanian lain
- + Bahan dan bekas pembungkus yang digunakan
- + Bahan yang digunakan bagi pembaikan dan penyelenggaraan
- + Alat tulis dan bekalan pejabat yang digunakan
- + Air yang dibeli
- + Tenaga elektrik yang dibeli
- + Bahan pembakar, pelincir dan gas yang digunakan
- + Bayaran pembaikan dan penyelenggaraan semasa yang dibuat oleh pihak lain bagi harta tetap pertubuhan ini
- + Pengangkutan barangan (pengangkutan keluar)
- + Perbelanjaan perjalanan
- + Bayaran perakaunan, kesetiausahaan dan audit
- + Perbelanjaan pengiklanan dan promosi
- + Bayaran guaman
- + Bayaran perkhidmatan profesional lain
- + Bayaran pengurusan
- + Komisen dan bayaran agensi
- + Bayaran telekomunikasi
- + Bayaran pos (termasuk perkhidmatan kurier)
- + Caj bank
- + Premium insurans dibayar ke atas bangunan, jentera, alat pengangkutan dan barangan
- + Bayaran bagi perkhidmatan keselamatan
- + Bayaran pemprosesan data dan lain-lain perkhidmatan yang berkaitan dengan teknologi maklumat
- + Bayaran sewa (tidak termasuk bagi sewa untuk penggunaan tanah)
- + Perbelanjaan ke atas agro pelancongan
- + Bayaran royalti: Organisasi bukan kerajaan/ tajaan korporat
- + Cukai Barang dan Perkhidmatan pada pembelian bersih yang tidak boleh d  
sebagai cukai input

- + Bayaran kepada pengarah tidak bekerja kerana kehadiran mereka dan mesyuarat Lembaga Pengarah
- + Perbelanjaan lain: Input
- + Nilai pakaian percuma yang disediakan
- + Kos latihan kepada pekerja

ii. Nilai Input perantaraan **Perlombongan & Pengkuarian, Pembuatan dan Pembinaan** ditakrifkan dengan memasukkan unsur berikut :

### **Nilai bahan dan bekalan yang digunakan**

- + Kos kerja perindustrian (memproses) yang dibuat oleh orang lain
- + Kos bahan dan bekas pembungkus yang digunakan
- + Tenaga elektrik dan air yang dibeli
- + Nilai bahan pembakar, pelincir dan gas yang digunakan
- + Kos bahan yang digunakan bagi pembaikan dan penyelenggaraan harta tetap (termasuk pembayaran kepada pihak lain ke atas kerja ini)
- + Pembayaran terhadap perkhidmatan bukan perindustrian (termasuk bayaran bagi pengangkutan keluar barangan, perjalanan, pengurusan perundangan, teknologi maklumat, pengiklanan, bank, pos telekomunikasi, dll.)
- + Semua kos input lain (termasuk kos latihan dan nilai pakaian percuma yang disediakan kepada pekerja)

iii. Nilai Input perantaraan **perkhidmatan** ditakrifkan dengan memasukkan unsur berikut :

### **Pembelian barangan, bahan dan perkhidmatan**

- + Premium insurans
- + Royalti dan paten
- + Caj bank
- + Pembelian elektrik dan air
- + Pembelian bahan pembakar, pelincir dan gas
- + Perbelanjaan penyelidikan dan pembangunan
- + Perbelanjaan pematuhan alam sekitar
- + Perbelanjaan operasi lain

## 9. Nilai ditambah

Nilai ditambah ialah tambahan kepada nilai barang dan perkhidmatan yang dikeluarkan oleh sesebuah pertubuhan. Nilai ditambah diperoleh daripada perbezaan antara nilai output kasar dan nilai input perantaraan.

## 10. Bilangan pekerja

Bilangan pekerja dalam sesebuah pertubuhan ditakrifkan sebagai jumlah bilangan orang yang diambil bekerja pada bulan Disember atau pada tempoh pembayaran gaji terakhir bagi tahun rujukan. Bilangan orang yang bekerja adalah seperti yang dijelaskan di perenggan i) dan ii). Termasuk dalam golongan ini ialah pekerja sambilan yang terdapat di dalam daftar gaji dan pekerja yang mogok, berpiket dan bercuti jangka pendek (cuti sakit, cuti rehat atau cuti kecemasan). Tidak termasuk pekerja yang cuti berpanjangan.

## 11. Nilai harta tetap

Harta tetap meliputi semua barangan, baru atau terpakai, ketara atau tidak ketara yang mempunyai hayat produktif lebih daripada setahun. Ia termasuk tanah, bangunan dan struktur, peralatan pengangkutan, komputer dan peralatan periferal, peralatan serta perabot dan pemasangan lain. Nilai harta tetap bagi awal dan akhir tahun 2015 adalah berasaskan nilai buku bersih. Pembelian, pindaan dan pembaikan besar atau perbelanjaan modal pada tahun berkenaan dikira pada nilai sebenar yang dibayar. Nilai harta tetap yang dijual dalam tahun semasa juga dikira pada nilai sebenar.

## 12. Pembundaran

Jumlah bagi komponen-komponen mungkin berbeza daripada jumlah besar di jadual penerbitan ini oleh kerana pembundaran angka.

## 13. Kadar pertumbuhan tahunan dikompaun (CAGR)

Pengiraan kadar pertumbuhan tahunan ( $r$ ) adalah berdasarkan formula berikut:

$$y_t = y_0 (1 + r)^t$$

Penyelesaian bagi  $r$ ,

$$r = \left[ e^{\frac{1}{t} \ln \left( \frac{y_t}{y_0} \right)} - 1 \right] \times 100$$

- Di mana,
- $y_t$  = Nilai pada tahun semasa
  - $y_0$  = Nilai pada tahun sebelum
  - $t$  = Bilangan tahun,  $y_t - y_0$
  - $r$  = Kadar pertumbuhan tahunan

## 14. Simbol dan singkatan

Simbol dan huruf ringkas berikut telah digunakan di dalam keseluruhan penerbitan:

-	tiada
&	dan
%	peratus
}	digabungkan
/	Atau
0.0	Kurang daripada 0.05
dll.	dan lain-lain
n.a	tidak berkaitan
W.P	Wilayah Persekutuan
CAGR	Kadar Pertumbuhan Tahunan Dikompaun
APM	Mekanisme harga automatik
ATF	Bahan bakar jet
Av GAS	Bahan bakar pesawat
CAGR	Kadar Pertumbuhan Tahunan Dikompaun
CHP	Gabungan haba dan kuasa
ESCM	<i>Energy Statistics Compiler Manual</i>
GTL	Gas ke cecair
GWH	Giga watt sejam
IRES	<i>International Recommendations for Energy Statistics</i>
IRIS	<i>International Recommendations of Industrial Statistics</i>
JMG	Jabatan Mineral dan Geosains Malaysia
KDNK	Keluaran dalam negeri kasar
KPDNKK	Kementerian perdagangan dalam negeri dan hal ehwal pengguna
LNG	Gas asli cecair
LPG	Gas petroleum cecair
LPIPM	Lembaga Pembangunan Industri Pembinaan Malaysia
MIDA	Lembaga Kemajuan Perindustrian Malaysia
MOA	Kementerian Pertanian dan Industri Asas Tani
MSIC	Piawaian Klasifikasi Industri Malaysia
MW	Juta watts
NEB	Imbangan tenaga kebangsaan
PKS	Perusahaan kecil dan sederhana

