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APEC Energy Intensity Reduction Analysis

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Asia-Pacific Economic Cooperation

Outline

- **APEC energy intensity goal**
- **Measuring intensity**
- **Issues with current measures of intensity**
- **Relating intensity to efficiency**
- **Formalizing energy intensity target reporting**

1. APEC Energy Intensity Goal

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APEC Energy intensity goal

- Honolulu Energy Ministers Meeting in 2011.
- 45% Energy intensity reduction by 2035, compared with 2005.
- Collective goal
  - Recognizes that economies' rates of improvement may vary for many reasons
- But, intensity as really a proxy for efficiency.
  - Efficiency is relative to activities.
  - Need to relate the intensity target to actual efficiency gains across APEC.

Direction from EWG Lead Shepherd

Excerpt from the EWG 52 meeting record:

Member economies had discussion over methodology. The Lead Shepherd echoed the difficulty of measurement of energy efficiency improvement, and invited IEA's comments on it. EGEEC stated that the methodology, scope of energy intensity and linkage between energy efficiency and energy intensity will be covered in the Expert group's discussion and it will report back to EWG53 for member economies' consideration.

The Lead Shepherd suggested APERC, EGEDA, EGEEC worked with assistance from IEA to seek collaboration with each other on data and methodology issues, and requested Member Economies to provide an up-to-date data to APERC and EGEDA, including NDC/INDC commitments. The Lead Shepherd also suggested APERC and EGEDA to jointly work on definition of energy efficiency and scenario analysis.

Action point arising from EWG 52:

EGEEC to investigate and study in detail for the improvement, including scenarios, on deepening energy intensity reduction. APERC and EGEDA are requested to provide assistance.

2. Measuring intensity

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Defining Intensity

- Energy intensity is generally defined as the amount of energy needed to produce USD 1 million.
- But what measure of energy do we use?
  - Primary energy supply? (TPES)
  - Final energy demand? (FED)
  - Non-energy use of energy products?
- What form of GDP to use
  - Purchasing Power Parity PPP (GDP PPP)

Three measures

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)

Data comes from IEA and EGEDA

- Energy data
  - IEA available through 2014 (with 2015 estimates for OECD);
  - APEC data available up to 2014 as of December 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 at PPP values 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%	5.7%	3.0%	0.0%	5.9%	4.4%	4.4%	3.8%	3.8%	42.6%	
Change in primary energy intensity	-2.5%	-2.2%	-2.6%	-0.4%	0.2%	-1.8%	-2.8%	-1.9%	-2.7%	**-15.4%**	**-42.8%**

- *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%	4.0%	1.4%	-0.2%	4.9%	4.0%	1.3%	1.5%	0.7%	20.8%	
Change in GDP 2011 US$ PPP	5.4%	5.7%	3.0%	0.0%	5.9%	4.4%	4.4%	3.8%	3.8%	42.6%	
Change in primary energy intensity	-3.7%	-1.6%	-1.6%	-0.2%	-0.9%	-0.4%	-2.9%	-2.2%	-2.9%	**-15.3%**	**-42.6%**

- *Primary energy intensity in 2014 improved by 2.9% 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 consumption	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%	5.7%	3.0%	0.0%	5.9%	4.4%	4.4%	3.8%	3.8%	42.6%	
Change in final energy intensity	-2.7%	-2.1%	-3.0%	-0.8%	-0.4%	-1.6%	-3.3%	-0.9%	-1.7%	**-15.3%**	**-42.6%**

- *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 consumption	2.2%	4.2%	0.5%	-1.4%	6.1%	4.1%	2.4%	1.7%	1.1%	22.7%	
Change in GDP 2011 US$ PPP	5.4%	5.7%	3.0%	0.0%	5.9%	4.4%	4.4%	3.8%	3.8%	42.6%	
Change in final energy intensity	-3.1%	-1.4%	-2.5%	-1.4%	0.3%	-0.2%	-1.9%	-2.0%	-2.6%	**-14.0%**	**-39.5%**

