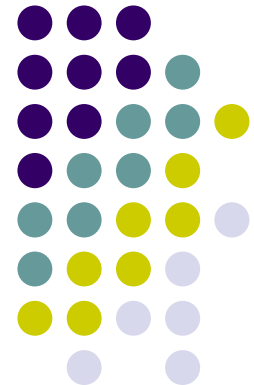


# APEC Energy Balances

## Workshop on Energy Statistics and Energy Balance

Berjaya Times Square Hotel  
Kuala Lumpur  
5 December 2011

E. Barcelona  
EDMMC/IEEJ



# Outline

- The APEC Energy Database
- The APEC Energy Balances
  - Description
  - Differences with Malaysian national energy balance
  - Data Collection
  - Processing
  - Review
  - Analysis
- Differences with National Energy Balances
- Why are Energy Balances Important?

# The APEC Energy Database

- <http://www.ieej.or.jp/egeda/>
- **Open to the public**
  - Annual energy balances and statistics of 21 APEC member economies from 1980 (for most economies)
  - Quarterly energy supply data from 1994 of most of the 21 APEC member economies
  - Monthly Oil (JODI Oil) and natural gas (JODI Gas) from 2001 for all APEC economies
- **For members only**
  - Annual CO<sub>2</sub> emissions for all the 21 APEC economies
  - Socio-economic statistics for all 21 member economies
  - Energy related statistics

# The APEC Energy Database



EGEDA under EWG-APEC - Windows Internet Explorer

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**APEC**  
Asia-Pacific  
Economic Cooperation

## EGEDA

under EWG-APEC

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On behalf of the Asia Pacific Energy Research Center (APEREC), the Energy Data and Modelling Center of the Institute of Energy Economics, Japan maintains this web site.

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# Description of the APEC Energy Balances

- **Primary energy supply**
  - Indigenous production, imports and exports, international marine and aviation bunkers, stock changes
- **Transformation**
  - Oil refining
  - Electricity and heat generation
  - Coal transformation
  - Gas processing
  - Others
- **Energy sector use and losses**
  - Energy sector consumption and losses
- **Final energy consumption**
  - Energy consumption by industry, transportation, residential, commercial and other sectors (industry further broken down into major branches)
  - Non-energy consumption
- **Numbers are calculated from net calorific values of each product**

# Differences of APEC Energy Balances and Malaysian National Energy Balance

- **Conversion of primary electricity**
  - APEC methodology assumes 100% efficiency of hydro, wind and solar electricity generation
  - Malaysia uses the average efficiency of thermal power plants which could vary every year
- **Indigenous Production**
  - Indigenous production in APEC definition is the marketable production that is:
    - For crude oil and coal, after removal of impurities
    - For natural gas, excludes gas vented re-injected and flared
  - In Malaysia, gas flared and re-injected are included; for crude oil, there is huge statistical discrepancy in the primary supply (is this because production is wellhead production?)
- **No other major difference**

# Collection of Data for APEC Energy Balances

- **Collected in 5 annual questionnaires since the collection of 2004 data (2006)**
  - Coal – kilotons for solid and  $10^{10}$  kilocalories for coal gases
  - Oil – kilotons for all products
  - natural gas – million cubic meters, kilotons for LNG
  - electricity and heat – GWh for electricity and  $10^{10}$  kilocalories for heat
  - new and renewable energy - kilotons for solid and liquid products and  $10^{10}$  kilocalories for biogases
- **Calorific values or energy content per unit of mass or volume are also collected for the conversion of physical units to energy units**

# Processing of Annual Energy Supply Demand Data

- Upon receipt of the annual questionnaires, the statistical discrepancies are checked. If these are large (greater than 5%), contacts in member economies are notified by email and asked for possible revisions
- Completeness and consistency are also checked referring to previous years' energy balances
  - Check for missing flows, missing products and calorific values
- Efficiency of electricity generation is checked as well as transformation losses or gains
- The 5 questionnaires are then processed into energy balance tables
- For countries, without official data, CO<sub>2</sub> emissions are calculated using the sectoral approach



# Review of Energy Balances

- Growth rates of TPES and TFEC and all other flows
- Transformation gains and losses
- Thermal efficiencies
- Statistical discrepancies
- Completeness

# Data Analysis Using the APEC Energy Balances

- ▶ ● Check on the completeness of the data
- ▶ ● High-level check on the data accuracy as apparent gains in conversion processes or large losses indicate data problems. Allows the user to see the fuel conversion efficiencies
- ▶ ● A natural starting point for the construction of various indicators of energy consumption
- ▶ ● Measure for the degree of dependency of the country to each kind of energy.
- ▶ ● Analysis of environmental impact of the energy use
- ▶ ● Starting point for energy modeling

# Analysis of EBT

## Check for Completeness and Accuracy of Data

Unit:KTOE

	Coal	Coal Products	Crude Oil, NGL and Condensate	Petroleum Products	Gas	Hydro	Nuclear	Geothermal, Solar, etc.	Others	Electricity	Heat	Total
Indigenous Production	354	0	175	0	1,929	2,254	0	0	4,599	0	0	9,310
Imports	2,651	0	11,097	3,935	5,280	0	0	0	0	185	0	23,149
Exports	0	-28	0	-1,836	0	0	0	0	0	0	0	-1,864
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0
International Aviation Bunkers	0	0	0	-689	0	0	0	0	0	0	0	-689
Stock Changes	-79	49	27	-461	-160	0	0	0	0	0	0	-624
<b>Total Primary Energy Supply</b>	<b>2,926</b>	<b>21</b>	<b>11,299</b>	<b>949</b>	<b>7,048</b>	<b>2,254</b>	<b>0</b>	<b>0</b>	<b>4,599</b>	<b>185</b>	<b>0</b>	<b>29,282</b>
Transfers	0	0	0	0	0	0	0	0	0	0	0	0
<b>Total Transformation Sector</b>	<b>-2,471</b>	<b>432</b>	<b>-11,037</b>	<b>10,249</b>	<b>-4,957</b>	<b>-2,254</b>	<b>0</b>	<b>0</b>	<b>-571</b>	<b>4,514</b>	<b>0</b>	<b>-6,096</b>
Main Activity Producer	-1,957	0	0	-820	-2,335	-2,206	0	0	-20	4,209	0	-3,129
Autoproducers	-8	0	0	-117	-377	-48	0	0	-551	305	0	-796
Gas Processing	0	-21	0	0	-2,245	0	0	0	0	0	0	-2,266
Refineries	0	0	-11,037	11,186	0	0	0	0	0	0	0	149
Coal Transformation	-506	453	0	0	0	0	0	0	0	0	0	-53
Petrochemical Industry	0	0	0	0	0	0	0	0	0	0	0	0
Biofuel Processing	0	0	0	0	0	0	0	0	0	0	0	0
Charcoal Processing	0	0	0	0	0	0	0	0	0	0	0	0
Non-specified Transformation	0	0	0	0	0	0	0	0	0	0	0	0
Loss & Own Use	0	0	0	-452	-748	0	0	0	0	-544	0	-1,745
Discrepancy	0	-4	-263	0	-66	0	0	0	0	0	0	-333
<b>Total Final Energy Consumptions</b>	<b>455</b>	<b>449</b>	<b>0</b>	<b>10,747</b>	<b>1,277</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>4,028</b>	<b>4,154</b>	<b>0</b>	<b>21,109</b>
<b>Industry Sector</b>	<b>439</b>	<b>449</b>	<b>0</b>	<b>2,067</b>	<b>768</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1,721</b>	<b>2,800</b>	<b>0</b>	<b>7,628</b>
Iron and Steel	0	449	0	29	20	0	0	0	0	49	0	547
Chemical (incl. Petro-Chemical)	0	0	0	5	9	0	0	0	0	78	0	92
Non Ferrous Metals	0	0	0	0	0	0	0	0	0	0	0	0
Non Metallic Mineral Products	129	0	0	74	26	0	0	0	0	42	0	271
Transportation Equipment	0	0	0	0	0	0	0	0	0	0	0	0
Machinery	0	0	0	0	0	0	0	0	0	0	0	0
Mining and Quarrying	56	0	0	1,171	228	0	0	0	0	1,556	0	3,012
Food, Beverages and Tobacco	80	0	0	14	0	0	0	0	0	9	0	103
Pulp, Paper and Printing	0	0	0	0	0	0	0	0	736	0	0	736
Wood and Wood Products	0	0	0	144	75	0	0	0	0	374	0	593
Construction	0	0	0	0	0	0	0	0	0	0	0	0
Textiles and Leather	0	0	0	0	0	0	0	0	0	0	0	0
Non-specified Industry	173	0	0	624	400	0	0	0	385	692	0	2,273
<b>Transport Sector</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>7,407</b>	<b>31</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>22</b>	<b>0</b>	<b>7,460</b>
Domestic Air Transport	0	0	0	30	0	0	0	0	0	0	0	30
Road	0	0	0	5,534	31	0	0	0	0	0	0	5,565
Rail	0	0	0	18	0	0	0	0	0	22	0	40
Inland Waterways	0	0	0	1,693	0	0	0	0	0	0	0	1,693
Pipeline Transport	0	0	0	0	0	0	0	0	0	0	0	0
Non-specified Transport	0	0	0	132	0	0	0	0	0	0	0	132
<b>Other Sector</b>	<b>16</b>	<b>0</b>	<b>0</b>	<b>1,279</b>	<b>488</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>2,907</b>	<b>1,332</b>	<b>0</b>	<b>6,022</b>
Residential & Commercial	4	0	0	1,173	442	0	0	0	2,907	1,322	0	5,847
Commerce and Public Services	4	0	0	237	87	0	0	0	0	609	0	937
Residential	0	0	0	936	355	0	0	0	2,907	712	0	4,910
Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
Fishing	13	0	0	105	46	0	0	0	0	11	0	175
Non-specified Others	0	0	0	0	0	0	0	0	0	0	0	0
of which Non-Energy Use*	0	213	0	0	2,264	0	0	0	0	0	0	2,478
Electricity Output in GWh	8,397	0	0	1,872	13,137	26,214	0	2,864	0	0	0	52,484

