



**Asia-Pacific
Economic Cooperation**

2019/EWG58/027
Agenda Item: 11ci

Progress Towards Energy Intensity Reduction Goal Data Report - Presentation

Purpose: Information
Submitted by: APERC



58th Energy Working Group Meeting
Antofagasta, Chile
16-17 October 2019

11.c.i. Progress toward energy intensity reduction goal

The 58th Meeting of APEC Energy Working Group (EWG)
Antofagasta, Chile; 16-17 October 2019

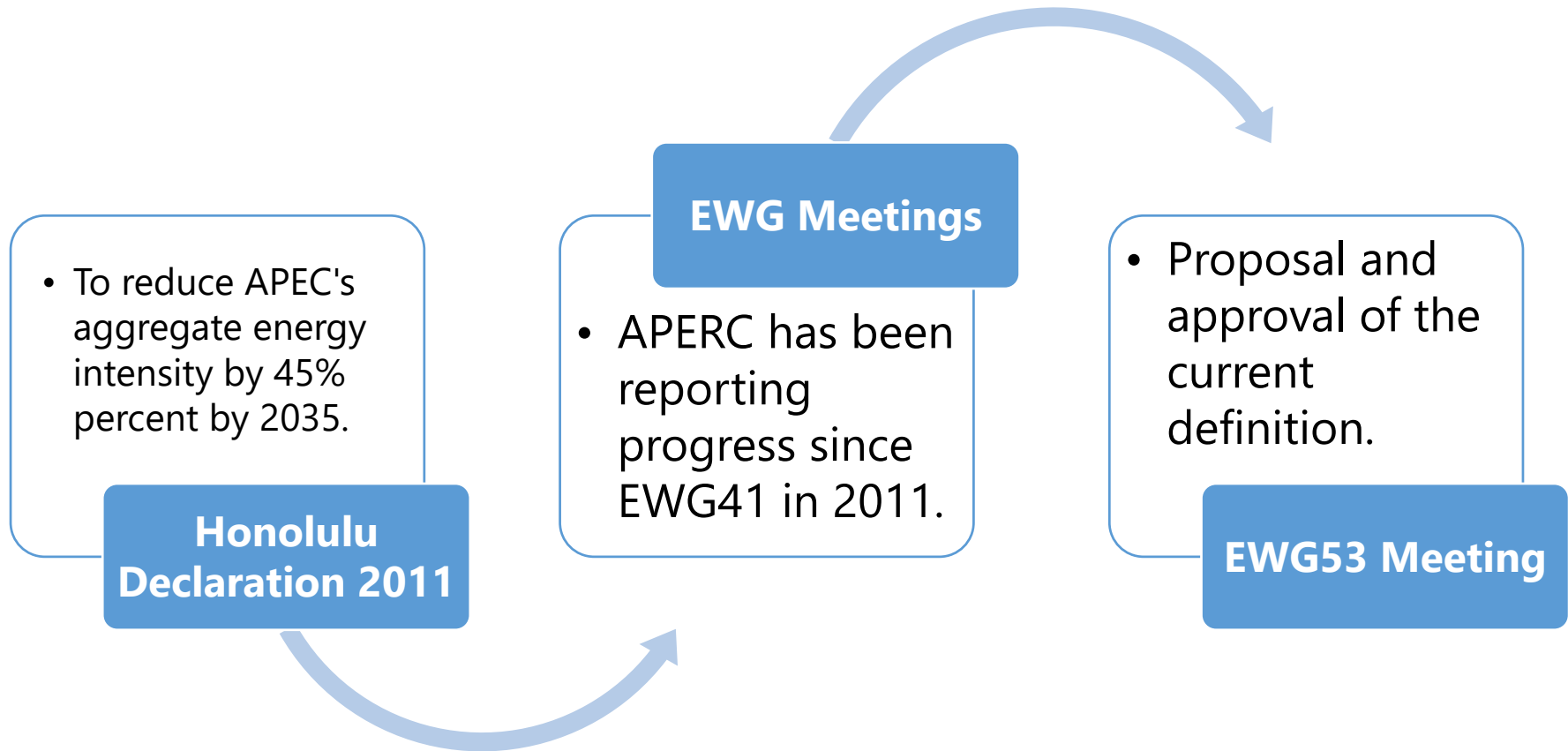
James Kendell, EGEDA Chair; Senior Vice President, APERC





1. Progress on APEC intensity goal

APEC energy intensity indicator milestones



- ❑ Agreement was reached at EWG53 to analyse final energy consumption intensity (excluding non-energy), using APEC data.