RM	Ringgit Malaysia
RMK	Rancangan Malaysia ke
RON	Nombor penyelidikan oktana
SEDA	Lembaga Pembangunan Tenaga Lestari
SIEC	<i>Standard International Energy Product Classification (SIEC)</i>
SSM	Suruhanjaya Syarikat Malaysia
ST	Suruhanjaya Tenaga
TBB	Tenaga boleh baharu

## 1. **Scope and coverage**

*This census covered all registered establishments engaged in the agriculture, mining and quarrying, manufacturing, construction and services activities. The main source of information for the frame was the Companies Commission of Malaysia (CCM). Apart from the CCM, the frame was also updated from other sources, such as the Malaysian Industrial Development Authority (MIDA), Ministry of Agriculture and Agro-based Industry Malaysia (MOA), Construction Industry Development Board, Malaysia (CIDB), Minerals & Geosciences Department, Malaysia (JMG), Energy Commission (EC), Malaysia, various businesses and trade associations, newspaper advertisements and websites.*

*Entrepreneurs in the Agriculture sector which were registered with the MOA or other government agencies for the purpose of receiving aid were NOT covered in this census.*

*Data Wholesale trade, Retail trade and Motor vehicles have been estimated using data from the Census of Distributive Trade 2014 (reference year 2013). Estimation was done by the average annual growth rate derived from Monthly Distributive Trade, 2010 to 2015.*

## 2. **Source of frame**

*The main source of the census frame was companies registered with the CCM and various businesses and trade associations.*

*The frame was updated with new establishments and to record changes in the status of the establishments, such as closed down, not in operation, change in principle activity and location/ correspondence address to ensure information in the frame was up to date.*

## 3. **Type of business activity**

*Type of business activity refers to principal and secondary activities. The principal activity refers to the activity in which the establishment devoted most of its resources or earns a significant portion of its revenue. Secondary activities are defined as those incidental or ancillary to the principal activity. The industry classification of the establishment refers to the principal activity and was classified according to the **Malaysian Industrial Classification Standards (MSIC)**, 2008 Version 1.0, which developed base on the International Standard Industrial Classification of All Economic Activities (ISIC), Revision 4 by the United Nations.*

## 4. **Concept and definition**

The definition of economic activity adopted in this publication was based on MSIC 2008 version

1.0. Economic activities include:

**i. Agriculture** was defined as:

*Activities of growing, breeding and rearing of animals and production of animal products, harvesting of timber and other plants, as well as capture fishery and aquaculture includes the use/ utilisation of plants/ vegetal and animals natural resources.*

**a. Crops** activities refer to the growing and production of crops, Also include are organic agriculture and the growing of genetically modified crops. Crops also include growing of non-perennial and perennial crops, plant propagation and mixed farming;

**b. Livestock** is animals or bird that preserved for commercial purpose, personal maintenance, breeding and recreation. Livestock production includes raising (farming) and breeding of all animals, except aquatic animal;

**c. Forestry and logging** includes the production of round wood for the forest-based manufacturing industries, as well as the extraction and gathering of wild growing non-wood forest product. Besides the production of timber, forestry activities result in products that undergo little processing, such as fire wood, charcoal, wood chips and round wood used in unprocessed form. These activities can be carried out in natural or planted forests. This also includes carrying out part of the forestry operation on a fee or contract basis; and

**d. Fisheries** refers to catching fish, marine life collection and breeding of ocean, seashore, interior and estuary waters on a commercial basis and for own consumption, but not for sports. Aquaculture refer to the production process involving the culturing or farming (including harvesting) of aquatic organisms using techniques designed to increase the production of the organisms beyond the natural capacity of the environment.

**ii. Mining & quarrying** include the extraction of minerals occurring naturally as solids (coal and ores), liquids (petroleum) or gases (natural gas). Extraction can be achieved

by different methods such as underground or surface mining, well operation, seabed mining, etc.

- a. Mining** is defined as the extraction, dressing and beneficiating of minerals occurring naturally as solids, such as coal and ores; liquids, such as crude oil; or gases, such as natural gas. Mining also includes underground and surface mines, quarries and wells and all supplemental activities for dressing and beneficiating ores and other crude minerals, such as crushing, screening, washing, cleaning, grading, milling, flotation, melting, pelleting, topping and other preparations needed to render the material marketable. Mining activities are classified into groups on the basis of the principal mineral produced.
- b. Quarrying** refers to activity of extraction from a mine or quarry, and also dredging of alluvial deposits, rock crushing and the use of salt marshes. The products are used most notably in construction (e.g. sands, stones, etc.), manufacture of materials (e.g. clay, gypsum, calcium, etc.), manufacture of chemicals, etc. It includes quarrying, rough trimming and sawing of monumental and building stone, such as marble, granite, sandstones, etc., quarrying, crushing and breaking of limestone, mining of gypsum and anhydrite, mining of chalk and unclaimed dolomite, extraction and dredging of industrial sand, sand for construction and gravel, breaking and crushing of stone and gravel, quarrying of sand and mining of clays, refractory clays and kaolin. An activity of it also includes mining of chemical and fertilizer minerals, extraction of peat, extraction of salt, etc.
- c. Petroleum and natural gas** refers to the production of crude petroleum, the mining and extraction of oil from oil shale and oil sands and the production of natural gas and recovery of hydrocarbon liquids. This includes the overall activities of operating and/ or developing oil and gas field properties, including such activities as drilling, completing and equipping wells, operating separators, emulsion breakers, desilting equipment and field gathering lines for crude petroleum and all other activities in the preparation of oil and gas up to the point of shipment from the producing property. It also includes support activities for petroleum and gas extraction, such as oil and gas field services, performed on a fee or contract basis, oil and gas well exploration and test drilling and boring activities newly covered in Economic Census 2016.

- iii. **Manufacturing** is defined as a physical or chemical transformation of materials or components into new products, whether the work is performed by power-driven machines or by hand, whether it is done in a factory or in the worker's home, and whether the products are sold at wholesale or retail.
- iv. **Construction** is defined as a new construction, alteration, repair and demolition. Installation of any machinery or equipment which is built-in at the time of the original construction is included, as well as installation of machinery or equipment after the original construction but which requires structural alteration in order to install.
- v. **Services** is including Electricity, gas, steam and air conditioning supply; Water supply, sewerage, waste management and remediation activities, Wholesale and retail trade, Transportation and storage; Information & communication; Accommodation; Food & beverage, Finance; Real estate; Professional, scientific and technical; Administrative and support services; Education; Health and social work; Art, entertainment and recreation; and Personal services & other activities.
- a. **Water supply, sewerage, waste management and remediation activities** comprised of activities related to waste management, (includes collection, treatment and disposal) such as scheduled waste, solid waste and waste water from industrial and household, including recovery materials and contaminated sites. The waste from the treatment process can be disposed off or used as input for other production process. Related activities in water treatment and supply are also included in this sector;
- b. **Wholesale and retail trade** refer to wholesale trade, retail trade and motor vehicles refers to the resale (sale without transformation) of new and used goods. Wholesale Trade refers to the resale (sale without transformation) of new and used goods to retailers; to industrial, commercial, institutional or professional users; or to other wholesalers; or involves acting as an agent or broker in buying merchandise for, or selling merchandise to such persons or companies. Retail Trade refers to the resale (sale without transformation) of new and used goods to the general public for personal or household consumption or utilization. Motor Vehicles refers to activity related to the wholesale and retail sale of motor vehicles and motorcycles, either new or used, sale of motor vehicle parts and accessories, maintenance and repair