# Analysis of EBT

## Check for Conversion Efficiency

Unit:KTOE

	Coal	Coal Products	Crude Oil, NGL and Condensate	Petroleum Products	Gas	Hydro	Nuclear	Geothermal, Solar, etc.	Others	Electricity	Heat	Total
Indigenous Production	354	0	175	0	1,929	2,254	0	0	4,599	0	0	9,310
Imports	2,651	0	11,097	3,935	5,280	0	0	0	0	185	0	23,149
Exports	0	-28	0	-1,836	0	0	0	0	0	0	0	-1,864
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0
International Aviation Bunkers	0	0	0	-689	0	0	0	0	0	0	0	-689
Stock Changes	-79	49	27	-461	-160	0	0	0	0	0	0	-624
<b>Total Primary Energy Supply</b>	<b>2,926</b>	<b>21</b>	<b>11,299</b>	<b>949</b>	<b>7,048</b>	<b>2,254</b>	<b>0</b>	<b>0</b>	<b>4,599</b>	<b>185</b>	<b>0</b>	<b>29,282</b>
Transfers	0	0	0	0	0	0	0	0	0	0	0	0
<b>Total Transformation Sector</b>	<b>-2,471</b>	<b>432</b>	<b>-11,037</b>	<b>10,249</b>	<b>-4,957</b>	<b>-2,254</b>	<b>0</b>	<b>0</b>	<b>-571</b>	<b>4,514</b>	<b>0</b>	<b>-6,096</b>
Main Activity Producer	-1,957	0	0	-820	-2,335	-2,206	0	0	-20	4,209	0	-3,129
Autoproducers	-8	0	0	-117	-377	-48	0	0	-551	305	0	-796
Gas Processing	0	-21	0	0	-2,245	0	0	0	0	0	0	-2,266
Oil Refineries	0	0	-11,037	11,186	0	0	0	0	0	0	0	149
Coal Transformation	-506	453	0	0	0	0	0	0	0	0	0	-53
Petrochemical Industry	0	0	0	0	0	0	0	0	0	0	0	0
Other Transformation	0	0	0	0	0	0	0	0	0	0	0	0
<b>Loss &amp; Own Use</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>-452</b>	<b>-748</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>-544</b>	<b>0</b>	<b>-1,745</b>
Discrepancy	0	-4	-263	0	-66	0	0	0	0	0	0	-333
<b>Total Final Energy Consumptions</b>	<b>455</b>	<b>449</b>	<b>0</b>	<b>10,747</b>	<b>1,277</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>4,028</b>	<b>4,154</b>	<b>0</b>	<b>21,109</b>
<b>Industry Sector</b>	<b>439</b>	<b>449</b>	<b>0</b>	<b>2,061</b>	<b>758</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1,121</b>	<b>2,800</b>	<b>0</b>	<b>7,628</b>
Iron and Steel	0	449	0	29	20	0	0	0	0	49	0	547
Chemical (incl. Petro-Chemical)	0	0	0	5	9	0	0	0	0	78	0	92
Non Ferrous Metals	0	0	0	0	0	0	0	0	0	0	0	0
Non Metallic Mineral Products	129	0	0	74	26	0	0	0	0	42	0	271
Transportation Equipment	0	0	0	0	0	0	0	0	0	0	0	0
Machinery	0	0	0	0	0	0	0	0	0	0	0	0
Mining and Quarrying	56	0	0	1,171	228	0	0	0	0	1,556	0	3,012
Food, Beverages and Tobacco	80	0	0	14	0	0	0	0	0	9	0	103
Pulp, Paper and Printing	0	0	0	0	0	0	0	0	736	0	0	736
Wood and Wood Products	0	0	0	144	75	0	0	0	0	374	0	593
Construction	0	0	0	0	0	0	0	0	0	0	0	0
Textiles and Leather	0	0	0	0	0	0	0	0	0	0	0	0
Non-specified Industry	173	0	0	624	400	0	0	0	385	692	0	2,273
<b>Transport Sector</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>7,407</b>	<b>31</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>22</b>	<b>0</b>	<b>7,460</b>
Domestic Air Transport	0	0	0	30	0	0	0	0	0	0	0	30
Road	0	0	0	5,534	31	0	0	0	0	0	0	5,565
Rail	0	0	0	18	0	0	0	0	0	22	0	40
Inland Waterways	0	0	0	1,693	0	0	0	0	0	0	0	1,693
Pipeline Transport	0	0	0	0	0	0	0	0	0	0	0	0
Non-specified Transport	0	0	0	132	0	0	0	0	0	0	0	132
<b>Other Sectors</b>	<b>16</b>	<b>0</b>	<b>0</b>	<b>1,279</b>	<b>488</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>2,907</b>	<b>1,332</b>	<b>0</b>	<b>6,022</b>
Residential & Commercial	4	0	0	1,173	442	0	0	0	2,907	1,322	0	5,847
Commerce and Public Services	4	0	0	237	87	0	0	0	0	609	0	937
Residential	0	0	0	936	355	0	0	0	2,907	712	0	4,910
Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
Fishing	13	0	0	105	46	0	0	0	0	11	0	175
Non-specified Others	0	0	0	0	0	0	0	0	0	0	0	0
of which Non-Energy Use*	0	213	0	0	2,264	0	0	0	0	0	0	2,478
Electricity Output in GWh	8,397	0	0	1,872	13,137	26,214	0	0	2,864	0	0	52,484
<b>Thermal Efficiency</b>	<b>36.8%</b>			<b>17.2%</b>	<b>41.7%</b>							

