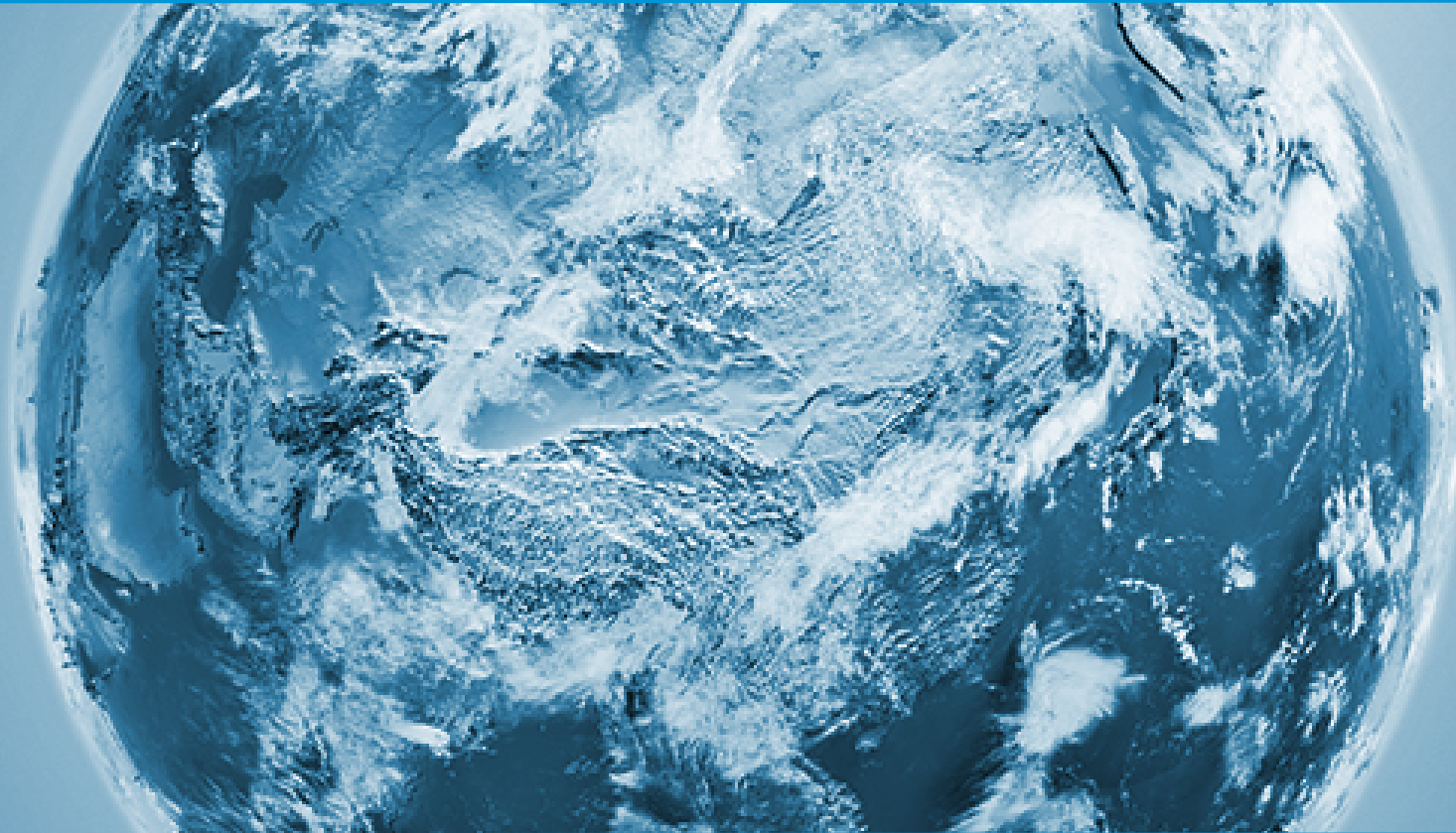


International Energy Outlook 2018

Energy implications of China's transition toward
consumption-led growth



Independent Statistics & Analysis
U.S. Energy Information
Administration

#IEO2018

July 24, 2018
www.eia.gov/ieo



Key takeaways

- Faster economic growth in China means higher energy use, but the amount depends on how quickly China transitions to a more service-oriented, personal consumption-based economy.
- In the case that this transition does not happen, energy consumption increases relative to the baseline in 2040 by 25%, compared with a 20% increase in the Fast Transition case.
- Across all IEO2018 China side cases considered, China remains by far the world's largest producer of energy-intensive goods in 2040.
- The IEO2018 China side cases highlight the need to further explore the relationships between projected changes in components of GDP (investment, consumption, and net exports) and the size of the manufacturing sector.



Overview

- EIA's *International Energy Outlook 2018* (IEO2018) is a supplement to the IEO2017. The IEO2018 Reference case updates the IEO2017 Reference case with macroeconomic information, but there are no modeling changes to other end-use sectors.
- IEO2018 focuses on macroeconomic uncertainty by conducting sensitivity analyses in three IEO regions: China, India, and Africa. These are projected to be three of the fastest growing and most populous regions in the IEO2018 Reference case, and there is significant uncertainty regarding their future economic growth.
- The economic structure of these three regions also varied substantially in 2015: China was a manufacturing-based economy; Africa had relatively little manufacturing compared to services, and India had a relatively more balanced mix of manufacturing and services.
- EIA performed high economic growth sensitivity cases in each of these regions in IEO2018 by raising average annual growth in GDP between 2015 and 2040. The composition of economic growth was also varied in the cases for India and China.
- The graphics and results in this document focus on projections through 2040 for the China cases. U.S. projections appearing in IEO2018 are consistent with those released in the *Annual Energy Outlook 2017*.



