

Syllabus_Energy Economics and Policy

Energy and Economy

Introduction to different forms of energy; Understanding energy-economy linkages; Accounting energy balance; Understanding energy intensity and efficiency; Tradeoffs between energy-environment, Role of globalization and urbanization on energy demand

Economics of Non-renewable Energy

Economics of coal, petroleum and natural gas; Pricing of exhaustible energies - theories and practical issues; Regulation of fossil fuels energy markets

Economics of Renewable Energy

Drivers and sources of renewable energy; Economics of renewable energy supply; Developing markets for renewable energies

Environmental Implications of Energy

Energy-economic growth-environment Interactions; Income inequality-energy-pollution linkages; Climate change and environmental Kuznets Curve; Pollution haven hypothesis; Analysis on energy mixclimate change-market failure; natural resources management, The Clean Development Mechanism

Current Energy Issues and Policies

Current energy market trend and challenges; Energy policies in selected countries; Energy governance in India; Policy and institutional arrangement for energy efficiency and management in developing countries; Promoting clean energy usage for sustainable development goals

Suggested Readings

- 1.Griffin, J. M., & Steele, H. B. (2013). Energy economics and policy. Elsevier.
- 2.Tietenberg, T. Environmental and Natural Resource Economics, seventh edition, Addison Wesley, 2006
- 3.Munasinghe, M. and P. Meier, Energy Policy Analysis and Modelling. U.K.: Cambridge University Press, 1993
4. Ristinen, R. and J. Kraushaar, Energy and the Environment, John Wiley and Sons, 1998.
5. Wright, R.T., Environmental Science: Towards Sustainable Future, Pearson, Eleventh Edition, 2011

Country Maps: The Middle East

1. Bahrain
2. Cyprus
3. Egypt
4. Iran
5. Iraq
6. Israel
7. Jordan
8. Kuwait
9. Lebanon
10. Oman
11. Qatar
12. Saudi Arabia
13. Syria
14. Turkey
15. United Arab Emirates
16. Yemen