# Analysis of EBT

## Basis for Energy Indicator Analysis

	Coal	Coal Products	Crude Oil, NGL and Condensate	Petroleum Products	Gas							Unit:KTOE
												Total
Indigenous Production	354	0	175	0	0	0	0	0	0	0	0	9,310
Imports	2,651	0	11,097	3,935	0	0	0	0	0	0	0	23,149
Exports	0	-28	0	-1,836	0	0	0	0	0	0	0	-1,864
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0
International Aviation Bunkers	0	0	0	-689	0	0	0	0	0	0	0	-689
Stock Changes	-79	49	27	-461	-160	0	0	0	0	0	0	-624
<b>Total Primary Energy Supply</b>	<b>2,926</b>	<b>21</b>	<b>11,299</b>	<b>949</b>	<b>7,048</b>	<b>2,254</b>	<b>0</b>	<b>0</b>	<b>4,599</b>	<b>185</b>	<b>0</b>	<b>29,282</b>
Transfers	0	0	0	0	0	0	0	0	0	0	0	0
<b>Total Transformation Sector</b>	<b>-2,471</b>	<b>432</b>	<b>-11,037</b>	<b>10,249</b>	<b>-4,957</b>	<b>-2,254</b>	<b>0</b>	<b>0</b>	<b>-571</b>	<b>4,514</b>	<b>0</b>	<b>-6,096</b>
Main Activity Producer	-1,957	0	0	-820	-2,335	-2,206	0	0	-20	4,209	0	-3,129
Autoproducers	-8	0	0	-117	-3	0	0	0	0	0	0	-796
Gas Processing	0	-21	0	0	-2	0	0	0	0	0	0	-2,266
Refineries	0	0	-11,037	11,186	0	0	0	0	0	0	0	149
Coal Transformation	-506	453	0	0	0	0	0	0	0	0	0	-53
Petrochemical Industry	0	0	0	0	0	0	0	0	0	0	0	0
Biofuel Processing	0	0	0	0	0	0	0	0	0	0	0	0
Charcoal Processing	0	0	0	0	0	0	0	0	0	0	0	0
Non-specified Transformation	0	0	0	0	0	0	0	0	0	0	0	0
Loss & Own Use	0	0	0	-452	-7	0	0	0	0	0	0	-1,745
Discrepancy	0	-4	-263	0	-66	0	0	0	0	0	0	-333
<b>Total Final Energy Consumptions</b>	<b>455</b>	<b>449</b>	<b>0</b>	<b>10,747</b>	<b>1,277</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>4,028</b>	<b>4,154</b>	<b>0</b>	<b>21,109</b>
<b>Industry Sector</b>	<b>439</b>	<b>449</b>	<b>0</b>	<b>2,067</b>	<b>758</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1,727</b>	<b>2,800</b>	<b>0</b>	<b>7,628</b>
Iron and Steel	0	449	0	29	20	0	0	0	0	49	0	547
Chemical (incl. Petro-Chemical)	0	0	0	5	9	0	0	0	0	78	0	92
Non Ferrous Metals	0	0	0	0	0	0	0	0	0	0	0	0
Non Metallic Mineral Products	129	0	0	0	0	0	0	0	0	0	0	271
Transportation Equipment	0	0	0	0	0	0	0	0	0	0	0	0
Machinery	0	0	0	0	0	0	0	0	0	0	0	0
Mining and Quarrying	56	0	0	0	0	0	0	0	0	0	0	012
Food, Beverages and Tobacco	80	0	0	0	0	0	0	0	0	0	0	103
Pulp, Paper and Printing	0	0	0	0	0	0	0	0	0	0	0	736
Wood and Wood Products	0	0	0	0	0	0	0	0	0	0	0	593
Construction	0	0	0	0	0	0	0	0	0	0	0	0
Textiles and Leather	0	0	0	0	0	0	0	0	0	0	0	0
Non-specified Industry	173	0	0	624	400	0	0	385	692	0	0	2,273
<b>Transport Sector</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>7,407</b>	<b>31</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>22</b>	<b>0</b>	<b>0</b>	<b>7,460</b>
Domestic Air Transport	0	0	0	30	0	0	0	0	0	0	0	30
Road	0	0	0	5,534	31	0	0	0	0	0	0	5,565
Rail	0	0	0	18	0	0	0	0	22	0	0	40
Inland Waterways	0	0	0	1,693	0	0	0	0	0	0	0	1,693
Pipeline Transport	0	0	0	0	0	0	0	0	0	0	0	0
Non-specified Transport	0	0	0	132	0	0	0	0	0	0	0	132
<b>Other Sector</b>	<b>16</b>	<b>0</b>	<b>0</b>	<b>1,279</b>	<b>488</b>	<b>0</b>	<b>0</b>	<b>2,907</b>	<b>1,332</b>	<b>0</b>	<b>0</b>	<b>6,022</b>
Residential & Commercial	4	0	0	1,173	442	0	0	2,907	1,322	0	0	5,847
Commerce and Public Services	4	0	0	237	87	0	0	0	609	0	0	937
Residential	0	0	0	936	355	0	0	2,907	712	0	0	4,910
Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
Fishing	13	0	0	105	46	0	0	0	11	0	0	175
Non-specified Others	0	0	0	0	0	0	0	0	0	0	0	0
of which Non-Energy Use*	0	213	0	0	2,264	0	0	0	0	0	0	2,478
Electricity Output in GWh	8,397	0	0	1,872	13,137	26,214	0	2,864	0	0	0	52,484

