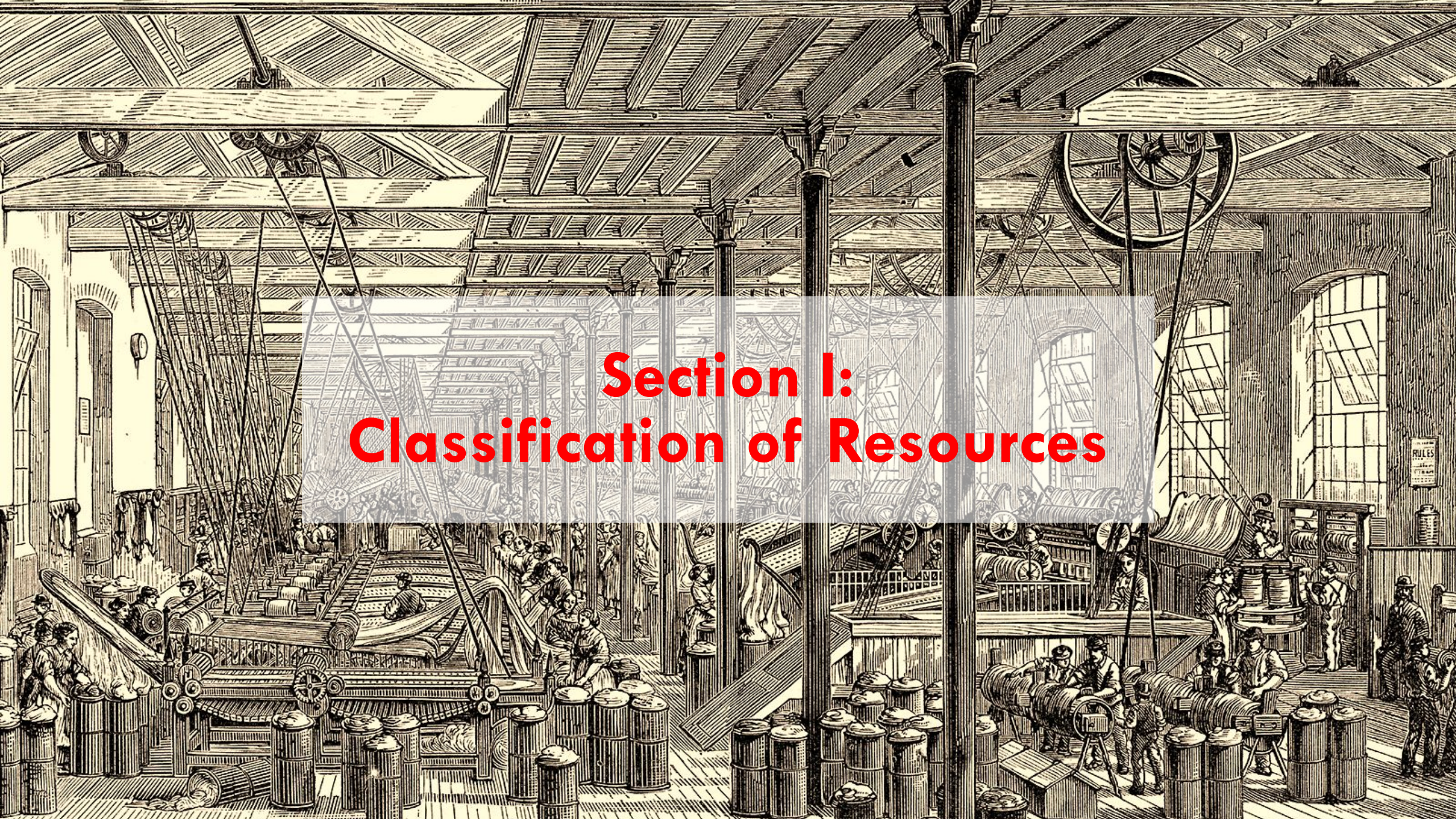
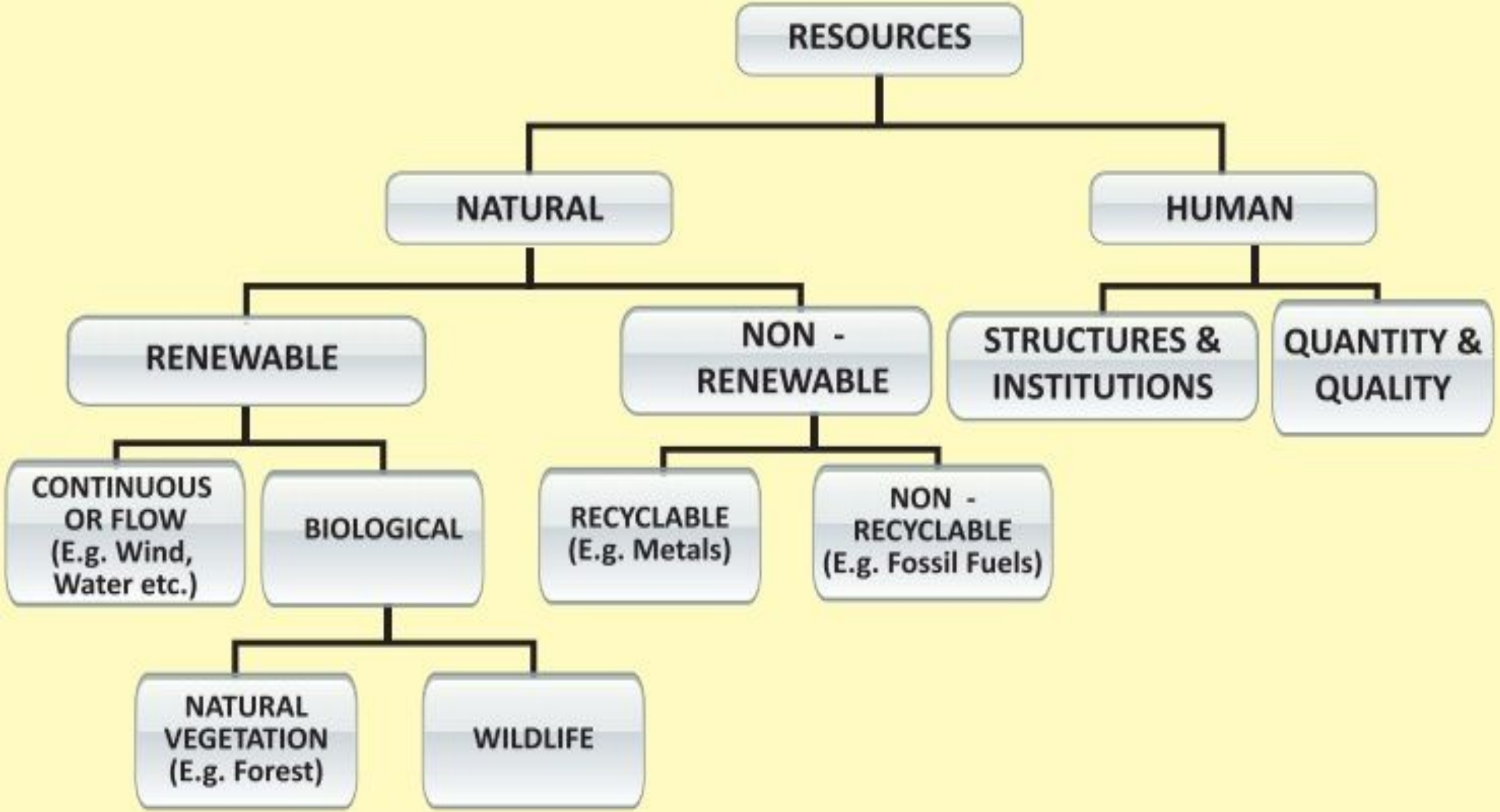
Industry | Energy



Section I:
Classification of Resources


RESOURCES
NATURAL
HUMAN
RENEWABLE
NON - RENEWABLE
STRUCTURES & INSTITUTIONS
QUANTITY & QUALITY
CONTINUOUS OR FLOW (E.g. Wind, Water etc.)
BIOLOGICAL
RECYCLABLE (E.g. Metals)
NON - RECYCLABLE (E.g. Fossil Fuels)
NATURAL VEGETATION (E.g. Forest)
WILDLIFE

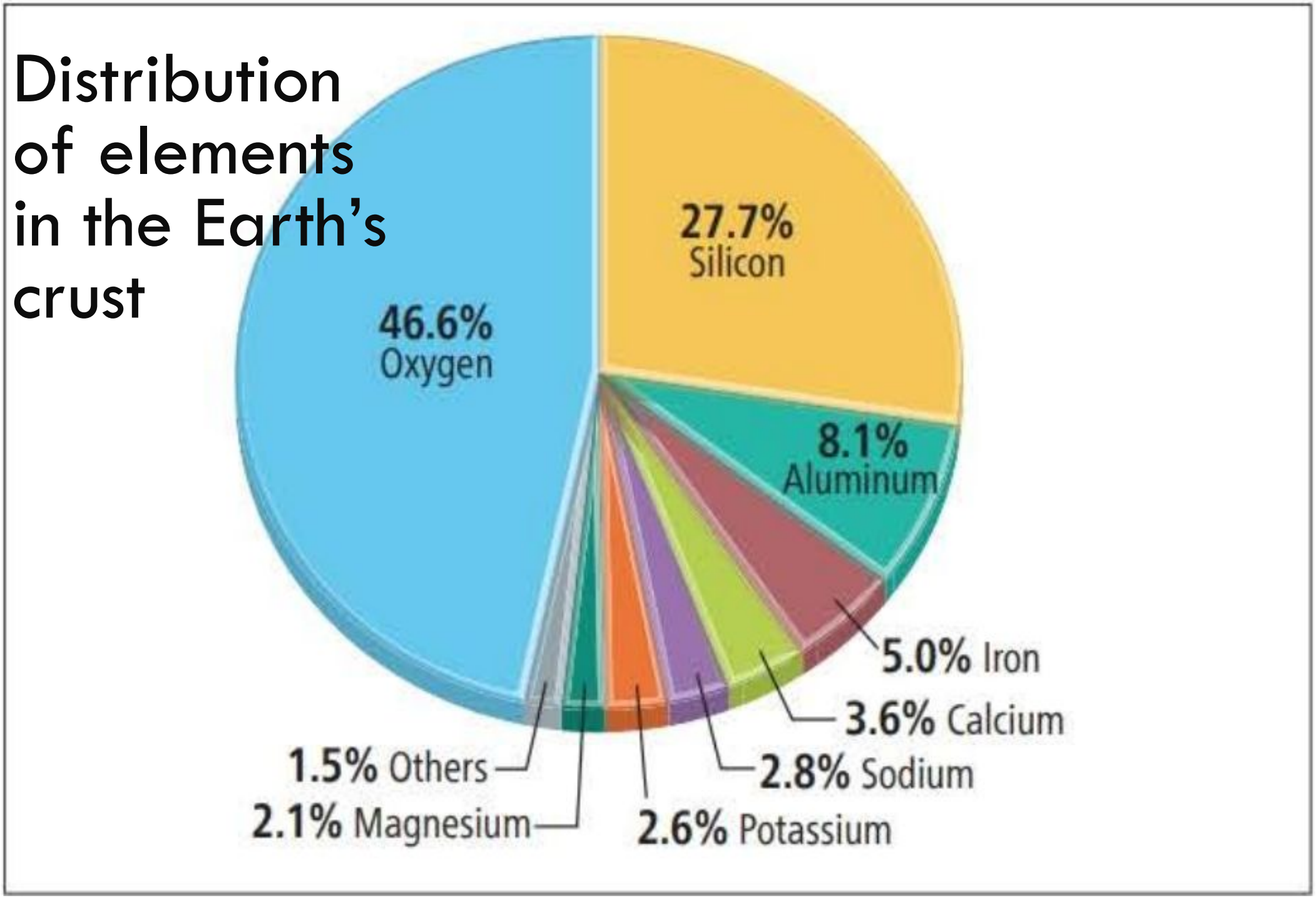
Mineral Resources

Minerals are especially important inputs for many industries. Earth has 92 natural elements, but about 99 percent of the crust is composed of eight of them (*next slide*). The eight most common elements combine with less abundant elements to form approximately 3,000 different minerals, all with their own properties of hardness, color, and density as well as spatial distribution. Many of these minerals have important industrial uses.
Minerals are either nonmetallic or metallic:

- **Nonmetallic minerals.** By weight, more than 90 percent of the minerals that humans use are nonmetallic. Important nonmetallic minerals include building stones, gemstones such as diamonds, and minerals used in the manufacture of fertilizers such as nitrogen, phosphorus, potassium, calcium, and sulfur.

