



The 28th Meeting of APEC Expert Group on Energy Data and Analysis (EGEDA)  
Putrajaya, Malaysia, 1-3 November, 2016

## 6. APERC's Research Activities

James Kendell

Vice President, Asia Pacific Energy Research Centre (APERC)

November 2, 2016



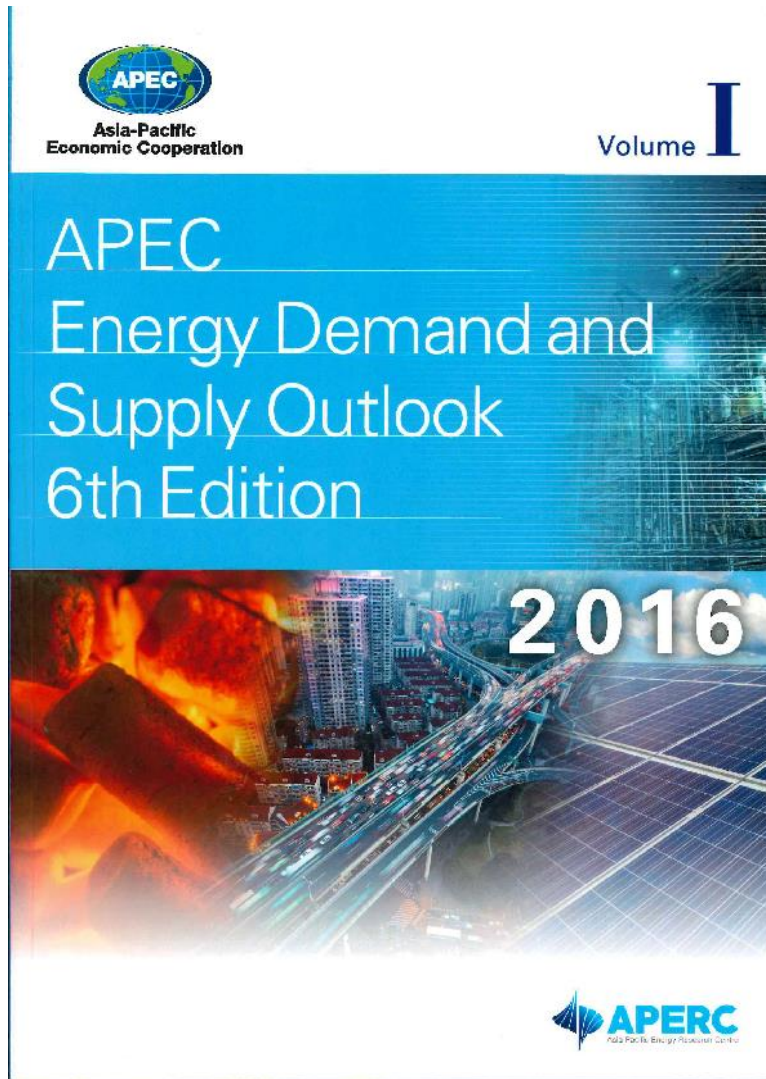
**Asia-Pacific  
Economic Cooperation**

- **APERC research activities**
  - **APEC Energy Outlook 6<sup>th</sup> edition**
  - **APEC Energy Outlook 7<sup>th</sup> edition**
  - **Independent research projects**
- **APEC Energy Overview**
- **Monitoring APEC energy intensity goal**



# 1. APERC's research activities

# The 6<sup>th</sup> edition of the Outlook was published in May



- APERC has historically produced an *APEC Energy Demand and Supply Outlook* every 3 or 4 years
- The 6<sup>th</sup> Edition was published in May
- A **25-year look-ahead** (2013-2040) assuming business-as-usual and several alternative cases

# The Outlook is published in two volumes

## **Volume 1: Overall APEC demand and supply**

- Summary of key trends
- Energy demand outlook by sector
- Energy supply outlook by fuel type
- Alternative scenarios
- Energy Investment
- Energy security and climate change

## **Volume 2: Discussion of specific APEC economies**

- Introduction to each economy's
  - Energy demand
  - Energy resources
  - Energy policies
- Business-as-usual scenario
- Alternative scenarios
  - Improved efficiency
  - High renewables
  - Alternative power mix

# The Outlook is available on the APERC website

**Asia-Pacific Economic Cooperation**

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Asia Pacific Energy Research Centre

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## About us

## APERC brochure

## Activities

## Publications

### Reports

- ▶ APEC Energy Demand and Supply Outlook
- ▶ APEC Energy Overview
- ▶ PREE
- ▶ CEEDS
- ▶ PRLCE
- ▶ LCMT
- ▶ OGSJ
- ▶ Other research reports

### Papers

## APEC Energy Demand and Supply Outlook

The APEC Energy Demand and Supply Outlook is designed to provide a basic point of reference for anyone wishing to become more informed about the energy choices facing the APEC region. The business-as-usual projections illustrate the risks of the development path the APEC region is now on. Alternative scenarios examine options for improving sustainability. APERC normally prepares a new version of the Outlook every 2 or 3 years.