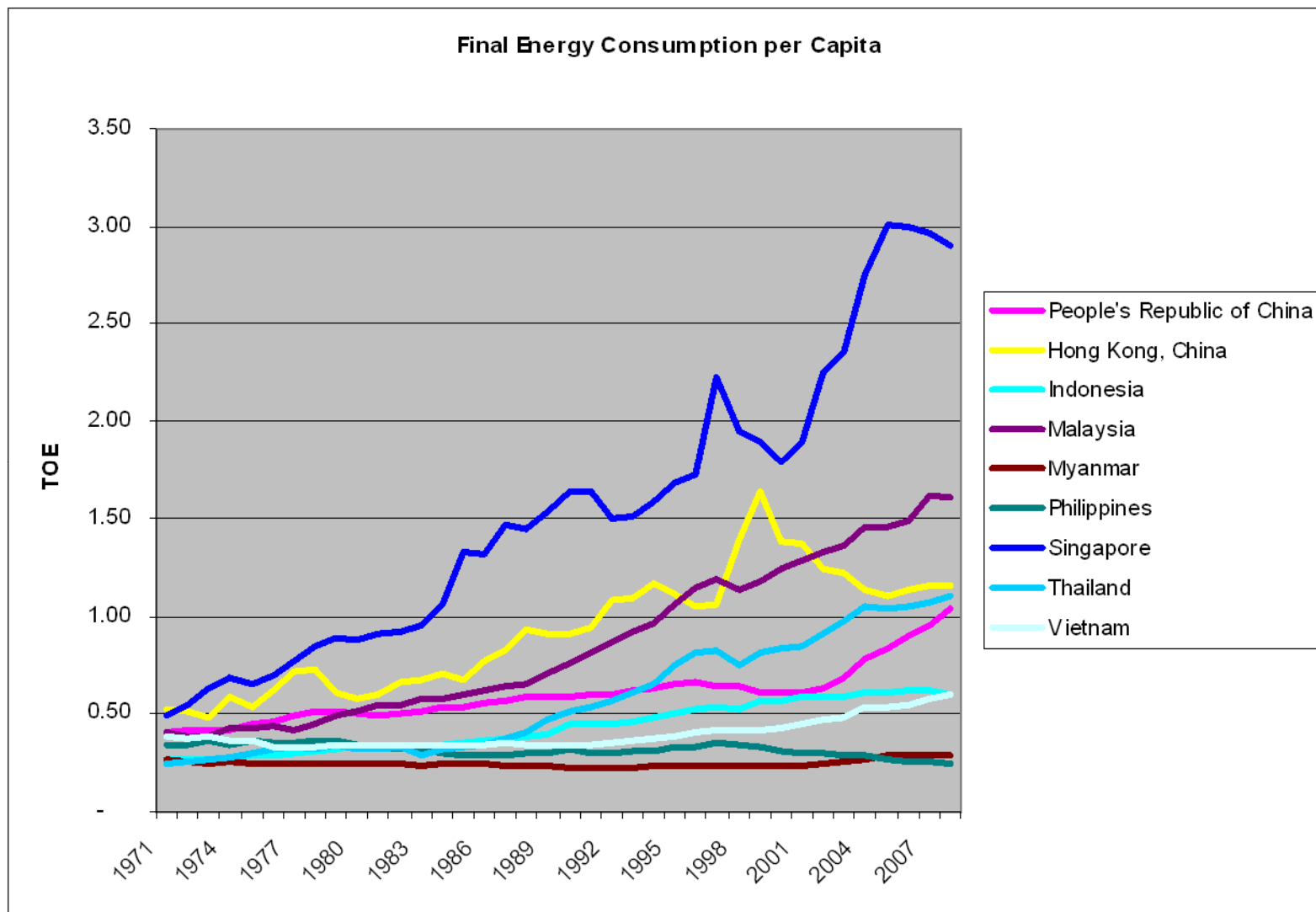
Divide this number with GDP, you get **Energy Intensity**

Divide this number with population, you get **per Capita Final Energy Consumption**

Divide by steel production, you get **Energy Consumption per unit of steel output**