*of motor vehicles and motorcycles including washing, polishing and towing as well as sales by commission agents.*

- c. Transportation and storage** covers all establishment which provides land transport, freight transport by road other land transport, water transport, warehousing & support activities such as storage & warehousing, terminal operations, car parking services, highway operations, port operations, cargo handling/ stevedoring, shipping agencies & forwarding of freight and other supporting activities for transportation;
- d. Information & communication** comprised of motion picture, video and television program production, sound recording and music publishing activities, programming and broadcasting activities, telecommunication services, computer programming, consultancy and related activities and information services activities;
- e. Accommodation** refers to the provision on a fee of short-term lodging, whether open to the general public or restricted to members of a particular organisation;
- f. Food and beverage services** includes food and beverage serving activities providing complete meals or drinks fit for immediate consumption, whether in traditional restaurants, self-service or take-away restaurants, whether as permanent or temporary stands with or without seating;
- g. Financial services** include monetary intermediation activities; other financial service activities and activities auxiliary to financial services; insurance/ takaful, reinsurance/ retakaful and pension & provident funding activities; and activities auxiliary to insurance/ takaful and pension funding;
- h. Real estate services** includes acting as lessors, agents and/ or brokers in one or more of the following: selling or buying real estate, renting real estate, providing other real estate services, such as appraising real estate, property management or acting as real estate escrow agents. Activities in this division may be carried out on own or leased property and may be done on a fee or contract basis. Also included is the building of structures, combined with maintaining ownership of leasing of such structures.

- i. Professional, scientific and technical** includes specialised professional, scientific and technical activities which require a high degree of expertise and training, and specialised knowledge and skills available to users. Activities performed include legal and accounting activities, activities of head offices, management consultancy activities, architecture and engineering activities, technical testing and analysis, scientific research and development, advertising and market research, other professional, scientific and technical activities, veterinary activities;
- j. Administrative and support services** includes a variety of activities that support general business operations including rental and leasing activities, employment activities, travel agency, tour operator and other reservation service activities, security and investigation activities, services to building and landscape activities and office administrative, office support and other business support activities;
- k. Private educational services** refer to establishments registered with the Ministry of Education, Malaysia and the Ministry of Higher Education that provides academic, vocational and commercial educational services. Included in this group are pre primary, primary schools, secondary schools, technical and vocational secondary schools, private university and colleges (including schools of nursing, commercial and other technical institute). Also included are sports and recreation education, cultural education, tuition centres, driving schools which provide automobile educational services, religious instruction, computer training, other schools or other institutions as well as other educational supportive services;
- l. Human health and social work activities** includes hospital services, general and specialised medical services, maternity home services, dental services, dialysis centres, medical laboratories, acupuncture centres, herbalist and homeopathy services and other human health services;
- m. Arts, entertainment and recreation services** includes a wide range of activities to meet varied cultural, entertainment and recreational interests of the general public, including live performances, operation of museum sites, gambling, sport and recreation activities; and
- n. Personal services & other activities** includes activities of membership organisations, activities of business, employers and professional membership

*organisations, activities of trade unions, activities of others membership organisations, repair of computers and personal and household goods and others personal services activities such as washing and dry-cleaning of textiles and fur products; hairdressing and other beauty treatment and funeral and other services activities.*

## **5. Definition of energy products**

*The definitions adopted in this publication are based on the recommendations of the **Standard International Energy Product Classification (SIEC)**. The latest definitions of energy products are as follows:*

### **i. Solid fossil fuels**

#### **a. Hard coal**

*Coals with a gross calorific value (moist, ash-free basis) which is not less than 24MJ/kg or which is less than 24 MJ/kg provided that the coal has a vitrinite mean random reflectance greater than or equal to 0.6 per cent. Hard coal comprises anthracite and bituminous coals.*

#### **b. Brown coal**

*Coals with a gross calorific value (moist, ash-free basis) less than 24 MJ/ kg and a vitrinite mean random reflectance less than 0.6 per cent. Brown coal comprises subbituminous coal and lignite.*

#### **c. Peat**

*A solid fuel formed from the partial decomposition of dead vegetation under conditions of high humidity and limited air access (initial stage of coalification). It is available in two forms for use as a fuel, sod peat and milled peat. Only peat used as fuel is included.*

#### **d. Patent fuel**

*A composition fuel made by moulding hard coal fines into briquette shapes with the addition of a binding agent such as pitch.*

**e. Brown coal briquettes**

*A composition fuel made of brown coal produced by briquetting under high pressure with or without the addition of a binding agent. Either sub-bituminous coal or lignite may be used, including dried lignite fines and dust.*

**f. Peat product**

*This includes products such as peat briquettes derived directly or indirectly from sod peat and milled peat.*

**g. Coal coke**

*This group includes the solid, cellular, infusible material remaining after the carbonisation of certain coals. Various cokes are defined according to the type of coal carbonised and their conditions of carbonisation or use: coke oven coke, gas coke, coke breeze and semi cokes. For collection purposes, coke breeze and semi cokes are included with coke oven coke.*

**h. Coal tar**

*The liquid by-product of the carbonization of coal in coke ovens. Coal tar may be separated by distillation into several liquid products which may be used for pharmaceutical or wood preservative purposes.*

**i. Other coal products**

*Coal products not elsewhere specified (if any).*

**j. Oil shale**

*A sedimentary rock which contains organic matter in the form of kerogen. Kerogen is a waxy hydrocarbon-rich material regarded as a precursor of petroleum. Oil shale may be burned directly or processed by heating to extract shale oil.*

*Note that this product was formerly included under Lignite by the IEA.*

**ii. Liquid fossil fuels**

**a. Conventional crude oil**

*A mineral oil of fossil origin extracted by conventional means from underground reservoirs, and comprises liquid or near-liquid hydrocarbons and associated impurities such as sulphur and metals. Conventional crude oil exists in the liquid*

*phase under normal surface temperature and pressure, and usually flows to the surface under the pressure of the reservoir. This is termed “conventional” extraction.*

*Crude oil includes condensate from condensate fields, and “field” or “lease” condensate extracted with the crude oil. The various crude oils may be classified according to their sulphur content (“sweet” or “sour”) and API gravity (“heavy” or “light”). There are no rigorous specifications for the classifications but a heavy crude oil may be assumed to have an API gravity of less than 20° and a sweet crude oil may be assumed to have less than 0.5% sulphur content. For simplicity this publication refers to conventional crude oil as simply crude oil.*

### **b. Natural gas liquids (NGL)**

*Natural gas liquids are a mixture of ethane, propane, butane (normal and iso), (iso) pentane and a few higher alkanes collectively referred to as pentanes plus. NGL are produced in association with oil or natural gas. They are removed in field facilities or gas separation plants before sale of the gas. All of the components of NGL except ethane are either liquid at the surface or are liquefied for disposal. The definition given above is the most commonly used. However, there is some use of terms based on the vapour pressure of the components which are liquid at the surface or can be easily liquefied.*

*The three resulting groups are in order of increasing vapour pressure: condensates, natural gasoline and liquefied petroleum gas. NGL may be distilled with crude oil in refineries, blended with refined oil products or used directly. NGL differs from LNG (liquefied natural gas) which is obtained by liquefying natural gas from which the NGL has been removed.*

### **c. Additives and oxygenates**

*Compounds added to or blended with oil products to modify their properties (octane, cetane, cold properties, etc.). Examples are:*

- *Oxygenates such as alcohols (methanol, ethanol) and ethers [MTBE (methyl tertiary butyl ether), ETBE (ethyl tertiary butyl ether), TAME (tertiary amyl methyl ether)];*

- Esters (e.g., rapeseed or dimethyl ester, etc.); and
- Chemical compounds (such as TML, TEL and detergents). Some additives/oxygenates may be derived from biomass while others may be of fossil hydrocarbon origin.