Recent editions of the Outlook have been published in two volumes. Volume 1 discusses the outlook for the APEC region as a whole, and compares the outlook for the various APEC economies. Volume 2 has provides an 'Economy Review' (chapter) discussing the outlook for each APEC economy.

### ▶ APEC Energy Demand and Supply Outlook 6th Edition

#### Contents

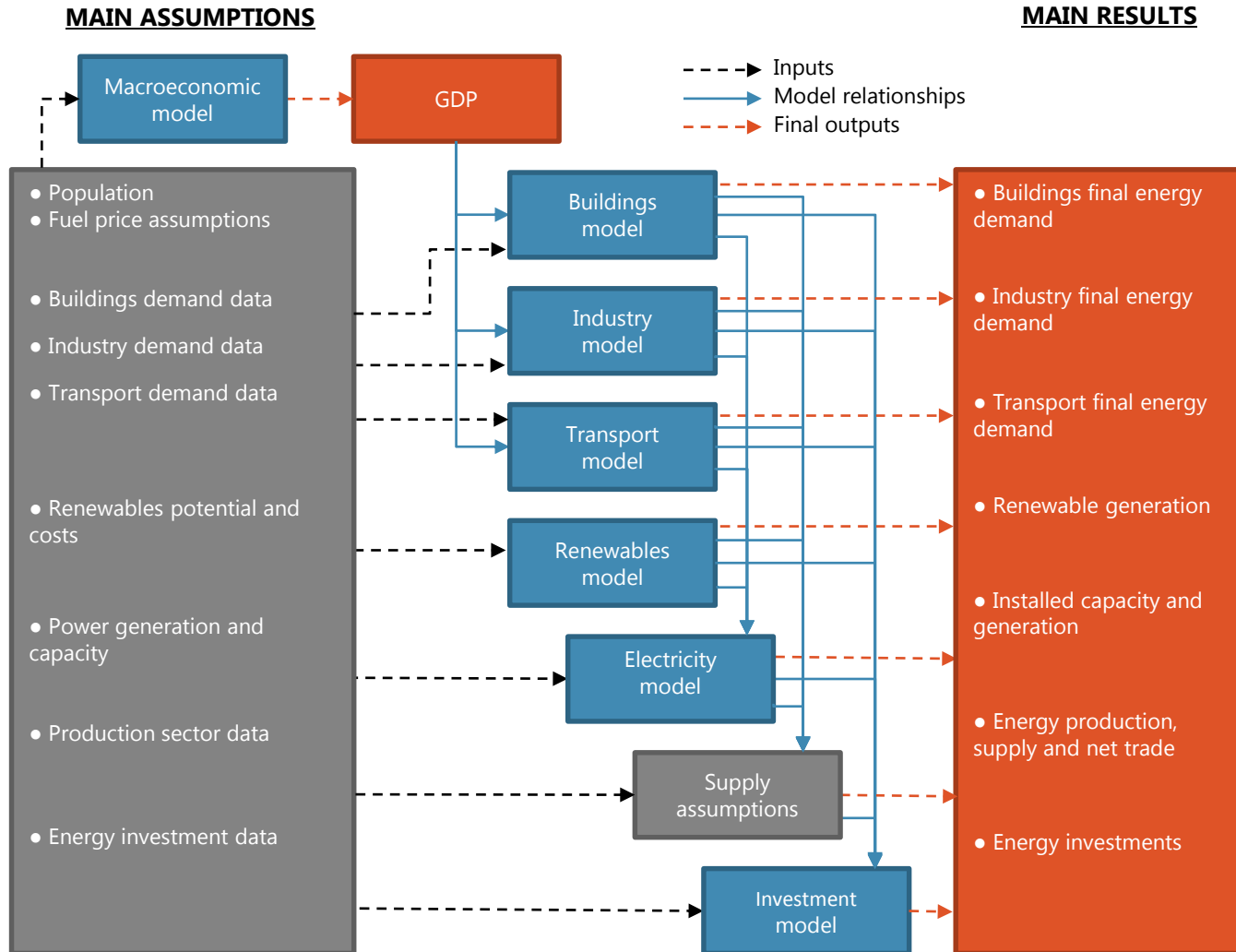
	text in pdf	tables in pdf
Outlook Volume 1		
Outlook Volume 2		
Annex I		
Annex II		

<http://aperc.iecej.or.jp/publications/reports/outlook.php>

# Five key Outlook trends highlight energy challenges

- 1. China and Southeast Asia drive APEC energy demand**
- 2. Renewables is the fastest-growing energy source**
- 3. Fossil fuels remain dominant in the energy mix**
- 4. The APEC energy supply-demand gap widens**
- 5. CO<sub>2</sub> emissions continue rising as coal remains the largest power source**