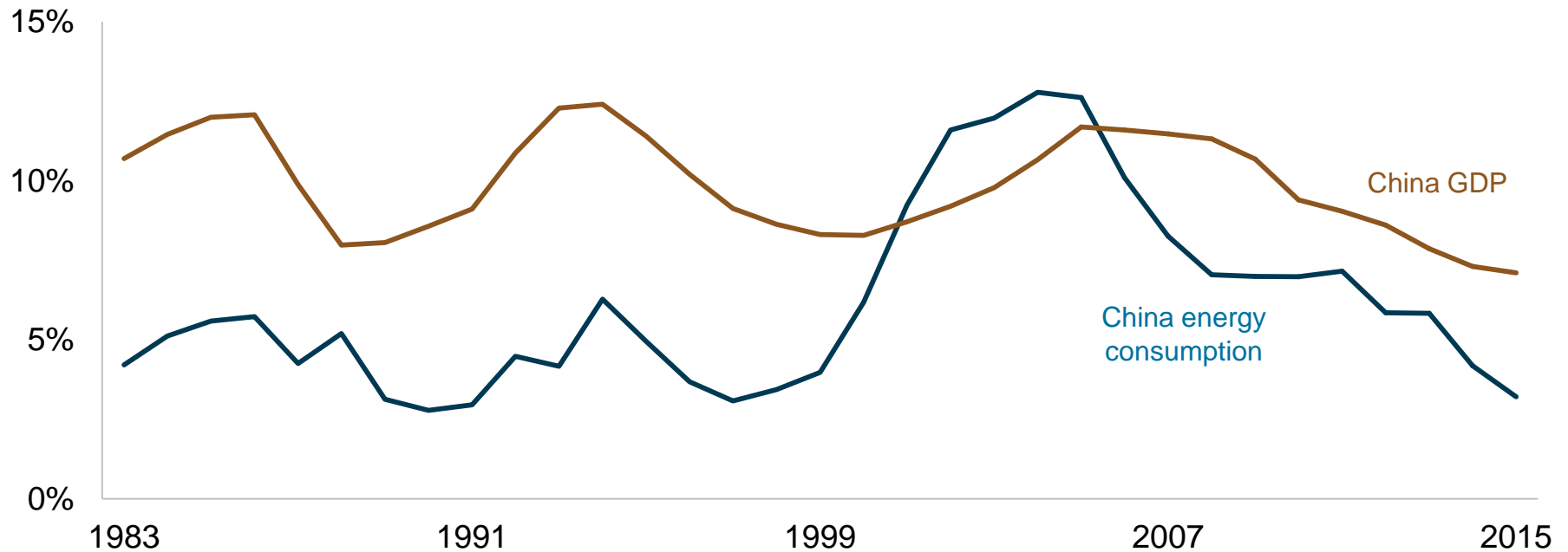
The *International Energy Outlook 2018* provides long-term energy projections for the major world regions

- Projections in the *International Energy Outlook 2018* (IEO2018) are not predictions of what will happen, but rather modeled projections of what may happen given certain assumptions under different cases.
- The IEO is developed using the World Energy Projection System Plus (WEPS+), an integrated model that captures various interactions of economic changes and energy supply, demand, and prices across regional markets.
- Energy market projections are subject to much uncertainty, because the events that shape future developments in technology, demographic changes, economic trends, and resource availability that drive energy use cannot be projected with certainty.
- The IEO projections are published under the Department of Energy Organization Act of 1977, which requires the U.S. Energy Information Administration (EIA) to prepare reports on trends and projections for energy use and supply.



China's GDP and energy consumption growth have slowed in recent years—

Chinese GDP and energy consumption
annual growth rate, 5-year moving average





—and the slower growth in energy consumption is consistent with stated policy goals

