2A.5 Tracking efficiency in the industry sector

The 19th APEC workshop on energy statistics – Joint APEC-IEA training workshop on end-use energy consumption data

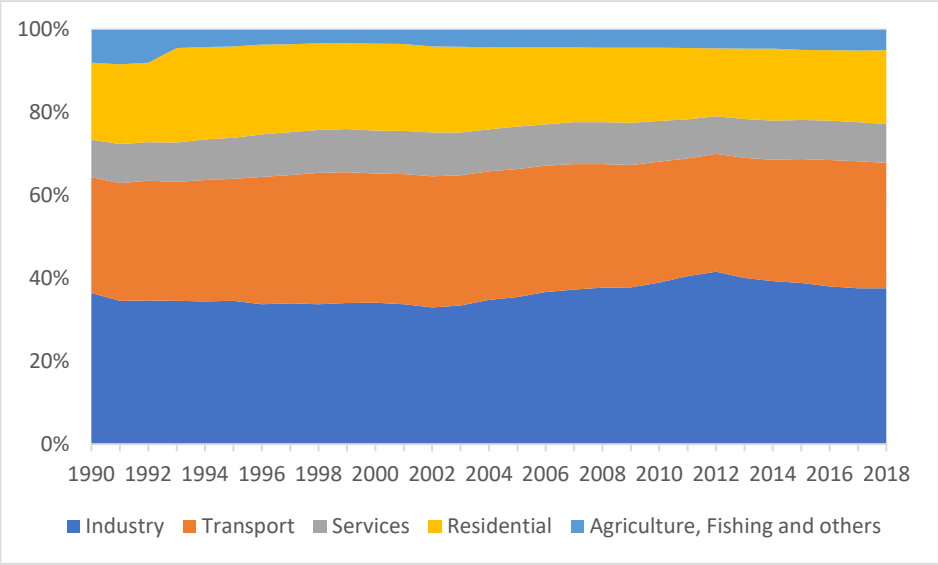
28-30 June 2021 (Virtual Event)

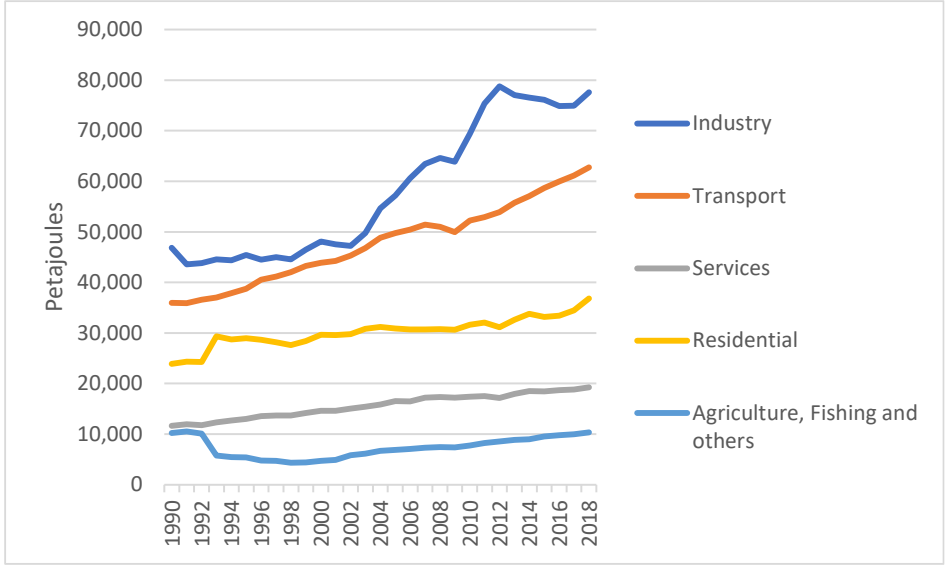
Edito BARCELONA
Senior research fellow, ESTO/APERC

Outline

1. *Industrial energy consumption in APEC*
2. *Measuring EE in industry*
3. *Energy intensity per unit of value added*
4. *Energy consumption per unit of output*
5. *Data requirements*
6. *Are the data available?*