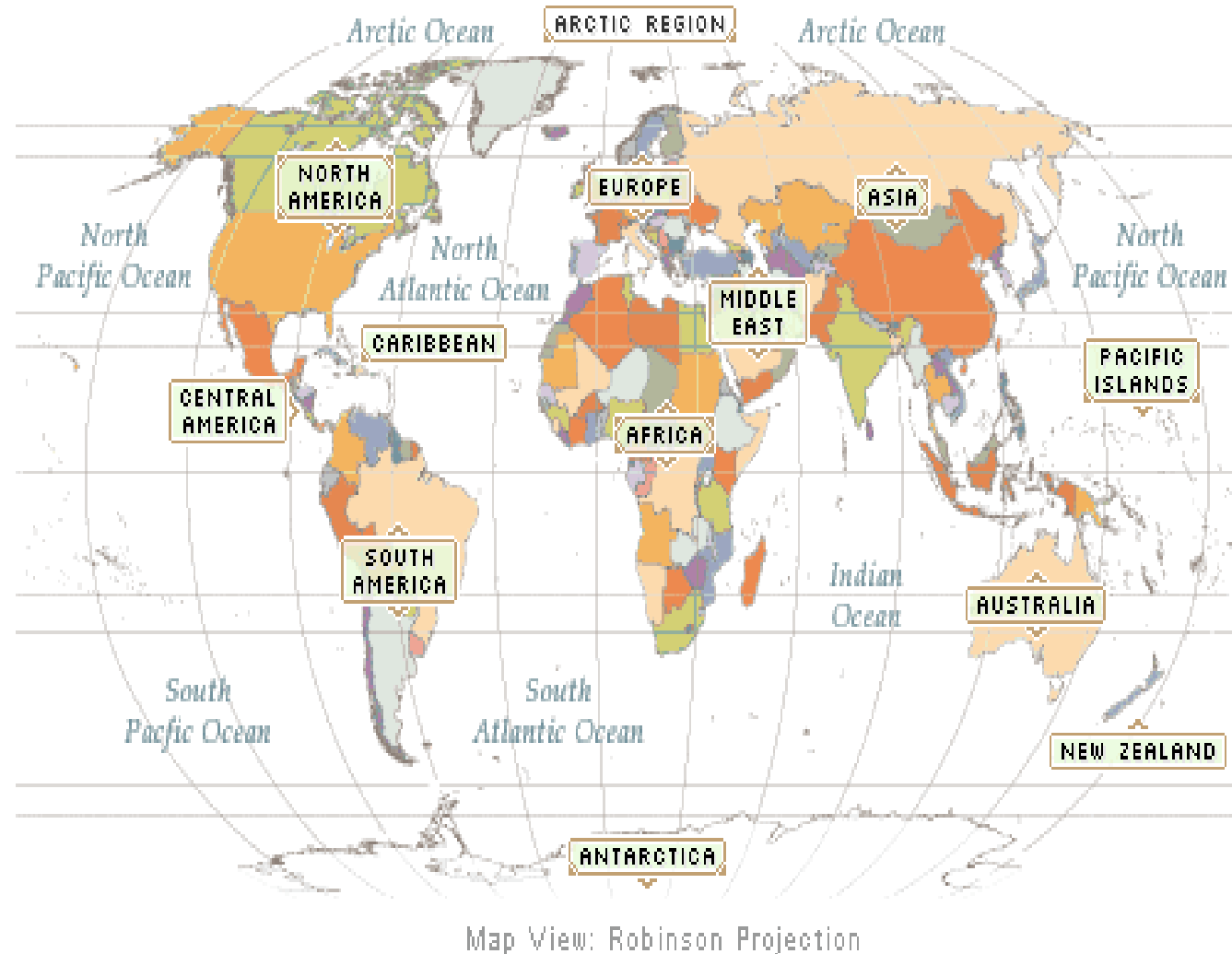




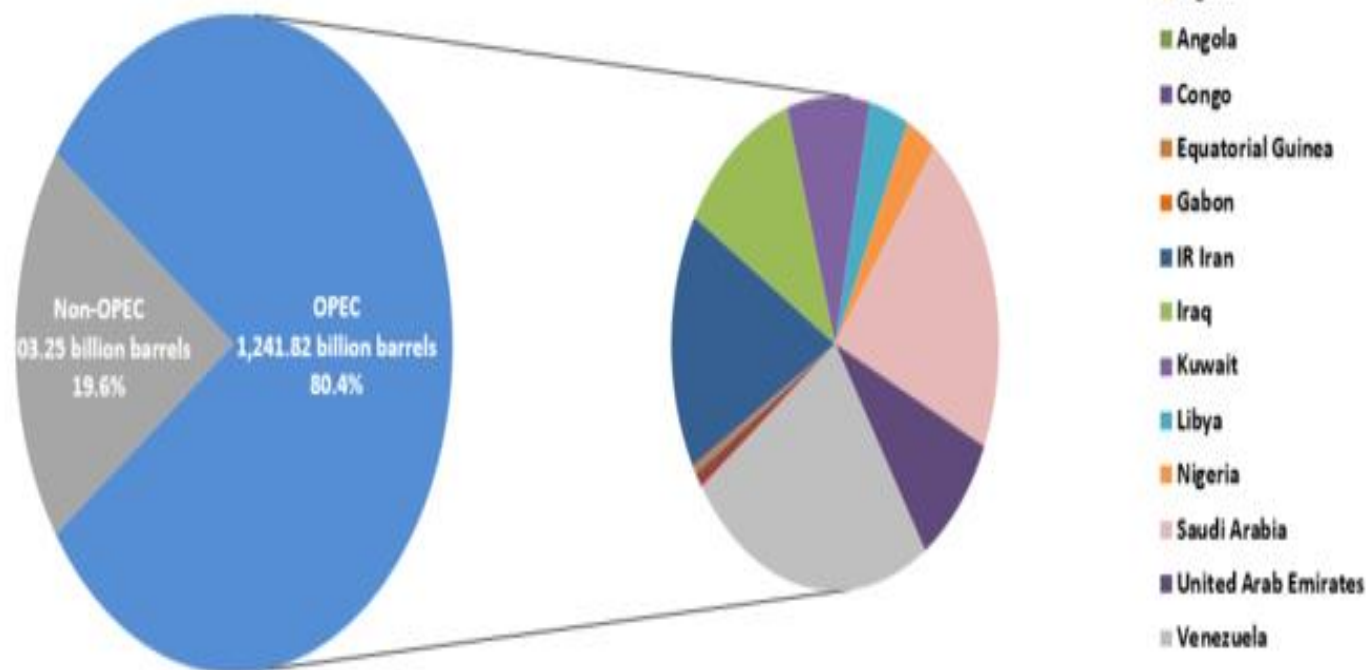
FIGURE 1.3 Map of the Middle East. Major oil pipelines are shown as broken lines. Major oil fields are indicated by small black spots of irregular shape.

Organization of the Petroleum Exporting Countries (OPEC, 1960, Iraq)

1. Iran (1960)
2. Iraq (1960)
3. Kuwait (1960)
4. Saudi (1960)
5. Arabia (1960)
6. Venezuela (1960)
7. Qatar (1961)
8. Indonesia (1962)
9. Libya (1962)
10. the United Arab Emirates (1967)
11. Algeria (1969), Nigeria (1971)
12. Ecuador (1973)
13. Gabon (1975)
14. Angola (2007)
15. Equatorial Guinea (2017)
16. Congo (2018)

- “any country with a substantial net export of crude petroleum, which has fundamentally similar interests to those of Member Countries, may become a Full Member of the Organization”
- Currently, the Organization has a total of 13 Member Countries

OPEC share of world Crude Oil Reserves, 2021



OPEC proven crude oil reserves , at end 2021 (billion barrels, OPEC share)

| | | | | | | | | | | | |
|--------------|--------|-------|----------------------|--------|------|---------|-------|------|-------------------|------|------|
| Venezuela | 303.47 | 24.4% | United Arab Emirates | 111.00 | 8.9% | Algeria | 12.20 | 1.0% | Equatorial Guinea | 1.10 | 0.1% |
| Saudi Arabia | 267.19 | 21.5% | Kuwait | 101.50 | 8.2% | Angola | 2.52 | 0.2% | | | |
| IR Iran | 208.60 | 16.8% | Libya | 48.36 | 3.9% | Gabon | 2.00 | 0.2% | | | |
| Iraq | 145.02 | 11.7% | Nigeria | 37.05 | 3.0% | Congo | 1.81 | 0.1% | | | |