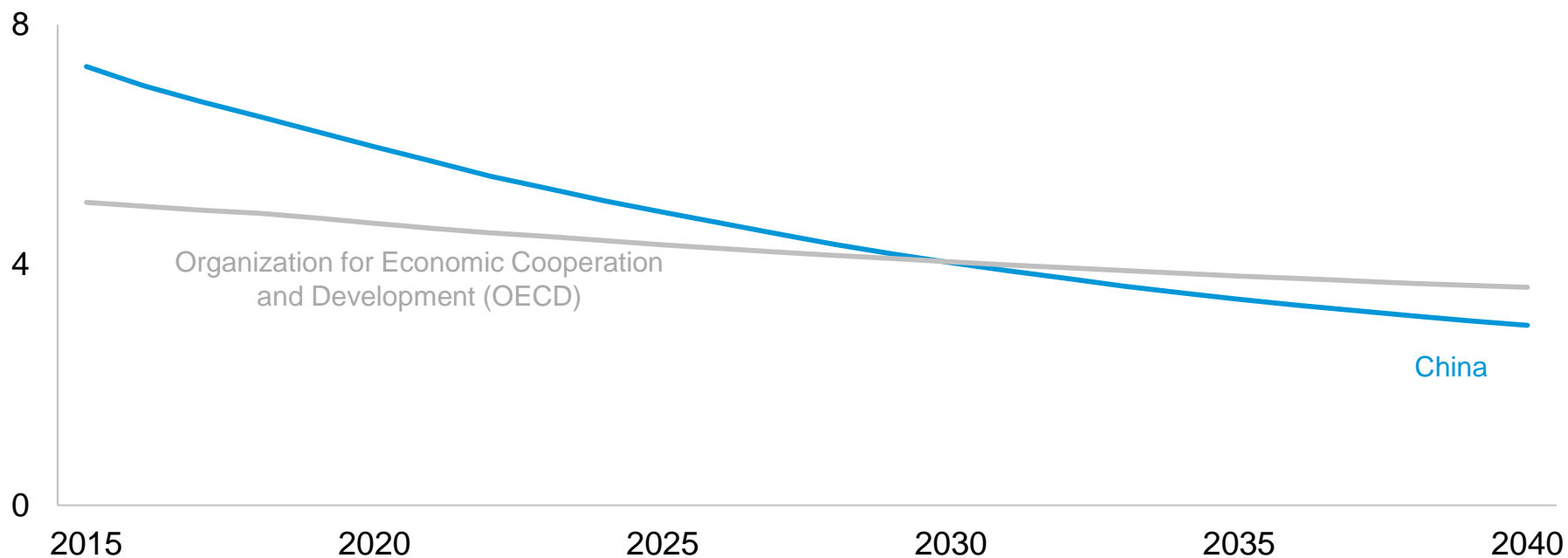
- China had double-digit real GDP growth for much of 1980–2005, and energy demand more than tripled during that time.
- Over the past seven years, annual economic growth has slowed to the single digits, and the rate of increase in energy demand has also slowed.
- This recent change is consistent with China’s policy goal to lower growth in energy consumption.



China's energy intensity declines faster than the OECD's throughout the IEO2018 Reference case—

regional energy intensity

thousand Btu per 2010 dollar GDP





—ending lower than the OECD average in 2040

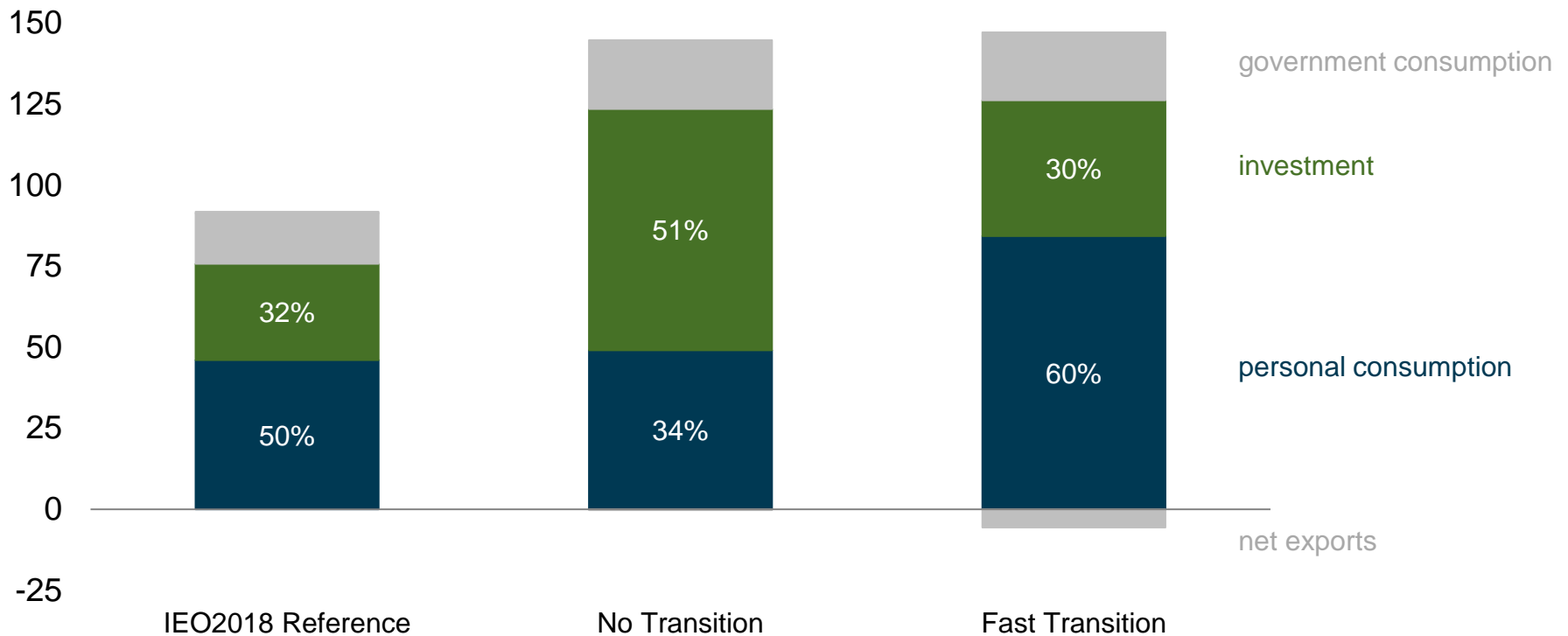
- Reductions in energy intensity are driven in part by a gradual shift in the economy's structure from manufacturing toward services.
- Providing services is generally less energy intensive than manufacturing goods.