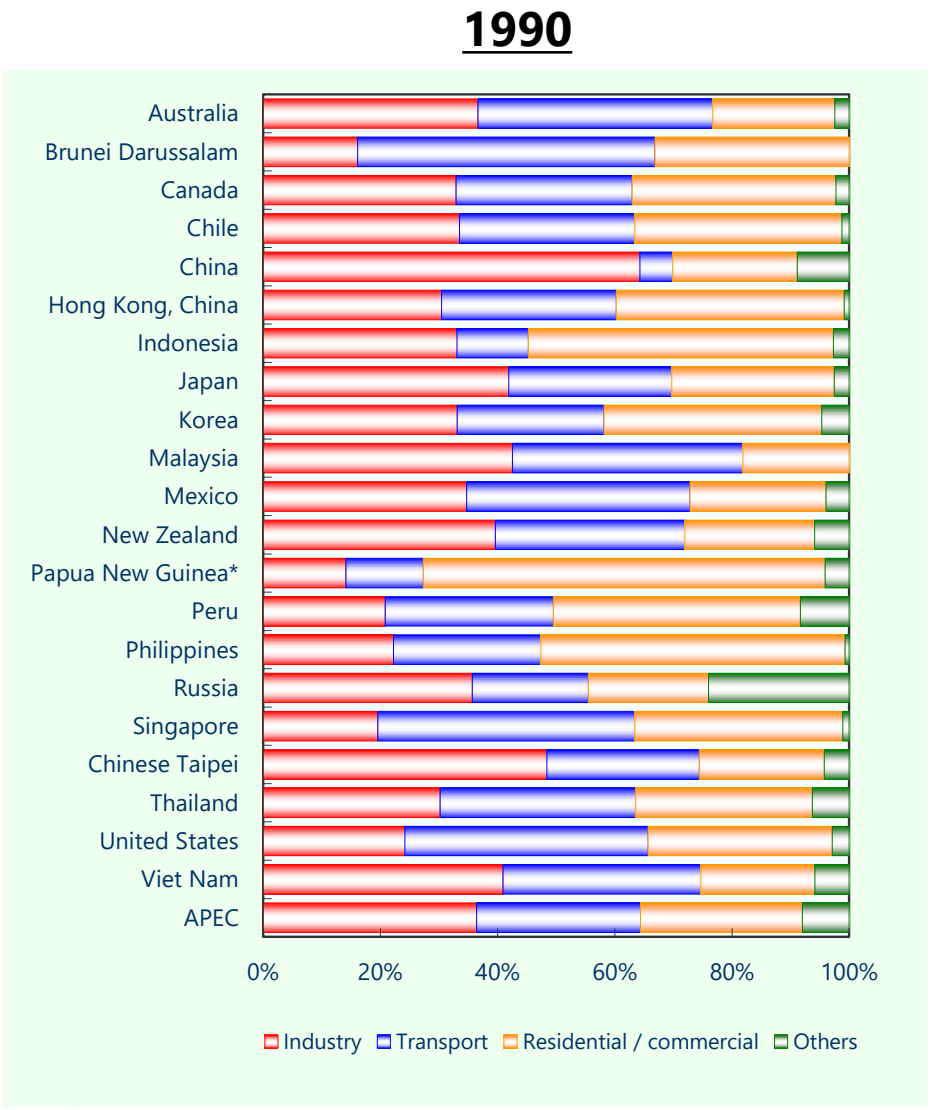
Industrial energy consumption in APEC

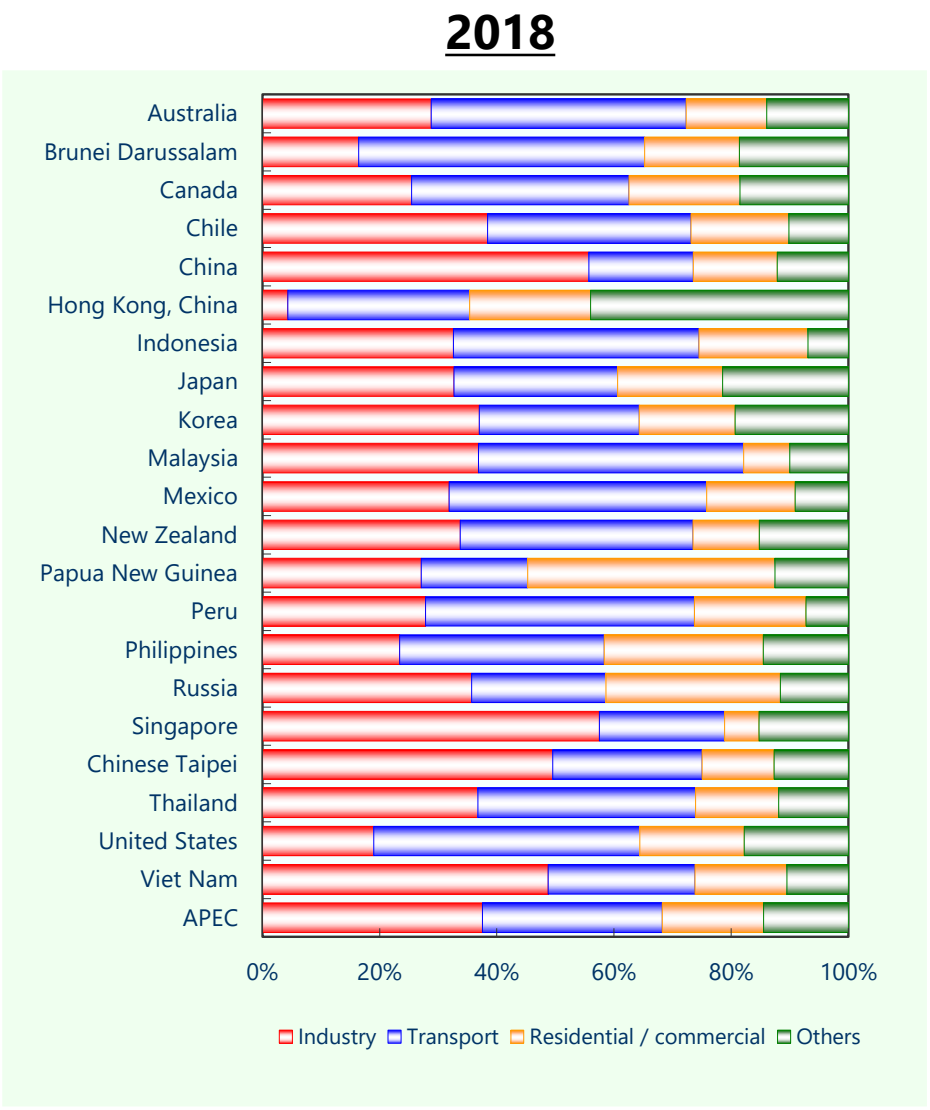




- Industry is the biggest energy consumer in APEC responsible for close to 40% of the final energy consumption from 1990 to 2018
- This excludes the energy industry and feedstocks in the chemical industry
- Industry sector consumption was also the second fastest growing after the transport sector but was the fastest growing until 2012.

Industry is the major energy consumer in most economies