Percentage of World Crude Oil Production by Country, 1850-1984

| | United States | Russia | Indonesia | Mexico | Venezuela | Middle East | Africa | Other |
|------|---------------|--------|-----------|--------|-----------|-------------|--------|-------|
| 1860 | 98 | | | | | | | 2 |
| 1865 | 92 | 2 | | | | | | 6 |
| 1870 | 91 | 3 | | | | | | 6 |
| 1875 | 91 | 5 | | | | | | 4 |
| 1880 | 88 | 10 | | | | | | 2 |
| 1885 | 60 | 34 | | | | | | 6 |
| 1890 | 60 | 37 | | | | | | 3 |
| 1895 | 51 | 44 | 1 | | | | | 4 |
| 1900 | 43 | 52 | 2 | | | | | 3 |
| 1905 | 63 | 25 | 4 | | | | | 8 |
| 1910 | 64 | 27 | 4 | 1 | | | | 4 |
| 1915 | 65 | 14 | 3 | 8 | | | | 10 |
| 1920 | 64 | 4 | 3 | 23 | | | | 6 |
| 1925 | 71 | 5 | 2 | 12 | 2 | 3 | | 5 |
| 1930 | 64 | 8 | 2 | 3 | 10 | 3 | | 10 |
| 1935 | 60 | 9 | 2 | 2 | 9 | 4 | | 14 |
| 1940 | 63 | 10 | 3 | 2 | 10 | 4 | | 8 |
| 1945 | 66 | 6 | 1 | 2 | 12 | 7 | | 6 |
| 1950 | 52 | 7 | 1 | 2 | 15 | 15 | | 8 |
| 1955 | 45 | 9 | 2 | 2 | 14 | 19 | | 9 |
| 1960 | 35 | 14 | 2 | 1 | 14 | 23 | 1 | 10 |
| 1965 | 27 | 16 | 2 | 1 | 12 | 25 | 6 | 11 |
| 1970 | 22 | 17 | 2 | 1 | 8 | 30 | 13 | 7 |
| 1975 | 16 | 18 | 2 | 1 | 4 | 36 | 16 | 7 |
| 1980 | 14 | 20 | 3 | 3 | 4 | 30 | 16 | 10 |
| 1984 | 16 | 22 | 3 | 5 | 3 | 20 | 6 | 25 |

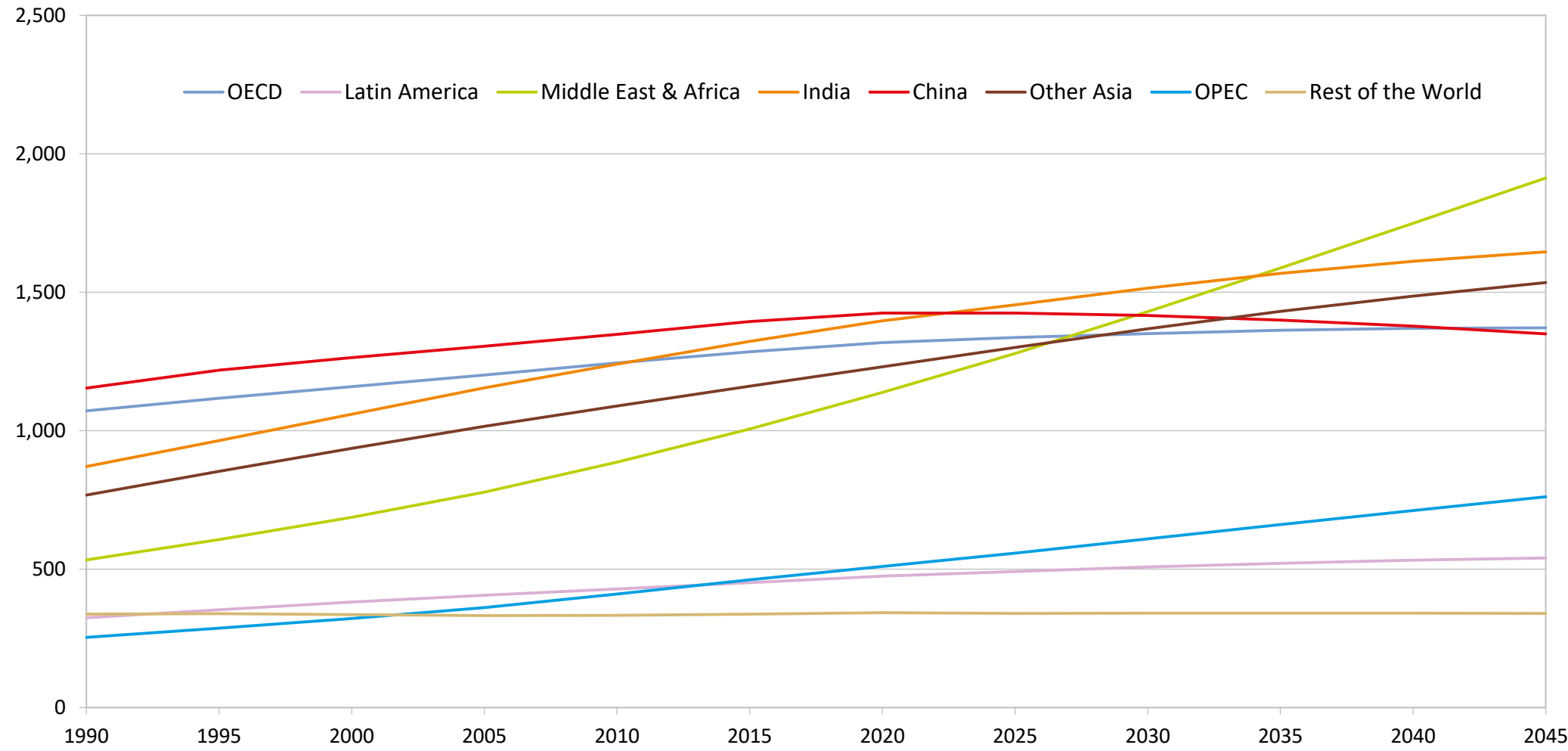
SOURCES: 1860–1920: U.S. Bureau of Mines; 1925–1965: Energy in the World Economy; 1970–1984: Monthly Energy Review.