- **Metallic minerals.** Metallic minerals have properties that are especially valuable for fashioning machinery, vehicles, and other essential elements of contemporary society. They are to varying degrees malleable (able to be hammered into thin plates) and ductile (able to be drawn into fine wire) and are good conductors of heat and electricity.

Distribution of elements in the Earth's crust



Metal Alloys

Many metals are capable of combining with other metals to form alloys with distinctive properties that are important for industry. Alloys are known as ferrous or nonferrous. A ferrous alloy contains iron, and a nonferrous one does not:

- **Ferrous alloys.** The word ferrous comes from the Latin for "iron." Iron is extracted from iron ore, by far the world's most widely used ore. Humans began fashioning tools and weapons from iron 4,000 years ago. Important metals used to make ferrous alloys include chromium, manganese, molybdenum, nickel, tin, titanium, and tungsten.

- **Nonferrous alloys.** Important metals utilized to manufacture products that don't contain iron and steel include aluminum, copper, lead, lithium, magnesium, zinc, precious metals (silver, gold, and the platinum group), and rare earth metals.

FIGURE 11-16
DISTRIBUTION OF MINERALS
Australia and China are especially well endowed with minerals that are important for industry.

Ferrous metals

FE fe	Iron ore	NI ni	Nickel
CR cr	Chromium	SN sn	Tin
MG mg	Magnesium	TI ti	Titanium
MN mn	Manganese	W w	Tungsten
MO mo	Molybdenum		

Nonferrous metals

B b	Bauxite	PD pd	Palladium
CU cu	Copper	PT pt	Platinum
AU au	Gold	AG ag	Silver
PB pb	Lead	ZN zn	Zinc
LI li	Lithium		

Percent of total world production

FE B 15 and above
fe b 5–14

Major mineral producer

Non-mineral resources

Non-mineral resources include: the sedimentary, igneous and metamorphic rock that we quarry for buildings, monuments, construction and decoration; glacial deposits, such as clay, peat, sand and gravel; and the soil, which provides the nutrients and minerals for crops, forests and grasslands. Non-mineral resources also encompass the fossil fuels: coal, oil and gas. Just as minerals are vital to the economy and functioning of modern civilization, so too are the non-mineral resources found around the world.

Section II:
Distribution of Industry

What factors influence the distribution of industry?
Situation Factors:

- Raw materials
- Fuel
- Energy
- Labor
- Consumer
- Transport
- Ecology

Raw materials | Сырье | Шикізат

The raw material factor refers to the placement of enterprises near the sources of raw materials for obtaining certain products: near mineral deposits, large water bodies, in forest areas, etc. The placement of such industries near the sources of raw materials eliminates the transportation of large volumes and reduces the costs of enterprises. Therefore, production is organized as close as possible to the sources of raw materials. **The finished products of enterprises will be cheaper due to lower costs for the delivery of raw materials.** The raw material factor has a significant impact on the location of a number of industrial productions: for example, the production of **potash fertilizers, cement, sawmilling, and the enrichment of non-ferrous metal ores.**

Fuel | Топливо | Отын

The fuel factor, as well as the raw material factor, has the same effect on the placement of production. It is decisive in the placement of industries that **use large volumes of mineral fuel for the production of products:** coal, natural gas, fuel oil. Such industries include heat and power engineering, individual production of **ferrous metallurgy, chemical industry.** So, the most powerful **thermal power plants** in the USA, Russia, In China, they were built near large coal deposits. Many enterprises for the production of cast iron and steel are located near coal deposits.

Energy | Энергия

Regions with a developed energy infrastructure are preferable for production, but **energy-intensive and fuel-intensive production should be located in regions in the zone of cheap energy.** The energy factor affects the placement of production facilities in which a large amount of mainly electrical energy is consumed to create a unit of production. Such productions are called energy-intensive. These include the **production of many light non-ferrous metals (aluminum, titanium, etc.), chemical fibers, and paper.** Enterprises producing energy-intensive products are located in areas where mainly cheap electricity is produced in large volumes, for example near large hydroelectric power plants.

Labor | Труд | Еңбек

The labor factor has a decisive influence on the placement of production facilities based on the use of a large number of labor resources, including highly qualified specialists. These are **labor-intensive** productions. For example, in light industry, such industries include **sewing production** (textile industry).
In agriculture, **rice growing, vegetable growing, and fruit growing** are the most labor-intensive.
Enterprises that require high qualification/education of its workers (thus, focusing on *quality* instead of *quantity*) are also considered labor-intensive. The production of **electronic equipment, personal computers** involves the use of qualified personnel.
New enterprises with labor-intensive products, the production of which requires large labor costs, should be built in areas with a **high concentration of population.** However, due to further restrictions on industrial development in the largest and largest cities, it is preferable to place new enterprises primarily in medium-sized and small cities with labor reserves and other favorable conditions for industrial development.

Consumer/Transport
Потребитель/Транспорт
Тұтынушы/Транспорт

For many firms, the optimal location is close to customers. Proximity to markets is a critical locational factor for three types of industries:

1. **bulk-gaining industries,**
2. **single-market manufacturers**, and
3. **perishable-products companies.**

Bulk-Gaining Industries

A bulk-gaining industry makes something that gains volume or weight during production. To minimize transport costs, a bulk-gaining industry needs to locate near where the product is sold. A prominent example of a bulk-gaining industry is the fabrication of parts and machinery from steel and other metals. A fabricated-metal factory brings together metals such as steel and previously manufactured parts as the main inputs and transforms them into a more complex product. Fabricators shape individual pieces of metal using such processes as bending, forging (hammering or rolling metal between two dies), stamping (pressing metal between two dies), and forming (pressing metal against one die). Separate parts are joined together through welding, bonding, and fastening with bolts and rivets. Beverage bottling is another good example of a bulk-gaining industry. In this case, the product gains weight. Because water is the principal ingredient in beer or cola, a filled container is much heavier than an empty one. Shipping filled containers is more expensive than shipping empty ones, so to minimize shipping costs, bottlers locate near their customers rather than the manufacturers of the containers.

Single-Market Manufacturers

A single-market manufacturer is a specialized manufacturer with only one or two customers. The optimal location for these factories is often in close proximity to the customers. An example of a single-market manufacturer is a producer of buttons, zippers, clips, pins, or other specialized components attached to clothing. The clothing manufacturer may need additional supplies of these pieces on very short notice. The world's largest manufacturer of zippers, YKK, for example, has factories in 68 countries in order to be near its customers, the manufacturers of clothing. The makers of parts for motor vehicles are another example of specialized manufacturers with only one or two customers -the major motor vehicle producers, such as GM and Honda (next slide).

Carmakers' assembly plants account for only around 30 percent of the value of the vehicles that bear their names. Independent parts makers supply the other 70 percent of the value. In the past, most motor vehicle parts were made in Michigan and shipped to nearby warehouses and distribution centers maintained in that state by the major producers. From the warehouses, the producers sent the parts to plants around the country where the vehicles were assembled. Parts makers now ship most of their products directly to assembly plants and are therefore more likely than in the past to cluster near the final assembly plants.

Perishable-Products Companies

To deliver their products to consumers as rapidly as possible, perishable-products industries must be located near their markets. Because few people want stale bread or sour milk, food producers such as bakers and milk bottlers must locate near their customers to assure rapid delivery. Processors of fresh food into frozen, canned, and preserved products can, however, locate far from their customers. Cheese and butter, for example, are manufactured in Wisconsin because rapid delivery to the urban markets is not critical for products with a long shelf life, and the area is well suited agriculturally for raising dairy cows.

Truck, Train, Ship, or Plane?

Inputs and products are transported in one of four ways:
truck,
train,
boat,
or airplane.
Firms seek the lowest-cost mode of transport, but which of the four alternatives is cheapest changes with the distance that goods are being sent. The farther something is transported, the lower the cost per kilometer (or mile).
Longer-distance transportation is cheaper per kilometer in part because firms must pay workers to load goods on and off vehicles, whether the material travels 10 kilometers or 10,000. The cost per kilometer decreases at different rates for each of the four modes because the loading and unloading expenses differ for each mode.

Trucks: Short Distances

Trucks are most often used for short-distance delivery because they can be loaded and unloaded quickly and cheaply. Truck delivery is especially advantageous if the driver can reach the destination within one day, before having to stop for an extended rest.

Trains: Cross-Country Shipment

Trains are often used to ship to destinations that take longer than one day to reach, such as between the East and West coasts of the United States. Loading trains takes longer than loading trucks, but once under way, trains aren't required to make daily rest stops like trucks.

Airplanes: Small & Valuable Packages

Airplanes are most expensive for all distances so are usually reserved for speedy delivery of small-bulk, high-value packages.

Boats: Crossing Oceans

Ships are attractive for transport over very long distances because the cost per kilometer is very low. Ships are slower than land-based transportation, but unlike trains or trucks, they can cross oceans, such as to North America from Europe or Asia.