Notes on data sources and definitions

Data and data sources

- ❑ All energy data collected by ESTO were as of 30 September 2019.
 - Including updates from 1990 onwards
- ❑ GDP data from the World Bank (PPP, constant 2011 US dollars)
- ❑ Exceptions:
 - APERC/ESTO estimates Papua New Guinea energy consumption.
 - APERC estimates Chinese Taipei GDP data.

Definitions

- ❑ Final energy consumption (FEC) includes industry, transport, commercial, residential and agriculture (forestry and fishery)
- ❑ Final energy intensity

$$FEI = \frac{\text{FEC (Mtoe)}}{\text{GDP (million USD, PPP)}}$$

Energy intensity continued to decline in 2017...

APEC final energy intensity, 2006-17

	2006	07	08	09	10	11	12	13	14	15	16	17	Trend to 2035
Change in final energy consumption	2.6%	3.6%	0.6%	-1.1%	5.5%	4.3%	1.8%	1.5%	1.3%	0.3%	1.2%	0.3%	
Change in GDP (PPP, constant 2011 US dollars)	5.4%	5.6%	3.0%	0.0%	5.8%	4.3%	4.3%	4.0%	3.9%	3.7%	3.5%	4.0%	
Change in final energy intensity	-2.7%	-1.9%	-2.3%	-1.2%	-0.3%	0.00%	-2.4%	-2.4%	-2.5%	-3.3%	-2.1%	-3.6%	-46.5%

- ❑ *Final energy intensity has been improving reasonably consistently year-on-year, with the largest reduction in 2017 (-3.6%)*
- ❑ *Final energy intensity fell 22.1% between 2005 and 2017.*
- ❑ *If the current trend continues, the APEC final energy intensity goal of 45% will be met in 2035.*