Percentage of Government Owned Oil Production for Selected Years in OPEC Countries

| Country | 1970 | 1972 | 1974 | 1976 | 1978 | 1980 |
|--------------|------|------|------|------|------|------|
| Saudi Arabia | .9 | .7 | 58.5 | 58.7 | 58.7 | 97.7 |
| Iran | 4.5 | 5.0 | 96.2 | 96.2 | 94.6 | 100 |
| Kuwait | 1.2 | 1.2 | 55.1 | 90.6 | 94.1 | 90.6 |
| Iraq | 0 | 53.8 | 77.2 | 100 | 100 | 100 |
| Libya | 0 | 3.6 | 60.7 | 64.2 | 65.7 | 67.5 |
| U.A.E. | 0 | 0 | 49.5 | 62.1 | 64.4 | 64.4 |
| Venezuela | 1.2 | 1.9 | 2.5 | 100 | 100 | 100 |
| Qatar | 0 | 0 | 60.0 | 78.5 | 99.4 | 100 |
| Nigeria | 0 | 0 | 54.9 | 55.1 | 54.9 | 71.1 |
| Indonesia | 11.7 | 16.2 | 30.5 | 36.6 | 44.6 | 45.7 |
| Algeria | 14.6 | 76.9 | 88.2 | 90.5 | 89.1 | 93.7 |
| Ecuador | — | 1.3 | 25.4 | 25.5 | 62.9 | 62.7 |
| Gabon | 0 | 0 | 0 | 0 | 0 | 0 |

SOURCE: OPEC Annual Statistical Yearbook.

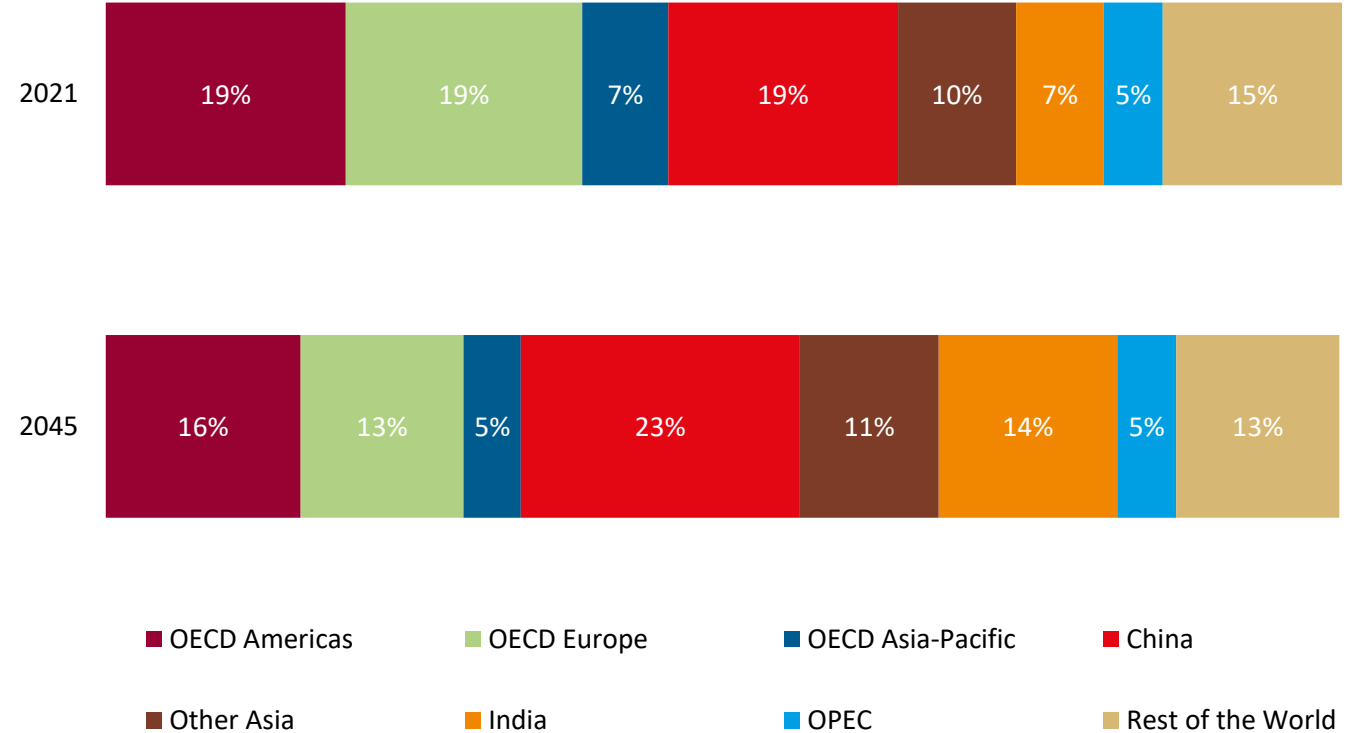
World population trends, 1990-2045 (Millions)