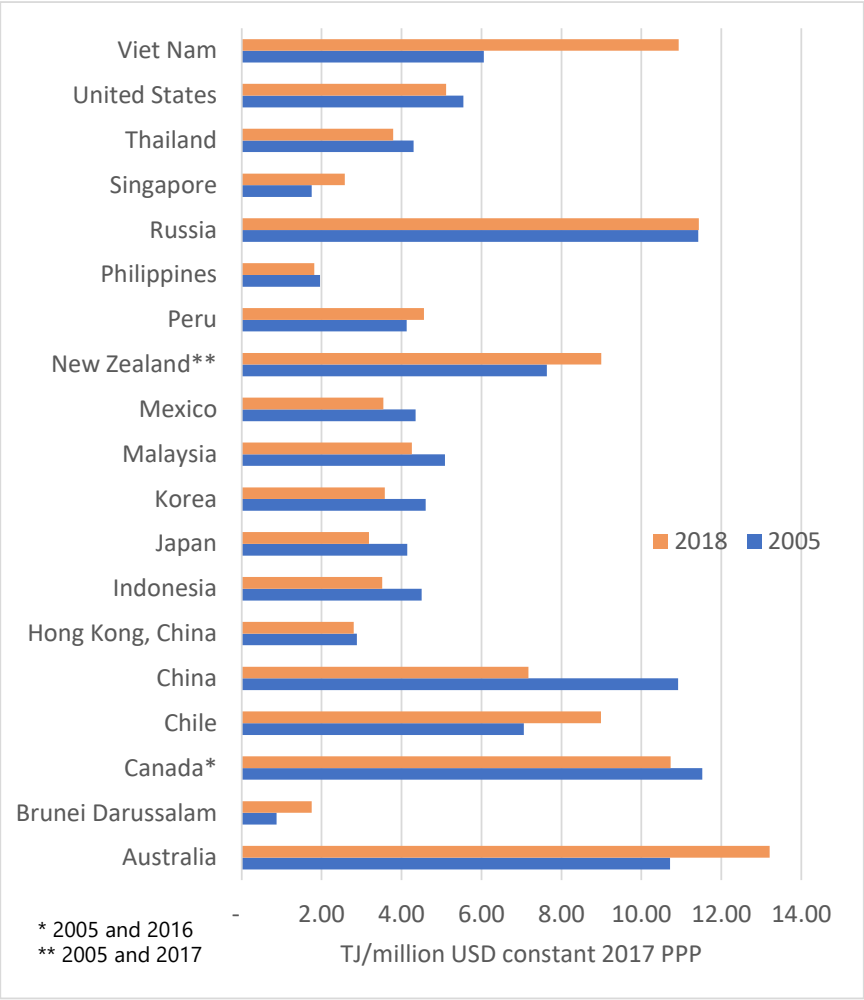


Measuring energy efficiency in industry

- Energy consumption per unit of output
  - Energy consumption per unit of industry value added (**energy intensity**)
  - Energy consumption per unit of physical output (**specific energy consumption**)

  - **Industry value added** – a given industry's net output derived from the difference of gross output and intermediate consumption
  - **Physical output** – tons of crude steel, cement, pulp, paper and paper board, chemicals, etc.