# 6<sup>th</sup> Edition Outlook used seven models



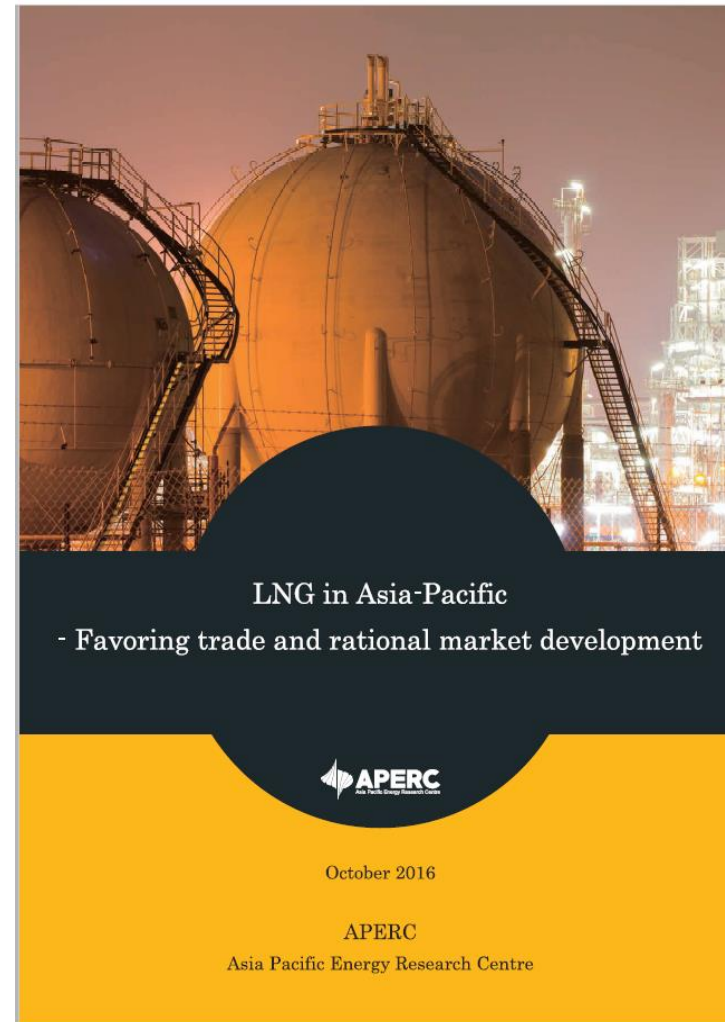


# Modelling changes are planned for the 7<sup>th</sup> edition

- Extend forecast to 2050
- Reduce alternative scenarios from three to two
  - High renewables + improved efficiency
  - 2-degree rise in temperature
- Use OECD GDP forecasts
- Make buildings model activity driven
- Start to change industrial model from top-down to bottom up
- Add buses to the transportation model
- Distribute renewables to demand and electricity models
- Add a supply model

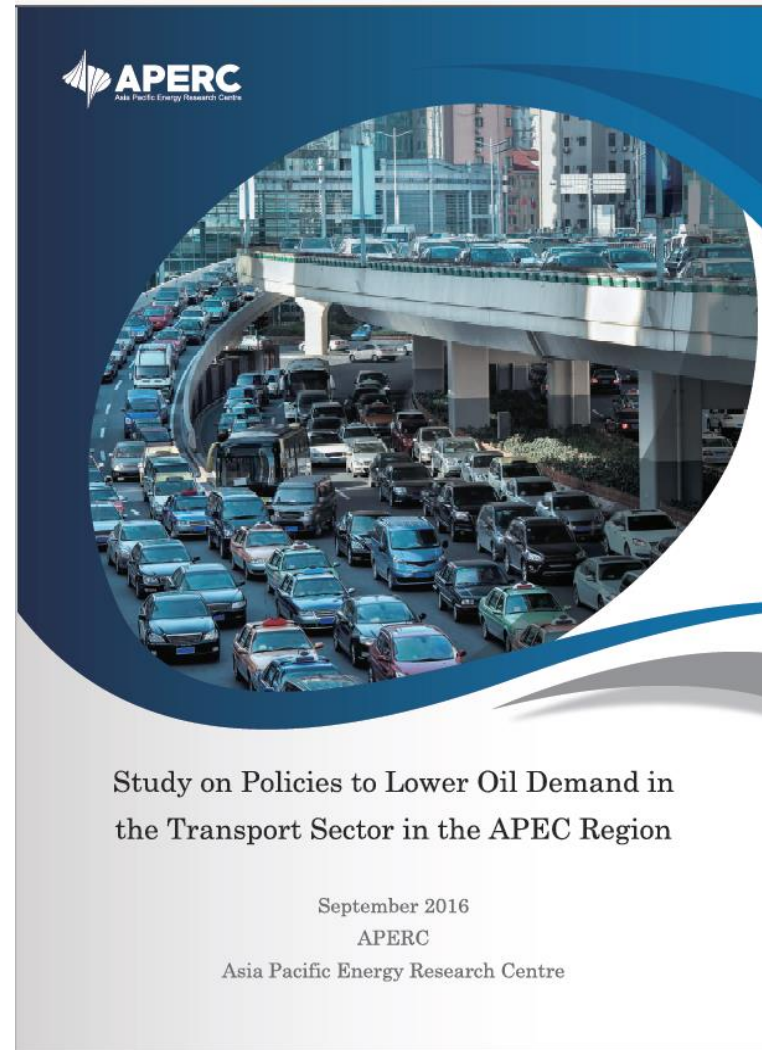
# Much of the ongoing research is on the supply side