Source: UN, OPEC

Distribution of the global economy, 2021 and 2045 (%)

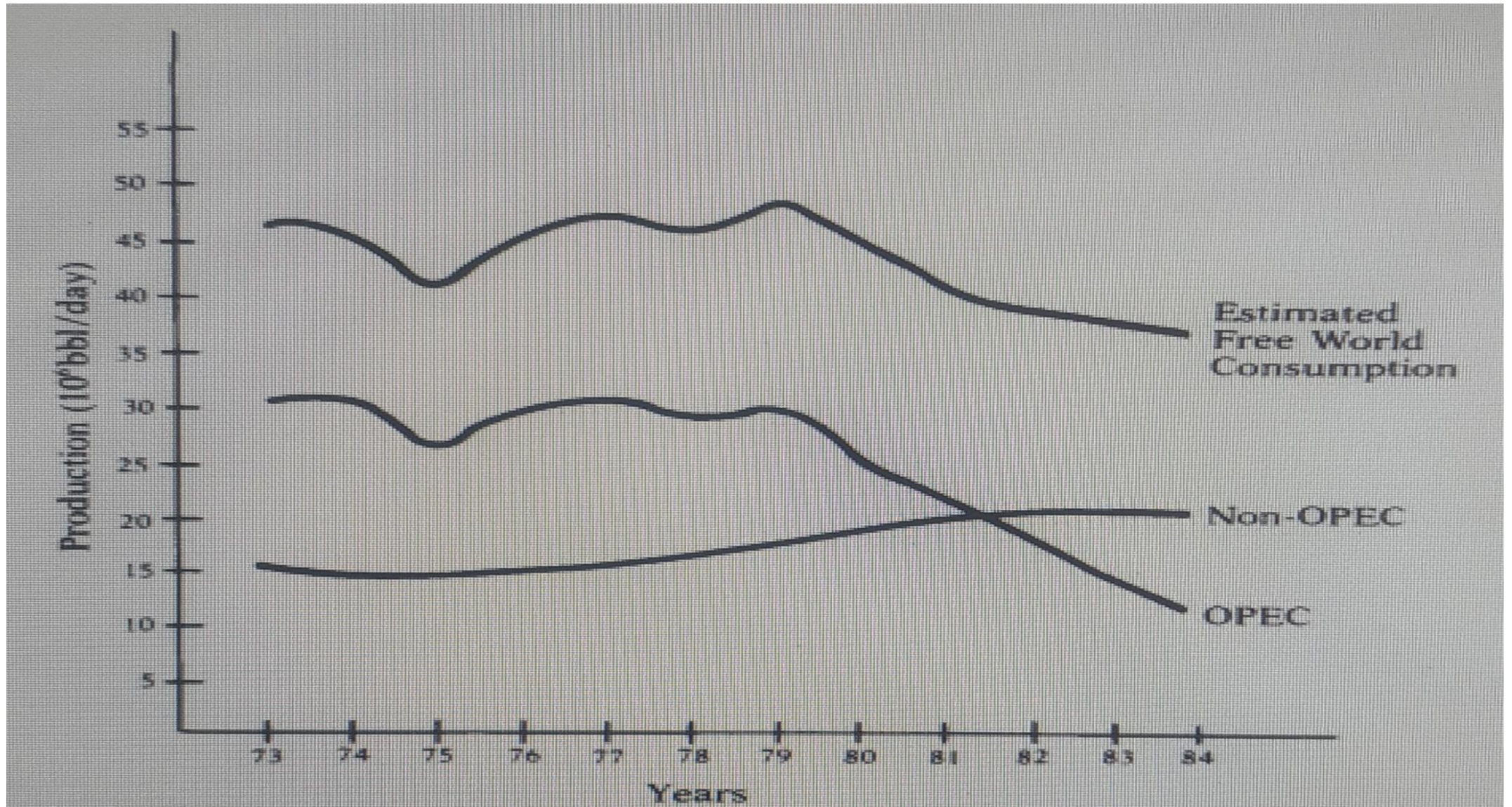
| | 2045 | 2021 |
|-------------------|--------|--------|
| OECD Americas | 15.81% | 19.45% |
| OECD Europe | 13.21% | 19.18% |
| OECD Asia-Pacific | 4.62% | 6.96% |
| China | 22.63% | 18.63% |
| Other Asia | 11.25% | 9.58% |
| India | 14.47% | 7.10% |
| OPEC | 4.78% | 4.78% |
| Rest of the World | 13.23% | 14.60% |



Implications for OPEC

- Urbanised Asia is the key to growth of OPEC region.
- Growth performance in OPEC appears to be stagnant.
- It is a concern for OPEC if no growth in long-run.
- Resources depletion or low oil generation could be a reason for no growth.
- The countries in OPEC region may think of oil diversification for society welfare.
- Massive renewable energy investment is required on the ground of environmental quality and domestic consumption.