#### **d. Other hydrocarbons**

*This includes nonconventional oils and hydrogen. Nonconventional oils refer to oils obtained by nonconventional production techniques, that is oils which are extracted from reservoirs containing extra heavy oils or oil sands which need heating or treatment (e.g., emulsification) in situ before they can be brought to the surface for refining/ processing. It also include the oils extracted from oil sands, extra heavy oils, coal and oil shale which are at, or can be brought to, the surface without treatment and require processing after mining (ex situ processing). Nonconventional oils may also be produced from natural gas. The oils may be divided into two groups:*

- Oils for transformation (e.g., synthetic crudes extracted from extra heavy oils, oil sands, coal and oil shale); and
- Oils for direct use (e.g. emulsified oils such as orimulsion and GTL liquids).

#### **e. Oil products**

*Products obtained from crude oil, non-conventional oils or gases from oil and gas fields. It may be produced through the refining of conventional crude and nonconventional oils or during the separation of natural gas from gases extracted from oil or gas fields.*

*This category includes Aviation gasoline, Motor gasoline, Gasoline-type jet fuel, Kerosene type jet fuel, Other kerosene, Gas/diesel oil, Fuel oil, LPG, Feedstocks, Naphtha, White spirit and SBP, Lubricants, Bitumen, Paraffin waxes, Petroleum coke, Refinery gas, Ethane, and other oil products.*

#### **f. Aviation gasoline**

*Gasoline prepared especially for aviation piston engines with additives which assure performance under flight conditions. Aviation gasolines are predominantly*

alkylates (obtained by combining C<sub>4</sub> and C<sub>5</sub> isoparaffins with C<sub>3</sub>, C<sub>4</sub> and C<sub>5</sub> olefins) with the possible addition of more aromatic components including toluene. The distillation range is 25°C to 170°C.

**g. Motor gasoline**

A mixture of some aromatics (e.g., benzene and toluene) and aliphatic hydrocarbons in the C<sub>5</sub> to C<sub>12</sub> range. The distillation range is 25°C to 220°C. Additives are blended to improve octane rating, improve combustion performance, reduce oxidation during storage, maintain cleanliness of the engine and improve capture of pollutants by catalytic converters in the exhaust system. Motor gasoline may also contain biogasoline products when blended.

**h. Gasoline-type jet fuel**

Light hydrocarbons for use in aviation turbine power units, distilling between 100°C and 250°C. They are obtained by blending kerosene and gasoline or naphtha in such a way that the aromatic content does not exceed 25 per cent in volume and the vapour pressure is between 13.7 kPa and 20.6 kPa. Gasoline-type jet fuel is also known as “aviation turbine fuel”.

**i. Kerosene**

Mixtures of hydrocarbons in the range C<sub>9</sub> to C<sub>16</sub> and distilling over the temperature interval 145°C to 300°C, but not usually above 250°C and with a flash point above 38°C.

The chemical compositions of kerosenes depend on the nature of the crude oils from which they are derived and the refinery processes that they have undergone. Kerosenes obtained from crude oil by atmospheric distillation are known as straight-run kerosenes. Such streams may be treated by a variety of processes to produce kerosenes that are acceptable for blending as jet fuels.

Kerosenes are primarily used as jet fuels. They are also used as domestic heating and cooking fuels, and as solvents. Kerosenes may include components or additives derived from biomass when blended.

- **Kerosene-type jet fuel**

*A blend of kerosenes suited to flight conditions with particular specifications, such as freezing point. The specifications are set down by a small number of national standards committees, most notably ASTM (U.S.), MOD (UK), GOST (Russia).*

- **Other kerosene**

*Kerosene which is used for heating, cooking, lighting, solvents and internal combustion engines. Other names for this product are burning oil, vaporizing oil, power kerosene and illuminating oil.*

**j. Gas oil/ diesel oil**

*Gas oils are middle distillates, predominantly of carbon number range C<sub>11</sub> to C<sub>25</sub> and with a distillation range of 160°C to 420°C. The principal marketed products are fuels for diesel engines (diesel oil), heating oils and marine fuel. Gas oils are also used as middle distillate feedstock for the petrochemical industry and as solvents. Also included here is heavy gas oil, which is a mixture of predominantly gas oil and fuel oil which distils in the range of approximately 380°C to 540°C.*

**k. Fuel oil**

*Comprises residual fuel oil and heavy fuel oil. Residual fuel oils have a distillation range of 350°C to 650°C and a kinematic viscosity in the range 6 to 55 cSt at 100°C. Their flash point is always above 60°C and their specific gravity is above 0.95. Heavy fuel oil is a general term describing a blended product based on the residues from various refinery processes.*

*Other names commonly used to describe fuel oil include: bunker fuel, bunker C, fuel oil No. 6, industrial fuel oil, marine fuel oil and black oil.*

*Residual and heavy fuel oil are used in medium to large industrial plants, marine applications and power stations in combustion equipment such as boilers, furnaces and diesel engines. Residual fuel oil is also used as fuel within the refinery.*

**l. Liquefied petroleum gases (LPG)**

*LPG refers to liquefied propane (C<sub>3</sub>H<sub>8</sub>) and butane (C<sub>4</sub>H<sub>10</sub>) or mixtures of both. Commercial grades are usually mixtures of the gases with small amounts of*

*propylene, butylene, isobutene and isobutylene stored under pressure in containers. The mixture of propane and butane used varies according to purpose and season of the year. The gases may be extracted from natural gas at gas separation plants or at plants regasifying imported liquefied natural gas. They are also obtained during the refining of crude oil. LPG may be used for heating and as a vehicle fuel. See also the definition for natural gas liquids. Certain oil field practices also use the term LPG to describe the high vapour pressure components of natural gas liquids.*

**m. Ethane**

*A naturally straight-chain hydrocarbon (C<sub>2</sub>H<sub>6</sub>). Ethane is obtained at gas separation plants or from the refining of crude oil. It is a valuable feedstock for petrochemical manufacture.*

**n. Refinery gas**

*Includes a mixture of noncondensable gases mainly consisting of hydrogen, methane, ethane and olefins obtained during distillation of crude oil or treatment of oil products (e.g., cracking) in refineries or from nearby petrochemical plants. It is used mainly as a fuel within the refinery.*

**o. Feedstocks**

*This includes refinery feedstocks, i.e. oils or gases from crude oil refining or the processing of hydrocarbons in the petrochemical industry which are destined for further processing in the refinery excluding blending. Typical feedstocks include naphthas, middle distillates, pyrolysis gasoline and heavy oils from vacuum distillation and petrochemical plants.*

**p. Naphtha**

*Light or medium oils distilling between 30°C and 210°C which do not meet the specification for motor gasoline. Different naphthas are distinguished by their density and the content of paraffins, isoparaffins, olefins, naphthenes and aromatics. The main uses for naphthas are as feedstock for high octane gasolines and the manufacture of olefins in the petrochemical industry.*