- *Final energy intensity improved by 2.6% 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 consumption	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%	5.7%	3.0%	0.0%	5.9%	4.4%	4.4%	3.8%	3.8%	42.6%	
Change in final energy intensity	-2.7%	-2.1%	-2.5%	-1.2%	-0.4%	-1.5%	-3.2%	-1.1%	-1.7%	-15.3%	**-42.6%**

- *Final energy consumption intensity (excluding non-energy) in 2014 improved by 1.8% compared to 2013;*
- *Annual improvement in final energy intensity (exc. NE) was on average 1.8% 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 consumption	2.0%	3.9%	0.8%	-1.8%	5.6%	4.7%	2.4%	1.4%	0.6%	21.1%	
Change in GDP 2011 US$ PPP	5.4%	5.7%	3.0%	0.0%	5.9%	4.4%	4.4%	3.8%	3.8%	42.6%	
Change in final energy intensity	-3.2%	-1.7%	-2.2%	-1.9%	-0.2%	0.3%	-1.9%	-2.3%	-3.0%	-15.1%	**-42.0%**

- *The final energy consumption intensity (excluding non-energy) in 2014 improved by 0.6% compared to 2013*
- *Annual improvement in final energy intensity (exc NE) was on average 1.8% since 2006*

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

Trends in IEA and APEC data are similar

Trend to 2035

	IEA (updated in Aug. 2016)	APEC (updated Dec. 2017)
	2005-2014 (EWG 52)	2005-2014
Primary energy supply intensity	-42.8%	-42.6%
Final energy consumption intensity	-42.6%	-39.5%
Final energy consumption intensity excluding non-energy	-42.6%	-42.0%

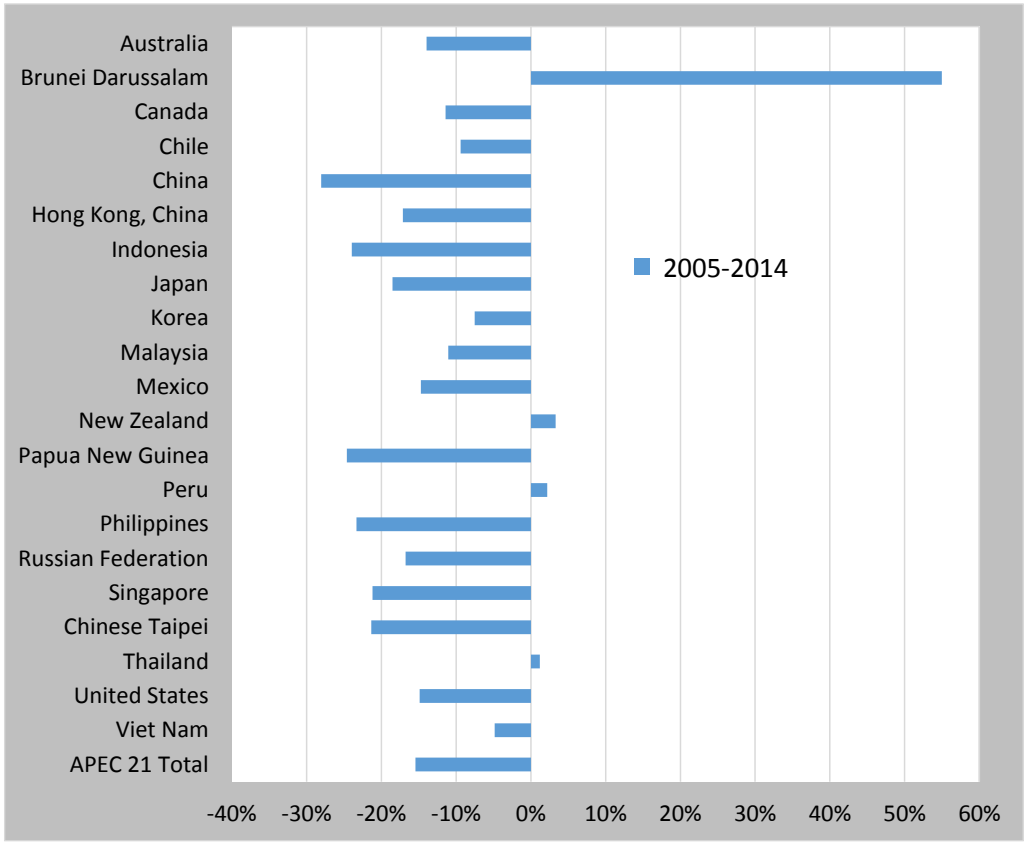
- In IEA data (2015 Nov. version), primary energy, final energy and final excluding non-energy intensities will all achieve the 45% reduction goal in **2038**.
- In APEC data (as of March 2016), primary energy and final energy excluding non-energy intensities achieve the 45% reduction goal in **2038**,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