CHANGING PUBLIC PERCEPTIONS OF THE "ENERGY PROBLEM"



“Energy problem” becomes a history

- Increasing oil consumption is stable.
- Gap between oil demand and supply is higher.
- OPEC monopoly action of reducing oil supply drives such gap, resulting for oil price rise.
- Poor economies can not create pressure on OPEC in reducing oil price.
- Because poor economies are beneficiary of remittances, commodity export and oil import.
- Cartel formation among poor economies may not be effective due to their insignificant share of import.

Way out for “energy problem”

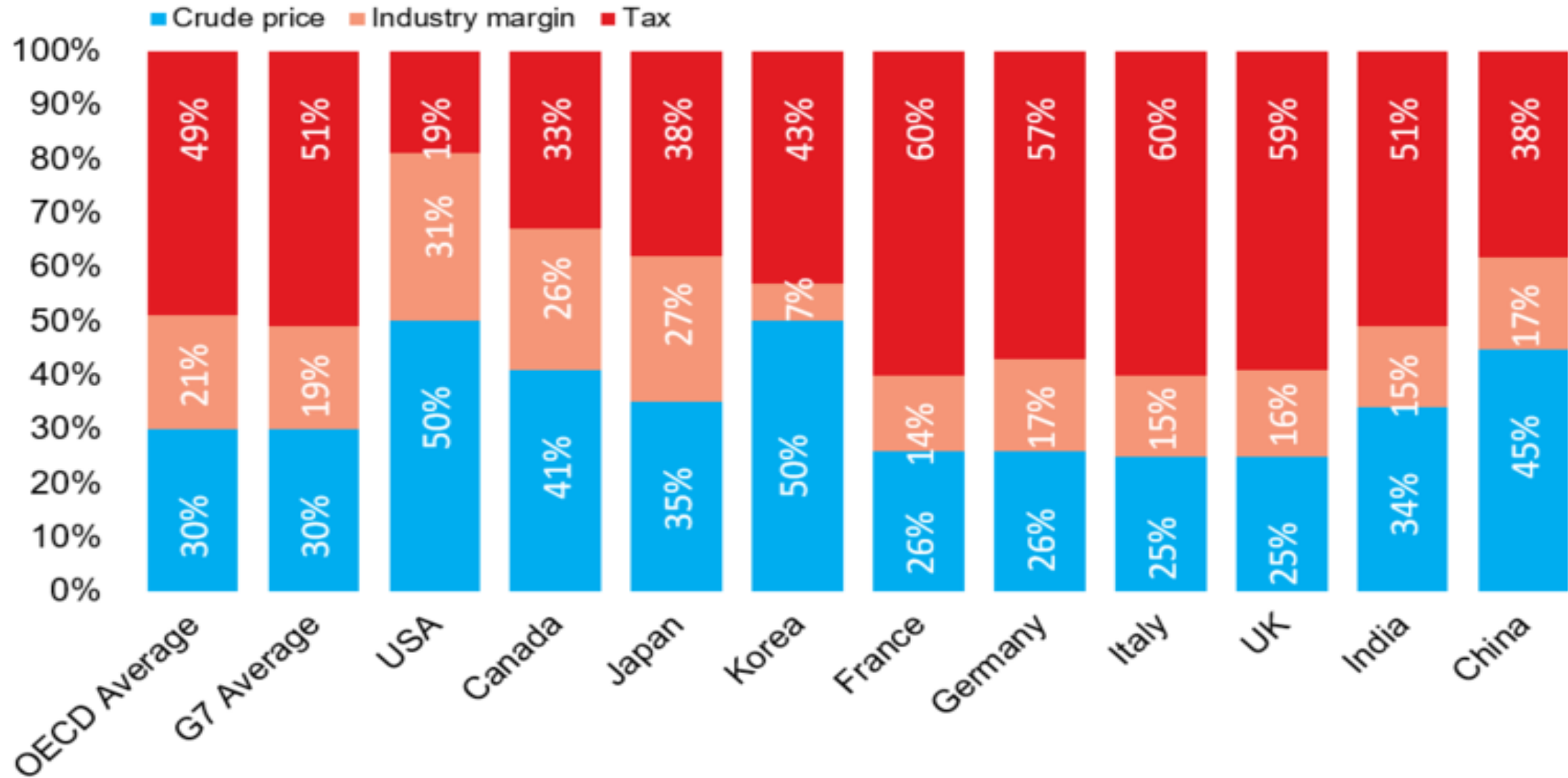
- Monopoly action of OPEC region is checked with oil supply reduction.
- Accept the energy issue with public opinion.
- So public opinion matters a lot.
- Reduce oil dependency.
- Energy diversification may be an option for solving energy problem.
- Easy option for advanced economies due to wealth reserve.
- Poor economies may think of energy efficiency.

Total World Crude Oil Reserves by Region in 1975 and 1984, in Billions of Barrels of Proved Reserves

| | | |
|-------------------------------|-----|-----|
| OPEC areas: | | |
| Saudi Arabia | 152 | 169 |
| Other Middle East | 208 | 201 |
| Other OPEC | 90 | 81 |
| Total OPEC | 450 | 451 |
| North America | 40 | 82 |
| Western Europe | 25 | 23 |
| Rest of Noncommunist World | 40 | 29 |
| Total Non-OPEC | 105 | 134 |
| Total, All Noncommunist Areas | 555 | 585 |
| Communist Areas | 103 | 85 |
| Total World | 658 | 670 |

SOURCE: Oil and Gas Journal, Year-end Summary Issues, 1975 and 1984.