Sea trade

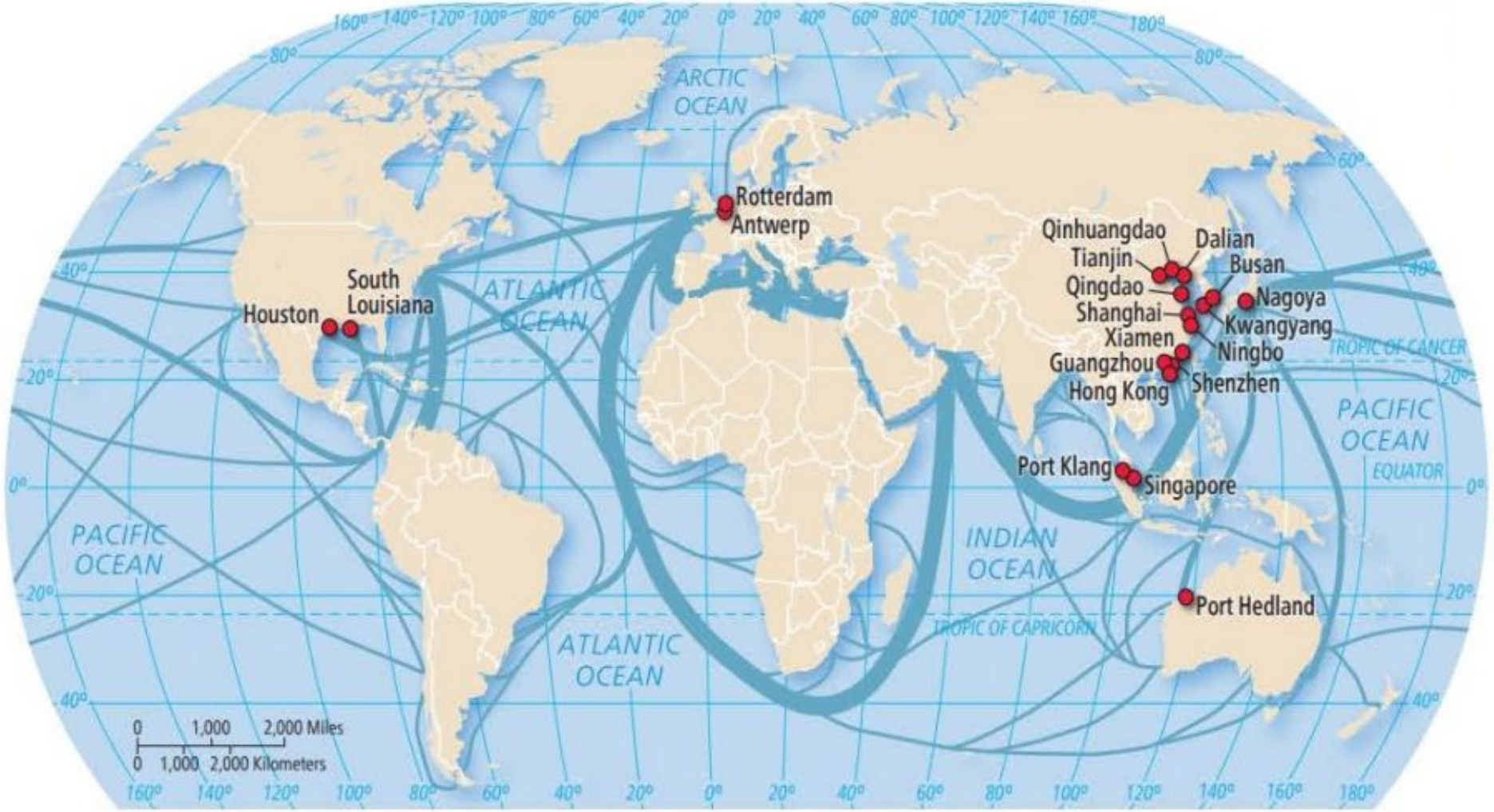


FIGURE 11-25 SHIP BY BOAT The world's largest cargo ports and shipping routes are shown.

Source: American Association of Port Authorities

Shipping routes (million metric tons)

- 200 and above
- 20–199
- 5–19

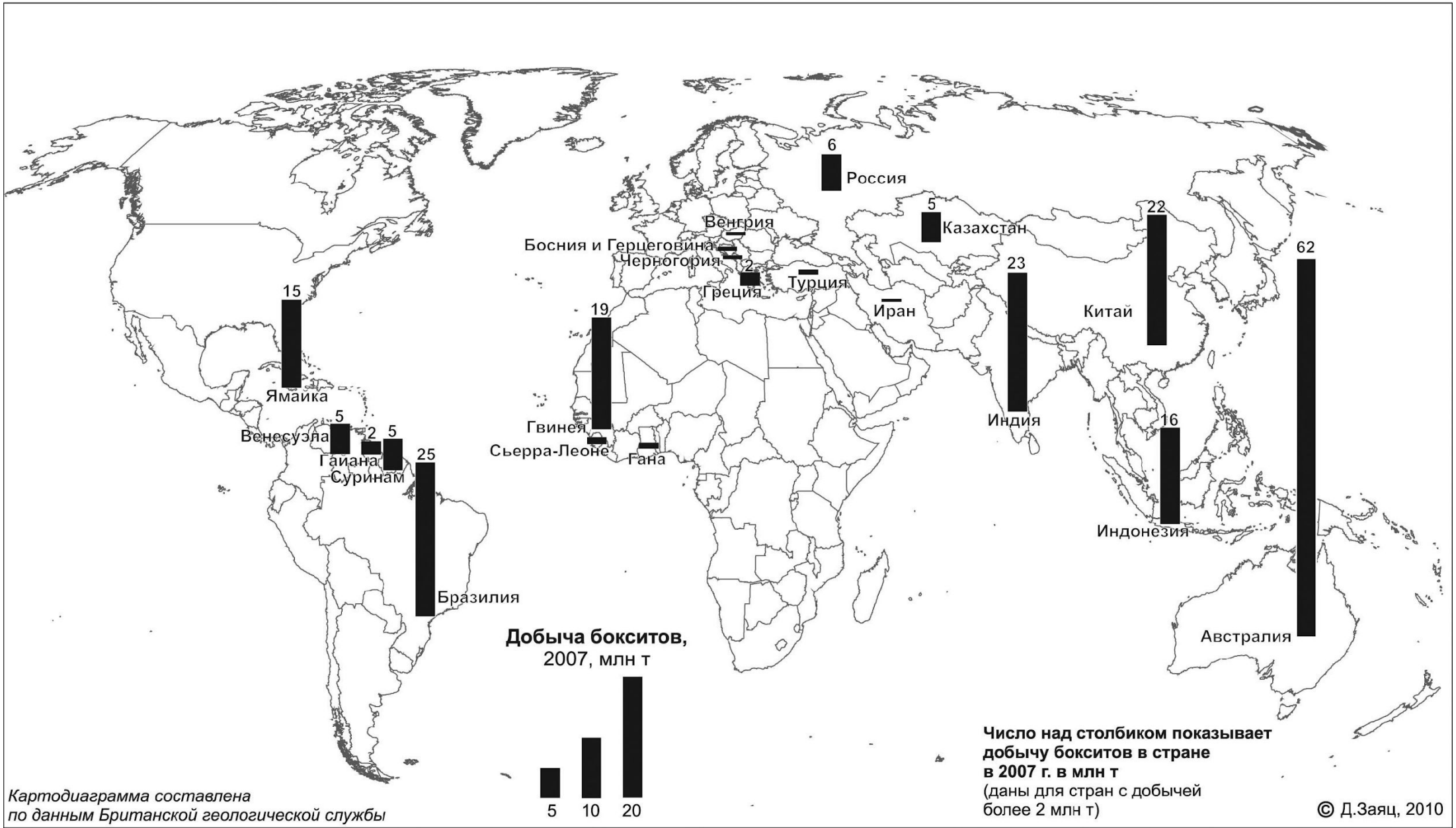
Major cargo port

Ecology | Экология

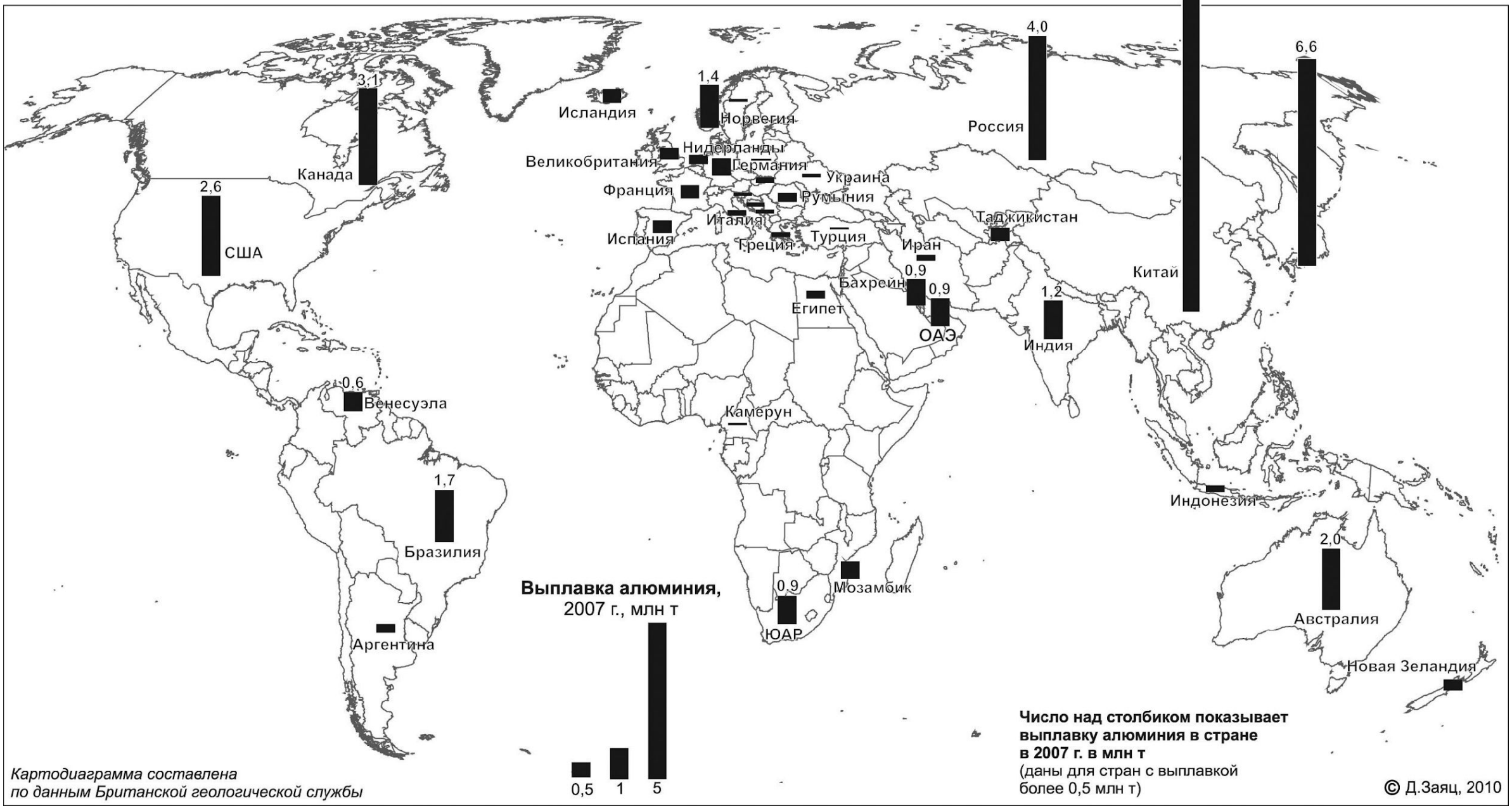
When placing production facilities, the environmental factor associated with environmental protection is of great importance. This factor limits the creation of production if it can harm the environment. Industries that are characterized by large emissions of pollutants or other harmful effects on the environment are subject to increased environmental requirements. It is forbidden to place them in large cities and densely populated areas. Modern low-waste technologies should be used at these enterprises and facilities for cleaning emissions should be built.In modern conditions, the role of the environmental factor is increasing — it affects the location of all production facilities. It is most important to take into account the environmental factor when placing chemical industry, metallurgy, and energy enterprises, especially during the construction of nuclear power plants.