Economic growth in China may be driven by investment—

components of GDP in 2040

trillion 2010 U.S. dollars





—or by a faster transition to personal consumption

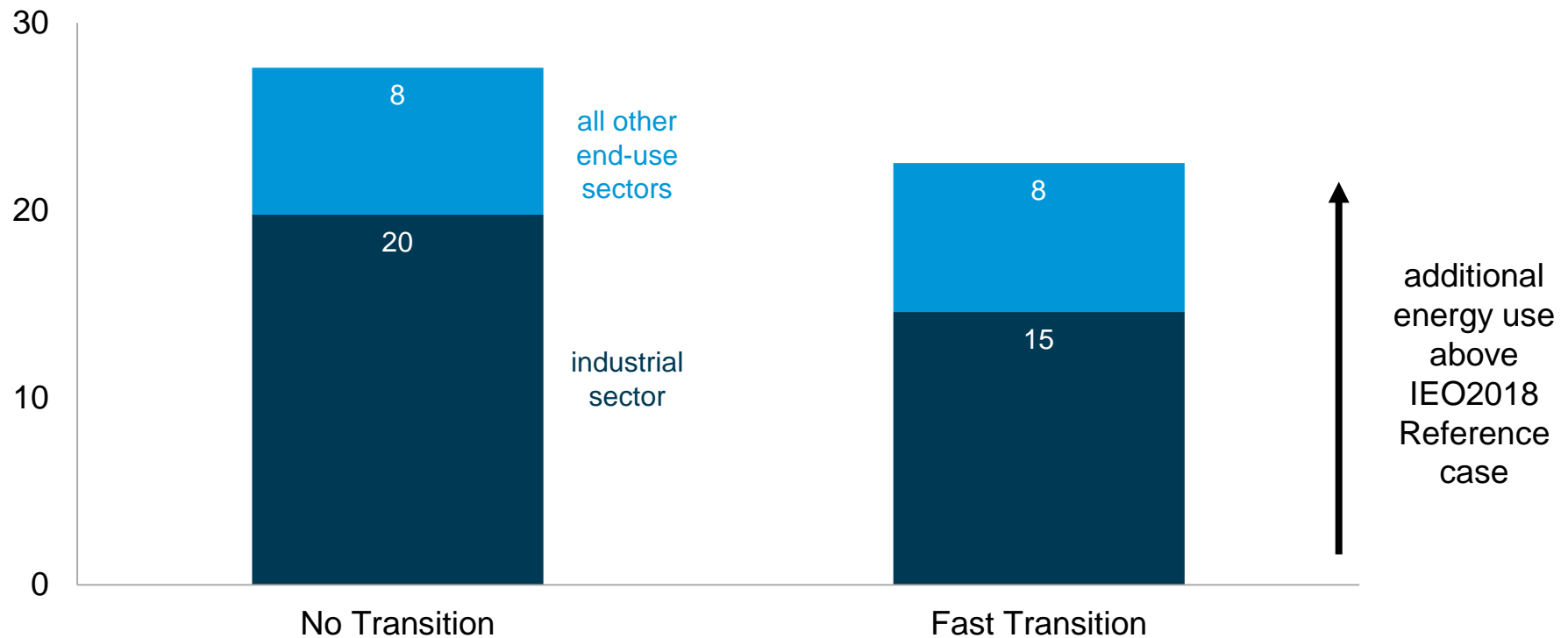
- EIA examined two high economic growth cases, where China's economy grows 5.7% per year on average through 2040 instead of the IEO2018 Reference case average of 4.5%.
- GDP includes four components: personal consumption, investment, government consumption, and net exports (exports minus imports).
- In the **No Transition case**, the investment share of GDP in 2040 is 51%, compared with 32% in the IEO2018 Reference case.
- In the **Fast Transition case**, the personal consumption share of GDP rises to 60% by 2040, compared with 50% in the IEO2018 Reference case.



In the IEO2018 China high growth cases, economic growth is accompanied by increased energy use—