- Climate Change
- Security
- Oil
- Natural gas
- Renewables
- Nuclear
- Electricity



# Demand-side research rounds out the program

- Climate change
- Industry
- Buildings
- Transportation





## 2. APEC Energy Overview

# Energy Overview focuses on supply/demand, policy

- Introduction
- Energy Supply and Demand
  - Primary Energy Supply
  - Final Energy Consumption
- Energy Intensity Analysis
- Policy Overview
  - Energy Policy Framework
  - Energy Markets
  - Energy Efficiency
  - Renewable Energy
  - Climate Change
- Notable Energy Developments
- References
- Useful Links

# Outlook tables use EGEDA data (1)

Table 1: Key data and economic profile, 2013

Key data <sup>a, b</sup>		Energy reserves <sup>c</sup>	
Area (million km <sup>2</sup> )	330 803	Oil (billion barrels)	5.9
Population (million)	29.5	Gas (trillion cubic metres)	2.8
GDP (2010 USD billion PPP)	658	Coal (million tonnes)	1 938
GDP (2010 USD PPP per capita)	22 321	Uranium (million tonnes)	–

Sources: a. EPU (2013); b. EGEDA (2015); c. EC (2014a).

Table 2: Energy supply and consumption, 2013

Primary energy supply (ktoe)		Final energy consumption (ktoe)		Power generation (GWh)	
Indigenous production	91 528	Industry sector	13 638	Total power generation	138 330
Net imports and others	–6 387	Transport sector	19 751	Thermal	126 472
Total primary energy supply	81 100	Other sectors	8 450	Hydro	10 586
Coal	15 290	Non-energy	6 945	Nuclear	–
Oil	31 648	Total final energy consumption	48 784	Others	1 272
Gas	33 223	Coal	1 538		
Others	939	Oil	26 775		
		Gas	9 886		
		Electricity and others	10 585		

Note: For full details of the energy balance table, see [www.ieej.or.jp/egeda/database/database-top.html](http://www.ieej.or.jp/egeda/database/database-top.html).

Source: EGEDA (2015).

# Outlook tables use EGEDA data (2)

Table 3: Energy intensity analysis, 2013

Energy	Energy intensity (toe/million USD)		Change (%)
	2012	2013	2012 vs 2013
Total primary energy supply	122	123	1.1
Total final energy consumption	71	74	4.4
Industry	24	21	-15
Transportation	24	30	25
Others	12.9	12.8	-0.6
Non-energy	9.6	10.6	9.7

Source: EGEDA (2015).

# Overview tentatively goes to EGEDA in March 2017

**Data Preparation**

**Final Data**

**Drafting**

**Send 1<sup>st</sup> Round Draft to Editor**

**Received 1<sup>st</sup> Draft**

**Send to EGEDA Members for comments**

**Send back to Researchers to incorporate EGEDA comments**

**2<sup>nd</sup> Round of Edits if needed (Outside Editor)**

**Finalization**

**For publication**

**September-October 2016**

**30 October 2016**

**1 November 2016 – 20 January 2017**

**1<sup>st</sup> week of February 2017**

**end of February 2017**

**1<sup>st</sup> week - 3<sup>rd</sup> week March 2017**

**27-31 March 2017**

**3-14 April 2017**

**16-29 April 2017**

**May 2017**





# 3. Monitoring APEC Energy Intensity Goal

Three measures of energy intensity are considered (only numerator varies)

- Primary energy supply
- Final energy consumption
- Final energy consumption excluding non-energy use

GDP is used as the denominator in all calculations

Energy intensity comparison (IEA vs APEC energy data)

## □ Energy data

- IEA available through 2014 (with 2015 estimates for OECD);
- APEC data available up to 2014 as of October 2016 (through ESTO)

## □ GDP data from World Bank (constant 2011 USD PPP – data available through 2015)

## □ Exceptions:

- Papua New Guinea's energy data come from APEC under coordination of ESTO
- Chinese Taipei's GDP data are estimated by APERC

# Primary energy supply intensity improves over time

## IEA primary energy supply intensity

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2005-2014	Trend to 2035
Change in primary energy	2.8%	3.4%	0.4%	-0.4%	6.1%	2.5%	1.4%	1.9%	1.0%	20.6%	
Change in GDP (2011 US \$PPP)	5.4%	5.6%	3.0%	0.0%	5.8%	4.3%	4.3%	3.7%	3.8%	42.2%	
Change in primary energy intensity	-2.5%	-2.1%	-2.6%	-0.3%	0.2%	-1.8%	-2.8%	-1.8%	-2.7%	<b>-15.2%</b>	<b>-42.3%</b>

- Primary energy intensity in 2014 improved by 2.7% compared with 2013;
- Annual improvement in primary energy intensity was on average 1.8% since 2006.