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

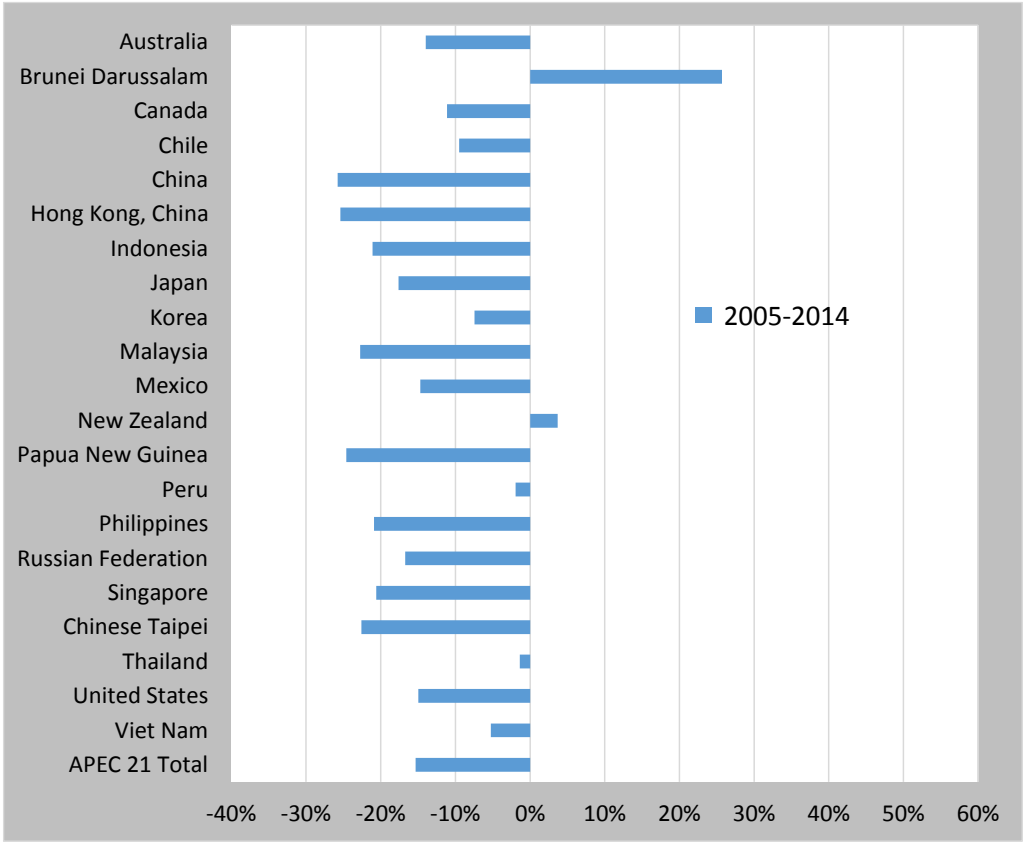
Economy level results show IEA/APEC differences (1)

Primary energy intensity (toe/million $ @2011 PPP)

