FEATURE ARTICLE

Benchmarking Singapore's Energy Intensity

BENCHMARKING SINGAPORE'S ENERGY INTENSITY

SYNOPSIS

Among the three most widely used international databases on energy, namely the EIA, BP and the IEA, there is a large disparity on Singapore's energy intensity. This paper finds that IEA's data on Singapore's energy intensity is the most accurate of the three sources, as it had taken out marine bunkers from its calculation of energy consumption. The paper further finds that Singapore's energy intensity is roughly on par for an economy of its level of development. Compared to less energy intensive economies, Singapore's higher energy intensity is due mostly to the use of energy in the manufacturing sector, the consumption of fuels as feedstock in the petrochemicals industry and the sale of jet fuel to the international civil aviation sector.

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INTRODUCTION

Singapore is sometimes perceived to be a highly energy intensive economy. This paper discusses how this view may arise, and shows that despite being a major oil refining, petrochemicals and aviation hub, Singapore's energy intensity is roughly on par for an economy of its level of development.

SINGAPORE'S ENERGY INTENSITY – 2 DIFFERENT VIEWS

There are three commonly cited sources of data on energy consumption and energy intensity — the United States Energy Information Administration (EIA)[1], British Petroleum's Statistical Review of World Energy[2], and the OECD-linked International Energy Agency (IEA)[3].

EIA's data suggests that Singapore is a very heavy energy user. According to EIA, Singapore's energy intensity is higher than that of developed economies [Exhibit 1]. BP's numbers paint a similar picture to EIA.

The views expressed in this paper are solely those of the author and do not necessary reflect those of the Ministry of Trade and Industry or the Government of Singapore.

1 http://www.eia.doe.gov/emeu/international/contents.html
2 http://www.bp.com/productlanding.do?categoryId=6842&contentId=7021390
3 http://www.iea.org/dbtw-wpd/Textbase/stats/index.asp

In contrast, IEA's data suggests a significantly lower level of energy intensity in Singapore than the other sources. According to IEA, Singapore's energy intensity is about 40 – 50 per cent lower than the estimates by EIA and BP, and is below that of developed economies and newly industrialized economies (NIEs) such as Australia, New Zealand, Finland, Taiwan, Canada and South Korea.

ENERGY INTENSITY, 2003

[Exhibit 1]

Tons of Oil Equivalent per Million US$ GDP at 2000 Prices

	EIA		BP		IEA	
1	Japan	116	Japan	106	Hong Kong	95
2	Switzerland	132	Switzerland	118	Japan	108
3	Ireland	136	Hong Kong	120	Switzerland	108
4	Hong Kong	138	Denmark	120	Denmark	127
5	Denmark	138	Ireland	125	Ireland	133
6	United Kingdom	161	United Kingdom	146	United Kingdom	151
7	Italy	183	Italy	165	Norway	155
8	Germany	191	Germany	173	Italy	165
9	France	203	Sweden	182	Germany	181
10	Sweden	213	France	188	France	196
11	United States	241	Norway	218	Sweden	204
12	Spain	245	Spain	222	Netherlands	207
13	Netherlands	257	United States	224	Spain	214
14	Finland	261	Finland	227	United States	222
15	Norway	262	Netherlands	231	Singapore	230
16	Australia	288	Australia	261	Australia	254
17	Taiwan	345	New Zealand	303	New Zealand	292
18	New Zealand	371	Taiwan	309	Finland	296
19	South Korea	374	South Korea	361	Taiwan	321
20	Canada	446	Canada	396	Canada	344
21	Singapore	480	Singapore	409	South Korea	352
22	Thailand	575	Thailand	529	Malaysia	568
23	Malaysia	622	Indonesia	554	Thailand	628
24	Indonesia	631	Malaysia	565	China	807
25	India	669	India	640	Indonesia	878
26	China	723	China	709	India	1,009
27	Russia	2,362	Russia	2,141	Russia	2,084

Source: EIA, BP and IEA

Singapore's energy intensity is below that of economies such as Australia, New Zealand, and Finland...