2040 Chinese energy consumption

quadrillion Btu difference from the IEO2018 Reference case





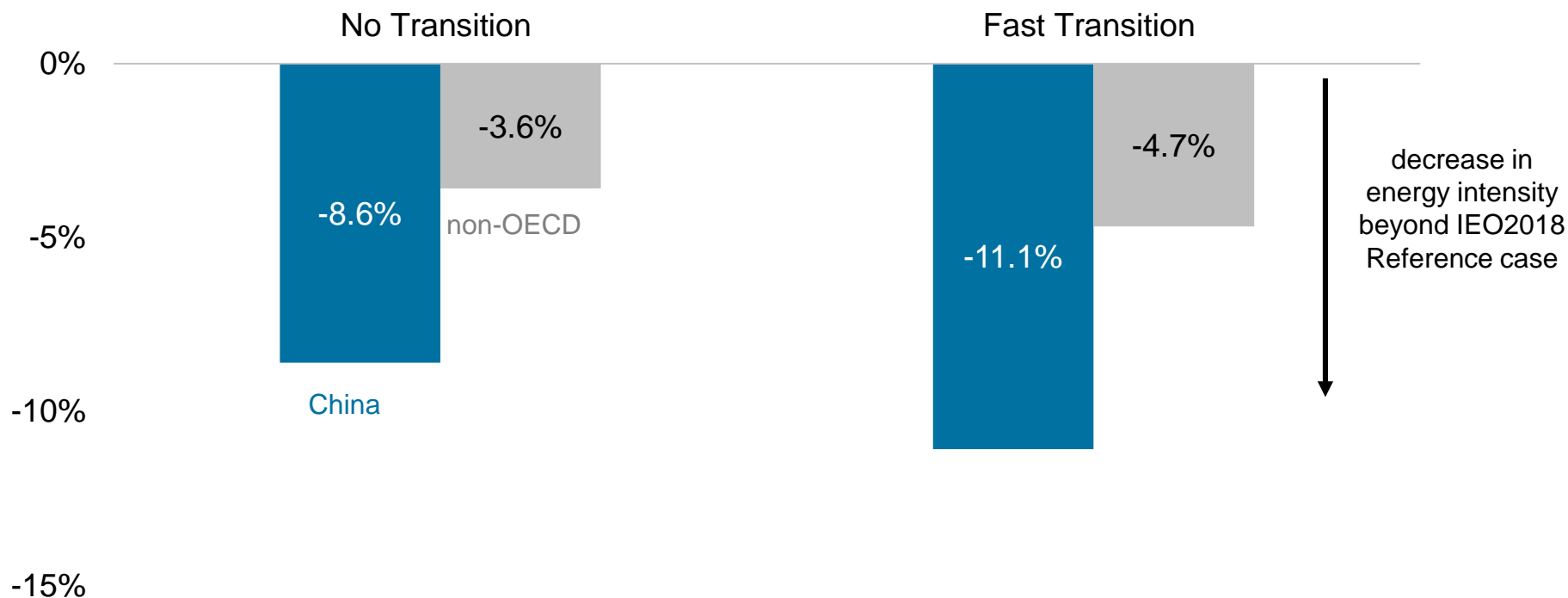
—between 20% to 25% higher than in the IEO2018 Reference case

- The pace of economic transition from investment-led to consumption-led growth affects Chinese energy consumption over the longer term.
- Differences in energy use in both cases are primarily the result of differences in industrial sector demand (agriculture, construction, mining, and manufacturing).



China's energy intensity decreases much faster than in other non-OECD countries in both IEO2018 high growth cases—

regional energy intensity relative to the IEO2018 Reference case in 2040
percent change





—and decreases more with a fast transition

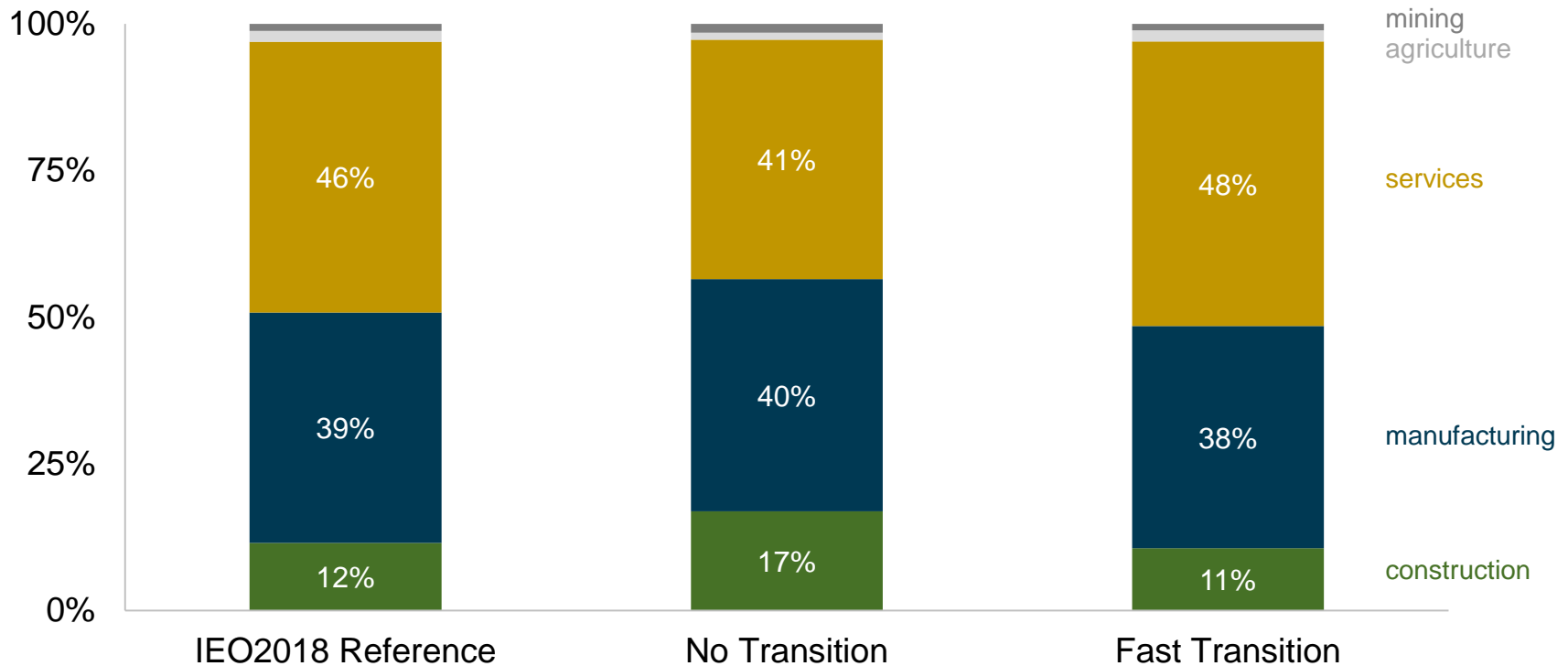
- Both of the China high economic growth cases have lower energy intensities than in the IEO2018 Reference case in the long run.
- Energy intensity in the Fast Transition case is lower because it has the same GDP growth rate as the No Transition case with less energy use from heavy industry.