IEA data



APEC data

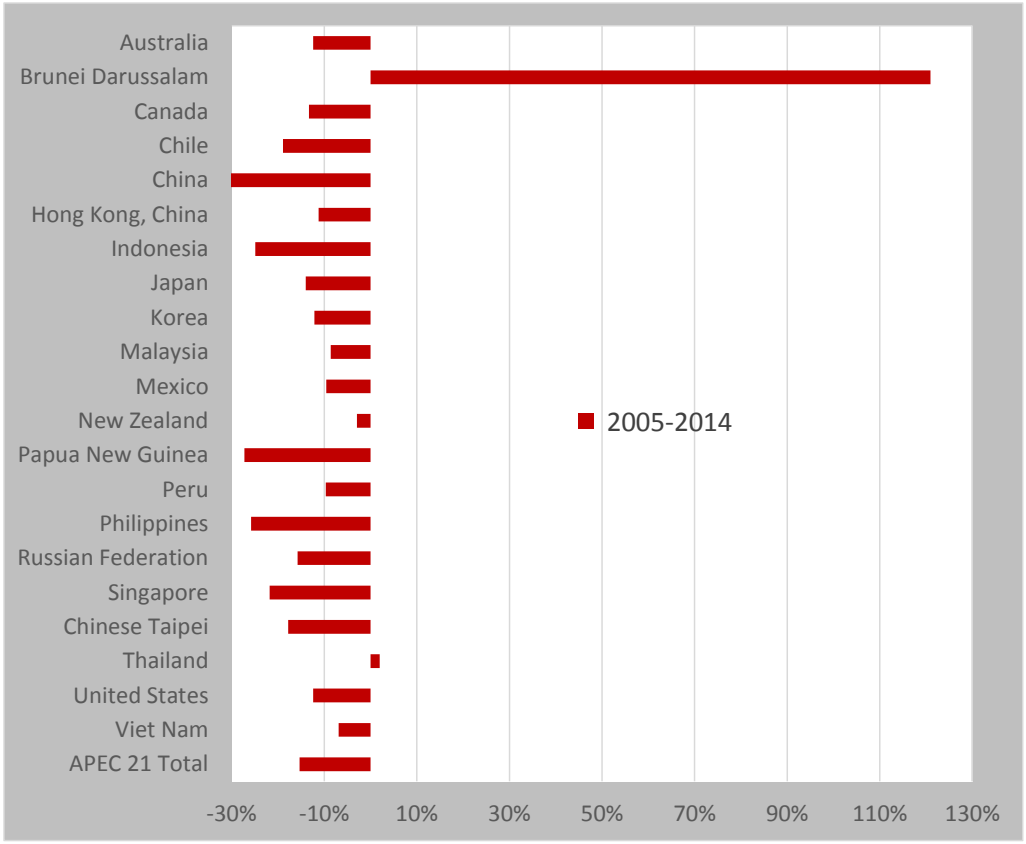


Note : Data from IEA and ESTO, energy intensity calculation by APERC

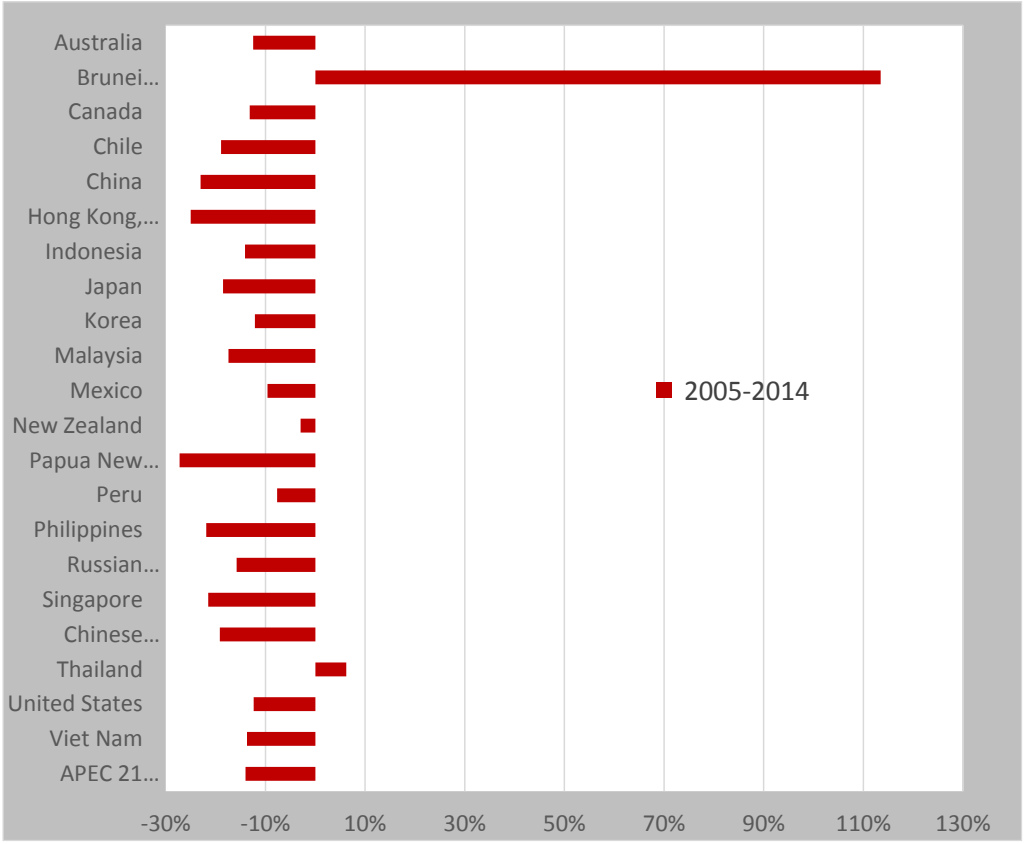
Economy level results show IEA/APEC differences (2)

Final energy intensity (toe/million $ @2011 PPP)