..and APEC intensity goal looks achievable

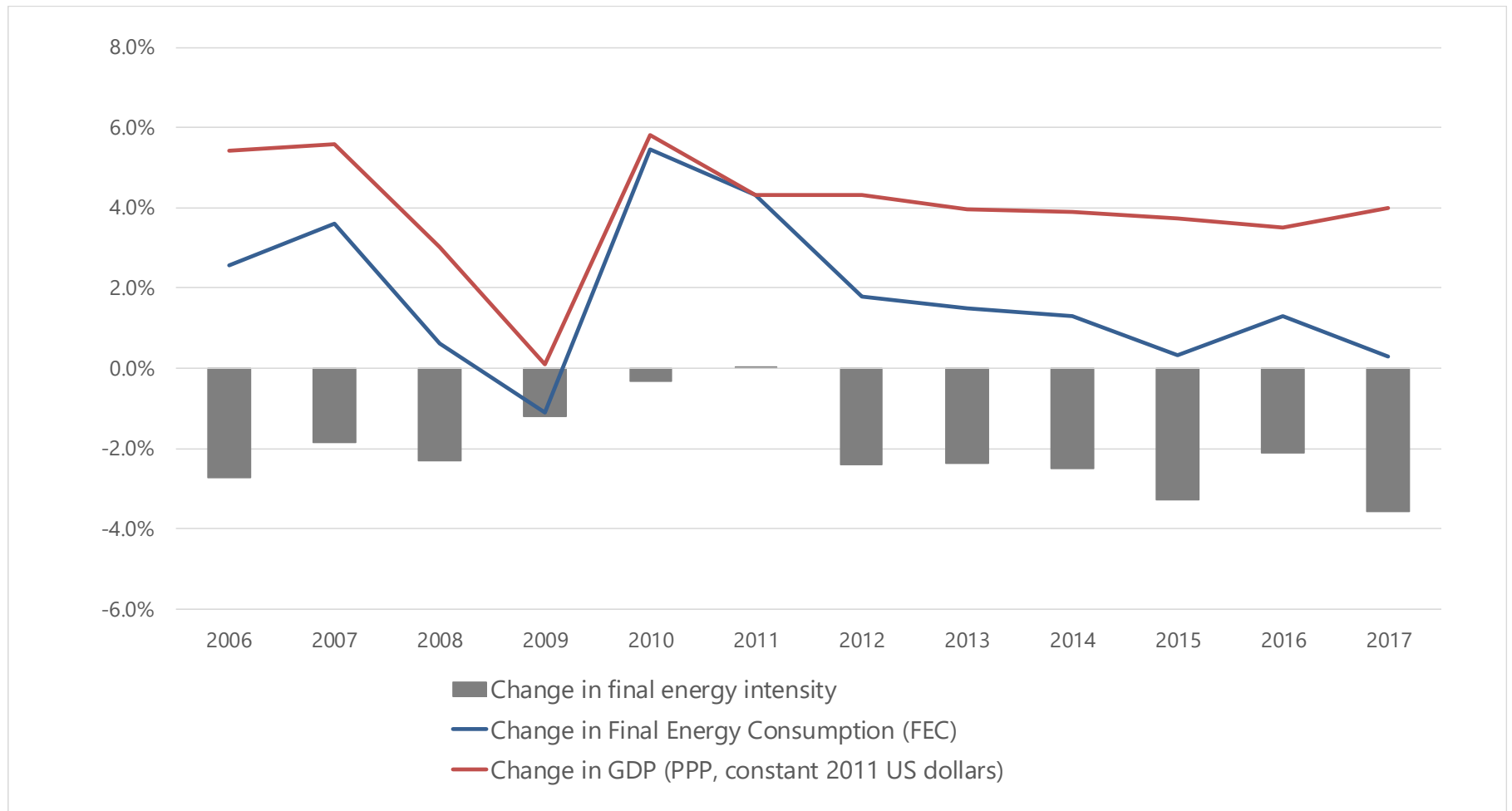
EWG reporting comparison

	EWG55 2005-15	EWG57 2005-16	EWG58 2005-17
Change in Final Energy Consumption (FEC)	21.5%	22.9%	24.1%
Change in GDP (PPP, constant 2011 US dollars)	47.9%	53.2%	59.4%
Change in final energy intensity	-17.9%	-19.8%	-22.1%
Trend to 2035 (by extrapolation)	-44.6%	-45.1%	-46.5%

Sources: APEC statistics (energy), WB (GDP) and APERC analysis.

GDP and energy consumption remain decoupled

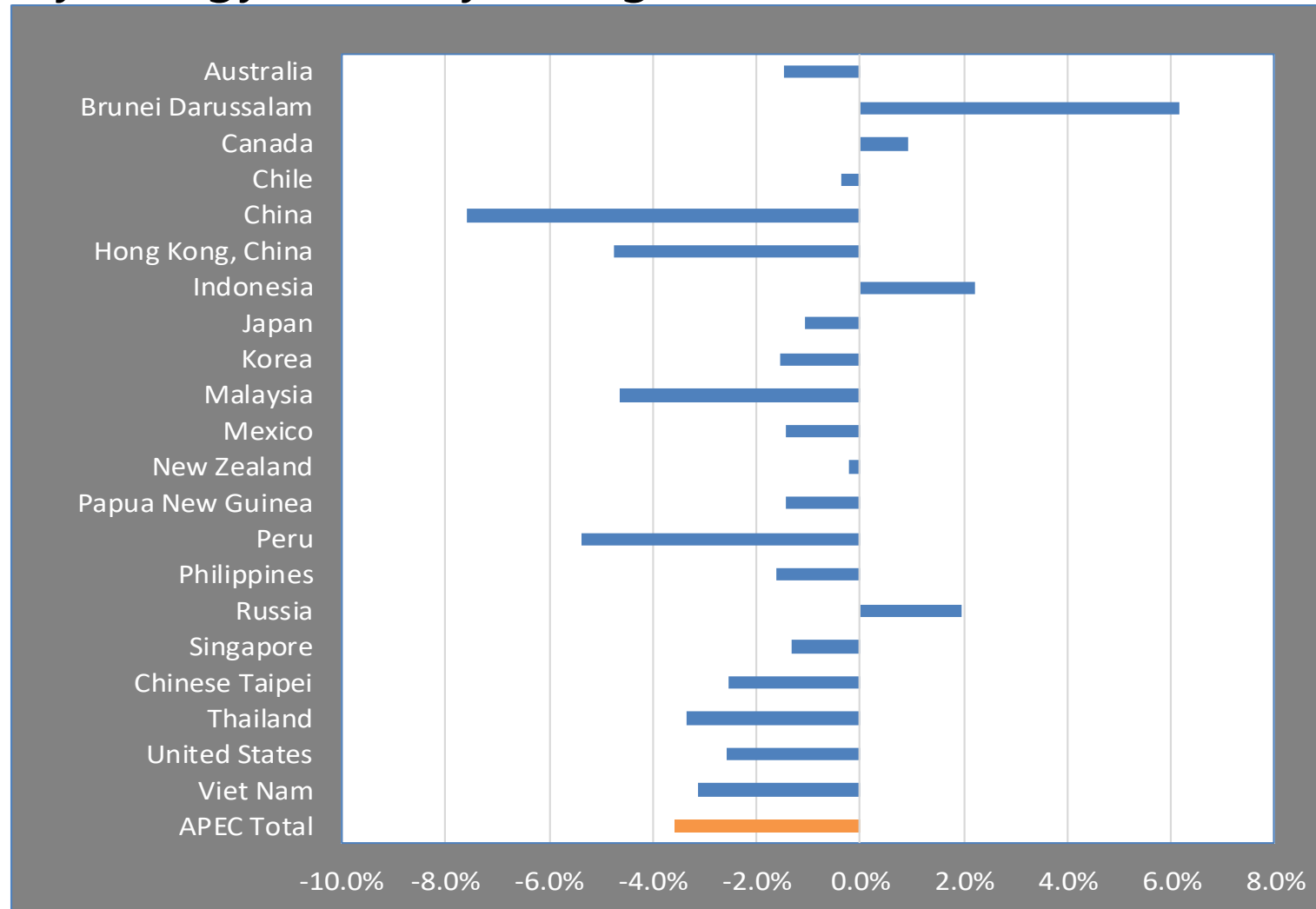
Annual changes to intensity, energy demand and GDP, 2006-17