## APEC primary energy supply intensity

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2005-2014	Trend to 2035
Change in primary energy	1.6%	4.1%	1.4%	0.0%	4.9%	4.1%	1.3%	1.7%	0.3%	20.8%	
Change in GDP (2011 US \$PPP)	5.4%	5.6%	3.0%	0.0%	5.8%	4.3%	4.3%	3.7%	3.8%	42.2%	
Change in primary energy intensity	-3.7%	-1.5%	-1.6%	0.0%	-0.9%	-0.3%	-2.9%	-2.0%	-3.3%	<b>-15.1%</b>	<b>-42.0%</b>

- Primary energy intensity in 2014 improved by 3.3% compared with 2013;
- Annual improvement in primary energy intensity was on average 1.8% since 2006.

Note : Data from IEA and ESTO, energy intensity calculation by APERC

# ...and final energy consumption intensity as well

## IEA final energy consumption intensity

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2005-2014	Trend to 2035
Change in final energy	2.6%	3.4%	-0.1%	-0.7%	5.4%	2.7%	1.0%	2.9%	2.0%	20.7%	
Change in GDP (2011 US \$PPP)	5.4%	5.6%	3.0%	0.0%	5.8%	4.3%	4.3%	3.7%	3.8%	42.2%	
Change in final energy intensity	-2.7%	-2.1%	-3.0%	-0.7%	-0.4%	-1.6%	-3.2%	-0.8%	-1.7%	<b>-15.1%</b>	<b>-42.1%</b>

- ❑ Final energy intensity improved by 1.7% in 2014 as compared with 2013;
- ❑ Annual improvement in final energy intensity was on average 1.8% since 2006.

## APEC final energy consumption intensity

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2005-2014	Trend to 2035
Change in final energy	2.2%	4.2%	0.4%	-1.4%	6.2%	4.2%	2.4%	1.7%	0.9%	22.6%	
Change in GDP (2011 US \$PPP)	5.4%	5.6%	3.0%	0.0%	5.8%	4.3%	4.3%	3.7%	3.8%	42.2%	
Change in final energy intensity	-3.1%	-1.3%	-2.5%	-1.4%	0.3%	-0.1%	-1.8%	-2.0%	-2.8%	<b>-13.8%</b>	<b>-39.0%</b>

- ❑ Final energy intensity improved by 2.8% in 2014 as compared with 2013;
- ❑ Annual improvement in final energy intensity was on average 1.6% since 2006.

Note : Data from IEA and ESTO, energy intensity calculation by APERC

# ... and final energy consumption intensity excluding non-energy

## IEA final energy consumption intensity excluding non-energy (NE)

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2005-2014	Trend to 2035
Change in final energy excluding non energy	2.6%	3.4%	0.5%	-1.2%	5.4%	2.8%	1.0%	2.7%	2.0%	20.7%	
Change in GDP (2011 US \$PPP)	5.4%	5.6%	3.0%	0.0%	5.8%	4.3%	4.3%	3.7%	3.8%	42.2%	
Change in final energy excluding non energy intensity	-2.5%	-2.0%	-7.5%	3.8%	-0.2%	-2.8%	-3.9%	0.9%	-1.7%	<b>-15.0%</b>	<b>-41.9%</b>

- ❑ *Final energy consumption intensity excluding non-energy intensity in 2014 improved by 1.7% compared to 2013 and almost no improvement compared with final energy consumption in 2014 with 2005 as base;*
- ❑ *Annual improvement in final energy exc. NE intensity was on average 1.7% since 2006.*

## APEC final energy consumption intensity excluding non-energy (NE)

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2005-2014	Trend to 2035
Change in final energy excluding non energy	1.9%	4.0%	0.7%	-2.0%	5.8%	4.8%	2.4%	1.4%	0.5%	20.6%	
Change in GDP (2011 US \$PPP)	5.4%	5.6%	3.0%	0.0%	5.8%	4.3%	4.3%	3.7%	3.8%	42.2%	
Change in final energy excluding non energy intensity	-3.3%	-1.5%	-2.3%	-2.0%	0.0%	0.4%	-1.9%	-2.3%	-3.2%	<b>-14.9%</b>	<b>-41.6%</b>

- ❑ *The reduction in final energy consumption intensity excluding non-energy in 2014 improved by 3.2% compared to 2013 and reduced by 1.1 percentage point compared to final energy intensity in 2014 with 2005 as base;*
- ❑ *Annual improvement in final energy exc. NE intensity was on average 1.8% since 2006.*