## **q. White spirit and SBP industrial spirits**

*White spirit and special boiling point industrial spirits (SBP) are refined distillate intermediates with a distillation in the naphtha/ kerosene range. They are mainly used for non-fuel purposes and sub-divided as:*

- *White spirit - an industrial spirit with a flash point above 30°C and a distillation range of 135°C to 200°C; and*
- *Industrial spirit (SBP) - light oils distilling between 30°C and 200°C.*

*There are 7 or 8 grades of industrial spirits, depending on the position of the cut in the distillation range. The grades are defined according to the temperature difference between the 5 per cent and 90 per cent volume distillation points (which is not more than 60°C). White spirit and Industrial spirits are mostly used as thinners and solvents.*

## **r. Lubricants**

*Oils, produced from crude oil, for which the principal use is to reduce friction between sliding surfaces and during metal cutting operations. Lubricant base stocks are obtained from vacuum distillates which result from further distillation of the residue from atmospheric distillation of crude oil. The lubricant base stocks are then further processed to produce lubricants with the desired properties.*

## **s. Bitumen**

*A solid, semi-solid or viscous hydrocarbon with a colloidal structure, being brown to black in colour. It is obtained as a residue in the distillation of crude oil and by vacuum distillation of oil residues from atmospheric distillation. It should not be confused with the nonconventional primary extra heavy oils which may also be referred to as bitumen.*

*In addition to its major use for road pavements, bitumen is also used as an adhesive, a waterproofing agent for roof coverings and as a binder in the manufacture of patent fuel. It may also be used for electricity generation in specially designed power plants.*

*Bitumen is also known in some countries as asphalt but in others asphalt describes the mixture of bitumen and stone aggregate used for road pavements.*

### **t. Paraffin waxes**

*Residues extracted when dewaxing lubricant oils. The waxes have a crystalline structure which varies in fineness according to the grade, and are colourless, odourless and translucent, with a melting point above 45°C. Paraffin waxes are also known as "petroleum waxes".*

### **u. Petroleum coke**

*Petroleum coke is a black solid obtained mainly by cracking and carbonizing heavy hydrocarbon oils, tars and pitches. It consists mainly of carbon (90 to 95 per cent) and has low ash content.*

*The two most important categories are "green coke" and "calcined coke". Green coke (raw coke) is the primary solid carbonization product from high boiling hydrocarbon fractions obtained at temperatures below 630°C. It contains 4-15 per cent by weight of matter that can be released as volatiles during subsequent heat treatment at temperatures up to approximately 1,330°C. Calcined coke is a petroleum coke or coal derived pitch coke obtained by heat treatment of green coke to about 1,330°C. It will normally have a hydrogen content of less than 0.1 per cent by weight.*

*In many catalytic operations (e.g., catalytic cracking) carbon or catalytic coke is deposited on the catalyst, thus deactivating it. The catalyst is reactivated by burning off the coke which is used as a fuel in the refining process. The coke is not recoverable in a concentrated form.*

### **v. Other oil products**

*Products (including partly refined products) from the refining of crude oil and feedstocks which are not specified above. These products will include basic chemicals and organic chemicals destined for use within the refinery or for sale to or processing in the chemical industry such as propylene, benzene, toluene and xylene.*

### **iii. Gaseous fossil fuels**

#### **a. Natural gas**

*A mixture of gaseous hydrocarbons, primarily methane, but generally also including ethane, propane and higher hydrocarbons in much smaller amounts and some non-combustible gases such as nitrogen and carbon dioxide.*

*The majority of natural gas is separated from both "non-associated" gases originating from fields producing hydrocarbons only in gaseous form, and "associated" gas produced in association with crude oil.*

*The separation process produces natural gas by removing or reducing the hydrocarbons other than methane to levels which are acceptable in the marketable gas. The natural gas liquids (NGL) removed in the process are distributed separately.*

*Natural gas also includes methane recovered from coal mines (colliery gas) or from coal seams (coal seam gas) and shale gas. When distributed it may also contain methane from anaerobic fermentation or the methanation of biomass. Natural gas may be liquefied (LNG) by reducing its temperature in order to simplify storage and transportation when production sites are remote from centres of consumption and pipeline transportation is not economically practicable.*

#### **b. Gas works gas (and other manufactured gases for distribution)**

*This includes gases obtained from the carbonisation or gasification of carbonaceous material of fossil or biomass origins in Gas Works. The gases comprise:*

- *Gases obtained from carbonisation or gasification of coals, cokes, biomass or waste;*
- *Substitute natural gas (a methane-rich gas) made from synthesis gas. Synthesis gas is a mixture of mainly hydrogen and carbon monoxide obtained by cracking hydrocarbons with high temperature steam.*

#### **c. Coke oven gas**

*A gas produced from coke ovens during the manufacture of coke oven coke.*

**d. Blast furnace gas**

*The by-product gas of blast furnace operation consisting mainly of nitrogen, carbon dioxide and carbon monoxide. The gas is recovered as it leaves the furnace. Its calorific value arises mainly from the carbon monoxide produced by the partial combustion of coke and other carbon bearing products in the blast furnace. It is used to heat blast air and as a fuel in the iron and steel industry. It may also be used by other nearby industrial plants. Note that where carbonised biomass (e.g., charcoal or animal meal) is used in blast furnaces, part of the carbon supply may be considered renewable.*

**e. Other recovered gases**

*Combustible gases of solid carbonaceous origin recovered from manufacturing and chemical processes not elsewhere defined. Examples of fuel gas production from metals and chemicals processing are in the production of zinc, tin, lead, ferroalloys, phosphorus and silicon carbide.*

**iv. Biofuels and waste**

**a. Fuelwood, wood residues and by products**

*Fuelwood or firewood (in log, brushwood, pellet or chip form) obtained from natural or managed forests or isolated trees. Also included are wood residues used as fuel and in which the original composition of wood is retained. Charcoal and black liquor are excluded.*

**b. Bagasse**

*The fuel obtained from the fibre which remains after juice extraction in sugar cane processing. It is often used as a fuel within the sugar milling industry.*

**c. Charcoal**

*The solid residue from the carbonisation of wood or other vegetal matter through slow pyrolysis.*

**d. Animal waste**

*Excreta of animals, meat and fish residues which, when dry, are used directly as a fuel. This excludes waste used in anaerobic fermentation plants. Fuel gases from these plants are included under biogases.*

**e. Vegetal waste**

*Refers to SIEC's 'Other vegetal materials and residues', which are solid primary biofuels not specified elsewhere, including straw, vegetable husks, ground nut shells, pruning brushwood, olive pomace and other wastes arising from the maintenance, cropping and processing of plants.*

**f. Municipal waste**

*Household waste and waste from companies and public services that resembles household waste and which is collected at installations specifically designed for the disposal of mixed wastes with recovery of combustible liquids, gases or heat. Municipal wastes can be divided into renewable and non-renewable fractions.*

**g. Industrial waste**

*Non-renewable waste which is combusted with heat recovery in plants other than those used for the incineration of municipal waste. Examples are used tires, specific residues from the chemical industry and hazardous wastes from health care. Combustion includes co-firing with other fuels. The renewable portions of industrial waste combusted with heat recovery are classified according to the biofuels which best describe them.*

**h. Black liquor**

*The alkaline-spent liquor obtained from the digesters during the production of sulphate or soda pulp required for paper manufacture. The lignin contained in the liquor burns to release heat when the concentrated liquor is sprayed into a recovery furnace and heated with hot gases at 900°C. Black liquor is used as a fuel in the pulping process.*