Source: APEC statistics and APERC analysis.

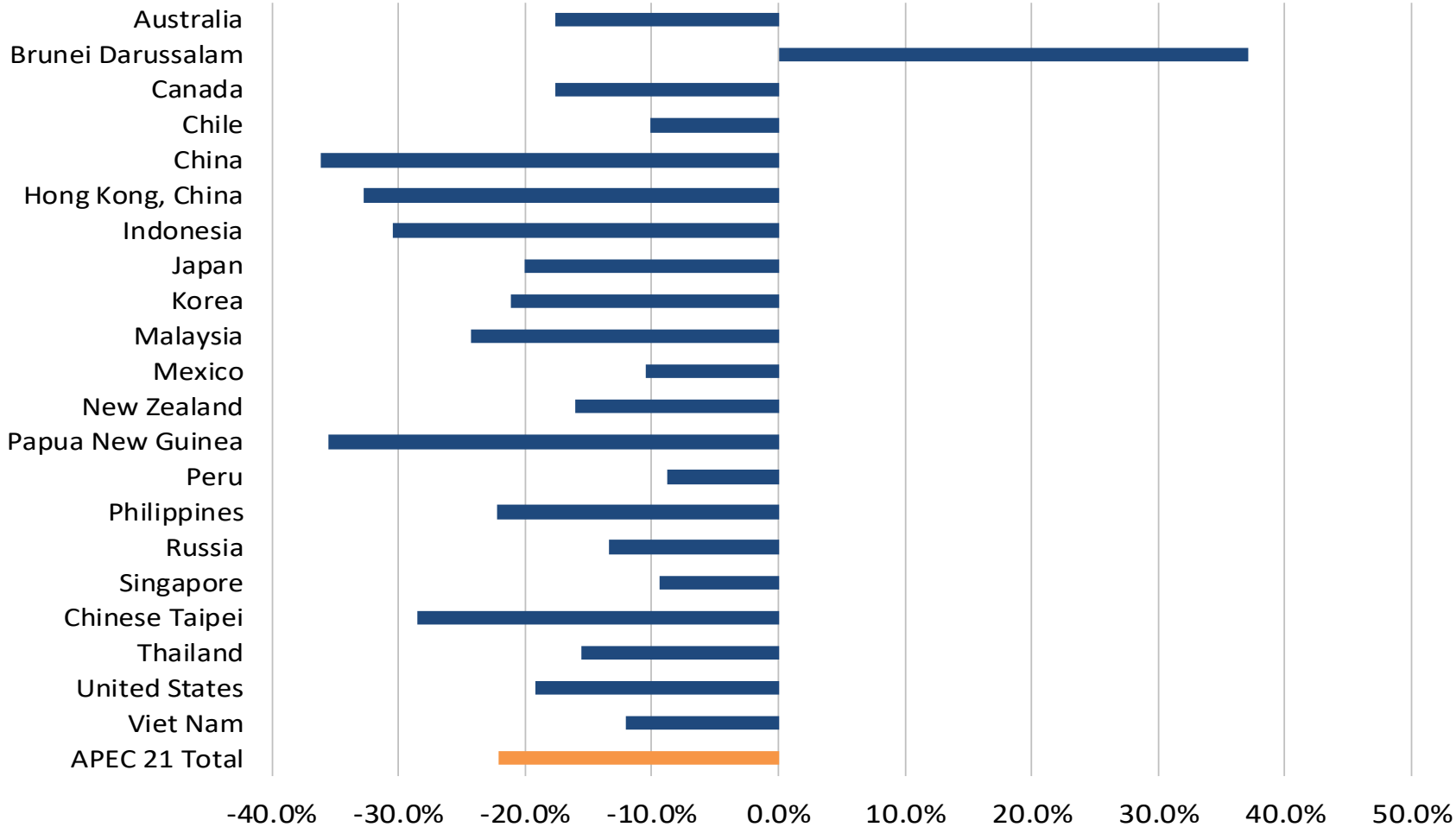
In the short run, not all economies have decoupled