Section III: Mineral Resources

ДОБЫЧА БОКСИТОВ
по странам мира

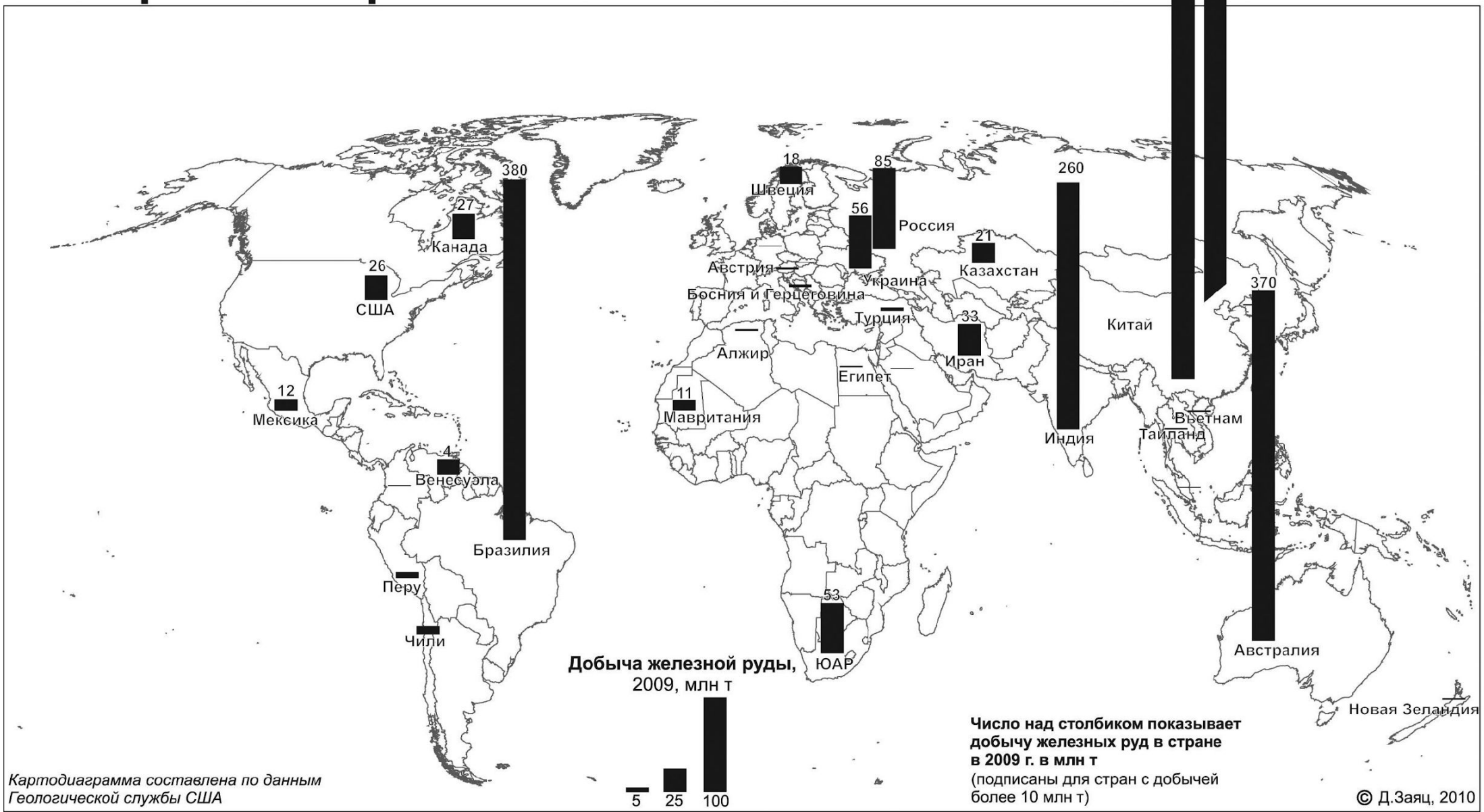


ВЫПЛАВКА ПЕРВИЧНОГО АЛЮМИНИЯ по странам мира



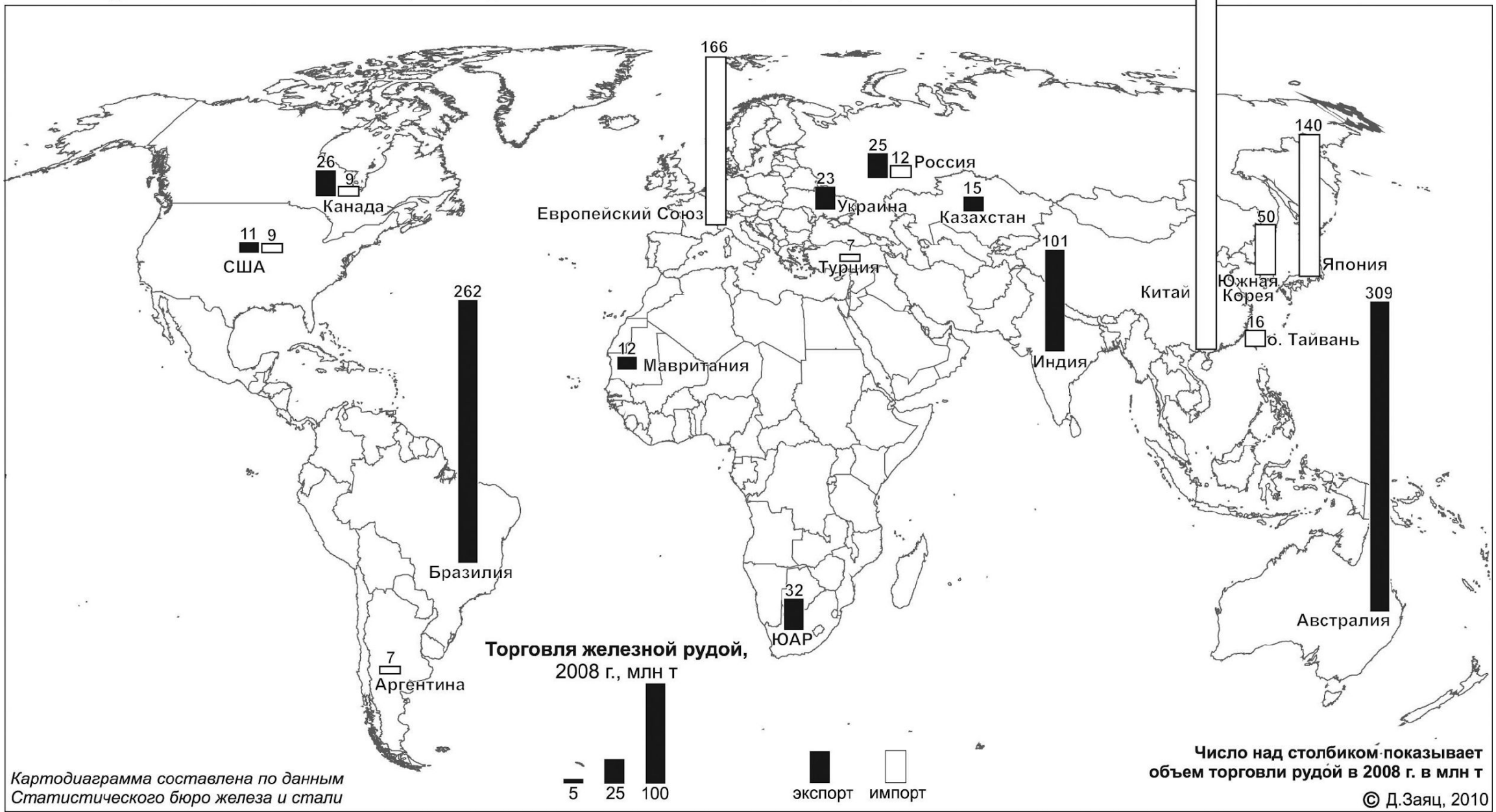
Картодиаграмма составлена по данным Британской геологической службы

ДОБЫЧА ЖЕЛЕЗНОЙ РУДЫ
по странам мира



МИРОВАЯ ТОРГОВЛЯ ЖЕЛЕЗНОЙ РУДОЙ

Ведущие экспортеры и импортеры



Картодиаграмма составлена по данным Статистического бюро железа и стали

Coal formed in tropical locations, in lush, swampy areas rich in plants. Thanks to the slow movement of Earth's drifting continents, the tropical swamps of 250 million years ago relocated to the mid-latitudes. As a result, today's main reserves of coal are in mid-latitude countries rather than in the tropics. China produces nearly one-half of the world's coal, other developing countries one-fourth, and developed countries (primarily the United States) the remaining one-fourth.