**i. Biogasoline**

*Liquid fuels derived from biomass and used in spark-ignition internal combustion engines. Common examples are: bioethanol (including both hydrous and anhydrous ethanol); biomethanol; biobutanol; bio ETBE (ethyl-tertiobutyl-ether); and bio MTBE (methyl-tertio-butylether). Biogasoline may be blended with petroleum gasoline or used directly in engines. The blending may take place in refineries or at or near the point of sale.*

## **j. Biodiesels**

*Liquid biofuels derived from biomass and used in diesel engines. Biodiesels obtained by chemical modification are a linear alkyl ester made by transesterification of vegetable oils or animal fats with methanol. The transesterification distinguishes biodiesel from straight vegetable and waste oils. Biodiesel has a flash point of around 150°C and a density of about 0.88 kg/litre. Biological sources of biodiesel include, but are not limited to, vegetable oils made from canola (rapeseed), soybeans, corn, oil palm, peanut or sunflower. Some liquid biofuels (straight vegetable oils) may be used without chemical modification and their use usually requires modification of the engine. A further category of diesel fuels can be produced by a range of thermal processes (including for example gasification followed by Fischer Tropsch synthesis, pyrolysis followed by hydrogenation, or conversion of sugar to hydrocarbons using microorganisms (e.g. yeast)). A wide range of biomass feedstocks, including cellulosic materials and algal biomass could be used in such processes. Biodiesels may be blended with petroleum diesel or used directly in diesel engines.*

## **k. Bio jet kerosene**

*Liquid biofuels derived from biomass and blended with or replacing jet kerosene. Bio jet kerosene can be produced by a range of thermal processes (including for example gasification followed by Fischer-Tropsch synthesis, pyrolysis followed by hydrogenation, or conversion of sugar to hydrocarbons using microorganisms (e.g. yeast). A wide range of biomass feedstocks, including cellulosic materials and algal biomass could be used in such processes.*

## **l. Other liquid biofuels**

*Includes liquid biofuels not elsewhere specified.*

## **m. Biogases**

*Gases arising from the anaerobic fermentation of biomass and the gasification of solid biomass (including biomass in wastes). The biogases from anaerobic fermentation are composed principally of methane and carbon dioxide and comprise landfill gas, sewage sludge gas and other biogases from anaerobic fermentation. Biogases can also be produced from thermal processes (by gasification or pyrolysis) of biomass and are mixtures containing hydrogen and carbon monoxide (usually known as syngas) along with other components. These*

*gases may be further processed to modify their composition and can be further processed to produce substitute natural gas. The gases are divided into two groups according to their production: biogases from anaerobic fermentation and biogases from thermal processes. Biogases are used mainly as a fuel but can be used as a chemical feedstock.*

## **v. Electricity and heat**

### **a. Electricity**

*The transfer of energy through the physical phenomena involving electric charges and their effects when at rest and in motion.*

*Electricity can be generated through different processes such as: the conversion of energy contained in falling or streaming water, wind or waves; the direct conversion of solar radiation through photovoltaic processes in semiconductor devices (solar cells); or by the combustion of fuels. Electricity production refers to gross production, which is the sum of the electrical energy production by all the generating units/installations concerned (including pumped storage) measured at the output terminals of the main generators.*

**b. Primary electricity** *refers to electrical energy from hydro, solar photovoltaic, wind, tide, wave and ocean sources.*

**c. Secondary electricity** *is defined as electricity derived from a product already accounted for within energy statistics. This includes electricity generated from combustible fuels, in addition to electricity coming from solar heat, nuclear heat, geothermal heat and heat from chemical sources.*

### **d. Main activity producers**

*These are enterprises which produce electricity or heat as their principal activity. Formerly known as public utilities, these enterprises may be privately or publicly owned companies.*

### **e. Autoproducers (electricity)**

*These are enterprises which produce electricity but for whom the production is not their principal activity.*

**f. Autoproducers (heat)**

*These are enterprises which produce heat for sale but for whom the production is not their principal activity. Deliveries of fuels for heat generated by an establishment for its own purposes are classified within the part of final consumption where they are consumed, and not as transformation inputs.*

**g. Heat**

*The energy obtained from the translational, rotational and vibrational motion of the constituents of matter, as well as changes in its physical state.*

*Heat can be produced by different production processes, both primary and secondary. It is usually sold in the form of steam or hot water, and for the purposes of energy statistics it is important to note that heat only represents quantities of energy for sale (or generated and consumed directly by direct use of solar thermal or geothermal). This means that any quantities “generated” at an end-use site (for example through the combustion of coal to power a boiler, or an electric filament heating a kettle) are not considered within the scope of heat production.*

**h. Uranium production**

*Comprises the U content of uranium ores and concentrates intended for treatment for uranium recovery.*

**vi. Energy flow definitions**

**a. Production** is defined as the capture, extraction or manufacture of fuels or energy in forms which are ready for general use. In energy statistics, two types of production are distinguished, primary and secondary.

- **Primary production** is the capture or extraction of fuels or energy from natural energy flows, the biosphere and natural reserves of fossil fuels within the national territory in a form suitable for use. Inert matter removed from the extracted fuels and quantities reinjected, flared or vented are not included. The resulting products are referred to as “primary” products.
- **Secondary production** is the manufacture of energy products through the process of transformation of primary fuels or energy. The quantities of secondary fuels reported as production include quantities lost through venting

*and flaring during and after production. In this manner, the mass, energy and carbon within the primary source(s) from which the fuels are manufactured may be balanced against the secondary fuels produced. Fuels, electricity and heat produced are usually sold but may be partly or entirely consumed by the producer (but see the definition of autoproducer heat plants for an important exception.)*

- b. Imports** of energy products comprise all fuel and other energy products entering the national territory. Goods simply being transported through a country (goods in transit) and goods temporarily admitted are excluded but re-imports, which are domestic goods exported but subsequently readmitted, are included. The bunkering of fuel outside the reference territory by national merchant ships and civil aircraft engaged in international travel is excluded from imports.

*Fuels delivered to national merchant ships and civil aircraft which are outside of the national territory and are engaged in international travel should be classified as “International Marine” or “Aviation Bunkers”, respectively, in the country where such bunkering is carried out. Note that the “country of origin” of energy products should be recorded as a country from which goods were imported.*

- c. Exports** of energy products comprise all fuel and other energy products leaving the national territory with the exception that exports exclude quantities of fuels delivered for use by merchant (including passenger) ships and civil aircraft, of all nationalities, during international transport of goods and passengers. Goods simply being transported through a country (goods in transit) and goods temporarily withdrawn are excluded but re-exports, foreign goods exported in the same state as previously imported, are included.