In the China Fast Transition case, the economy moves away from manufacturing and construction toward services by 2040—

sector share of total output in 2040

percent





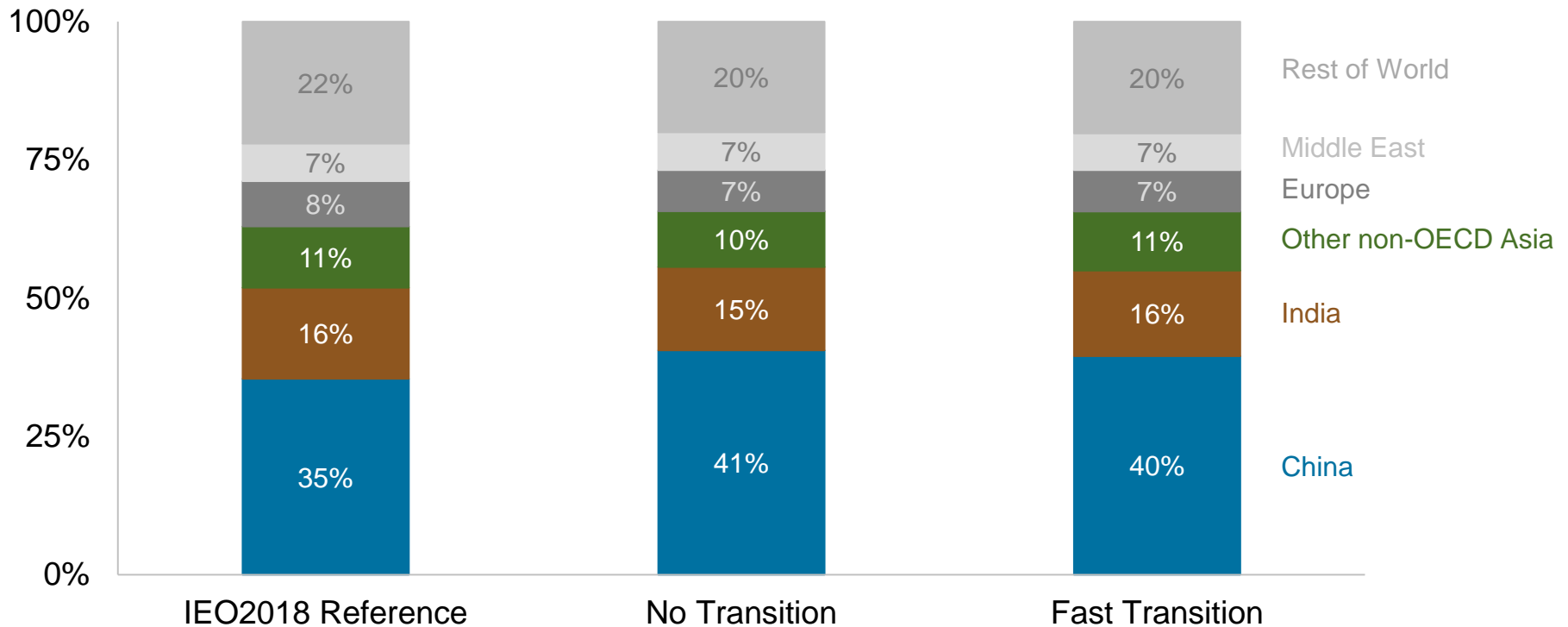
—which are less energy intensive than manufacturing

- Grouping industries by broad categories highlights how differences in expenditure shares translate into production.
- Reductions in the construction and manufacturing shares of output for the Chinese economy in the Fast Transition case in 2040 are offset by increases in the services share.
- Manufacturing production tends to be more energy intensive than other sectors.