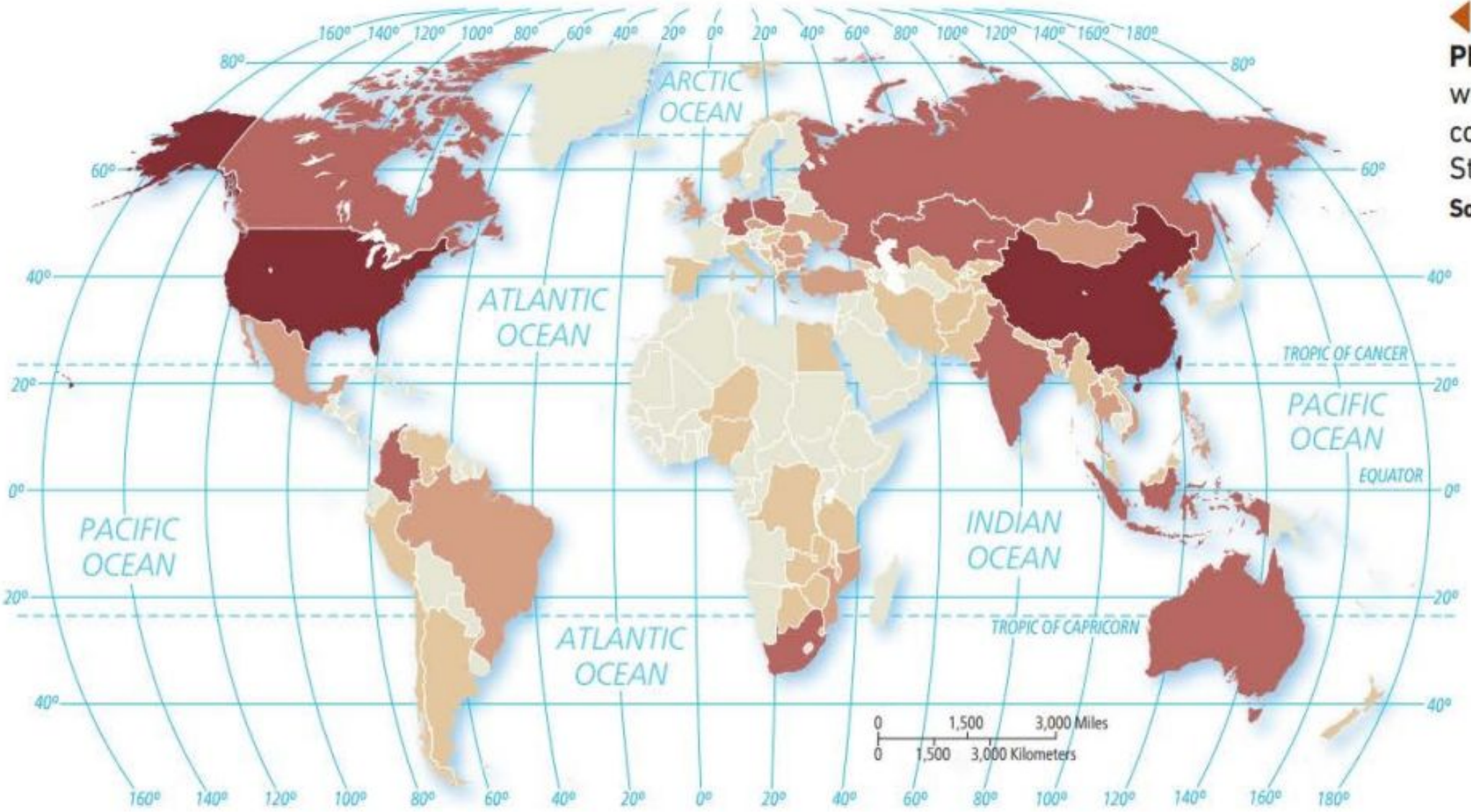
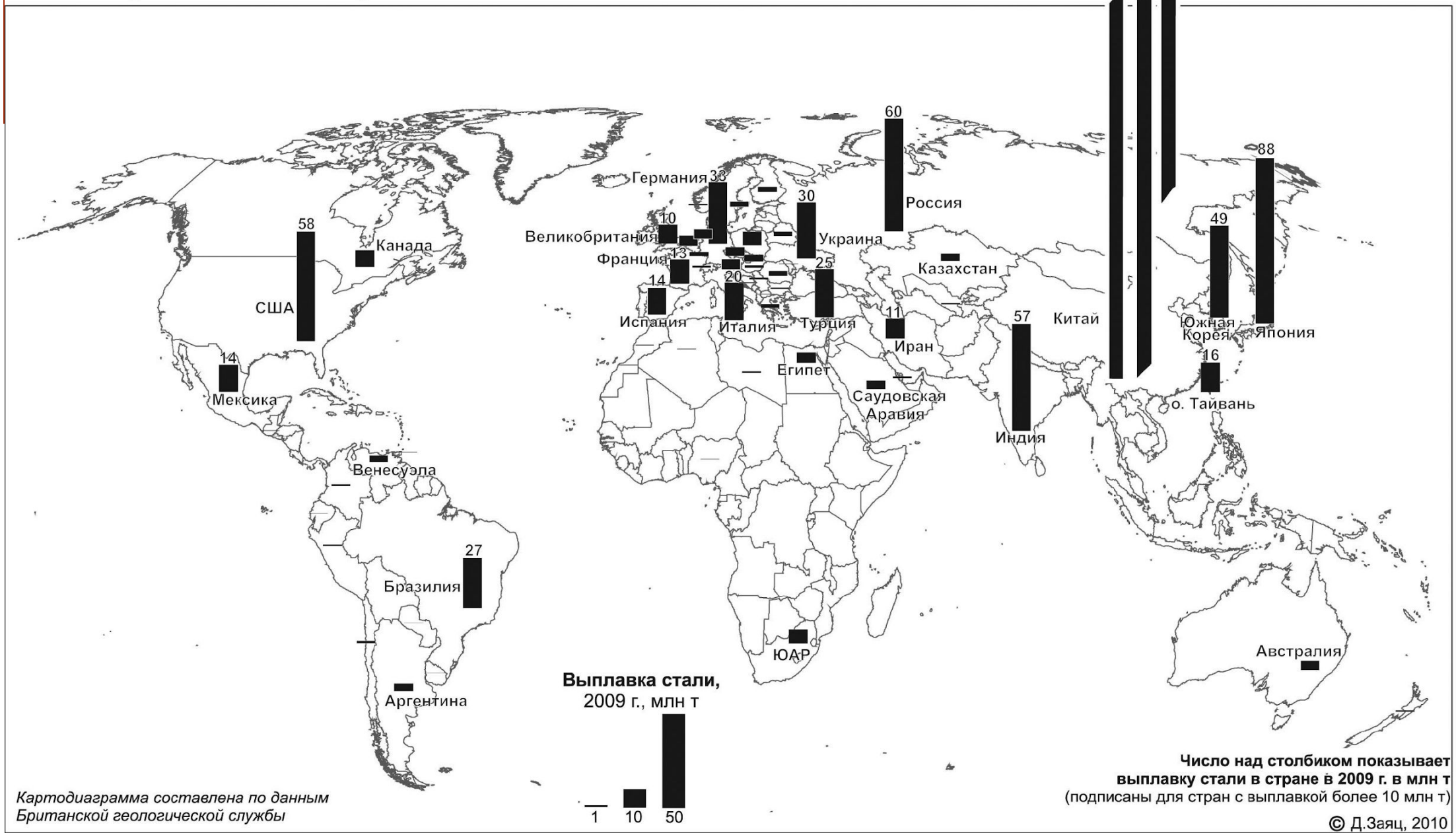


FIGURE 11-31 COAL PRODUCTION China is the world's leading producer of coal, followed by the United States.

Source: U.S. Department of Energy

ВЫПЛАВКА СТАЛИ
по странам мира



Картодиаграмма составлена по данным Британской геологической службы

Petroleum formed millions of years ago from residue deposited on the seafloor. Some still lies beneath such seas as the Persian Gulf and the North Sea, but other reserves are located beneath land that was under water millions of years ago. Russia and Saudi Arabia together supply one-fourth of the world's petroleum, other developing countries (primarily in Southwest and Central Asia) one-half, and developed countries (primarily the United States) the remaining one-fourth.

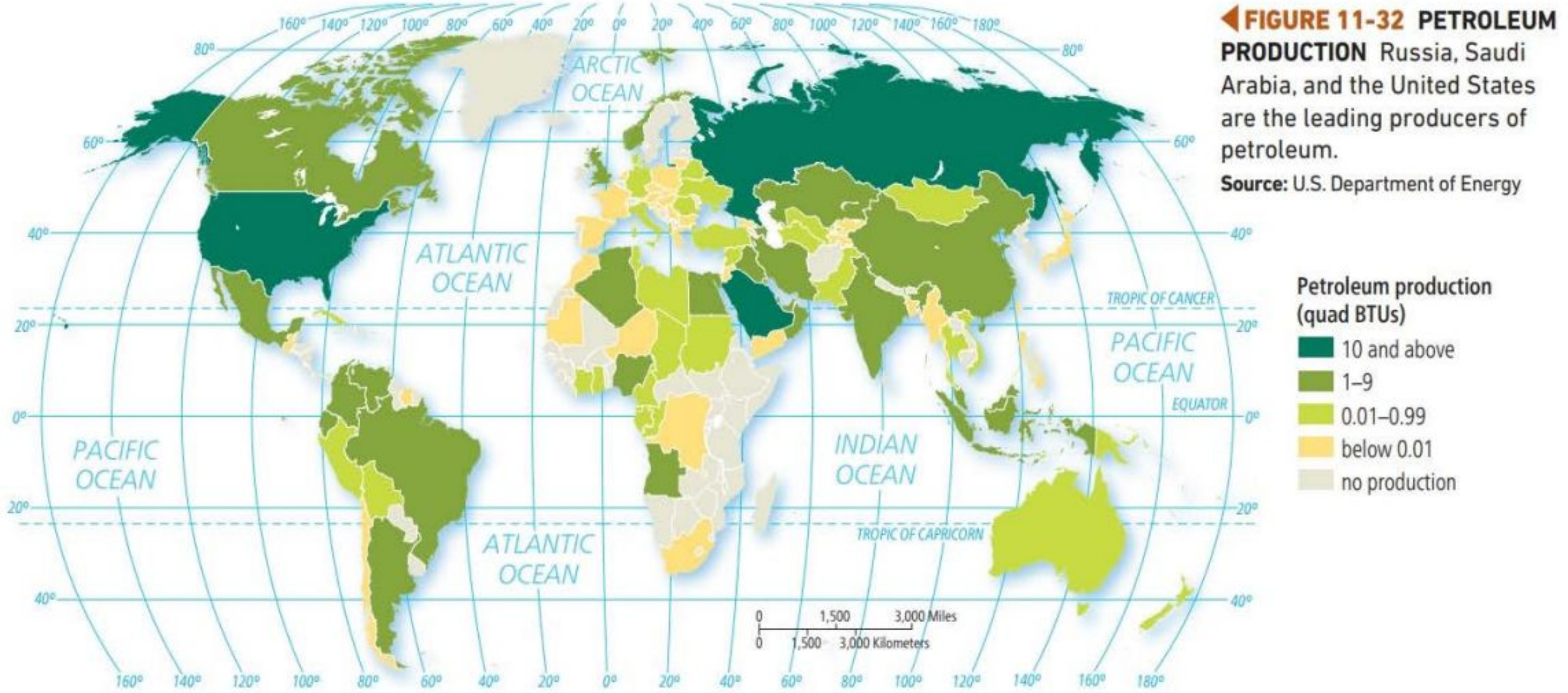


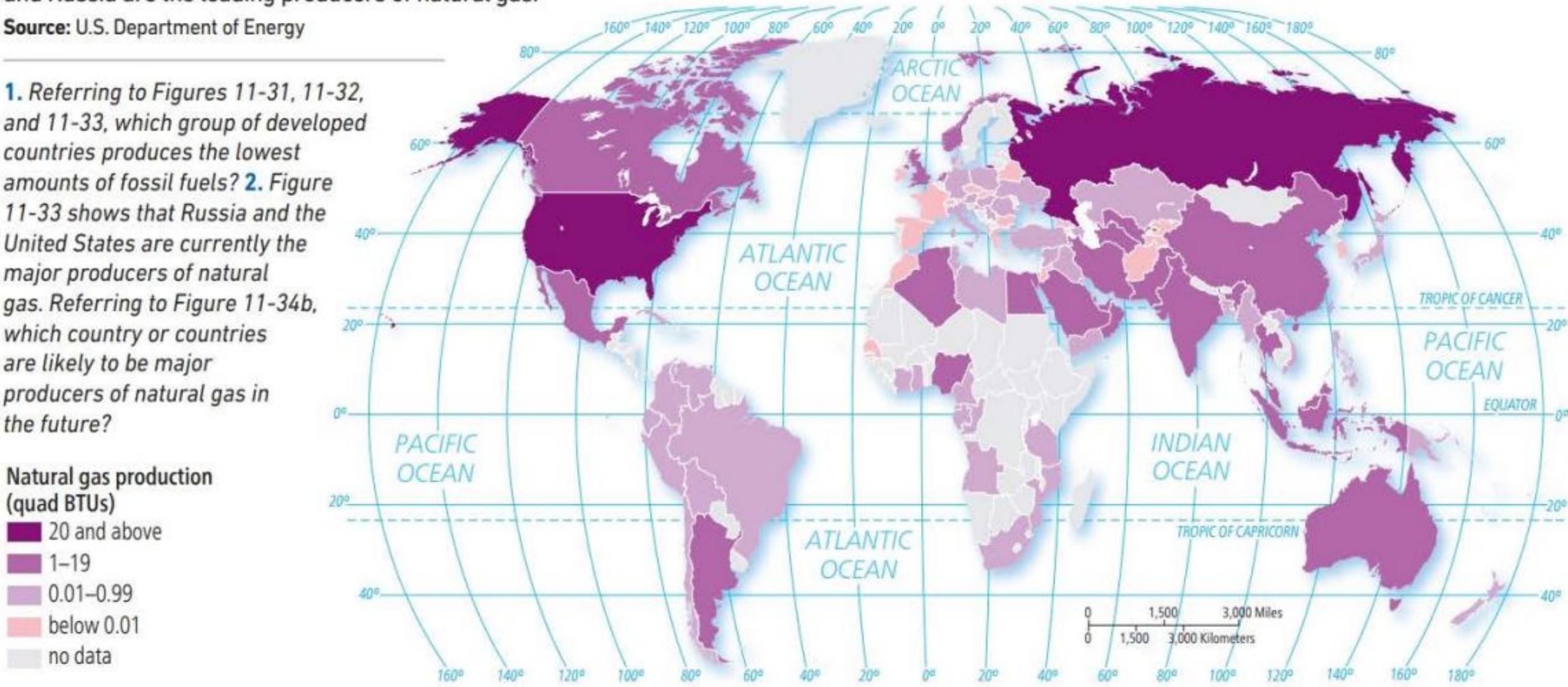
FIGURE 11-32 PETROLEUM PRODUCTION Russia, Saudi Arabia, and the United States are the leading producers of petroleum.