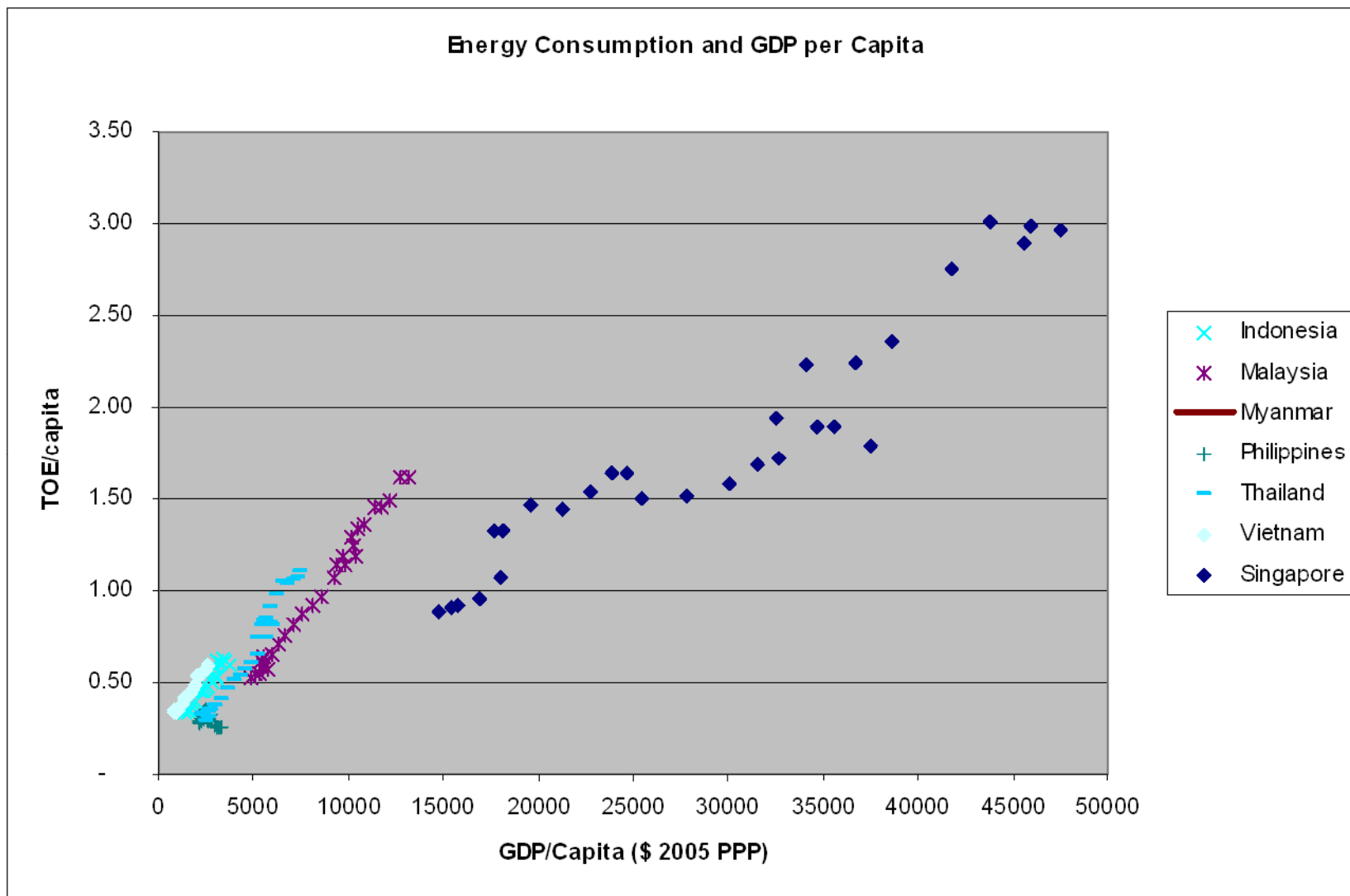
# Energy Indicator Analysis

## Final Energy Consumption of Selected Countries



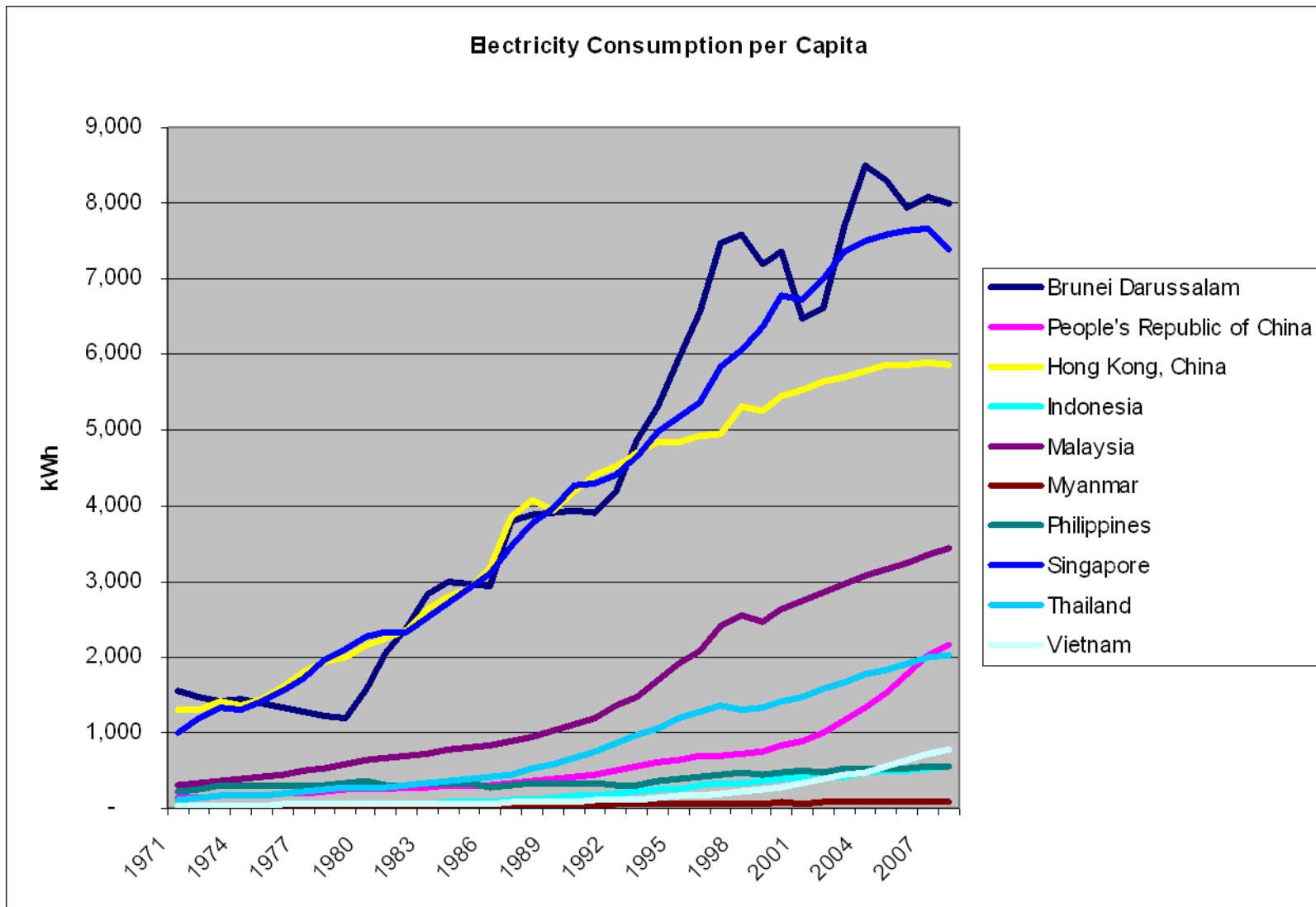
# Energy Indicator Analysis

## Final Energy Consumption vs. GDP per Capita



# Energy Indicator Analysis

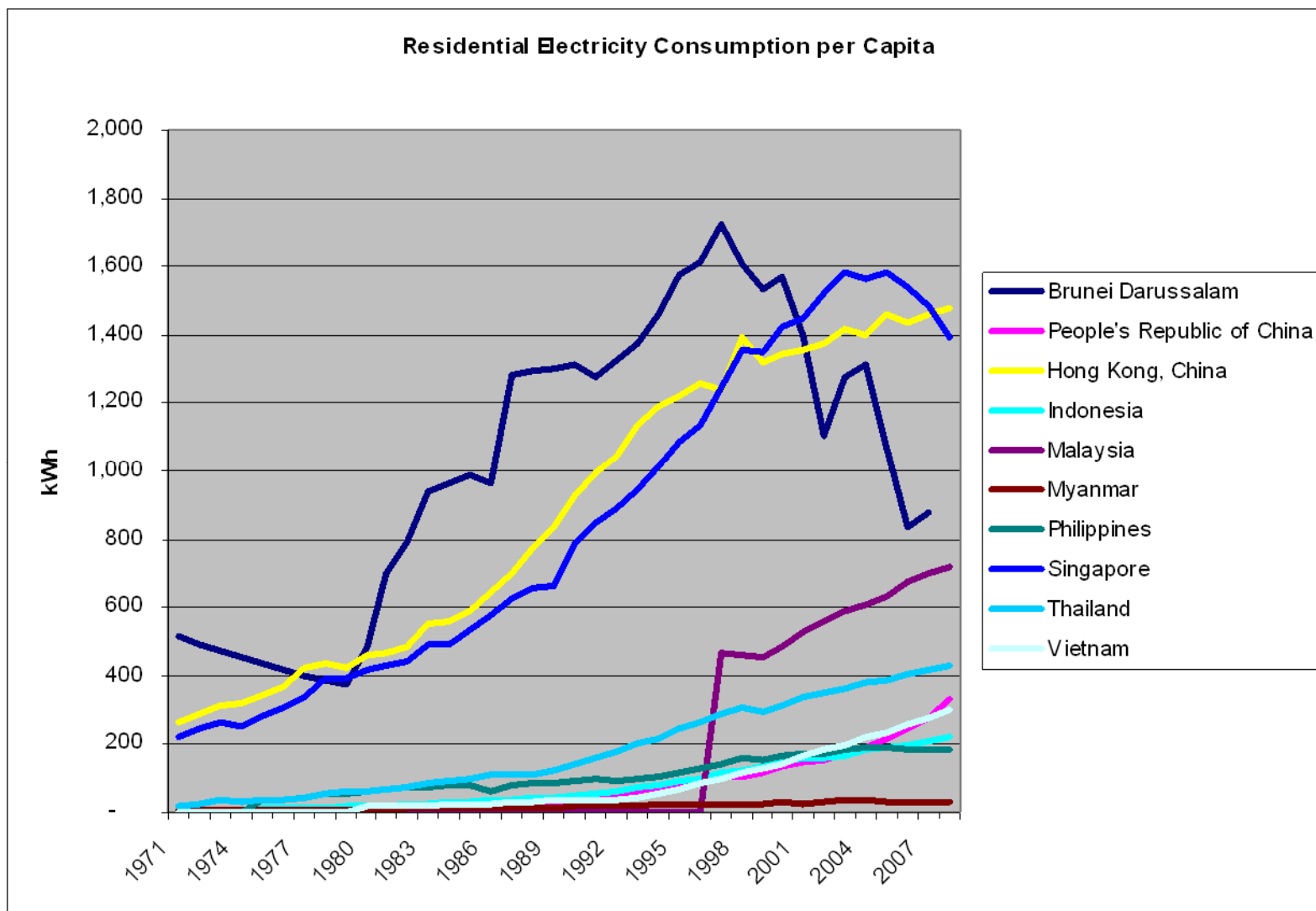
## Electricity Consumption per Capita





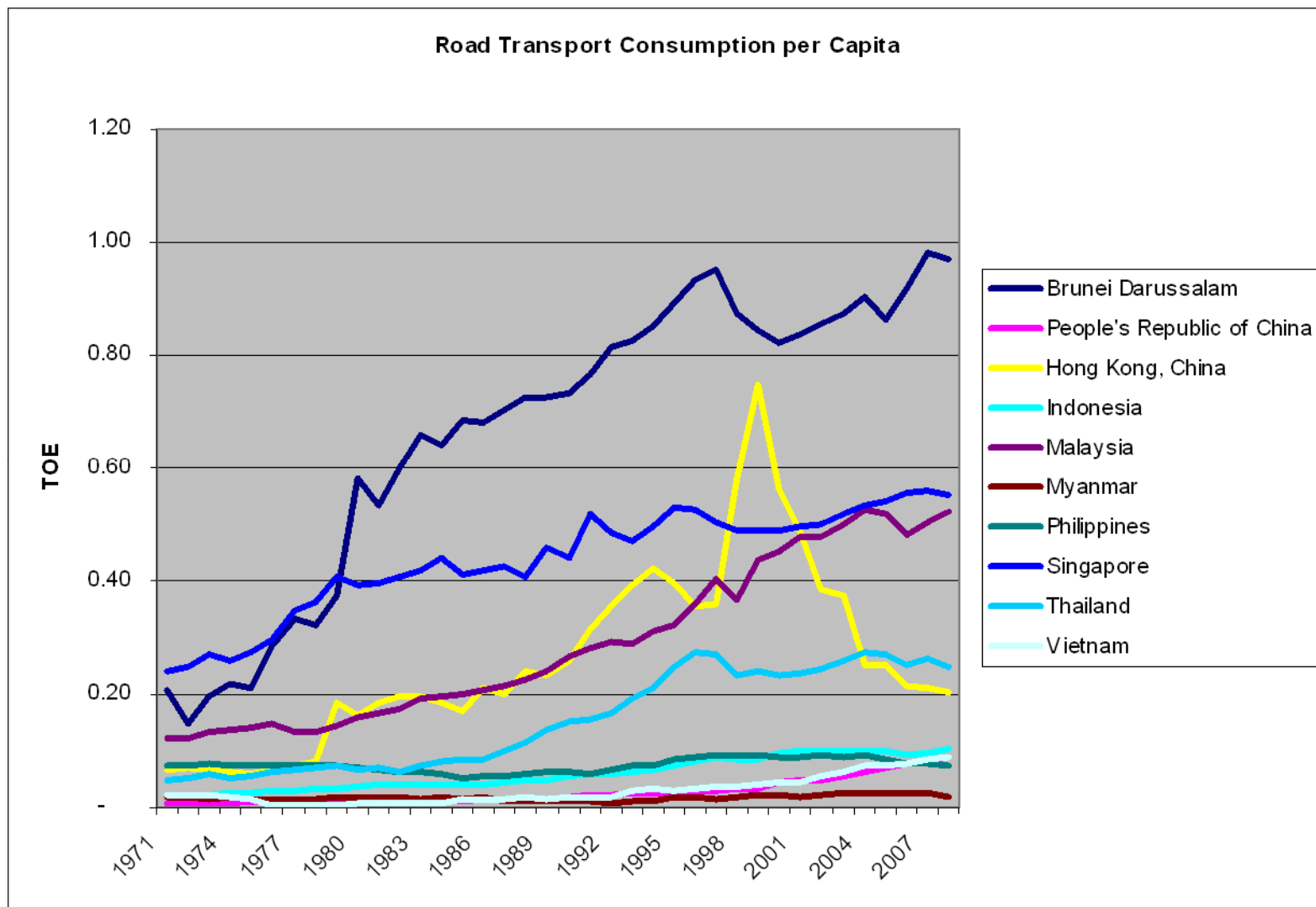
# Energy Indicator Analysis

## Residential Electricity Consumption per Capita



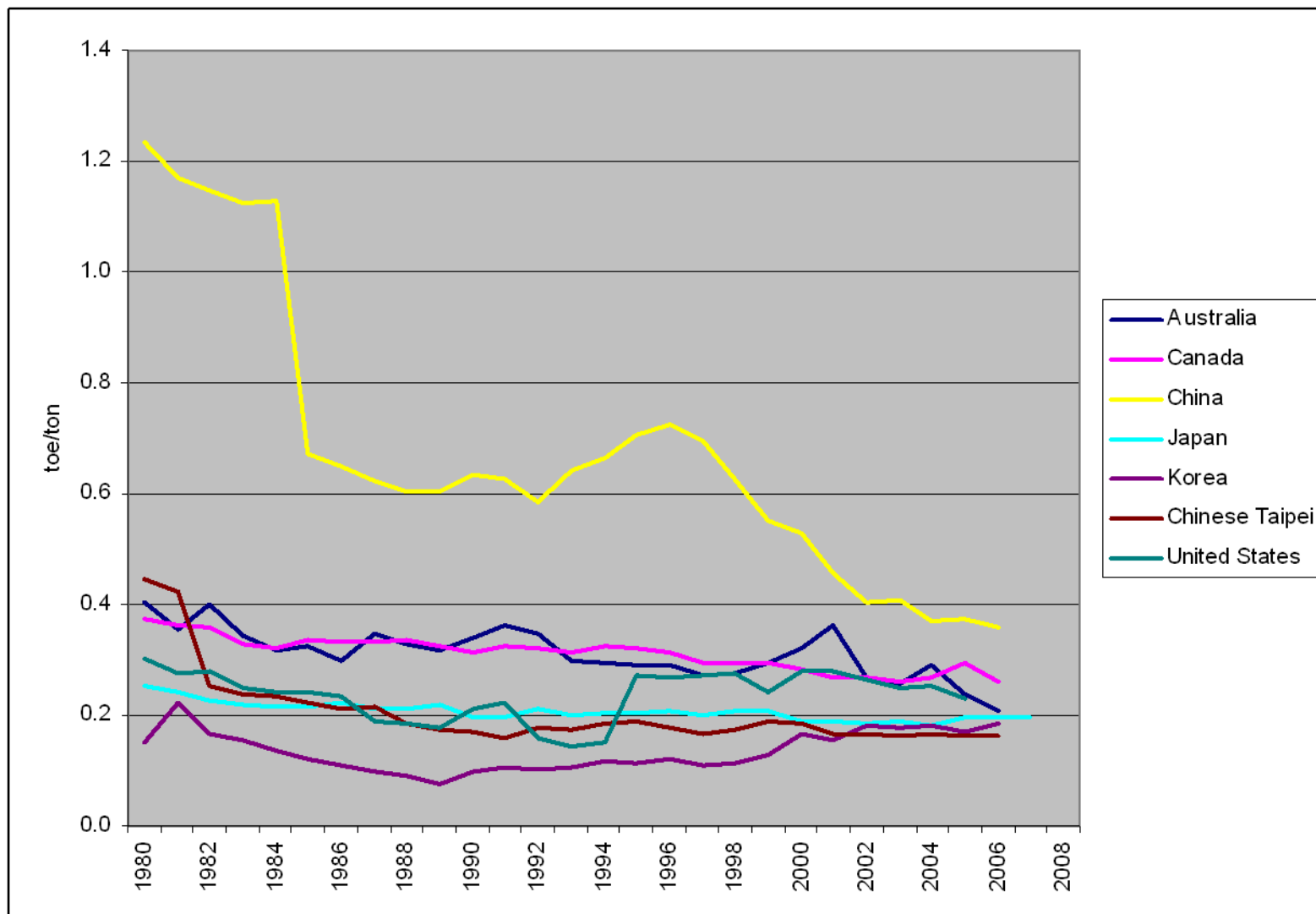
# Energy Indicator Analysis

## Road Transport Consumption per Capita



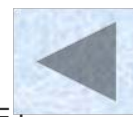
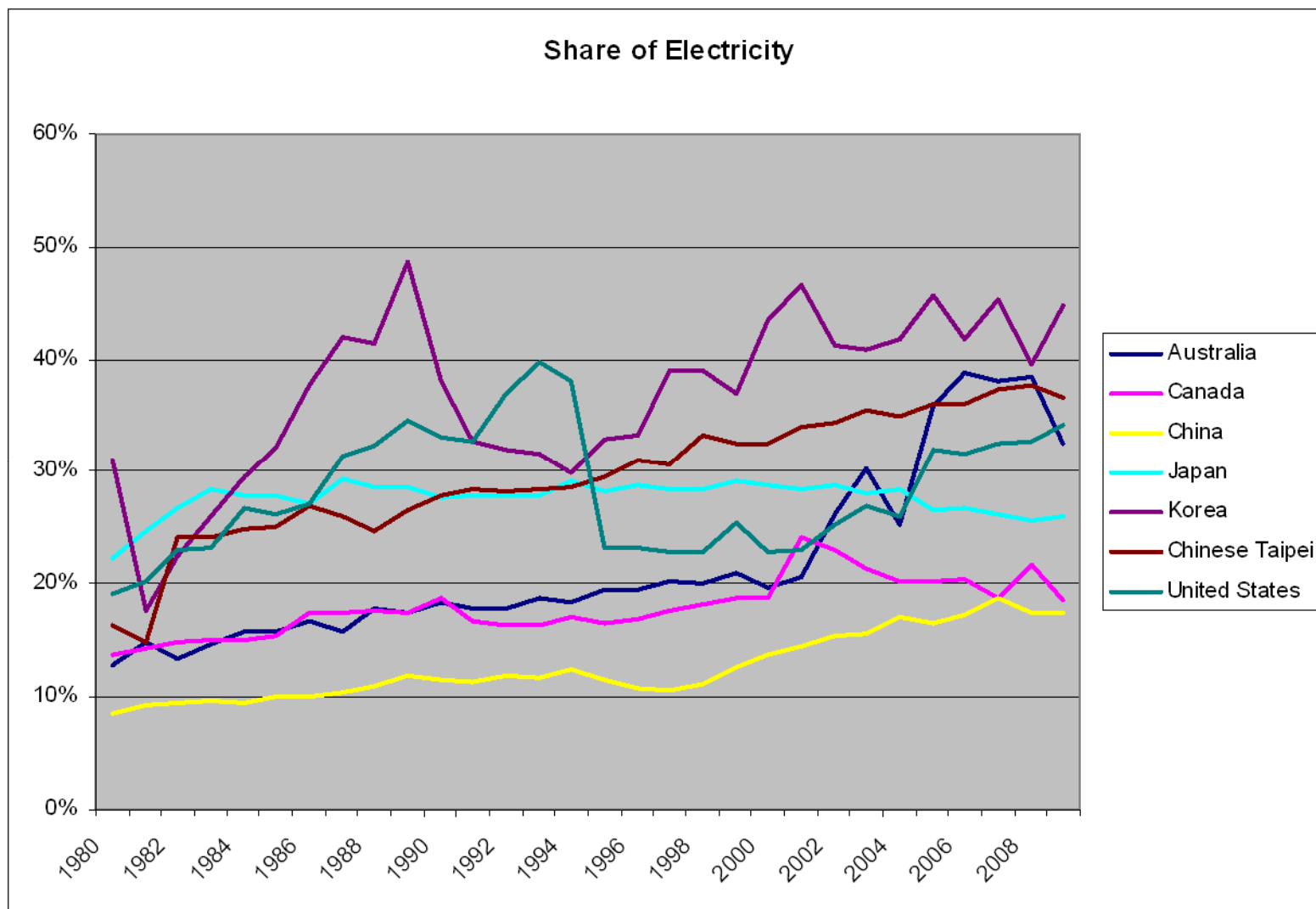
# Energy Indicator Analysis

## Energy Consumption in Iron & Steel Production



# Energy Indicator Analysis

## Energy Consumption in Iron & Steel Production



# Analysis of EBT

## Reveals Degree of Energy Dependency

Unit:KTOE

	Coal	Coal Products	Crude Oil, NGL and Condensate	Petroleum Products	Gas	Hydro	Nuclear	Geothermal, Solar, etc.	Others	Electricity	Heat	Total
Indigenous Production	354	0	175	0	1,929	2,254	0	0	4,599	0	0	9,310
Imports	2,651	0	11,097	3,935	5,280	0	0	0	0	185	0	23,149
Exports	0	-28	0	-1,836	0	0	0	0	0	0	0	-1,864
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0
International Aviation Bunkers	0	0	0	-869	0	0	0	0	0	0	0	-869
Stock Changes	-79	49	27	-461	-160	0	0	0	0	0	0	-624