Economy energy intensity changes, 2016-17



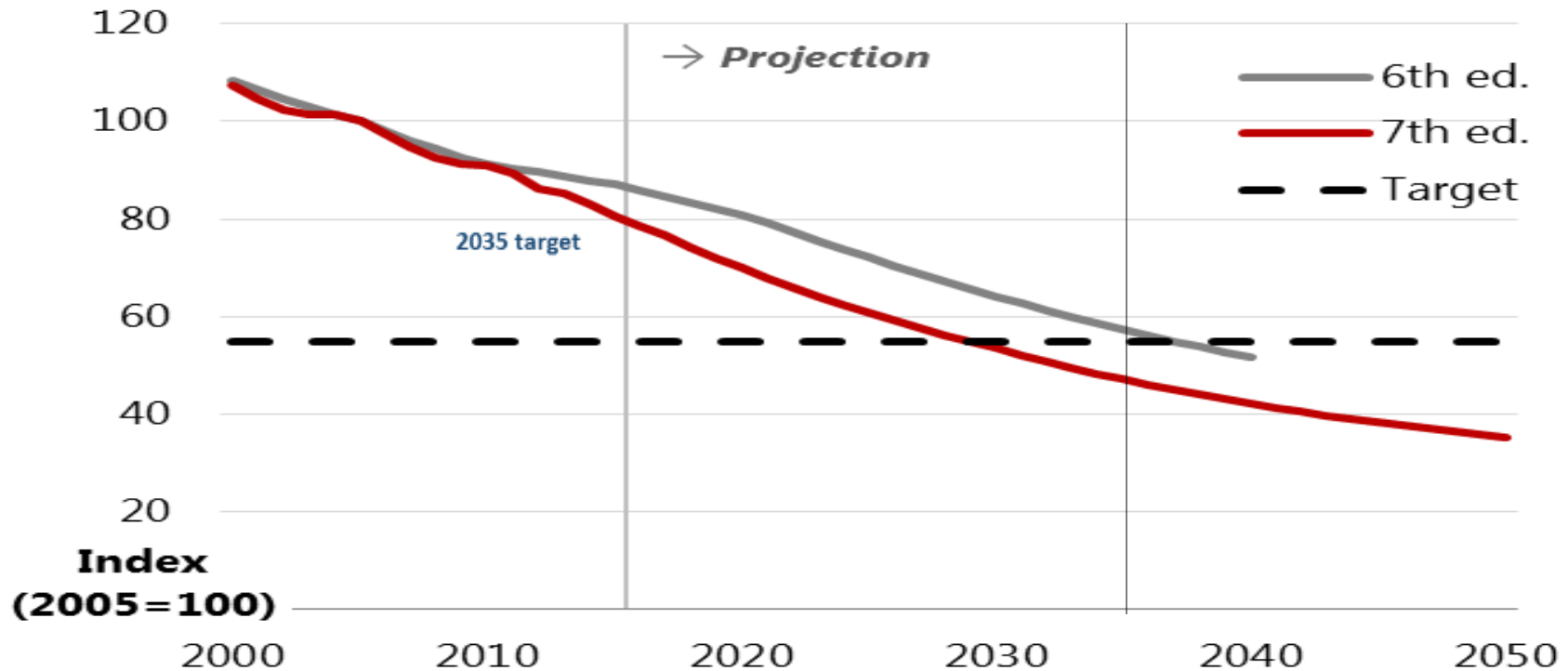
In the long run, most economies have decoupled