Source: U.S. Department of Energy

▼ FIGURE 11-33 NATURAL GAS PRODUCTION The United States and Russia are the leading producers of natural gas.

Source: U.S. Department of Energy

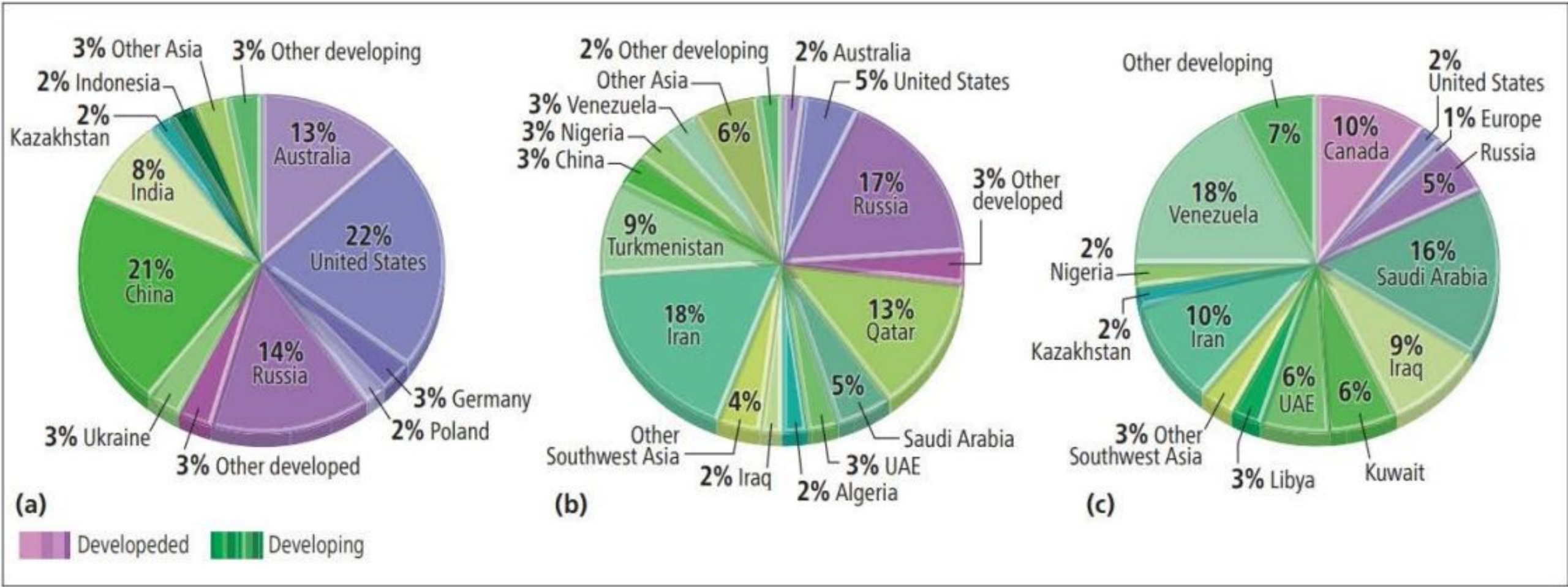
1. *Referring to Figures 11-31, 11-32, and 11-33, which group of developed countries produces the lowest amounts of fossil fuels?* **2.** *Figure 11-33 shows that Russia and the United States are currently the major producers of natural gas. Referring to Figure 11-34b, which country or countries are likely to be major producers of natural gas in the future?*



PROVEN RESERVES

(a) Coal, (b) Natural gas, (c) Petroleum

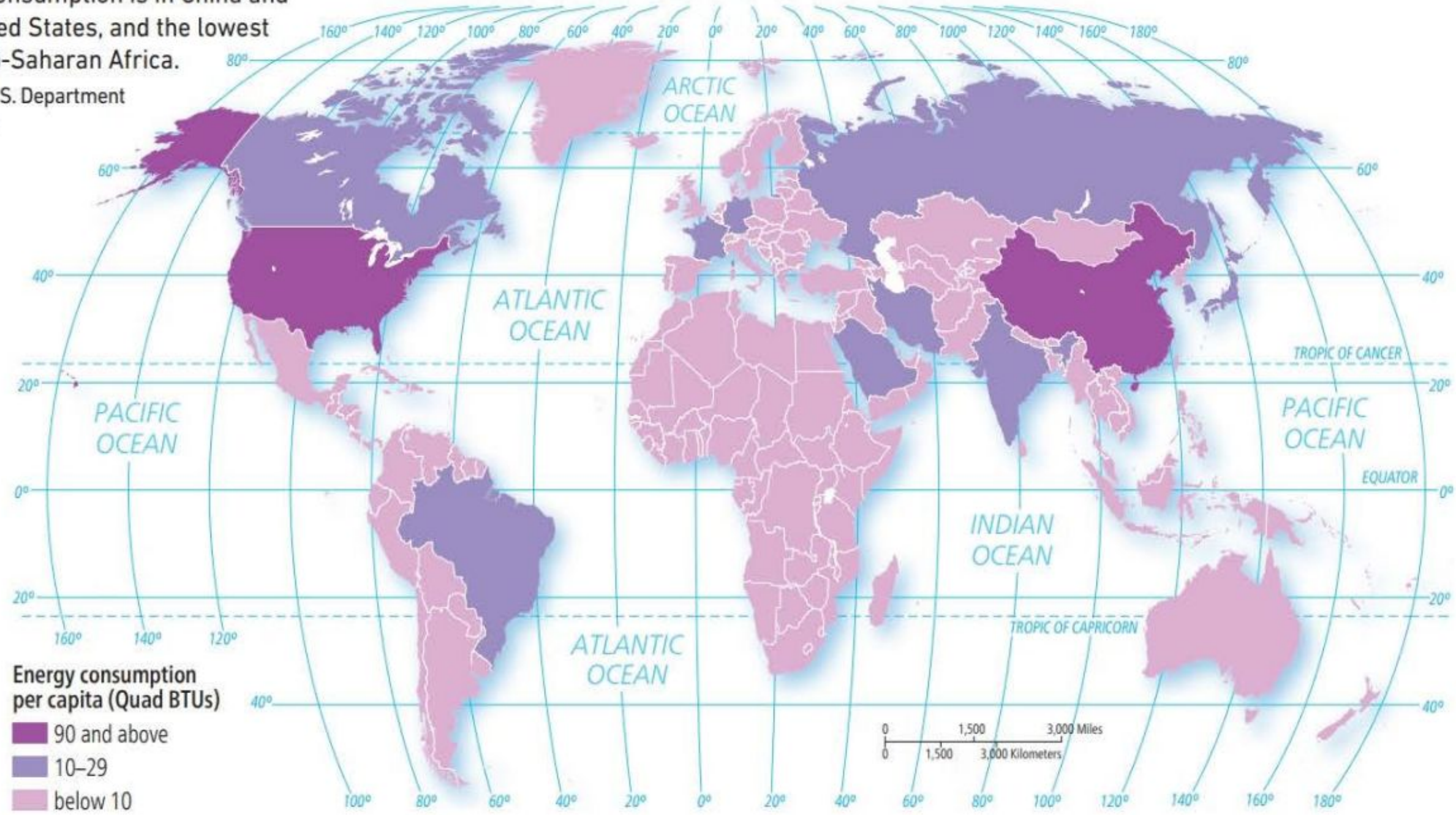
Source: BP Statistical Review of World Energy



▼ FIGURE 11-30 ENERGY DEMAND The highest per capita consumption is in China and the United States, and the lowest is in sub-Saharan Africa.