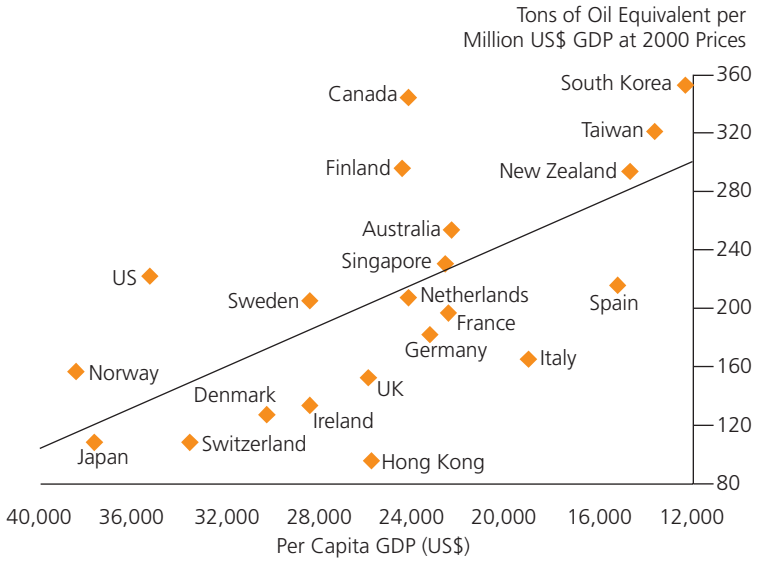
Among the three sources of data, IEA's numbers paint a more accurate picture of Singapore's true energy intensity, as IEA has stripped away marine bunkers from its calculation of energy consumption. Singapore is the largest marine bunkering centre in the world. In 2003, we supplied about 20.8 million tons of bunker oil to ships. EIA's and BP's data overestimated Singapore's energy intensity because they attributed marine bunkers as energy consumed in Singapore.

IS SINGAPORE AN ENERGY INTENSIVE ECONOMY?

Energy intensity refers to the amount of energy consumed by a country for a given GDP. It also includes the consumption of fuels as feedstock to make non-fuel products such as chemicals and plastics. The energy intensity of a country is related to its level of economic development, the structure of its economy, the state of technology and its energy efficiency. In general, a more advanced economy should be able to produce each unit of output using less energy than a less developed economy. A country that has a strong concentration of heavy industries such as petroleum refining and steel will also be more energy intensive than a service-oriented economy, even if they have similar levels of per capita income.

Using IEA's data, we plotted energy intensity against per capita GDP for developed countries and NIEs, and fitted a straight line regression through the data points [Exhibit 2]. The chart shows that Singapore falls very close to the regression line, suggesting that Singapore's energy intensity is roughly on par with our level of economic development.

ENERGY INTENSITY AND PER CAPITA GDP, 2003
[Exhibit 2]



Source: IEA

Compared to countries with low energy intensities, Singapore's higher energy intensity stems largely from the use of energy in our manufacturing sector. The manufacturing sector is more energy intensive than other sectors due to the extensive use of heat and electricity in manufacturing processes, especially in the petroleum refining, petrochemicals and semiconductors industries. In addition, the petrochemicals industry consumes petroleum products as feedstock for their processes, which alone is estimated to contribute to about 20 per cent of our energy use. Taken together, the manufacturing sector accounts for more than half of Singapore's total energy consumption.

The manufacturing sector's share of GDP was 24 per cent for Singapore in 2003, which was significantly higher than the average of 17 per cent for the countries that fell on or below the regression line in Exhibit 2. Hence, it is not surprising that Hong Kong, where the manufacturing sector was only 4 per cent of the economy, was one of the least energy intensive economies in the world.

Singapore's higher energy intensity stems largely from the use of energy in our manufacturing sector...

Another factor which contributes significantly to the calculation of Singapore's energy intensity is the sale of jet fuels to commercial airlines. Energy consumed by the international civil aviation industry is treated as part of a country's energy consumption by the IEA. Due to our connectivity and our excellent logistics and energy infrastructure, Singapore is among the major suppliers of jet fuels in the region. Netting out the consumption of jet fuels would reduce Singapore's energy intensity by around 11 per cent in 2003.

ENERGY INTENSITY AND IMPACT OF HIGHER OIL PRICES

One purpose of benchmarking energy intensity is to draw a link to the impact of rising energy prices on various economies. Generally, a country with higher energy intensity would be more seriously impacted by rising energy prices than a country with lower energy intensity. However, this rule of thumb holds true only under a ceteris paribus condition as there may be certain industries within a country that actually benefit from a rise in energy prices. For example, Russia is one of the most energy intensive economies in the world, yet it would stand to gain in an environment of rising energy prices because it is a major energy exporter.

Likewise, certain sectors of the Singapore economy have also benefited from the recent rise in oil prices. Singapore is one of the world's largest oil refining centers and a leading producer of oil rigs. Riding on the rising demand for oil products, our refineries' output has increased by 29 per cent over the past 3 years. Activities in the marine and offshore engineering industry have doubled in just 2 years, underpinned by strong orders for oil rigs. The oil trading market has also benefited from increased trading volume. However, these economic benefits will not be evenly spread across different sectors of the economy.

CONCLUSION

After accounting for marine bunkers, Singapore's energy intensity is roughly on par with countries of the same level of development. Compared to less energy intensive economies, Singapore's higher energy intensity is due mostly to the use of energy in the manufacturing sector, the consumption of fuels as feedstock in the petrochemicals industry and the sale of jet fuel to the international civil aviation sector.