Economy energy intensity changes, 2005-17



Intensity goal is met in 2029 in Outlook 7th edition

APEC business-as-usual energy intensity by edition, 2000-2050



Source: IEA statistics 2017 and APERC analysis.

Goal was met in 2037 in the 6th edition.



2. Decomposition analysis

Decomposition analysis milestones

- ❑ At EGEEEC53, presented a plan to develop energy efficiency indicators by using decomposition; and EWG57 as well.
- ❑ At EGEEEC54, presented the initial result of aggregate APEC energy intensity improvement using decomposition method

Decomposition will illuminate intensity measure

...but data intensive

Energy data - APEC data through ESTO

GDP (PPP)–World Bank Indicators. As oftentimes disaggregated GDP or gross value added (GVA) are not available in World Bank database, GVA may need to be sourced from each economy.

Other data–activity data; physical production output; sectoral end use from each economy; and other international sources such as IEA, WB, IMF, UN, ADB and OECD.

- *EGEEC supports decomposition of energy demand and development of energy efficiency measures to better understand the underlying causes of changes in energy intensity.*
- *EGEEC had preliminary discussions about updating the intensity goal.*
- *EWG57 supports decomposition analysis*

Activity, structure, and intensity effects are key

Decomposition represented by Logarithmic Mean Divisia Index (LMDI)-I Formula by B.W. Ang

$$\Delta E_{tot} = E^T - E^0 = \Delta E_{act} + \Delta E_{str} + \Delta E_{int}$$

Change in energy

$$= \underbrace{\sum_i \frac{E_i^T - E_i^0}{\ln E_i^T - \ln E_i^0} \ln \left(\frac{Q^T}{Q^0} \right)}_{\text{Change in activity}} + \underbrace{\sum_i \frac{E_i^T - E_i^0}{\ln E_i^T - \ln E_i^0} \ln \left(\frac{S_i^T}{S_i^0} \right)}_{\text{Share (change in structure)}} + \underbrace{\sum_i \frac{E_i^T - E_i^0}{\ln E_i^T - \ln E_i^0} \ln \left(\frac{I_i^T}{I_i^0} \right)}_{\text{Change in intensity}}$$

Where:

E = Total energy consumption (for all sectors)

Q = Overall activity level (for all sectors)