Source: U.S. Department of Energy

Source: U.S. Department of Energy



World Oil Trade, Monopoly of OPEC

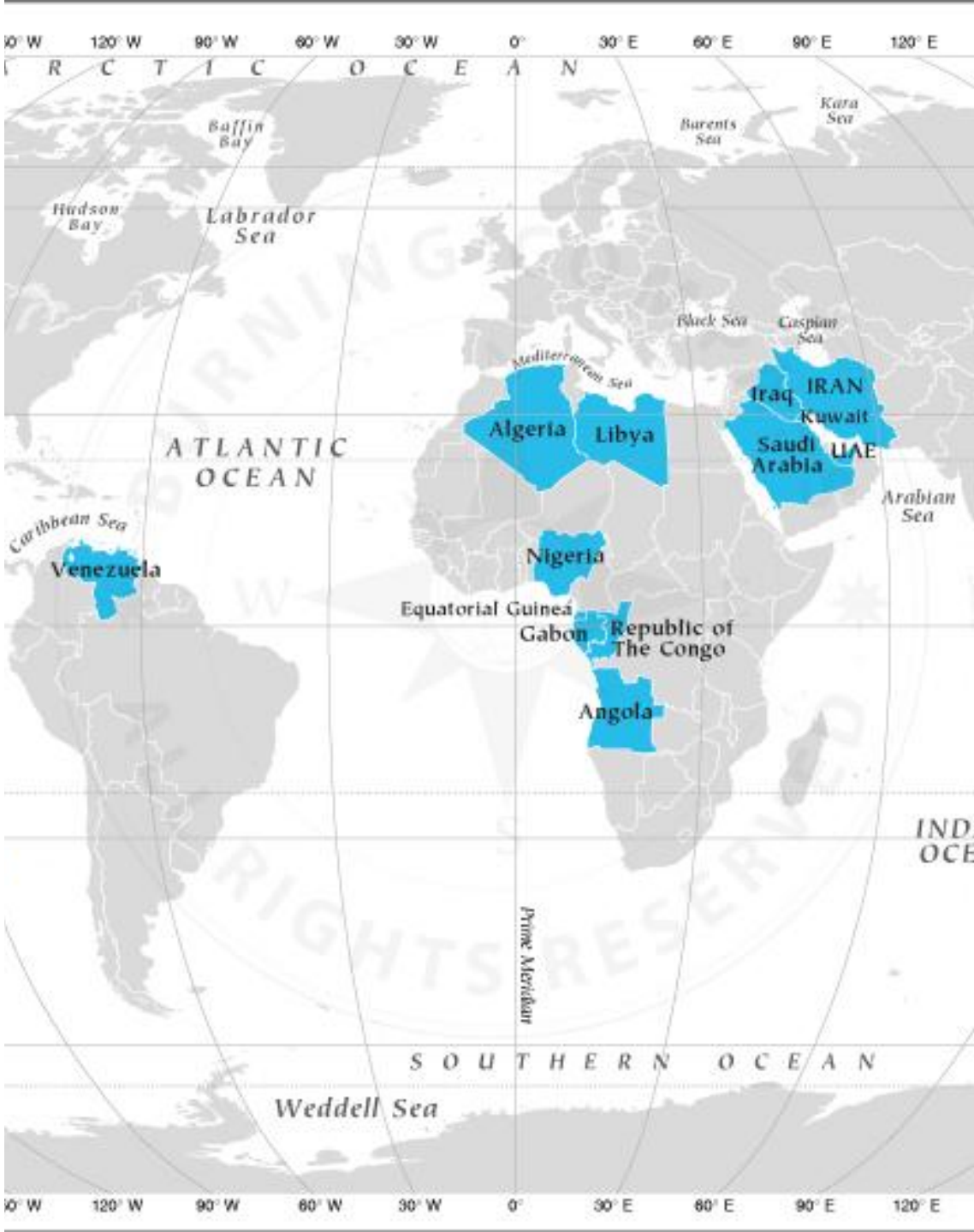
Developed countries supply a large share of the world's fossil fuels, but they demand more energy than they produce, so they must import fossil fuels, especially petroleum, from developing countries. The largest flows of oil are from Russia to Europe and from Canada to the United States (*next slide*). The United States and Europe import more than half their petroleum, and Japan imports more than 90 percent. Several developing countries possessing substantial petroleum reserves, primarily in Southwest Asia & North Africa, created the Organization of the Petroleum Exploiting Countries (OPEC) in 1960. OPEC was originally formed to enable oil-rich countries to gain more control over their resource. U.S. and European transnational companies, which had originally explored and exploited the oil fields, were selling the petroleum at low prices to consumers in developed countries and keeping most of the profits. Countries possessing the oil reserves nationalized or more tightly controlled the fields, and prices were set by governments rather than by petroleum companies.

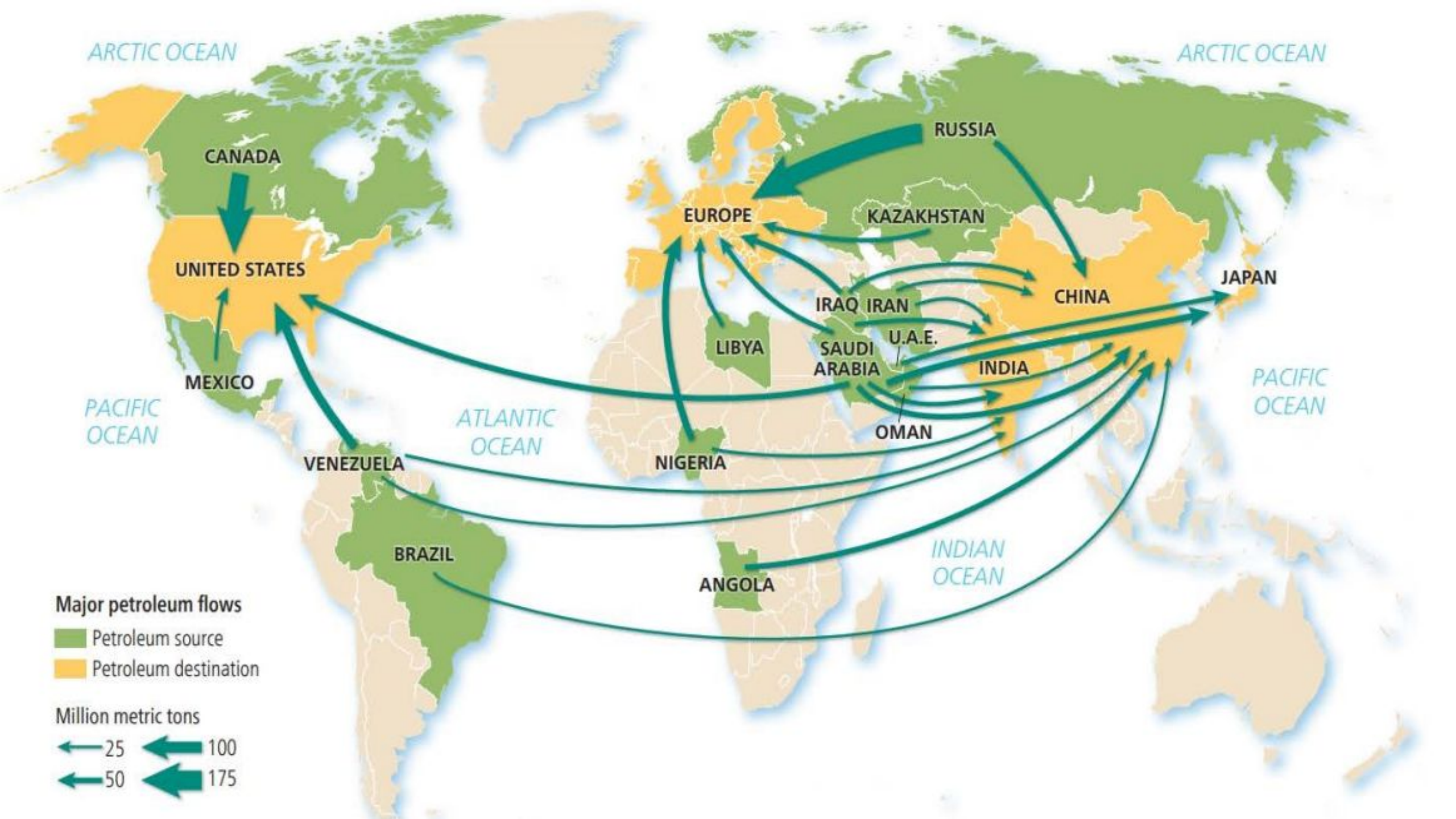
Big Oil companies[a] [hide]

Company	Revenue (USD)[1]	Profit (USD)	Brands
ExxonMobil	$286 billion	$23 billion	Mobil Esso Imperial Oil
Shell plc	$273 billion	$20 billion	Jiffy Lube Pennzoil
TotalEnergies	$185 billion	$16 billion	Bostik Elf Aquitaine SunPower
BP	$164 billion	$7.6 billion	Amoco Aral AG
Chevron	$163 billion	$16 billion	Texaco Caltex Havoline
Marathon	$141 billion	$10 billion	ARCO
Phillips 66	$115 billion	$1.3 billion	76 Conoco JET
Valero	$108 billion	$0.9 billion	Texaco
Eni	$77 billion	$5.8 billion	—
ConocoPhillips	$48.3 billion	$8.1 billion	—

OPEC >> (81.5% of oil reserves)

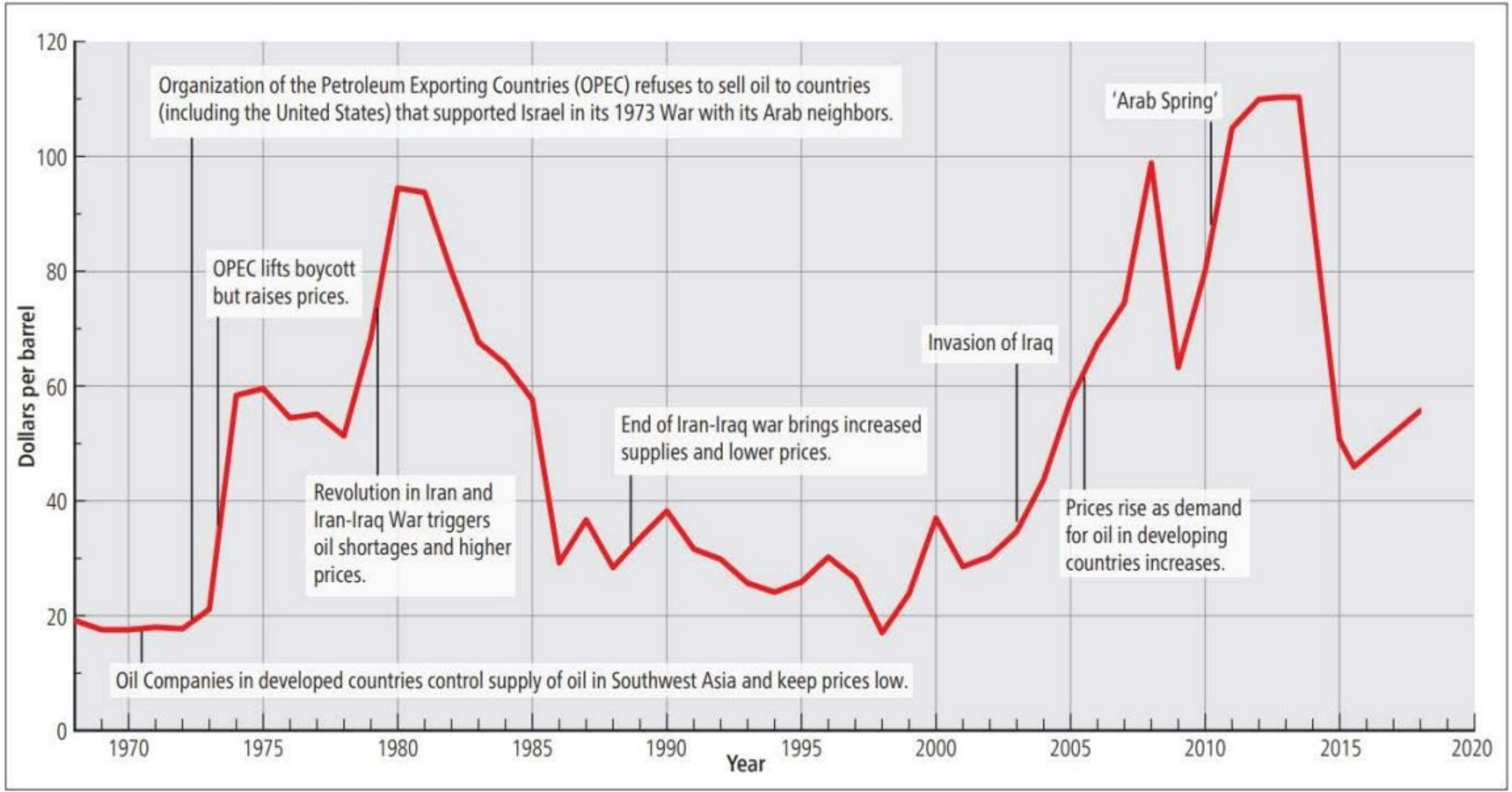
<< Big Oil (~6% now, around 85 per cent of the world's petroleum reserves before 1973 oil crisis)




ARCTIC OCEAN
ARCTIC OCEAN
CANADA
RUSSIA
EUROPE
KAZAKHSTAN
UNITED STATES
JAPAN
CHINA
IRAQ
IRAN
LIBYA
SAUDI ARABIA
U.A.E.
INDIA
MEXICO
PACIFIC OCEAN
PACIFIC OCEAN
ATLANTIC OCEAN
OMAN
VENEZUELA
NIGERIA
BRAZIL
INDIAN OCEAN
ANGOLA
Major petroleum flows
Petroleum source
Petroleum destination
Million metric tons
25
100
50
175

▼ **FIGURE 11-40 OIL PRICE HISTORY** Oil prices have changed sharply on several occasions.