# Trends in IEA and APEC data are similar

## Trend to 2035

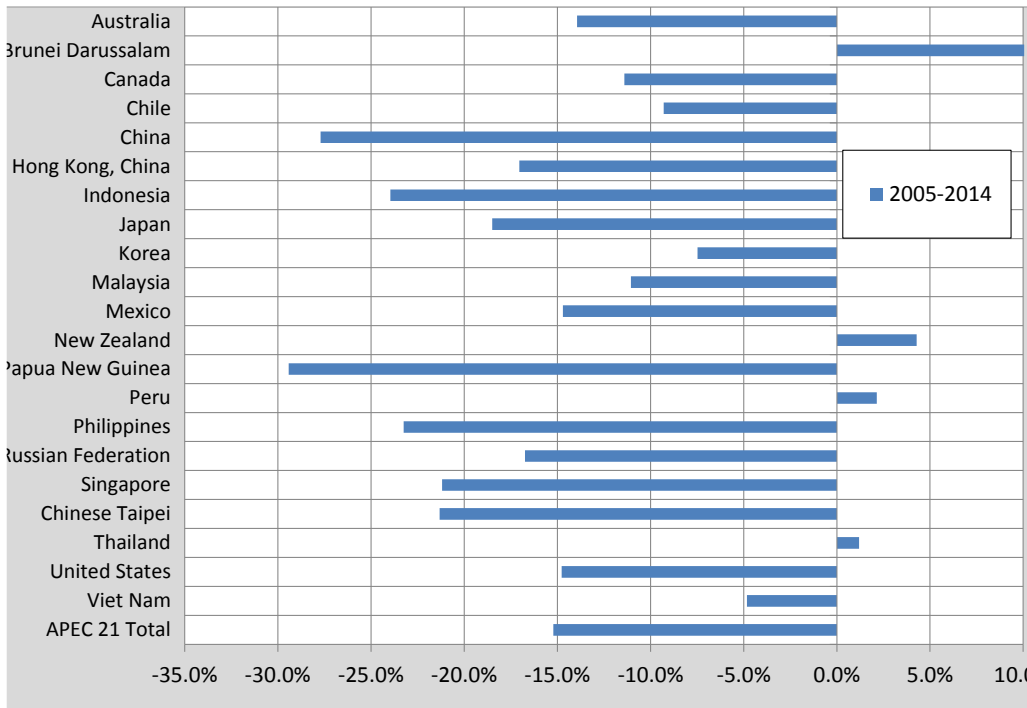
	IEA (updated in Aug. 2016)	APEC (updated Oct. 2016)
	2005-2014 (EWG 52)	2005-2014 (EGEDA 28)
Primary energy supply intensity	-42.3%	-42.0%
Final energy consumption intensity	-42.1%	-39.0%
Final energy consumption intensity excluding non-energy	-41.9%	-41.6%

- In IEA data (2015 Nov. version), primary energy, final energy and final excluding non-energy intensities will all achieve the 45% reduction goal in **2038**.
- In APEC data (2016 Oct. version), primary energy and final energy excluding non-energy intensities achieve the 45% reduction goal in **2038**, while final energy in **2041**.

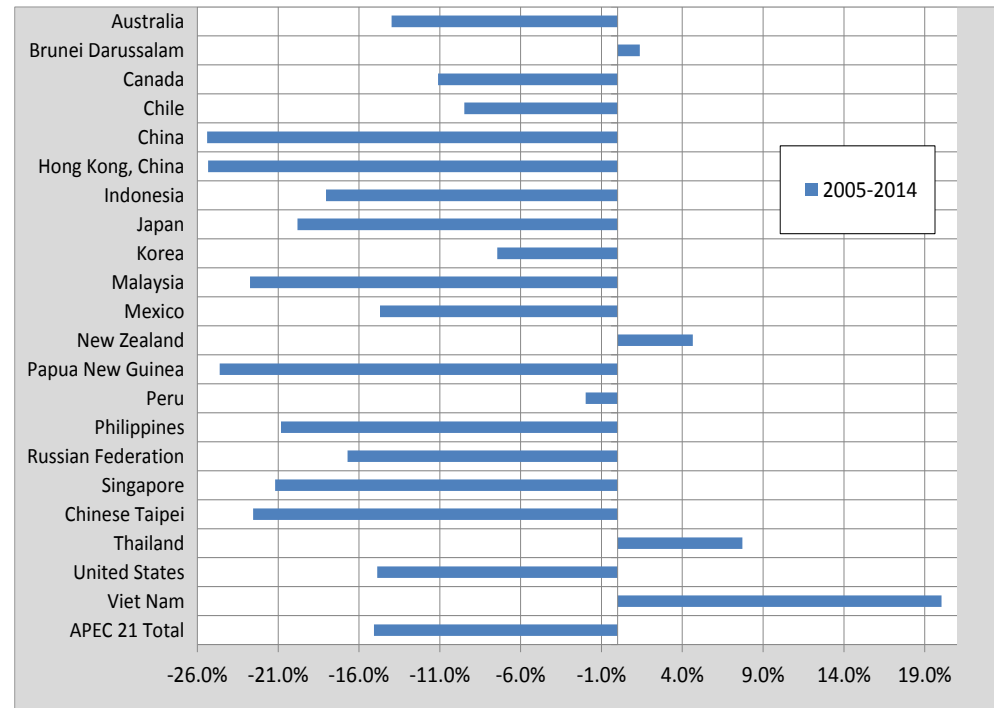
# Economy level results show IEA/APEC differences (1)