E_i = Energy consumption of sector i

T = current year

Q_i = Activity level of sector i

0 = base year

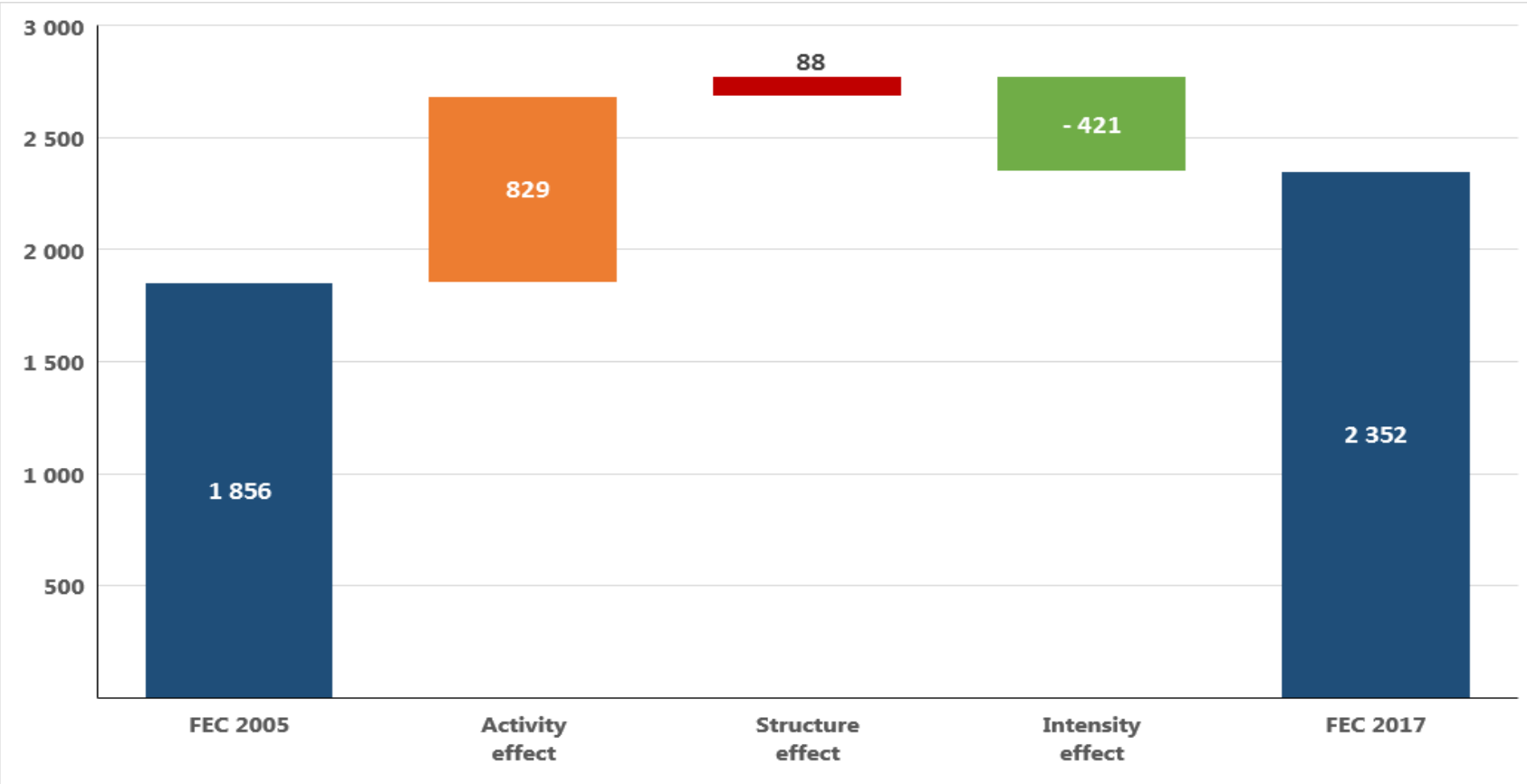
S_i = Activity share of sector i

I_i = Energy intensity of sector i

Data used for decomposition

- Energy (ktoe)
 - ESTO data (industry, services, agriculture)
- Activity data (constant 2010 USD)
 - World Bank GVA (industry, services, agriculture)
 - National Statistics (DGBAS)
- *GVA (of the three sectors indicated) is the measure of the level of activity of energy consumption associated with each sector.*
- *It is not a good proxy to measure activity in other sectors such as the transport or the residential.*
- *Transport consumption is not comparable to the GVA of the transport sector since the energy use attributed to transportation is part of the companies and activities included in all economic sectors.*
- *We did not consider the energy consumption in the domestic sector apart from transportation, since it is not directly related to any concrete production process.*

Intensity effect offset consumption increases



Sources: FEC (APEC) and GVA (WB and DGBAS) and APERC analysis

Energy intensity declines offset increases in final energy consumption brought about by activity and structural effects.

Suggestions from EGEEEC54

- Compare the past APERC Energy Outlooks on energy intensity projection;
- Look into the GDP projection of APEC economies and its assumptions;
- Provide historical trends in energy intensity and factors affecting the changes in the energy intensity; and
- If possible, in-depth analysis on the aggregate energy intensity trends for the following economies:
 - Group1: China; Japan; Russia and the US
 - Group2: other economies

Closing thoughts: better data = better analysis

- On intensity reduction goal: trends look good; decoupling seems likely to continue.
- Decomposition method allows us to separate structural shifts or activity shifts, understanding better true trends in energy consumption as well as trends in economic activity that influence energy consumption in APEC.
- However, more useful analysis requires more detailed data, e.g. as passenger-km travel and number of vehicles (transport*), floor area and weather effect (residential), etc.
- This can be a challenge (or opportunity...) for EGEDA members, EGEEC or even EWG members.

*Initially tried with 3-OECD APEC economies



Thank you for your kind attention.

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

<https://www.egeda.ewg.apec.org/>