Who gets what from a litre of oil in 2021



https://www.opec.org/opec_web/en/data_graphs/333.htm

WHY ENERGY ECONOMICS AND POLICY?

❑ THE DIMENSIONS OF THE ENERGY PROBLEM

- Arab Oil Embargo between 1973-1983 [Currently 13 member countries]
- OPEC Monopoly
 - Oil prices hike in 1973: energy crisis
 - Inflation & unemployment in Non-OPEC countries
 - Environmental threat in Non-OPEC countries

The Role of Energy in Economic Development

□ Role of Energy

- Energy is an input in economic activities.
- Energy consumption matters for households, firms and governments.
- Energy is the driver of economic growth (*energy-led economic growth hypothesis, Apergis and Tang, 2013*).

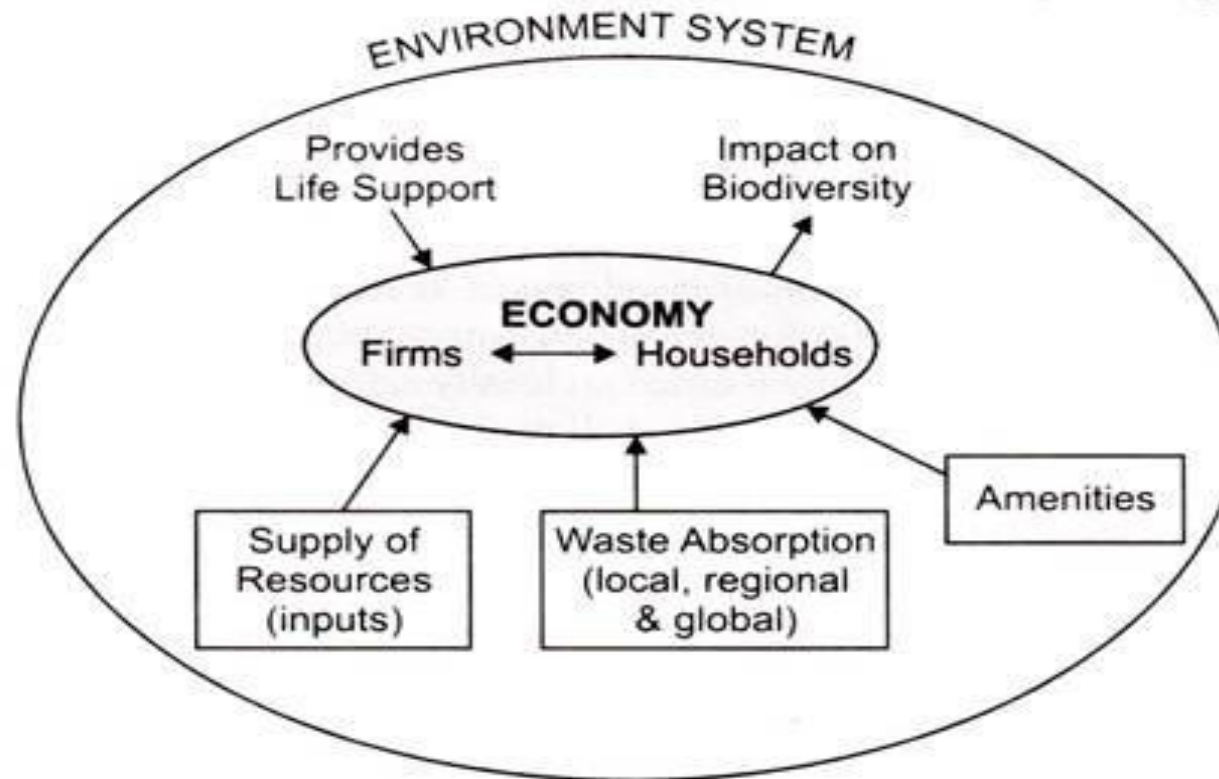


Fig. 56.1. Economy–environment linkages or relations

<https://adamasuniversity.ac.in/man-economy-and-nature-why-study-environmental-economics/>

Causality Results (Apergis and Tang, 2013; Energy Economics Journal)

- Validity of energy-led growth hypothesis for 85 countries (developed, developing and less developing)
- Though results are mixed among countries, but we do find a systematic pattern.
- Energy-led growth hypothesis remains valid at least in the 46 out of 85 selected countries.
- Both developed and developing countries are more likely to support the energy-led growth hypothesis compared to the less developed economies.
- Energy conservation policies should only focus on low income countries as these policies may not retard the process of economic growth