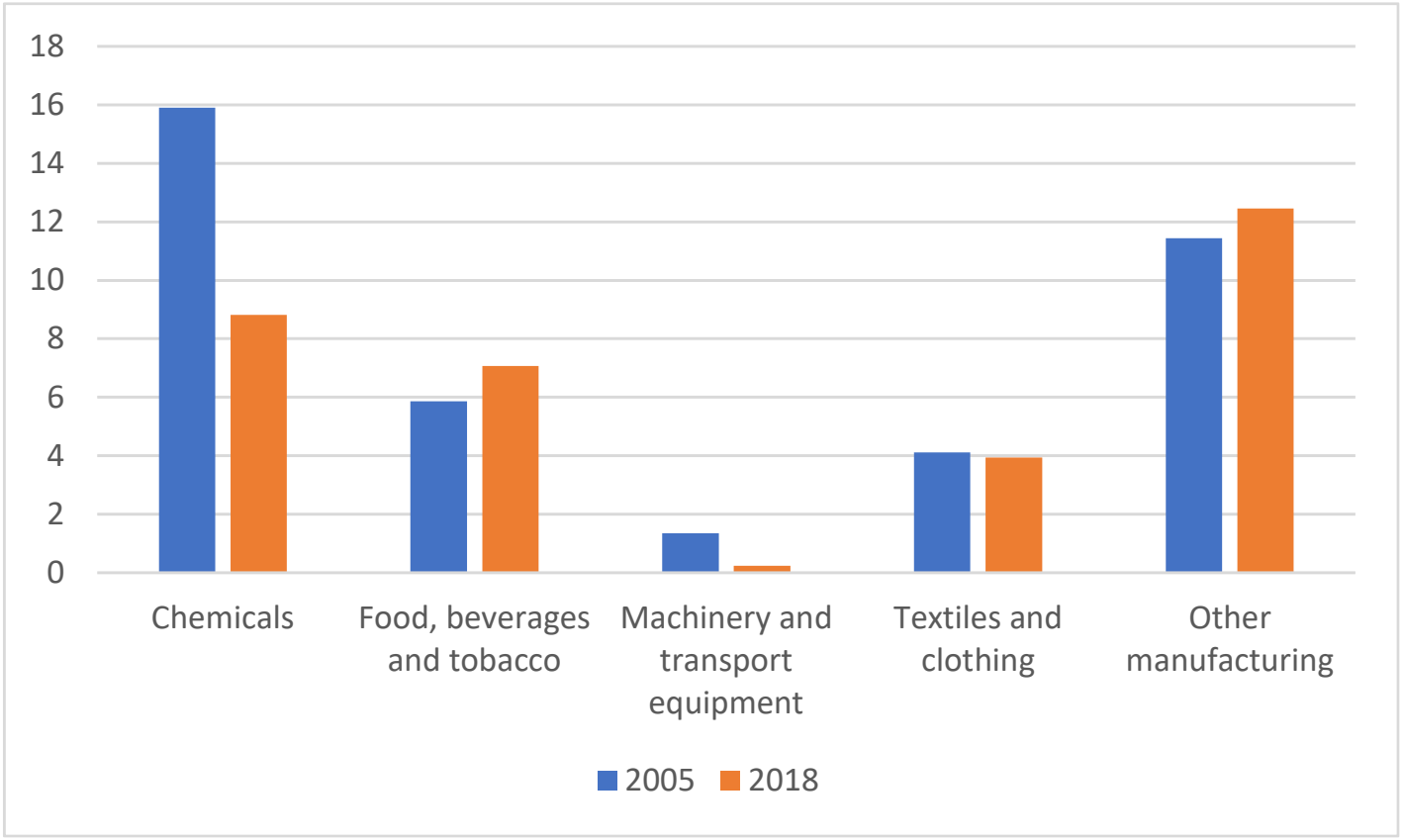
Energy intensity of manufacturing



- Energy intensities (TJ/million USD 2017 PPP) are calculated using energy data from the APEC energy database and the value added data from World Development Indicators of the World Bank
- The energy intensities of AUS, BD, CHL, NZ, PE, SGP and VN are higher in 2018 compared to 2005
- Does this mean that the manufacturing industries in those economies became less efficient?
  - No! We need to further examine each of the manufacturing branches before we can have any conclusion.

Source: APEC, IEA and EDMC.