<b>Total Primary Energy Supply</b>	<b>2,926</b>	<b>21</b>	<b>11,299</b>	<b>949</b>	<b>7,048</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>185</b>	<b>0</b>	<b>29,282</b>
Transfers	0	0	0	0	0	0	0	0	0	0	0	0
<b>Total Transformation Sector</b>	<b>-2,471</b>	<b>432</b>	<b>-11,037</b>	<b>10,249</b>	<b>-4,957</b>	<b>-2,254</b>	<b>0</b>	<b>0</b>	<b>-571</b>	<b>4,514</b>	<b>0</b>	<b>-6,096</b>
Main Activity Producer	-1,957	0	0	-820	-2,335	-2,206	0	0	-20	4,209	0	-3,129
Autoproducers	-8	0	0	-117	-377	-48	0	0	-551	305	0	-796
Gas Processing	0	-21	0	0	2,245	0	0	0	0	0	0	-2,266
Refineries	0	0	-11,037	0	0	0	0	0	0	0	0	149
Coal Tran	0	53	0	0	0	0	0	0	0	0	0	-53
Petrocher	0	0	0	0	0	0	0	0	0	0	0	0
Biofuel Pr	0	0	0	0	0	0	0	0	0	0	0	0
Charcoal	0	0	0	0	0	0	0	0	0	0	0	0
Non-spec	0	0	0	0	0	0	0	0	0	0	0	0
Loss & Own Use	0	0	0	-452	-748	0	0	0	0	-544	0	-1,745
Discrepancy	0	-4	-263	0	-66	0	0	0	0	0	0	-333
<b>Total Final Energy Consumptions</b>	<b>455</b>	<b>449</b>	<b>0</b>	<b>10,747</b>	<b>1,277</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>4,028</b>	<b>4,154</b>	<b>0</b>	<b>21,109</b>
<b>Industry Sector</b>	<b>439</b>	<b>449</b>	<b>0</b>	<b>2,067</b>	<b>758</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1,727</b>	<b>2,800</b>	<b>0</b>	<b>7,628</b>
Iron and Steel	0	449	0	29	20	0	0	0	0	49	0	547
Chemical (incl. Petro-Chemical)	0	0	0	5	9	0	0	0	0	78	0	92
Non Ferrous Metals	0	0	0	0	0	0	0	0	0	0	0	0
Non Metallic Mineral Products	129	0	0	74	26	0	0	0	0	42	0	271
Transportation Equipment	0	0	0	0	0	0	0	0	0	0	0	0