## Primary energy intensity

### IEA data



### APEC data



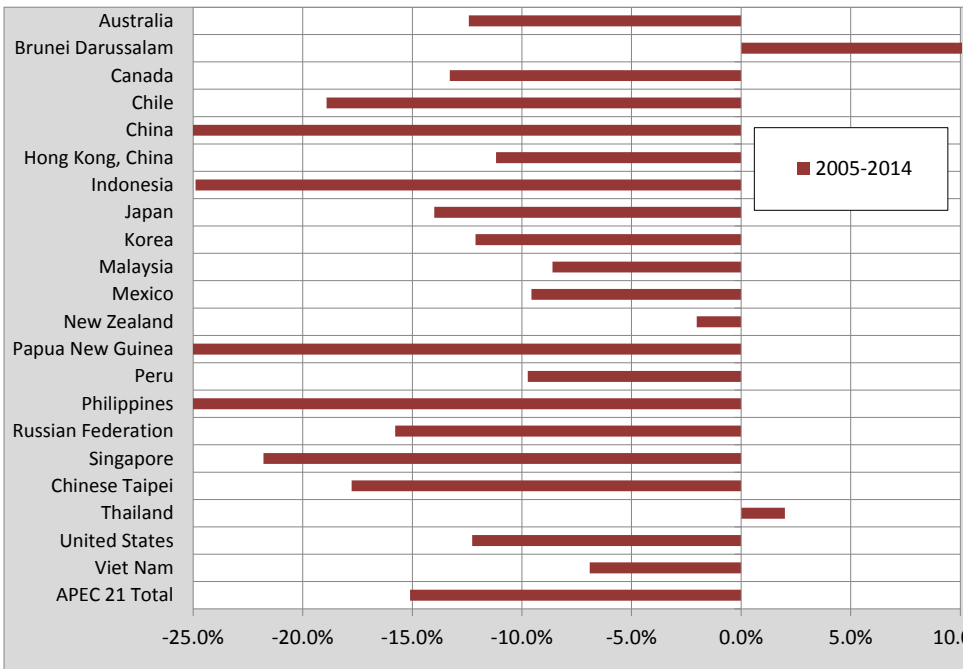
Note : Data from IEA and ESTO, energy intensity calculation by APERC



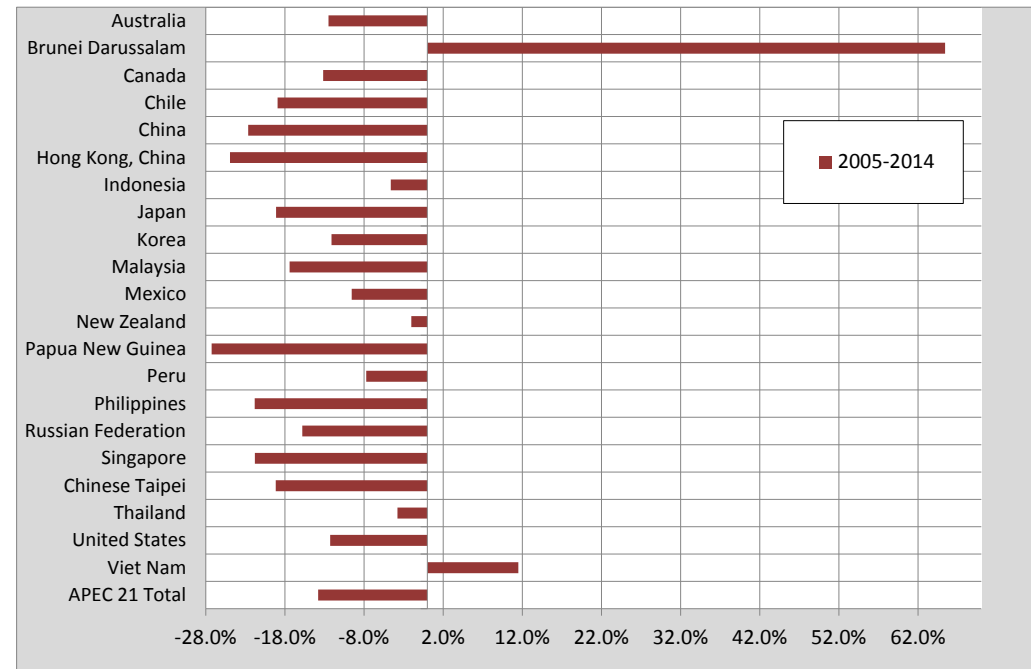
# Economy level results show IEA/APEC differences (2)