Energy intensity of manufacturing

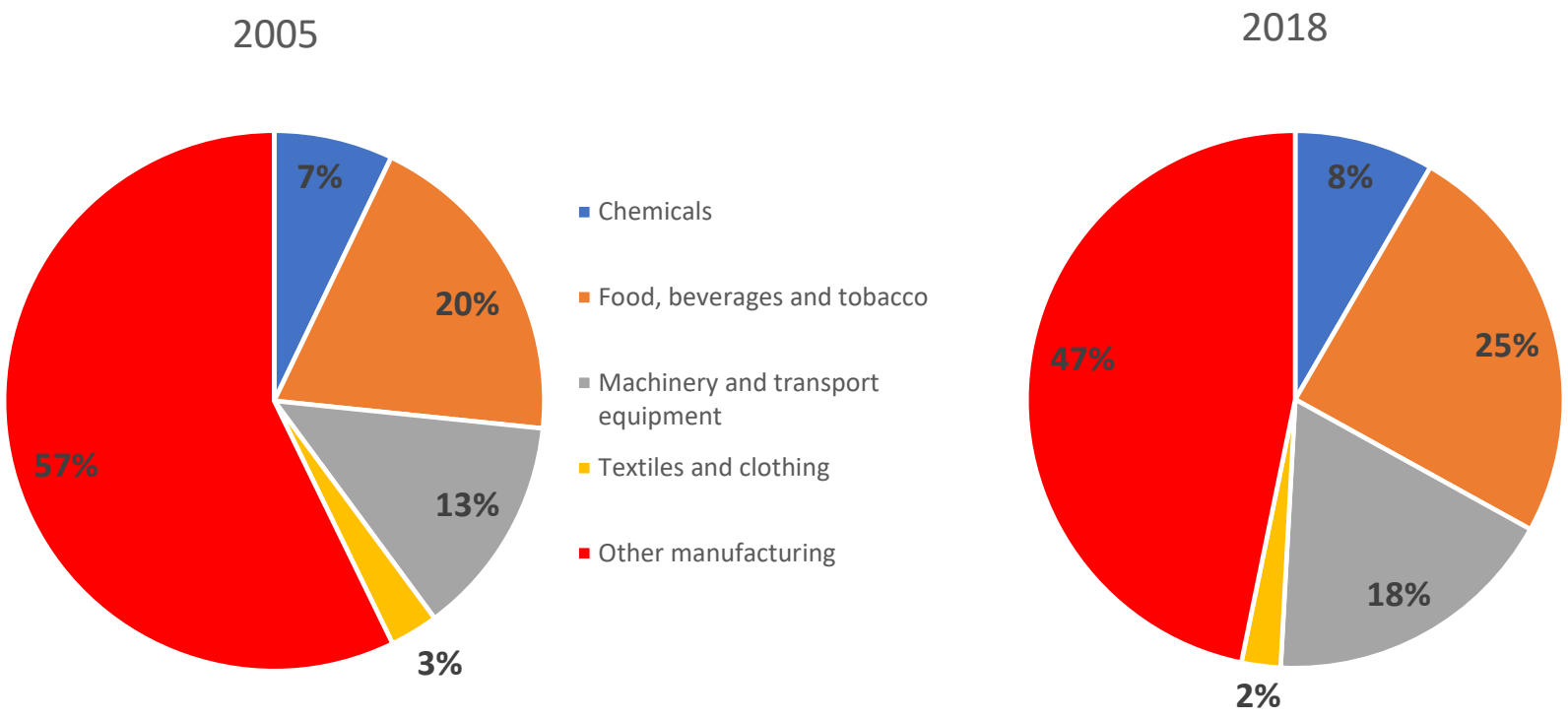


Source: IEA (energy), WB (value added)

Chemicals and machinery and transport equipment industries intensities are lower in 2018 compared to 2005 while those of food and beverages, textile and leather and other manufacturing have higher intensities than in 2005.

The energy intensive cement, iron and steel and pulp and paper industries are lumped together in other industries in the economic data

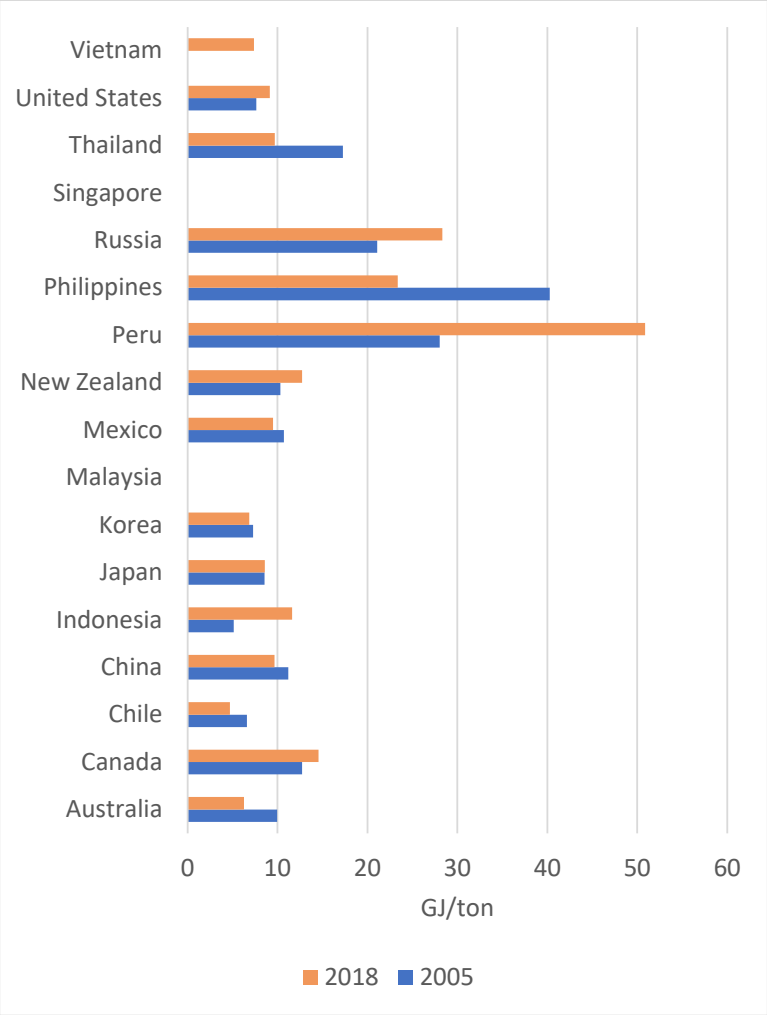
Shares of manufacturing branches to total value added