Machinery	0	0	0	0	0	0	0	0	0	0	0	0
Mining and Quarrying	56	0	0	1,171	228	0	0	0	0	1,556	0	3,012
Food, Beverages and Tobacco	80	0	0	14	0	0	0	0	0	9	0	103
Pulp, Paper and Printing	0	0	0	0	0	0	0	0	736	0	0	736
Wood and Wood Products	0	0	0	144	75	0	0	0	0	374	0	593
Construction	0	0	0	0	0	0	0	0	0	0	0	0
Textiles and Leather	0	0	0	0	0	0	0	0	0	0	0	0
Non-specified Industry	173	0	0	624	400	0	0	0	385	692	0	2,273
<b>Transport Sector</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>7,407</b>	<b>31</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>22</b>	<b>0</b>	<b>7,460</b>
Domestic Air Transport	0	0	0	30	0	0	0	0	0	0	0	30
Road	0	0	0	5,534	31	0	0	0	0	0	0	5,565
Rail	0	0	0	18	0	0	0	0	0	22	0	40
Inland Waterways	0	0	0	1,693	0	0	0	0	0	0	0	1,693
Pipeline Transport	0	0	0	0	0	0	0	0	0	0	0	0
Non-specified Transport	0	0	0	132	0	0	0	0	0	0	0	132
<b>Other Sector</b>	<b>16</b>	<b>0</b>	<b>0</b>	<b>1,279</b>	<b>488</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>2,907</b>	<b>1,332</b>	<b>0</b>	<b>6,022</b>
Residential & Commercial	4	0	0	1,173	442	0	0	0	2,907	1,322	0	5,847
Commerce and Public Services	4	0	0	237	87	0	0	0	0	609	0	937
Residential	0	0	0	936	355	0	0	0	2,907	712	0	4,910
Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
Fishing	13	0	0	105	46	0	0	0	0	11	0	175
Non-specified Others	0	0	0	0	0	0	0	0	0	0	0	0
of which Non-Energy Use*	0	213	0	0	2,264	0	0	0	0	0	0	2,478
Electricity Output in GWh	8,397	0	0	1,872	13,137	26,214	0	2,864	0	0	0	52,484