*Fuels delivered to foreign merchant ships and civil aircraft engaged in international travel are classified as “International Marine” or “Aviation Bunkers”, respectively. Note that “country of destination” of energy products (that is country of the last known destination as it is known at the time of exportation) should be recorded as a country to which these products are exported to.*

*For electricity, trade data include “goods in transit”, i.e. electricity transmitted through the country from one neighbour to another, as there is no practical way of*

*discerning which quantities are re-exported and which are consumed by the transit country.*

**d. International Marine Bunkers** *are quantities of fuels delivered to merchant (including passenger) ships, of any nationality, for consumption during international voyages transporting goods or passengers. International voyages take place when the ports of departure and arrival are in different national territories. Fuels delivered for consumption by ships during domestic transportation, fishing or military uses are not included here. For the purposes of energy statistics International Marine Bunkers are not included in exports.*

**e. International Aviation Bunkers** *are quantities of fuels delivered to civil aircraft, of any nationality, for consumption during international flights transporting goods or passengers. International flights take place when the ports of departure and arrival are in different national territories. Fuels delivered for consumption by aircraft undertaking domestic or military flights are not included here. For the purposes of energy statistics International Aviation Bunkers are not included in exports.*

**f. Stocks**

*For the purposes of energy statistics, stocks are quantities of energy products that are held on the national territory and can be used to:*

- maintain service under conditions where supply and demand are variable in their timing or amount due to normal market fluctuations*
- supplement supply in the case of a supply disruption. Stocks used to manage a supply disruption may be called "strategic" or "emergency" stocks and are often held separately from stocks designed to meet normal market fluctuations. Stock changes are defined as the increase (stock build) or decrease (stock draw) in the quantity of stock over the reporting period and are thus calculated as the difference between the closing and opening stocks.*

**g. Energy supply** *is defined as energy production plus imports minus exports minus international marine bunkers minus international aviation bunkers minus stock changes. Production can refer to either primary, secondary, or both primary and secondary production (see the note under production above).*

- h. Energy industries own use** refers to consumption of fuels and energy for the direct support of the production, and preparation for use of fuels and energy. Quantities of fuels which are transformed into other fuels or energy are not included here but within the transformation use. Neither are quantities which are used within parts of the energy industry not directly involved in the activities listed in the definition. These quantities are reported within final consumption.
- i. Final Consumption** refers to all fuel and energy that is delivered to users for both their energy and non-energy uses which do not involve a transformation process.

## **vii. Capacities**

- a. Refinery capacity** is the theoretical maximum capacity of crude oil refineries available for operation at the end of the reference year.
- b. Net maximum electrical capacity** is the maximum active power that can be supplied continuously, with all plants running, at the point of outlet (i.e., after taking the power supplies for the station auxiliaries and allowing for the losses in those transformers considered integral to the station). This assumes no restriction of interconnection to the network. Does not include overload capacity that can only be sustained for a short period of time (e.g., internal combustion engines momentarily running above their rated capacity). The net maximum electricity-generating capacity represents the sum of all individual plants' maximum capacities available to run continuously throughout a prolonged period of operation in a day.

## **viii. Energy resources and reserves**

### **a. Hard Coal, Brown coal and Peat**

*Proved amount in place is the resource remaining in known deposits that has been carefully measured and assessed as exploitable under present and expected local economic conditions with existing available technology.*

*Proved recoverable reserves are the tonnage within the proved amount in place that can be recovered in the future under present and expected local economic conditions with existing available technology.*

*Estimated additional amount in place is the indicated and inferred tonnage additional to the proved amount in place that is of foreseeable economic interest. It includes estimates of amounts which could exist in unexplored extensions of known deposits or in undiscovered deposits in known coal-bearing areas, as well as amounts inferred through knowledge of favourable geological conditions. Speculative amounts are not included.*

### **b. Crude Oil and Natural Gas Liquids**

*Proved recoverable reserves are the quantity within the proved amount in place that can be recovered in the future under present and expected local economic conditions with existing available technology. Proved amount in place is the resource remaining in known natural reservoirs that has been carefully measured and assessed as exploitable under present and expected local economic conditions with existing available technology.*

*The ratio of crude oil reserves to production (R/P ratio) is used to show the length of time those reserves would last in years if production continued at the then-current level and there were no further increases in the proved recoverable reserves. The ratio is calculated by dividing the proved recoverable crude oil and NGL reserves (which for the most part refer to reserves at the end of 2014) by the production. These R/P ratios should be viewed with caution. The definition used for proved recoverable reserves is very restrictive and confined to those known reserves which can be recovered with reasonable certainty under existing economic conditions.*

*The R/P ratios, therefore, can frequently give a very pessimistic impression of the expected life of a country's reserves. In addition, for some of those countries whose R/P ratios appear very large, it can reasonably be assumed that the figures for proved recoverable reserves include some unproved reserves.*

### **c. Oil Shale and Bituminous Sands**

*Proved recoverable reserves are the amount, expressed as tonnage of recoverable synthetic oil that has been both carefully measured and has also been assessed as exploitable under present and expected local economic conditions with existing available technology.*

**d. Natural Gas**

*Proved recoverable reserves are the volume within the proved amount in place that can be recovered in the future under present and expected local economic conditions with existing available technology.*

**e. Uranium**

*Reasonably assured resources refer to recoverable uranium that occurs in known mineral deposits of delineated size, grade and configuration such that the quantities which could be recovered within the given production cost ranges with currently proven mining and processing technology can be specified. Estimates of tonnage and grade are based on specific sample data and measurements of the deposits and on knowledge of deposit characteristics.*

**f. Inferred Resources** *refer to recoverable uranium (in addition to reasonably assured resources) that is inferred to occur, based on direct geological evidence, in extensions of well-explored deposits and in deposits in which geological continuity has been established, but where specific data and measurements of the deposits and knowledge of their characteristics are considered to be inadequate to classify the resource as reasonably assured resources.*

**g. Hydropower**

*Gross theoretical capability is the annual energy potentially available in the country if all natural flows were turbined down to sea level or to the water level of the border of the country (if the water course extends into another country) with 100% efficiency from the machinery and driving water-works. Unless otherwise stated, the figures have been estimated on the basis of atmospheric precipitation and water runoff.*

**6. Reporting unit**

*The reporting unit used in this census was **establishment**. An establishment was defined as “an economic unit that engaged in one activity, under a single legal entity and operating in a single physical location”. Each establishment was assigned an industry classification based on its principal activity.*

*Each branch of a multi-branch organisation at a different location was conceptually treated as a different establishment. The establishment was requested to give separate returns for each*

activity in terms of value. However, if in practice, the accounts were centrally kept such that it was not possible to obtain separate data for each individual unit or branch, the entity or enterprise was treated as a single reporting unit and allowed to submit a consolidated questionnaire covering all units or branches.

## 7. Value of gross output

- i. The value of gross output of **Agriculture** is defined to include the following items:

### **Sales of agriculture product**

- + Stocks of agricultural products (closing)
- + Goods in progress and stocks of finished goods (owned manufactured) (closing)
- + Sales from agricultural products
- + Income from agricultural work done for others
- + Income from products processed from agricultural
- + Value of sales from goods/ materials/ products related to agriculture that is purchased for resale without further processing
- + Other income related to agriculture
- + Income from other agricultural activities
- + Forestry area sub-contracted to contractors (Forestry & Logging only)
- + Royalties, copyrights, licensing and franchise fees
- + Rental income received
- + Income received from agro tourism (Crops/ Livestock/ Fisheries)
- + Value of sales from non-agricultural goods that is purchased for resale without further processing
- + All other income: Output
- + Research and development expenditure (In House)
- Rental income received: Land
- Stocks of agricultural products (opening)
- Goods in progress and stocks of finished goods (owned manufactured) (opening)
- Cost of goods/ materials/ products related to planting activity, purchased for resale without under going

- *further processing*
  - *Cost of goods/ materials sold (non-agricultural goods/ material that is purchased for resale without under going further processing)*
- ii.** *The value of gross output of **Mining & Quarrying, Manufacturing and Construction** is defined to include the following items*