The total share of food, beverages and tobacco and other manufacturing decreased from 77% to 72%.

Despite the decline in the share, the aggregate energy intensity of manufacturing still increased. Perhaps, the intensity effect contributed much to the increase.

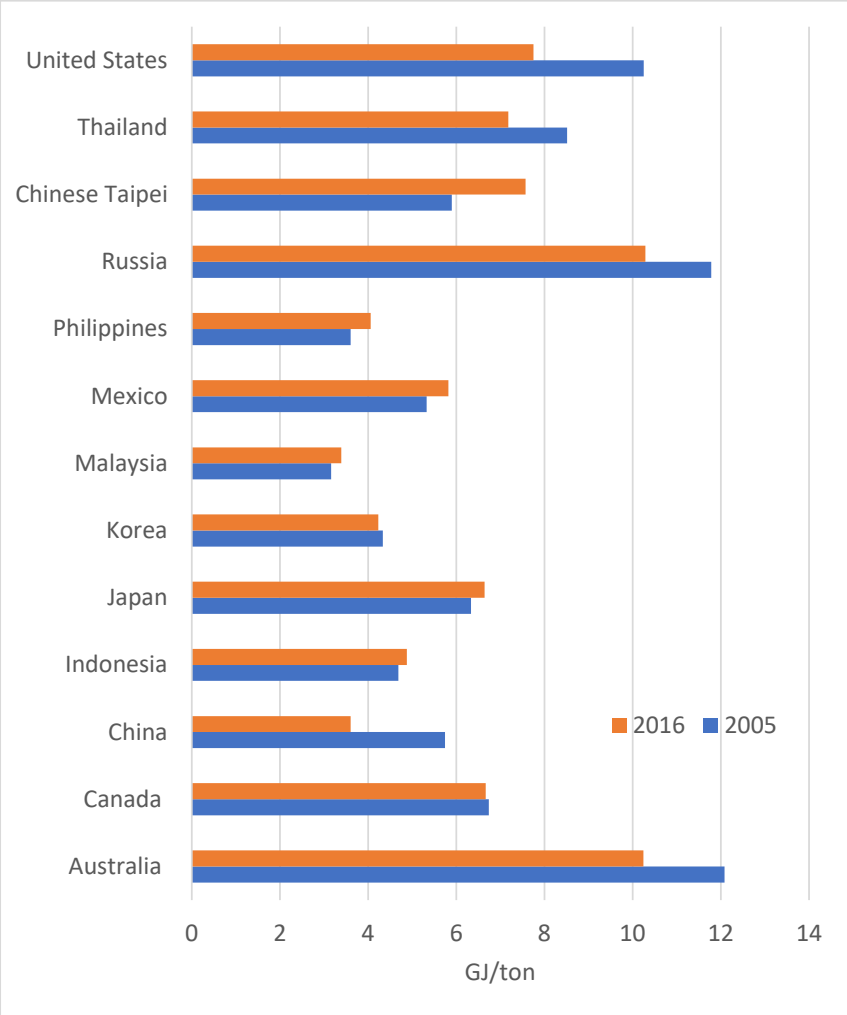
Energy consumption per ton of crude steel



- Energy consumption per ton of steel output decreased in 6 economies
- Singapore and Malaysia produce crude steel but there is no energy consumption data in the steel industry
- Philippines' energy consumption per ton of steel is very high despite using EAF only; this might include consumption of non-ferrous metals industry
- Energy consumption in steel industry in Peru might include energy consumption in mining

Source: APEC, IEA and EDMC.

Energy consumption per ton of cement



- Energy consumption is for non-metallic minerals industry which produces not only cement
- Cement production data excludes clinker for export
- These could explain why energy consumption per unit output is high
- Energy consumption data of the cement industry is needed to have a more sensible indicator of energy efficiency

Source: APEC, IEA and EDMC.