Self Sufficiency Level:  
 $9,310/29,282 = 31.8\%$

Coal Dependence:  
 $2,947/29282 = 10.1\%$

Oil Dependence:  
 $12,248/29,282 = 41.8\%$

# Analysis of EBT

## Basis for Analysis of Environmental Impact of Energy Use

Unit:KTOE

Calculated CO <sub>2</sub> Emissions							
	Emission Factors t CO <sub>2</sub> /TJ	ktoe (from EBT)	TJ	kt CO <sub>2</sub>	kt CO <sub>2</sub> (corrected for stored carbon)	kt CO <sub>2</sub> (corrected for unoxidized carbon)	
<b>Electricity Generation</b>		<b>5,514</b>	<b>230,860</b>	<b>16,953</b>	<b>16,953</b>	<b>16,736</b>	
Coal	94.60	1,965.0	82,271	7,782.80	7,782.80	7,627.14	
Natural Gas	56.10	2,612	109,359	6,135.05	6,135.05	6,104.38	
Petroleum Products	77.37	937.00	39,230	3,035.12	3,035.12	3,004.77	
<b>Own Use</b>		<b>1,200.00</b>	<b>50,242</b>	<b>3,145</b>	<b>3,145</b>	<b>3,122</b>	
Coal	94.60	53.00	2,219	209.92	209.92	205.72	
Natural Gas	56.10	748.00	31,317	1,756.90	1,756.90	1,748.11	
Petroleum Products	73.33	452.00	18,924	1,387.78	1,387.78	1,373.91	
<b>Industry</b>		<b>3,707.00</b>	<b>155,205</b>	<b>11,625</b>	<b>11,625</b>	<b>11,483</b>	
Coal	94.60	888.00	37,179	3,517.11	3,517.11	3,446.77	
Natural Gas	56.10	758.00	31,736	1,780.39	1,780.39	1,771.48	
Oil	73.33	2,061.00	86,290	6,327.64	6,327.64	6,264.37	
<b>Transport</b>		<b>7,438.00</b>	<b>311,414</b>	<b>21,564</b>	<b>21,564</b>	<b>21,349</b>	
Natural Gas	56.10	31.00	1,298	72.81	72.81	72.45	
Petroleum Products	69.30	7,407.00	310,116	21,491.06	21,491.06	21,276.15	
<b>Others</b>		<b>1,783.00</b>	<b>74,651</b>	<b>4,921</b>	<b>4,921</b>	<b>4,876</b>	
Coal	94.60	16.00	670	63.37	63.37	62.10	
Natural Gas	56.10	488.00	20,432	1,146.21	1,146.21	1,140.48	
Petroleum Products	69.30	1,279.00	53,549	3,710.96	3,710.96	3,673.85	
<b>Non-Energy</b>		<b>2,477.00</b>	<b>103,707</b>	<b>7,513.63</b>	<b>4,657.31</b>	<b>4,634.02</b>	
Coal	63.07	213.00	8,918	562.42	-	-	
Natural Gas	73.33	2,264.00	94,789	6,951.20	4,657.31	4,634.02	
Petroleum Products	73.33	-	-	-	-	-	
<b>Total</b>		<b>22,119</b>	<b>926,078</b>	<b>65,721</b>	<b>62,865</b>	<b>62,200</b>	
Non-specified Others of which Non-Energy Use*	0	0	0	0	0	0	0
Electricity Output in GWh	8,397	0	1,872	13,137	26,214	0	2,478

- How then would demand be met?
- The EBT gives some information on how demand would be supplied.
  - Electricity
  - Petroleum products
  - Coal products
  - Etc.
- Modeling starts with projection of final energy consumption

Unit:KTOE

ought to meet

Stock Changes	-79	49	27		0	0	0	0	0	0	-624
<b>Total Primary Energy Supply</b>	<b>2,926</b>	<b>21</b>	<b>11,299</b>		<b>2,254</b>	<b>0</b>	<b>0</b>	<b>4,599</b>	<b>185</b>	<b>0</b>	<b>29,282</b>
Transfers	0	0	0		0	0	0	0	0	0	0
<b>Total Transformation Sector</b>	<b>-2,471</b>	<b>432</b>	<b>-11,037</b>	<b>1</b>	<b>-2,254</b>	<b>0</b>	<b>0</b>	<b>-571</b>	<b>4,514</b>	<b>0</b>	<b>-6,096</b>
Main Activity Producer	-1,957	0	0		-2,266	0	0	-20	4,209	0	-3,129
Autoproducers	-8	0	0		-48	0	0	-551	305	0	-796
Gas Processing	0	-21	0		0	0	0	0	0	0	-2,266
Oil Refineries	0	0	-11,037	1	0	0	0	0	0	0	149
Coal Transformation	-506	453	0		0	0	0	0	0	0	-53

- This EBT gives an idea that electricity demand would be supplied by coal, oil, natural gas, hydro and other electricity sources. It also shows electricity imports
- It also gives information on the fuel needed to produce the required electricity (fuel inputs and electricity output indicate thermal efficiency of each type of power plants)
- It also gives an idea on how the country's refinery will produce the petroleum products needed by the consumers
- The EBT also gives an idea how the country will meet its primary energy requirements (production or importation)

Electricity Output in GWh	8,397	0	1,872	13,137	26,214	0	2,864	0	0	0	52,484
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# Differences with National Energy Balances

- Uses the **net calorific value (NCV)** of each energy product –NCV excludes the wasted heat during combustion of the fuel
- The unit used in the APEC energy balances is in energy unit, ktoe or thousand tons of oil equivalent, which is equal to  $10^{10}$  kilocalories
- The APEC Energy Balance has 70 columns and 78 rows
  - More columns for a variety of products
  - More transformation rows
  - More or less final consumption rows
- Statistical Difference is the difference between supply and demand and is not subtracted or added to the TPES



# Why are Energy Balances Important?

- **Provides basic data for energy policy formulation**
  - Supply policies
  - Demand policies
  - Security policies
  - Energy efficiency policies
  - Environmental protection policies
  - Climate change mitigation policies
  - Incentive/subsidy policies
- **Measuring efficiency of utilization**
- **Measuring public welfare**
- **Can be used in setting various benchmarks**
- **Can be used to model the future energy situation**

**Thank you for your attention**