China is the world's largest producer of energy-intensive goods—

regional share of global energy-intensive gross output in 2040
percent





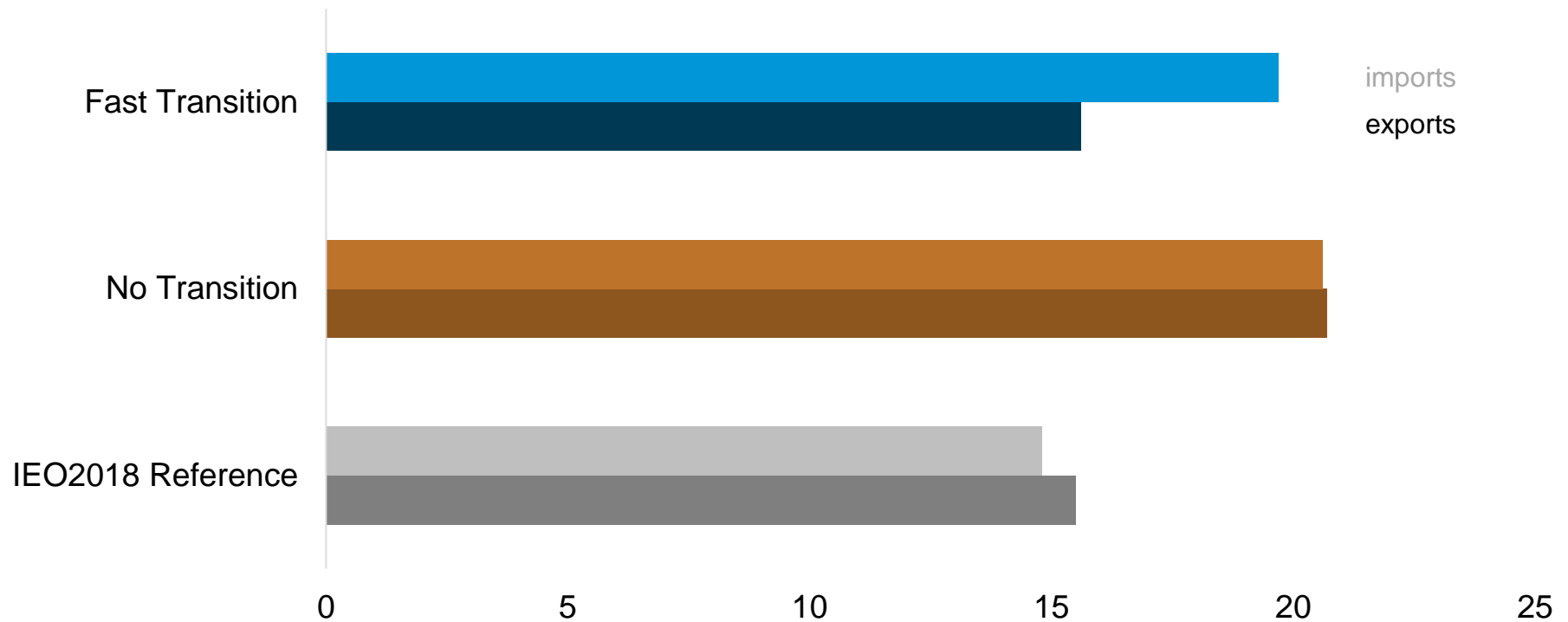
—and gains a larger share of the market for these goods in either high economic growth case

- China is projected to produce 35% of the world's energy-intensive manufactured goods in 2040 in the IEO2018 Reference case, more than double the next largest region, India.
- Even in the Fast Transition case, where China's manufacturing share of domestic output declines, China accounts for a larger share of world energy-intensive goods production in 2040 compared to the IEO2018 Reference case.



China's trade increases from the IEO2018 Reference case level in both economic growth cases—

China trade in 2040
trillion 2010 U.S. dollars





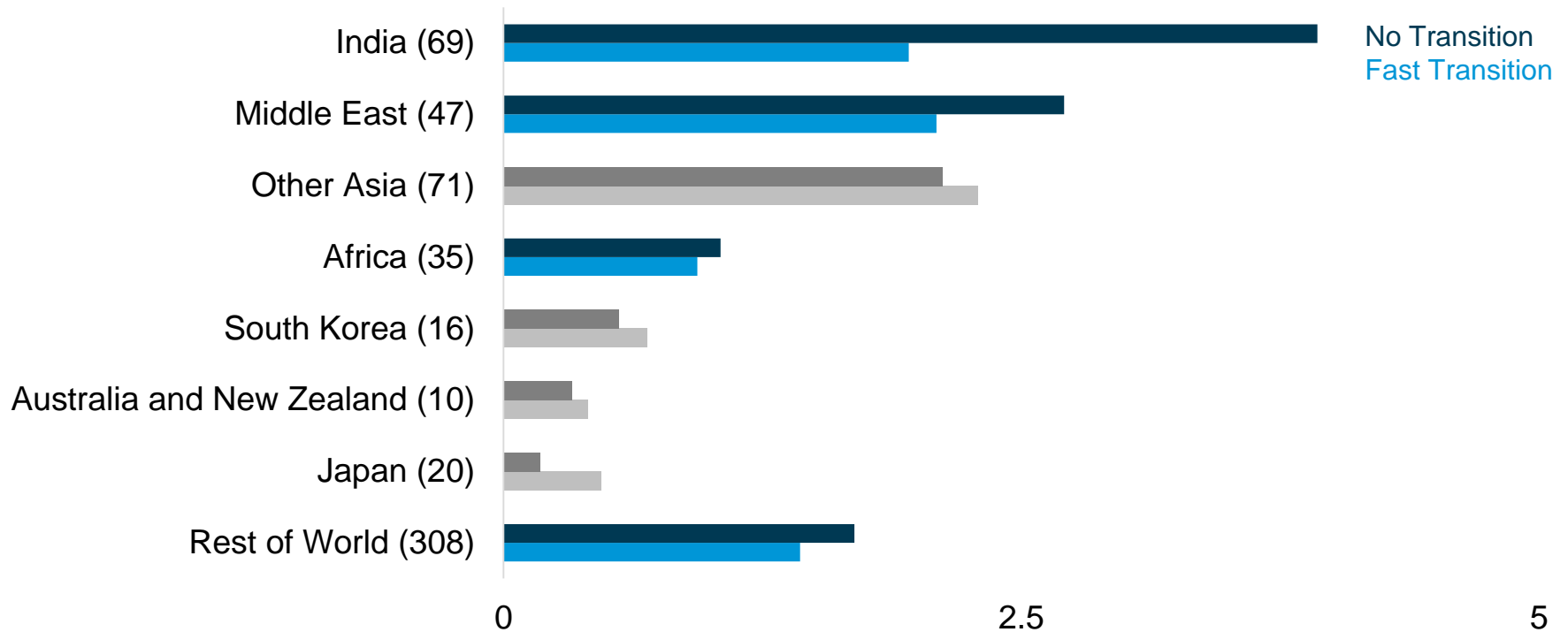
—but imports increase more than exports in the Fast Transition case

- Energy-intensive goods are highly tradable and link China to a large global supply chain.
- The Fast Transition case is projected to have fewer exports than the No Transition case.
- China's role in global trade and the effect of higher Chinese economic growth on projected global energy use underlines the importance of accurate projections of Chinese economic growth.