**Sale of mineral/quarry products/manufactured products and construction work done**

- + *Values of goods sold in the same condition as purchased*
  - *Cost of goods sold in the same condition as purchased*
  - + *Capital expenditure on own construction*
  - + *Income from industrial services rendered to others*
  - + *Income from industrial work done*
  - + *Receipt from scrap, electricity, waste product, etc. sold to others*
  - + *Receipt from commission and brokerage earned*
  - + *All other output (such as receipts of non-industrial services, e.g. management fees received, income from rental of property, etc.)*
  - + *Research & development expenditure (In-house)*
  - + *Closing stock of finished goods*
  - *Opening stock of finished goods*
  - + *Closing stock of goods being processed*
  - *Opening stock of goods being processed*
- iii.** *The value of gross output of **Services** is defined to include the following items:*
- Income from services rendered**
- + *Value of goods sold in the same condition as purchased*
  - + *Management services*
  - + *Commission and brokerage earned*
  - + *Fees earned from membership*
  - + *Rental income received except land rental*

- + *Other operating income*
- + *Service tax and services charges*
- *Value of goods purchased for resale in the same condition*
- + *Closing stocks*
- *Opening stocks*

## 8. **Reporting unit**

i. *Value of intermediate input of **Agriculture** (crops, livestock, forestry & logging and fisheries) is defined to include the following items:*

- + *Cost of direct materials consumed in agriculture*
- + *Total payment on agricultural work done by other establishments*
- + *Cost of non-perennial crops seeds/non-breeder livestock and fisheries*
- + *Expenditure for other agricultural activities*
- + *Packing materials consumed*
- + *Materials used for repairs and maintenance*
- + *Stationery and office supplies consumed*
- + *Electricity purchased*
- + *Water purchased*
- + *Fuel, lubricants and gas consumed*
- + *Payments for current repairs and maintenance work done by others on the establishment's fixed assets*
- + *Transportation of goods ( carriage outwards)*
- + *Travelling expenses*
- + *Accounting, secretarial and auditing fees*
- + *Advertising and promotional expenses*
- + *Legal fees*
- + *Payment for other professional services*
- + *Management fees*
- + *Commissions and agency fees*
- + *Telecommunication fees*
- + *Postage (include courier services)*
- + *Bank charges*
- + *Insurance premium on building, machinery, transport equipment and goods*
- + *Payment for security services*
- + *Payment for data processing and other services related to information technology*

- + Rental payment (excludes for rent on land)
- + Expenditure on agro tourism
- + Royalties paid to: Non-government organisations / corporate sponsorship
- + GST on net purchasers are not claimable as input tax
- + Fees paid to non-working directors for their attendance at Board of Directors' meetings
- + Other expenses: Input
- + Value of free wearing apparel provided
- + Staff training cost

ii. Value of intermediate input of **Mining & Quarrying, Manufacturing and Construction** are defined to include the following items:

**Value of materials and supplies consumed**

- + Cost of industrial work done by others include stripping overburden (earth removal) and internal transport in mines/ quarries site
- + Cost of packing materials & containers consumed
- + Electricity and water purchased
- + Value of fuels, lubricants and gas consumed
- + Cost of materials used for repairs and maintenance of assets (including payments to others for this work)
- + Payments for non-industrial services such as toll, ferry, pilotage, towage and harbour fees and charges (including payments for carriage outwards, travelling, management fees, legal services, information technology, advertising, bank charges, postage, telecommunication, etc.
- + All other input costs (including training and value of the free apparel provided for the workers)

iii. Value of intermediate input of **Services** is defined to include the following items:

**Purchase of goods, materials and services**

- + Insurance premiums
- + Royalty and patent fees
- + Bank charges
- + Purchase of electricity and water

- + *Purchase of fuels, lubricants and gas*
- + *Research and development expenditure*
- + *Environmental compliance expenditure*
- + *Other operating expenditure*

## **9. Value added**

*Value added is the increment to the value of commodities and services contributed by the establishment. This value added is derived as the difference between the value of gross output and intermediate input.*

## **10. Number of persons engaged**

*Number of persons engaged in an establishment is defined as the total number of persons employed during December or the last pay period of the reference year. The number of persons engaged includes all working proprietors and active business partners, unpaid family workers and paid employees as defined in paragraphs i) and ii). Included are part-time workers in the payroll and persons on strike, picket and short-term leave (sick, vacation or emergency leave) excluding workers on indefinite leave.*

## **11. Value of fixed assets**

*Fixed assets cover all goods, new or used, tangible or intangible that has a normal economic life span of more than one year. Included are land, buildings and structure, transport equipment, computer and peripheral equipment, other machinery, equipment and furniture and fittings. Value of assets as at the beginning and end of 2015 was based on net book value. Purchases, alterations and major repairs or capital expenditure during the year were valued at actual costs incurred. Value of fixed assets sold during the year refers to the realised value.*

## **12. Rounding**

*The sum of components may not add up to the total in the tables presented in this publication due to rounding.*

### 13. Compound annual growth rate (CAGR)

The calculation of annual growth rate ( $r$ ) is based on the following formula :

$$y_t = y_0 (1 + r)^t$$

Solving for  $r$ ,

$$r = \left[ e^{\frac{1}{t} \ln\left(\frac{y_t}{y_0}\right)} - 1 \right] \times 100$$

Where,	$y_t$	=	Value at current year
	$y_0$	=	Value at previous year
	$t$	=	Number of years, $y_t - y_0$
	$r$	=	Annual growth rate

### 14. Symbols & abbreviations

The following symbols and abbreviations have been used throughout the publication:

-	nil
&	and
%	per cent
}	combined
/	or
0.0	Less than 0.05
etc.	et cetera
n.a	not applicable
APM	Automatic price mechanism
ATF	Aviation turbine fuel
Av GAS	Aviation fuel
CAGR	Compounded Annual Growth Rate
CCM	Companies Commission of Malaysia
CHP	Combined heat and power
CIDB	Construction Industry Development Board
EC	Energy Commission
ESCM	Energy statistics compilers manual
GDP	Gross Domestic Product
GTL	Gas-to-liquids
GWH	Gigowatts hours
IRES	International Recommendations for Energy Statistics
IRIS	International Recommendations of Industrial Statistics
JMG	Minerals and Beosciences Department, Malaysia

<i>KPNKK</i>	<i>Ministry of Domestic Trade and Consumer Affairs</i>
<i>LNG</i>	<i>Liquefied natural gas</i>
<i>LPG</i>	<i>Liquefied petroleum gas</i>
<i>MIDA</i>	<i>Malaysia Industrial Development Authority</i>
<i>MOA</i>	<i>Ministry of Agriculture and Agro-based Industry Malaysia</i>
<i>MP</i>	<i>Malaysia plan</i>
<i>MSIC</i>	<i>Malaysia Standard Industri Classification</i>
<i>MW</i>	<i>Million watts</i>
<i>NEB</i>	<i>National energy balance</i>
<i>RES</i>	<i>Renewable energy sources</i>
<i>RM</i>	<i>Ringgit Malaysia</i>
<i>RON</i>	<i>Research Octane Number</i>
<i>SEDA</i>	<i>Sustainable Energy Development Outhority</i>
<i>SIEC</i>	<i>Standard International Energy Product Classification (SIEC)</i>
<i>SME</i>	<i>Small and medium enterprise</i>
<i>W.P</i>	<i>Wilayah Persekutuan</i>

