

II. Worldwide fossil fuel and uranium reserves

(See Tables 2-4, Maps 1-3.)

Although estimates vary, the world's proved, economically recoverable fossil fuel reserves include over one trillion short tons of coal, more than one trillion barrels of petroleum, and about six quadrillion cubic feet of natural gas². In addition to fossil fuels, mineral resources important to energy generation include over three million metric tons of uranium reserves. Developing countries contain a little over half of the world's uranium reserves, and a substantial majority of known worldwide recoverable reserves of all three major fossil fuels: coal (58%), oil (75%), and natural gas (77%).

Among developing countries, the vast majority of these resources are located within the middle income countries, with low income nations possessing only 14%, 5%, and 8% of the world's known coal, oil, and natural gas resources, respectively. Thirty-three low-income countries (48%) have no known fossil fuel reserves whatsoever, compared to 34 (40%) among middle-income countries, and those middle-income countries without known fossil fuel reserves are predominantly small island states. Low-income countries possess in total 147 billion short tons of coal reserves, but the vast majority of these resources (96%) are located in only four countries: Uzbekistan (3%), Indonesia (4%), Ukraine (26%), and India (63%). The remaining low-income countries with coal reserves have 0.6% or less, and 49 have no known coal reserves at all. As for crude oil, Nigeria contains nearly half (48%) of the reserves in low-income states, although it is still among the poorest 10% of all countries in terms of GDI per capita. Angola, Yemen, and Indonesia have 11%, 8%, and 10%, respectively, while other oil-possessing low-income states each have 3% or less. Forty-five low-income states have no known oil reserves. Natural gas is the most ubiquitous fossil fuel among the low-income states, with 28 countries possessing known reserves. Nigeria, Indonesia, and Uzbekistan account for most of these reserves (27%, 20%, and 15%, respectively).

The majority of the world's fossil fuel reserves lies within the middle-income developing states, which include most of the major oil-producing Middle Eastern countries. These countries possess 45%, 70%, and 68% of the world's coal, crude oil, and natural gas, respectively. Middle income states have 484 billion short tons of coal reserves, with two countries, China and Russia, together containing 62% of the total among these states. Other coal-possessing middle-income countries contain reserves ranging from 54.6 billion short tons (11%, South Africa) to 1 million short tons (0.0002%, Bolivia), and 54 middle-income countries have zero recorded coal reserves. More than 700 billion barrels of known oil reserves in the middle-income countries are divided among 47 states, with a bulk of those reserves lying in Saudi Arabia (261.8 billion barrels, 36%), Iraq (112.5 billion barrels, 16%), and Iran (89.7 billion barrels, 12%). Significant reserves are also located in Venezuela (77.7 billion barrels), Russia (48.6 billion barrels), Libya (29.5 billion barrels), Mexico (26.9 billion barrels), and China (24 billion barrels). The remaining oil-possessing, middle-income countries each

² These numbers are based on year 2001 data from the *International Energy Annual 2001 Edition* released by the Energy Information Administration of the US Department of Energy. Reserves include only occurrences that are identified and measured as economically and technically recoverable with current technologies and prices. Other occurrences with foreseeable or unknown potential for recovery exist, but are not included in this report.

contain one percent or less of the total among this group. Natural gas is present in 46 nations. With 1,680 trillion cubic feet (tcf), Russia has by far the largest reserves, comprising 45% of the total among middle-income states. Other major reserves are also in Iran (812.3 tcf), Saudi Arabia (219.5 tcf), Algeria (159.7 tcf), Venezuela (147.6 tcf), Iraq (109.8 tcf), and Turkmenistan (101 tcf).

In total, the developed countries have fewer fossil fuel reserves than the developing world (42% of the world's coal, 25% of oil, and 24% of natural gas), but still more than those countries in the low-income category. Like the developing world, however, the majority of these resources are concentrated in a relatively few states. Twenty out of 57 high-income countries together possess 452 billion short tons of coal reserves, but the majority of it exists in United States (274 billion short tons), with other major reserves located in Australia (90.5 billion short tons) and Germany (72.8 billion short tons). The remaining seventeen countries each have less than 2% of the total among high-income states. 258 billion barrels of crude oil reserves are concentrated not only in the United States (22.4 billion barrels), but also predominantly in several high-income Middle Eastern states: Kuwait (96.5 billion barrels), United Arab Emirates (97.8 billion barrels), and Qatar (15.2 billion barrels). Eighteen other high-income states contain oil reserves, but most of these do not exceed 1 billion barrels. As with the developing states, natural gas is the most common fossil fuel, with 22 high-income states possessing known reserves. Unsurprisingly, since natural gas often coincides with petroleum, the United States, Kuwait, United Arab Emirates, and Qatar have substantial reserves (177.4 tcf, 52.2 tcf, 212.1 tcf, 508.5 tcf, respectively). Other major reserves also exist in Canada (59.7 tcf), United Kingdom (26 tcf), the Netherlands (62.5 tcf), and Norway (44 tcf). However, the largest national reserves of oil and natural gas in the high-income countries do not exceed the reserves in Russia and the Middle Eastern middle-income developing countries.

Only 35 countries worldwide possess reported uranium reserves³ (11 low-income, 13 middle-income, and 11 high-income). The developing countries possess 54% of these reserves, with major reserves located in Niger (0.19 million metric tons), Brazil (0.16 million metric tons), Kazakhstan (0.43 million metric tons), Russia (0.16 million metric tons), and South Africa (0.24 million metric tons). Only industrialized countries possess large reserves: Australia (0.59 million metric tons), Canada (0.54 million metric tons), and the United States (0.32 million metric tons).

³ These numbers are based on year 2000 data from *Analysis of Uranium Supply to 2050* released by the International Atomic Energy Agency (IAEA). These reserves refer only to the reasonably assured resources (RARs) defined by the IAEA, and do not other sources of uranium such as unproved resources and secondary supplies from reprocessed uranium, reenriched uranium, and highly enriched uranium from the dismantlement of nuclear weapons. Forty-two percent of uranium used for nuclear power generation is currently supplied by secondary sources.