IEA data



APEC data

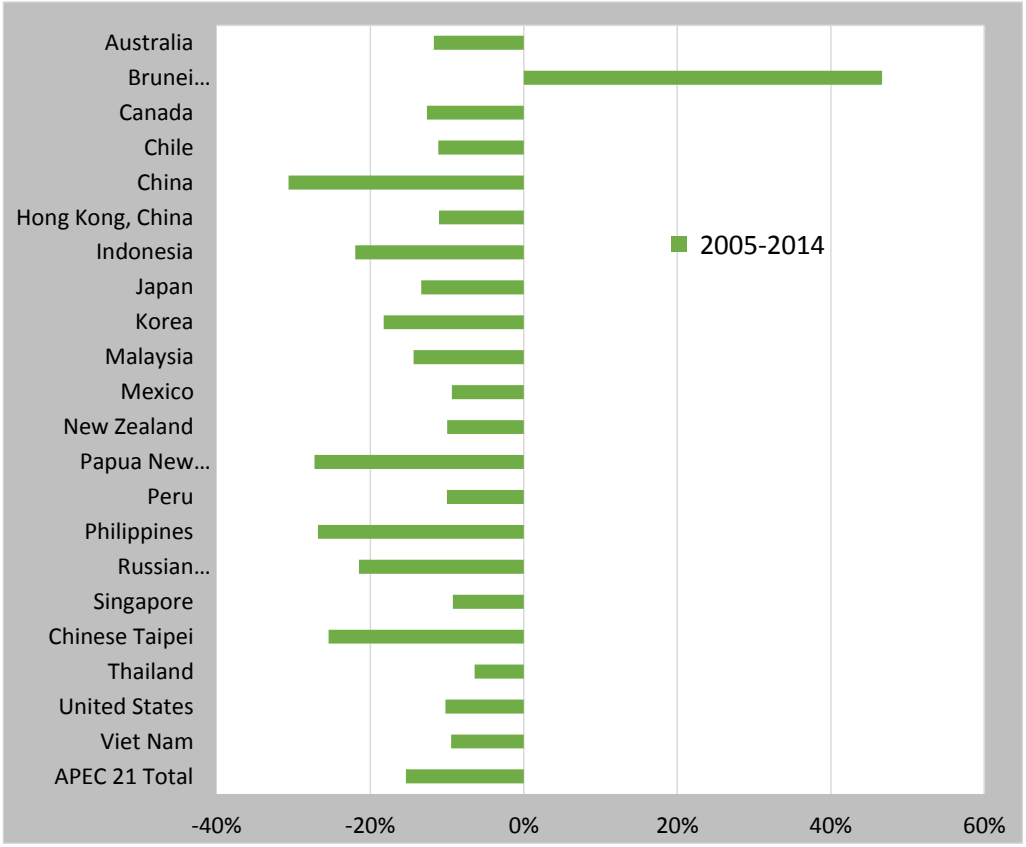


Note : Data from IEA and ESTO, energy intensity calculation by APERC

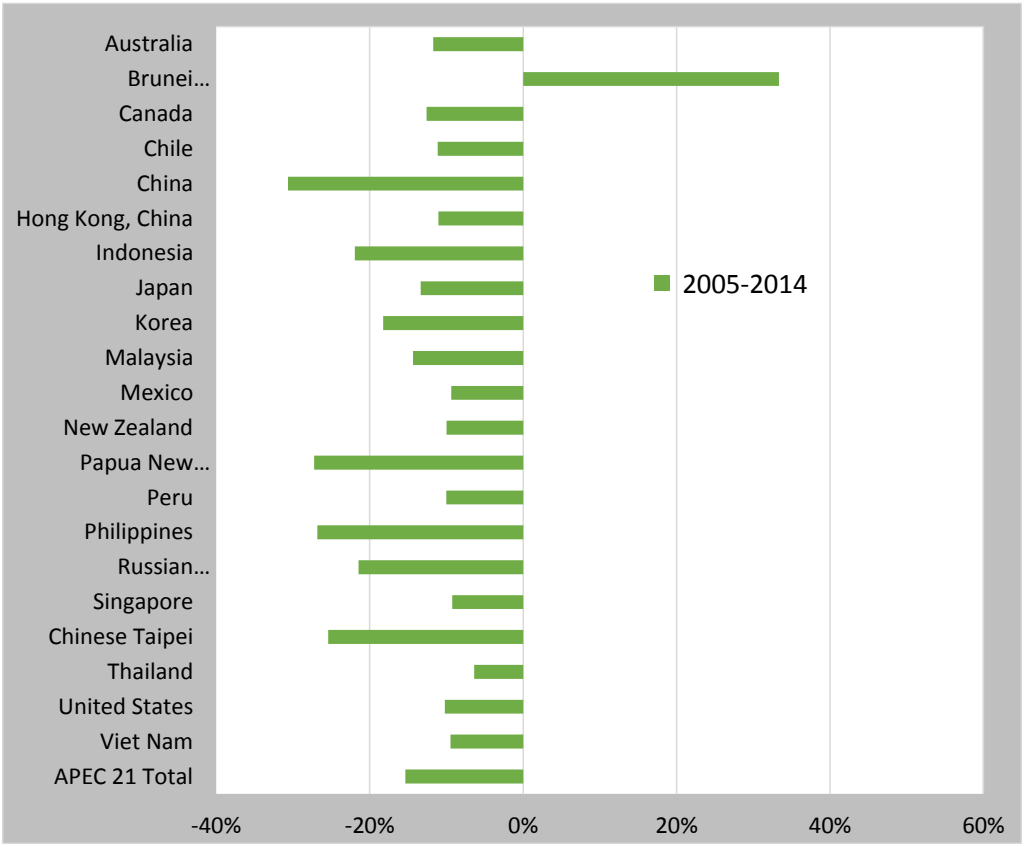
Economy level results show IEA/APEC differences (3)

Final energy less non-energy intensity (toe/million $ @2011 PPP)

IEA data



APEC data



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

3. Issues with current measures of intensity

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Issues with current considerations

- While all measures currently considered show a similar trend, the specific movement changes.
- Impractical and resource intensive to track all of these at the same time.
- Lack of clarity when reporting the actual progress with differing measures.

Responding to the issues

- Single measure (definition) of intensity should be adopted:
  - Final energy demand (FED) required to produce USD PPP 1 million of PPP GDP.
  - Non-energy use should be excluded as it is not a measure of energy consumption.
- Single source of data should be used
  - APEC data for APEC targets.