Important points

- Energy intensity can be a proxy but is not always a reliable indicator of energy efficiency
- Structural change can decrease/increase aggregate energy intensity
- More disaggregated energy and production data are needed for a more robust analysis

3. Data requirements

Tracking energy efficiency in industry

- The current disaggregation of APEC energy data, is not sufficient in analysing energy efficiency improvement in the industrial sector
  - In iron and steel industry – energy consumption of each production technology (BOF, EAF, Direct reduced iron)
  - In the cement industry – energy consumption in production of clinker and cement
  - In pulp and paper industry – we need to disaggregate further to pulp, paper and paperboard
- We need the same disaggregation for the volume of output

Some economies have detailed energy data

33	= 最終消費	33 = Total Final Consumption
34	能源消費	34 Energy Consumption
35	工業部門	35 Industrial Sector
36	礦業及土石採取業(不含煤、油及氣)	36 Mining and Quarrying(excluding coal,oil and gas)
37	食品飲料及菸草業	37 Food, Beverage and Tobacco
38	紡織成衣及服飾業	38 Textile,Wearing Apparel and Accessories
39	皮革及毛皮業	39 Leather and Fur
40	木竹及家具業	40 Wood, Bamboo and Furniture
41	紙漿、紙及紙製品業	41 Pulp, Paper and Paper Products
42	印刷業	42 Printing
43	化學材料製造業	43 Chemical Materials
44	基本化學材料製造業	44 Basic Chemical Materials
45	(基本化學工業)	45 (Basic Industrial Chemicals)
46	(石油化工原料製造業)	46 (Petrochemical Materials)
47	(肥料製造業)	47 (Chemical Fertilizers)
48	人造纖維製造業	48 Artificial Fibers
49	樹脂塑膠及橡膠製造業	49 Resin, Plastics and Rubber
50	其他化學材料製造業	50 Other Chemical Materials
51	化學製品製造業	51 Chemical Products
52	橡膠製品製造業	52 Rubber Products
53	塑膠製品製造業	53 Plastic Products
54		54 Non-metallic Mineral Products
55		55 Cement and Cement Products
56		56 Others
57	(陶瓷製品製造業)	57 (Pottery, China and Earthware)
58	(玻璃及玻璃製品製造業)	58 (Glass and Glass Products)
59	金屬基本工業	59 Basic Metal Industries
60	鋼鐵基本工業	60 Iron and Steel
61	非鐵金屬基本工業	61 Others
62	(鋁業)	62 (Aluminum)
63	金屬製品製造業	63 Fabricated Metal Products
64	機械設備製造業	64 Machinery and Equipments
65	電腦通信及視聽電子產品製造業	65 Electrical and Electronic Machinery
66	(電子零組件製造業)	66 (Electronic Parts)
67	運輸工具製造業	67 Transport Equipments
68	精密光學醫療器材及鐘錶製造業	68 Precision Instruments
69	其他工業製品製造工業	69 Miscellaneous Industries
70	用水供應及污染整治業	70 Water Supply and Remediation Activities
71	營造業	71 Construction
72	其他	72 Non-Specified

Source: Bureau of Energy, Ministry of Economic Affairs, R.O.C. - Energy Balance Sheet (moeaboe.gov.tw)

Some economies have detailed value added data

TABLE 3.18 Gross Value Added in Manufacturing by Industry Group: 2006 to 2018
(In million pesos: at constant 2000 prices)