Both China economic growth cases lead to increases in energy use in other countries because of trade links—

regional energy consumption above IEO2018 Reference case in 2040
quadrillion Btu difference from the IEO2018 Reference case





—the No Transition case affects raw material suppliers, and the Fast Transition case affects intermediate goods suppliers

- When China's economy grows more rapidly, energy use relative to the IEO2018 Reference case increases in most regions of the world in 2040.
- India and the Middle East show greater increases in energy use under China's No Transition case than in the Fast Transition case because exports from both regions support the production of Chinese energy-intensive manufactured goods.
- Energy use in the wider Asia-Pacific region increases more in China's Fast Transition case than in the No Transition because these regional neighbors all supply intermediate goods for Chinese production, particularly nonenergy-intensive consumer goods.



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Acronyms and abbreviations used in this report

AEO = Annual Energy Outlook

Btu = British thermal units

EIA = U.S. Energy Information Administration

GDP = gross domestic product (in purchasing power parity (PPP) dollars)

IEO = International Energy Outlook

WEPS+ = World Energy Projection System Plus

OECD = Organization for Economic Cooperation and Development

OPEC = Organization of the Petroleum Exporting Countries = Algeria, Angola, Ecuador, Equatorial Guinea, Gabon, Iran, Iraq, Kuwait, Libya, Nigeria, Qatar, Saudi Arabia, United Arab Emirates, and Venezuela. (Note: Equatorial Guinea became a member of OPEC on May 25, 2017, but their membership is not yet reflected in the IEO2018 projections.)



IEO regional definitions – OECD Regions

OECD Americas = United States, Canada, Chile, and Mexico.

OECD Europe = Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, and United Kingdom. (Note: Israel is included in OECD Europe for statistical reporting purposes. Latvia became an OECD member country on July 16, 2016, but it is not reported in OECD Europe for IEO2018.)

OECD Asia = Australia, Japan, New Zealand, and South Korea.



IEO regional definitions – non-OECD Regions

Non-OECD Europe and Eurasia = Albania, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Faroe Islands, Georgia, Gibraltar, Kazakhstan, Kosovo, Latvia, Lithuania, Macedonia, Malta, Moldova, Montenegro, Romania, Russia, Serbia, Tajikistan, Turkmenistan, Ukraine, and Uzbekistan. (Note: Latvia became an OECD member country on July 16, 2016, but it is reported in non-OECD Europe and Eurasia for IEO2018.)

Non-OECD Asia = Afghanistan, American Samoa, Bangladesh, Bhutan, Brunei, Burma (Myanmar), Cambodia (Kampuchea), China, Cook Islands, Fiji, French Polynesia, Guam, Hawaiian Trade Zone, Hong Kong, India, Indonesia, Kiribati, Laos, Macau, Malaysia, Maldives, Mongolia, Nauru, Nepal, New Caledonia, Niue, North Korea, Pakistan, Papua New Guinea, Philippines, Samoa, Singapore, Solomon Islands, Sri Lanka, Taiwan, Thailand, Timor-Leste (East Timor), Tonga, U.S. Pacific Islands, Vanuatu, Vietnam, and Wake Islands.

Middle East = Bahrain, Iran, Iraq, Jordan, Kuwait, Lebanon, Oman, Palestinian Territories, Qatar, Saudi Arabia, Syria, United Arab Emirates, and Yemen.



IEO regional definitions – non-OECD Regions

Africa = Algeria, Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Cape Verde, Central African Republic, Chad, Comoros, Congo (Brazzaville), Congo (Kinshasa), Côte d'Ivoire, Djibouti, Egypt, Equatorial Guinea, Eritrea, Ethiopia, Gabon, The Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Liberia, Libya, Madagascar, Malawi, Mali, Mauritania, Mauritius, Morocco, Mozambique, Namibia, Niger, Nigeria, Reunion, Rwanda, Sao Tome and Principe, Senegal, Seychelles, Sierra Leone, Somalia, South Africa, South Sudan, St. Helena, Sudan, Swaziland, Tanzania, Togo, Tunisia, Uganda, Western Sahara, Zambia, and Zimbabwe

Non-OECD Americas = Antarctica, Antigua and Barbuda, Argentina, Aruba, The Bahamas, Barbados, Belize, Bermuda, Bolivia, Brazil, British Virgin Islands, Cayman Islands, Colombia, Costa Rica, Cuba, Dominica, Dominican Republic, Ecuador, El Salvador, Falkland Islands, French Guiana, Greenland, Grenada, Guadeloupe, Guatemala, Guyana, Haiti, Honduras, Jamaica, Martinique, Montserrat, Netherlands Antilles, Nicaragua, Panama, Paraguay, Peru, Puerto Rico, St. Kitts and Nevis, St. Lucia, St. Pierre and Miquelon, St. Vincent/Grenadines, Suriname, Trinidad and Tobago, Turks and Caicos Islands, Uruguay, United States Virgin Islands, and Venezuela.



Map of regions used in the International Energy Outlook