Causality Results

| No | Countries | Income group | Energy consumption Granger-causes economic growth | | |
|-----|--------------------|--------------|---|------------------|--------------------|
| | | | Bivariate model | Trivariate model | Multivariate model |
| 1. | Algeria | Upper middle | | | ✓ |
| 2. | Argentina | Upper middle | ✓ | ✓ | ✓ |
| 3. | Australia | High | ✓ | ✓ | ✓ |
| 4. | Austria | High | ✓ | ✓ | ✓ |
| 5. | Bangladesh | Low | | | ✓ |
| 6. | Belgium | High | ✓ | ✓ | ✓ |
| 7. | Benin | Low | | | ✓ |
| 8. | Bolivia | Lower middle | | ✓ | ✓ |
| 9. | Brazil | Upper middle | ✓ | ✓ | ✓ |
| 10. | Brunei | High | | | ✓ |
| 11. | Cameroon | Lower middle | | | ✓ |
| 12. | Canada | High | ✓ | ✓ | ✓ |
| 13. | Chile | Upper middle | ✓ | ✓ | ✓ |
| 14. | China | Lower middle | | | ✓ |
| 15. | Colombia | Upper middle | ✓ | ✓ | ✓ |
| 16. | Congo dem. Rep | Low | | | ✓ |
| 17. | Congo Rep. | Lower middle | ✓ | ✓ | ✓ |
| 18. | Costa Rica | Upper middle | | | ✓ |
| 19. | Cote d'Ivoire | Lower middle | | | ✓ |
| 20. | Cuba | Upper middle | ✓ | ✓ | ✓ |
| 21. | Cyprus | High | | | ✓ |
| 22. | Denmark | High | ✓ | ✓ | ✓ |
| 23. | Dominican Republic | Upper middle | ✓ | | ✓ |
| 24. | Ecuador | Lower middle | ✓ | ✓ | ✓ |
| 25. | Egypt | Lower middle | | | ✓ |
| 26. | El Salvador | Lower middle | ✓ | ✓ | |
| 27. | Finland | High | ✓ | ✓ | ✓ |
| 28. | France | High | | ✓ | ✓ |
| 29. | Gabon | Upper middle | | ✓ | |
| 30. | Germany | High | | | |
| 31. | Ghana | Low | | ✓ | ✓ |
| 32. | Greece | High | ✓ | ✓ | ✓ |
| 33. | Guatemala | Lower middle | | ✓ | ✓ |
| 34. | Honduras | Lower middle | | | ✓ |
| 35. | Hong kong | High | ✓ | ✓ | ✓ |
| 36. | Hungary | High | | | |
| 37. | Iceland | High | ✓ | | ✓ |
| 38. | India | Lower middle | ✓ | ✓ | ✓ |
| 39. | Indonesia | Lower middle | ✓ | ✓ | ✓ |
| 40. | Iran | Upper middle | ✓ | ✓ | ✓ |
| 41. | Ireland | High | ✓ | | ✓ |
| 42. | Israel | High | | ✓ | ✓ |
| 43. | Italy | High | ✓ | ✓ | ✓ |
| 44. | Jamaica | Upper middle | | | ✓ |
| 45. | Japan | High | ✓ | ✓ | ✓ |

| | | | | | |
|----|---------------------|--------------|---|---|---|
| 46 | Jordan | Lower middle | ✓ | | ✓ |
| 47 | Kenya | Low | ✓ | ✓ | ✓ |
| 48 | Korea | High | ✓ | ✓ | ✓ |
| 49 | Luxembourg | High | | | ✓ |
| 50 | Malaysia | Upper middle | ✓ | ✓ | ✓ |
| 51 | Malta | High | | | ✓ |
| 52 | Mexico | Upper middle | ✓ | ✓ | ✓ |
| 53 | Morocco | Lower middle | | | |
| 54 | Nepal | Low | | | ✓ |
| 55 | Netherland | High | | ✓ | ✓ |
| 56 | New Zealand | High | | | |
| 57 | Nigeria | Lower middle | | | ✓ |
| 58 | Norway | High | ✓ | ✓ | ✓ |
| 59 | Oman | High | ✓ | ✓ | ✓ |
| 60 | Pakistan | Lower middle | ✓ | ✓ | ✓ |
| 61 | Panama | Upper middle | | ✓ | |
| 62 | Paraguay | Lower middle | ✓ | ✓ | ✓ |
| 63 | Peru | Upper middle | ✓ | ✓ | ✓ |
| 64 | Philippines | Lower middle | ✓ | ✓ | ✓ |
| 65 | Portugal | High | ✓ | | ✓ |
| 66 | Saudi Arabia | High | ✓ | ✓ | ✓ |
| 67 | Senegal | Lower middle | | ✓ | |
| 68 | Spain | High | ✓ | ✓ | ✓ |
| 69 | Sri Lanka | Lower middle | | | |
| 70 | Sudan | Lower middle | | | ✓ |
| 71 | Sweden | High | | ✓ | ✓ |
| 72 | Switzerland | High | | ✓ | |
| 73 | Syrian Arab Rep | Lower middle | | ✓ | ✓ |
| 74 | Thailand | Lower middle | ✓ | ✓ | ✓ |
| 75 | Togo | Low | | | |
| 76 | Trinidad and Tobago | High | | | |
| 77 | Tunisia | Lower middle | ✓ | ✓ | ✓ |
| 78 | Turkey | Upper middle | ✓ | ✓ | ✓ |
| 79 | UAE | High | ✓ | ✓ | ✓ |
| 80 | UK | High | ✓ | ✓ | ✓ |
| 81 | USA | High | ✓ | ✓ | ✓ |
| 82 | Uruguay | Upper middle | ✓ | ✓ | ✓ |
| 83 | Venezuela | Upper middle | ✓ | ✓ | ✓ |
| 84 | Zambia | Low | | | ✓ |
| 85 | Zimbabwe | Low | | | |