4. Linking intensity to efficiency

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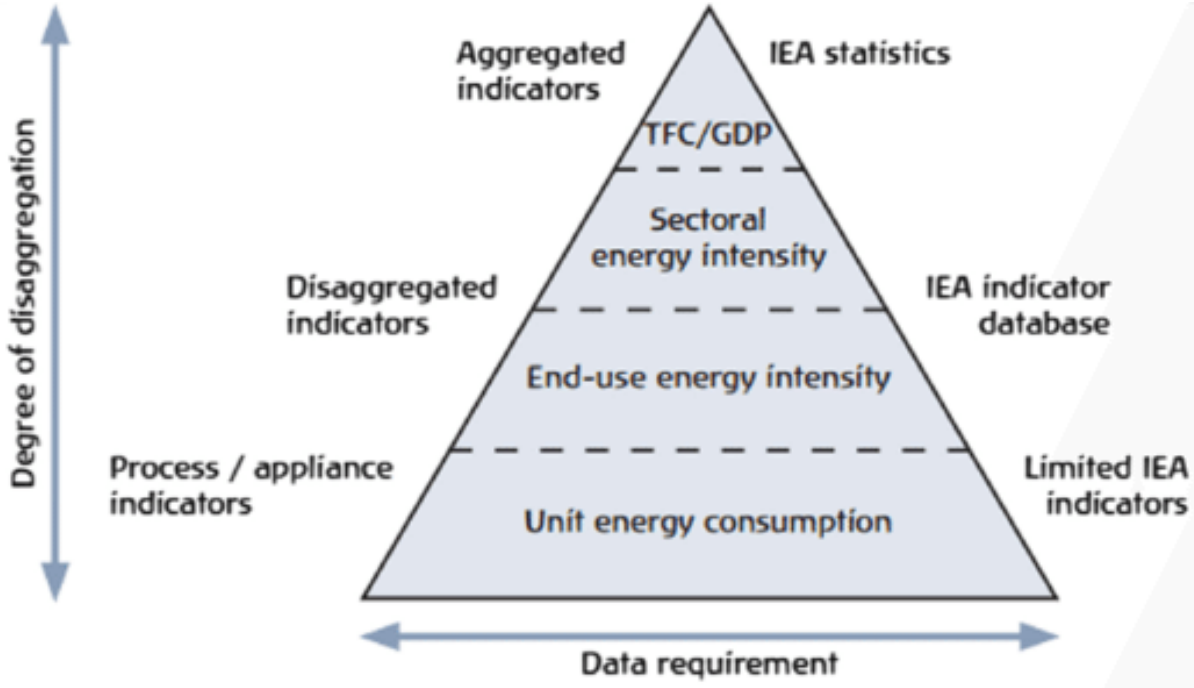
Linking intensity to efficiency

- Intensity was chosen as a proxy for efficiency
  - Suitable as an overarching marker
  - But, intensity is affected by variables other than efficiency
- Efficiency is linked to individual activities, or maybe sectors.
  - Needs more data, which are often not available.
  - More complex

IEA energy efficiency indicator framework

Energy efficiency indicator framework form IEA.



More disaggregate indicators require significantly more effort and data to produce usable results.

Source: IEA 2016.

Linking intensity to efficiency

- EGEE&C should discuss energy efficiency indicators development.
  - Suitability, complexity, depth.
- EGEE&C could initiate a project proposal on energy efficiency indicators
  - Assess data availability and data gaps.
  - Suggest indicators that could relate the intensity target to efficiency, and have the needed data to populate an indicator set.

5. Formalising intensity target reporting

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Progress reporting arrangements

- The intensity target falls within the purview of EGEE&C.
  - APERC suggests that this should be reflected in the updated EGEE&C Terms of Reference and have reporting obligations on the target.
- APERC proposes making an annual progress report on intensity at the second EGEE&C meeting of every year.
  - EGEE&C will then be able to update the EWG on this.

Thank you for your kind attention

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

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