Industry/Industry group	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016[r]	2017[r]	2018[P]
Gross Value Added in Manufacturing	1,106,052	1,145,529	1,194,921	1,137,534	1,264,523	1,324,330	1,395,711	1,538,912	1,666,514	1,760,989	1,885,514	2,044,189	2,145,011
Food manufactures	392,028	409,398	447,843	467,301	479,445	494,349	531,704	554,984	593,577	603,249	653,626	686,274	721,159
Beverage industries	37,834	44,175	50,102	46,051	50,133	58,743	60,303	58,632	73,080	72,375	79,345	80,481	82,495
Tobacco manufactures	9,558	8,632	10,861	10,952	5,968	4,844	4,675	4,349	4,307	5,480	5,854	5,052	4,304
Textile manufactures	40,148	40,395	35,392	29,199	31,472	30,763	30,102	26,435	30,428	32,384	29,761	26,195	26,424
Wearing apparel	34,310	34,758	37,227	29,346	26,465	27,976	39,554	33,330	31,994	31,258	31,238	31,320	31,390
Footwear and leather and leather products	6,876	7,051	7,795	6,036	5,634	5,388	6,269	6,993	7,137	7,478	8,518	8,992	9,325
Wood, bamboo, cane and rattan articles	14,709	19,212	16,336	13,984	14,009	12,788	14,316	13,316	13,567	17,366	20,504	21,470	23,800
Paper and paper products	9,431	11,160	11,215	10,389	12,347	14,147	13,592	12,708	13,437	15,392	16,430	17,109	19,470
Publishing and printing	9,308	9,560	8,890	8,470	8,623	8,140	8,509	8,225	15,308	17,916	18,809	19,389	19,065
Petroleum and other fuel products	53,379	55,394	59,751	48,614	55,869	50,806	48,790	43,266	49,683	49,035	49,689	55,023	65,675
Chemical & chemical products	70,455	68,547	71,466	67,851	77,406	91,401	95,267	184,363	191,229	220,902	242,753	261,770	251,449
Rubber and plastic products	16,166	15,677	16,385	18,399	20,297	21,845	22,516	23,208	24,561	25,398	31,596	32,449	36,782
Non-metallic mineral products	21,657	24,926	27,196	29,190	32,058	32,991	38,010	41,392	39,637	43,362	42,089	50,747	56,775
Basic metal industries	25,073	28,353	28,154	23,252	26,024	25,869	20,983	31,348	33,218	35,290	49,590	61,138	58,173
Fabricated metal products	12,043	12,551	13,528	11,983	13,488	14,391	13,961	14,063	20,335	21,994	21,986	33,277	34,864
Machinery and equipment except electrical	16,995	17,692	18,425	16,291	19,752	19,908	20,271	21,426	26,568	31,424	39,328	40,440	42,840
Office, accounting and computing machinery	18,290	17,571	17,492	15,821	16,539	17,362	20,940	20,936	23,638	20,342	29,323	34,434	37,435
Electrical machinery and apparatus	23,589	25,930	24,575	22,932	30,399	32,515	35,749	33,405	34,476	37,373	42,074	44,586	47,549
Radio, television and communication equipment	226,932	218,185	216,505	186,810	243,646	242,616	238,396	262,166	276,537	311,241	305,480	345,165	378,344
Transport equipment	18,772	21,257	22,094	24,554	31,580	29,565	33,285	26,845	28,867	31,301	38,926	43,556	44,105
Furniture and fixtures	17,560	20,327	18,937	16,875	20,185	39,326	53,346	77,078	94,741	90,378	89,500	104,252	110,935
Miscellaneous manufactures	30,940	34,778	34,753	33,235	43,186	48,599	45,176	40,444	40,189	40,050	39,096	41,072	42,652

Source: Philippine Statistics Authority

Source: Philippine Statistical Yearbook (PSY) | Philippine Statistics Authority (psa.gov.ph)

Some economies have manufacturing output data

istics of China **CHINA STATISTICAL YEARBOOK 2019**

13-12 Output of Industrial Products

Item		2017	2018
Coal	(100 million tons)		
Crude Petroleum Oil	(10 000 tons)		
Natural Gas	(100 million cu.m)		
Salt	(10 000 tons)		
Refined Edible Vegetable Oil	(10 000 tons)		
Refined Sugar	(10 000 tons)		
Canned Food	(10 000 tons)		
Beer	(10 000 kiloliter)		
Cigarettes	(100 million pieces)		
Yarn	(10 000 tons)		
Cloth	(100 million m)		
Machine-made Paper and Paperboard	(10 000 tons)		
Gasoline	(10 000 tons)		
Caustic Soda	(10 000 tons)		
Soda Ash	(10 000 tons)		
Ethylene	(10 000 tons)		
Synthetic Ammonia	(10 000 tons)		
Chemical Fertilizers	(10 000 tons)		
Nitrogen Fertilizers	(10 000 tons)		
Phosphate Fertilizers	(10 000 tons)		
Chemical Pesticides	(10 000 tons)		
Primary Plastic	(10 000 tons)		
Synthetic Rubber	(10 000 tons)		
Synthetic Detergents	(10 000 tons)		
Chemical Medicines	(10 000 tons)		
Traditional Chinese Medicine	(10 000 tons)		
Chemical Fiber	(10 000 tons)		
Tires	(10 000 tires)		
Cement	(10 000 tons)		
Plain Glass	(10 000 weight cases)		
Pig Iron	(10 000 tons)		
Crude Steel	(10 000 tons)		
Rolled Steel	(10 000 tons)		
Heavy Rail	(10 000 tons)		
Rolled-steel, Large	(10 000 tons)		
Rolled-steel, Medium and Small	(10 000 tons)		
Steel Bar	(10 000 tons)		
Corrugated Steel Bar	(10 000 tons)		
Wire Rod	(10 000 tons)		
Heavy Steel Plate	(10 000 tons)		
Thick Steel Plate	(10 000 tons)		
Medium Wide Steel Belt	(10 000 tons)		
Hot-roll Thin Wide Steel Belt	(10 000 tons)		
Non-hot-roll Thin Wide Steel Belt	(10 000 tons)		
Plated Plate(Belt)	(10 000 tons)		
Seamless Steel Pipe	(10 000 tons)		

Source: China Statistical Yearbook 2019 (stats.gov.cn)

Closing thoughts

- We need more data to track energy efficiency in industry
- Data are available online in some economies
- For other economies, data may not be available online but maybe found in printed publications
- For economies that don't have data, we could learn from those that have
  - Five economies had shared and two more will share how they collect data
  - Let us learn from each other for a more robust analysis of energy efficiency in our economies

Thank you for your kind attention.

https://aperc.or.jp/

APERC
Asia Pacific Energy Research Centre