## Final energy intensity

### IEA data



### APEC data

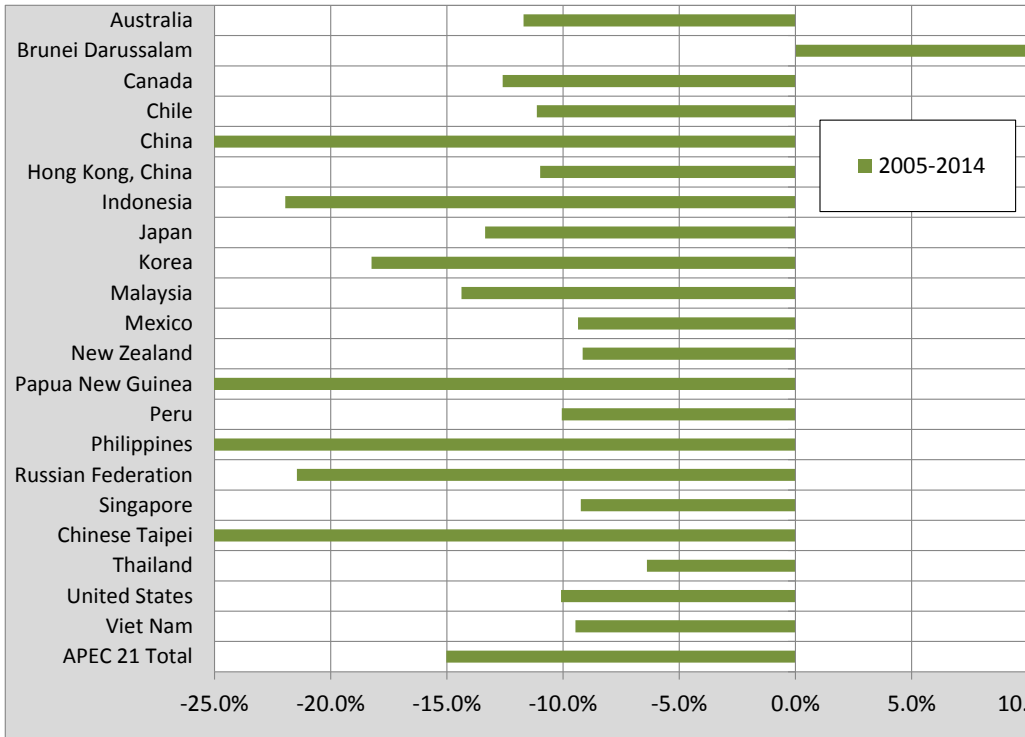


Note : Data from IEA and ESTO, energy intensity calculation by APERC

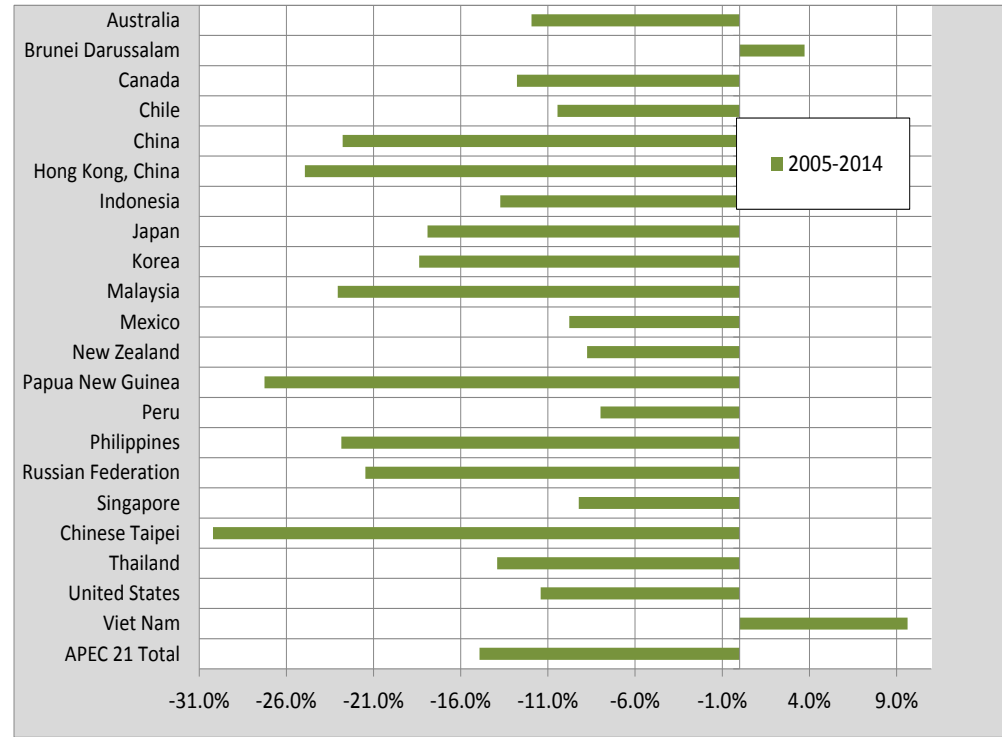
# Economy level results show IEA/APEC differences (3)

## Final energy less non-energy intensity

### IEA data



### APEC data



Note : Data from IEA and ESTO, energy intensity calculation by APERC



**Thank you for your kind attention**

<http://aperc.ieej.or.jp/>