Source: BP Statistical Review of World Energy



Reducing Demand

The world will not literally "run out" of petroleum during the twenty-first century. However, at some point, extracting the remaining petroleum reserves will prove so expensive and environmentally damaging that use of alternative energy sources will accelerate, and dependency on petroleum will diminish.

Demand for petroleum has been dampened in developed countries in two principal ways: conservation and pricing.

• **Conservation**. Factories have reduced their demand for petroleum, primarily by consuming more natural gas. The average vehicle driven in the United States got 22 miles per gallon in 1985, compared with 14 miles per gallon in 1975. A government mandate, known as Corporate Average Fuel Efficiency (CAFE), was responsible for the higher standard. Other countries have also mandated more fuel efficient vehicles.

• **Price**. Under OPEC control, world oil prices have increased sharply on several occasions, especially during the 1970s and 1980s and in the early twenty-first century. The average price paid for a gallon of petroleum exceeds $8 in most developed countries. When adjusted for inflation, prices are not high by historical standards in the United States, and they are lower than in other developed countries.

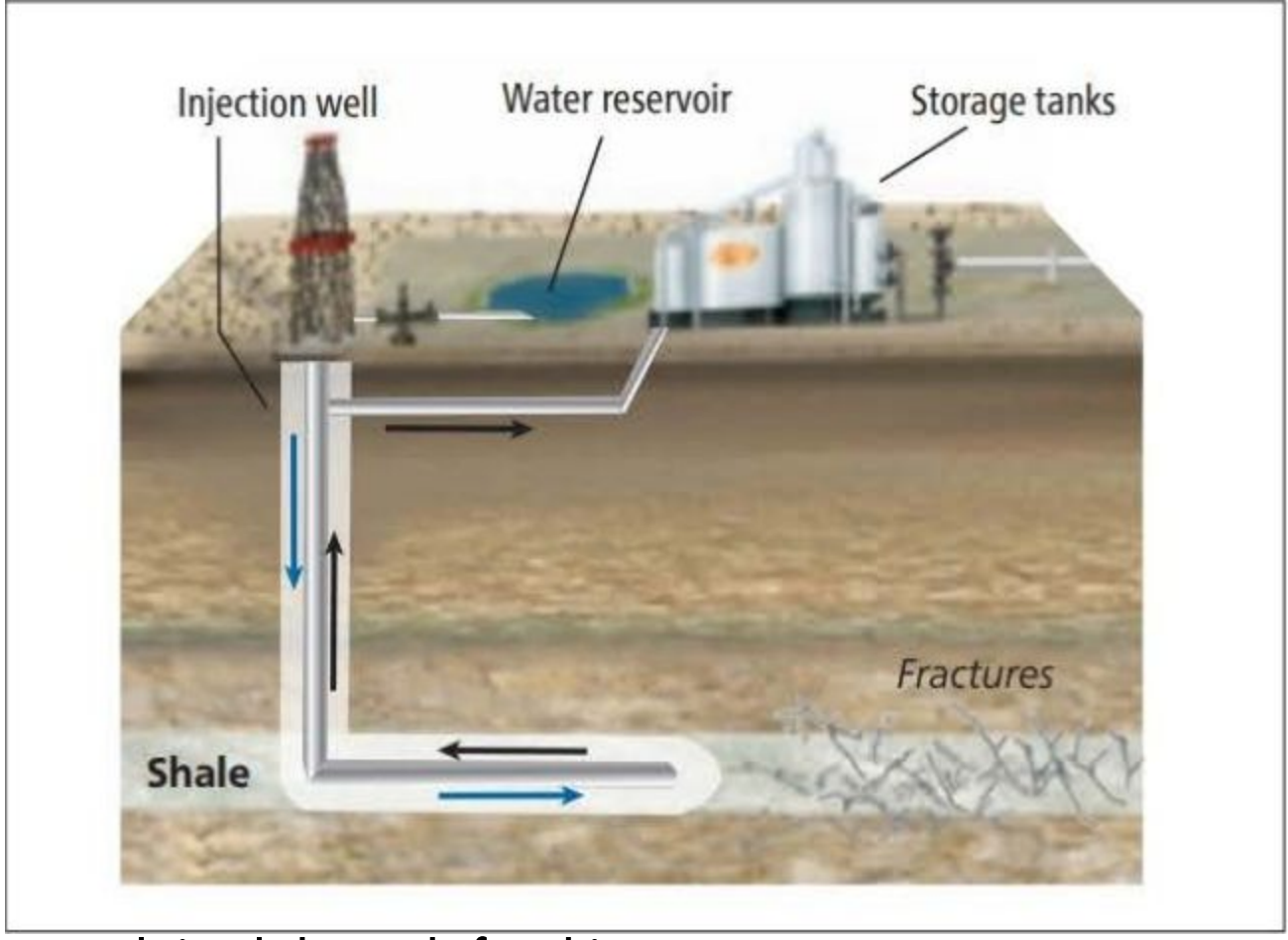
Unconventional Fossil Fuel Resources

Resources are considered unconventional if we lack economically feasible or environmentally sound technology with which to extract them. As demand increases for a resource and prices rise, exploiting an unconventional source can become profitable.

Oil sands

Abundant oil sands are found in Alberta, Canada, as well as in Venezuela and Russia. Oil sands are saturated with thick petroleum commonly called tar because of its dark color and strong odor. The mining of Alberta oil sands has become profitable, and extensive deposits of oil in Alberta oil sands have been reclassified from potential to proven reserves in recent years. As a result, Canada is now thought to have 10 percent of the world's petroleum proven reserves.

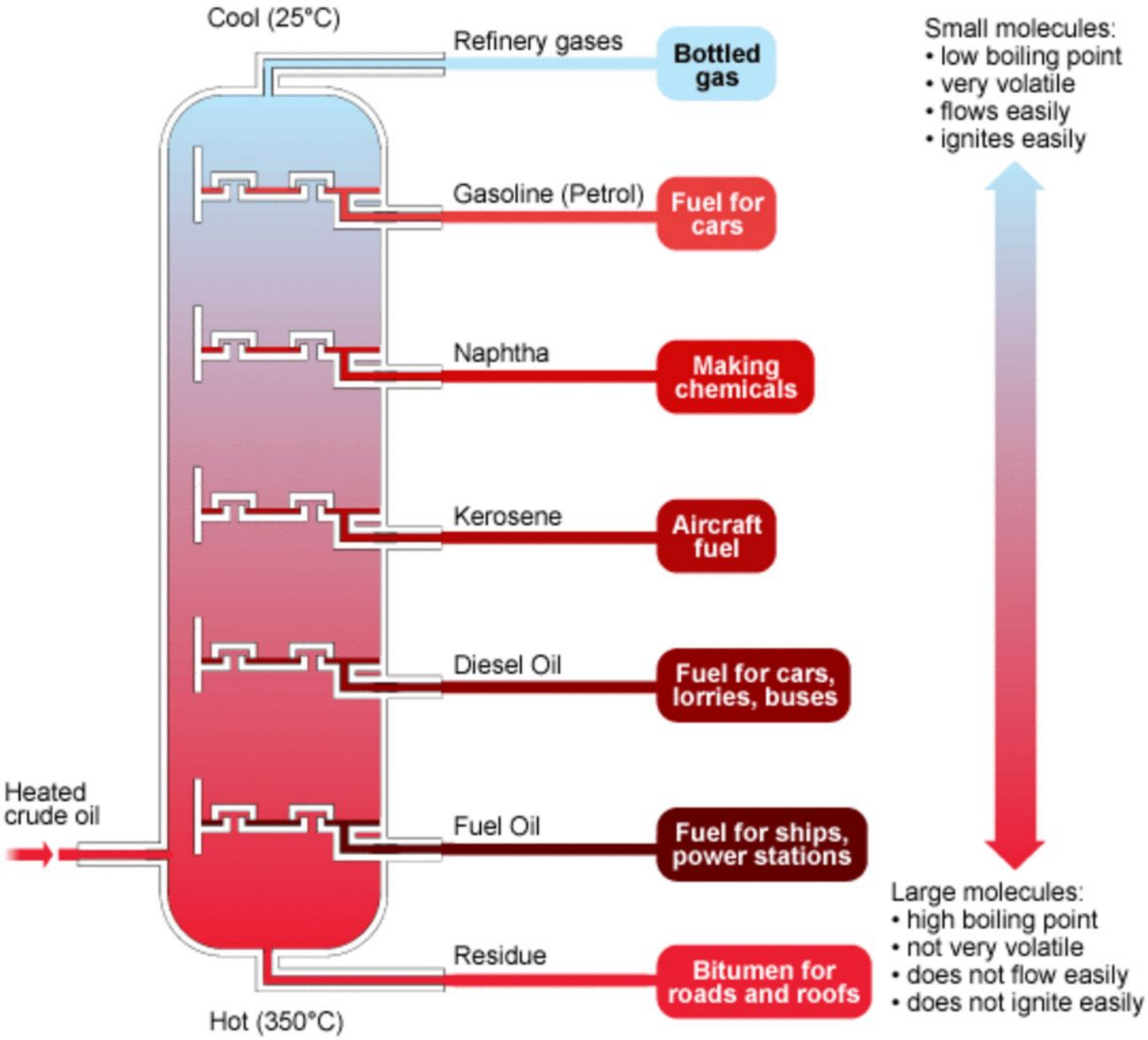
Hydraulic fracturing



Rocks break apart naturally, and gas can fill the space between the rocks.
Hydraulic fracturing, commonly called fracking, involves pumping water at high pressure to further break apart rocks and thereby release more gas that can be extracted. The United States has extensive natural gas fields, some of which are now being exploited through fracking.

Opponents of fracking fear environmental damage from pumping high-pressure water beneath Earth's surface. Safety precautions can minimize the environmental threat, but fracking does require the use of a large supply of water, and water is in high demand for other important uses, such as human consumption and agriculture.

Cracking


Cool (25°C)
Refinery gases
Bottled gas
Gasoline (Petrol)
Fuel for cars
Naphtha
Making chemicals
Kerosene
Aircraft fuel
Diesel Oil
Fuel for cars, lorries, buses
Heated crude oil
Fuel Oil
Fuel for ships, power stations
Residue
Bitumen for roads and roofs
Hot (350°C)
Small molecules:
• low boiling point
• very volatile
• flows easily
• ignites easily
Large molecules:
• high boiling point
• not very volatile
• does not flow easily
• does not ignite easily

References

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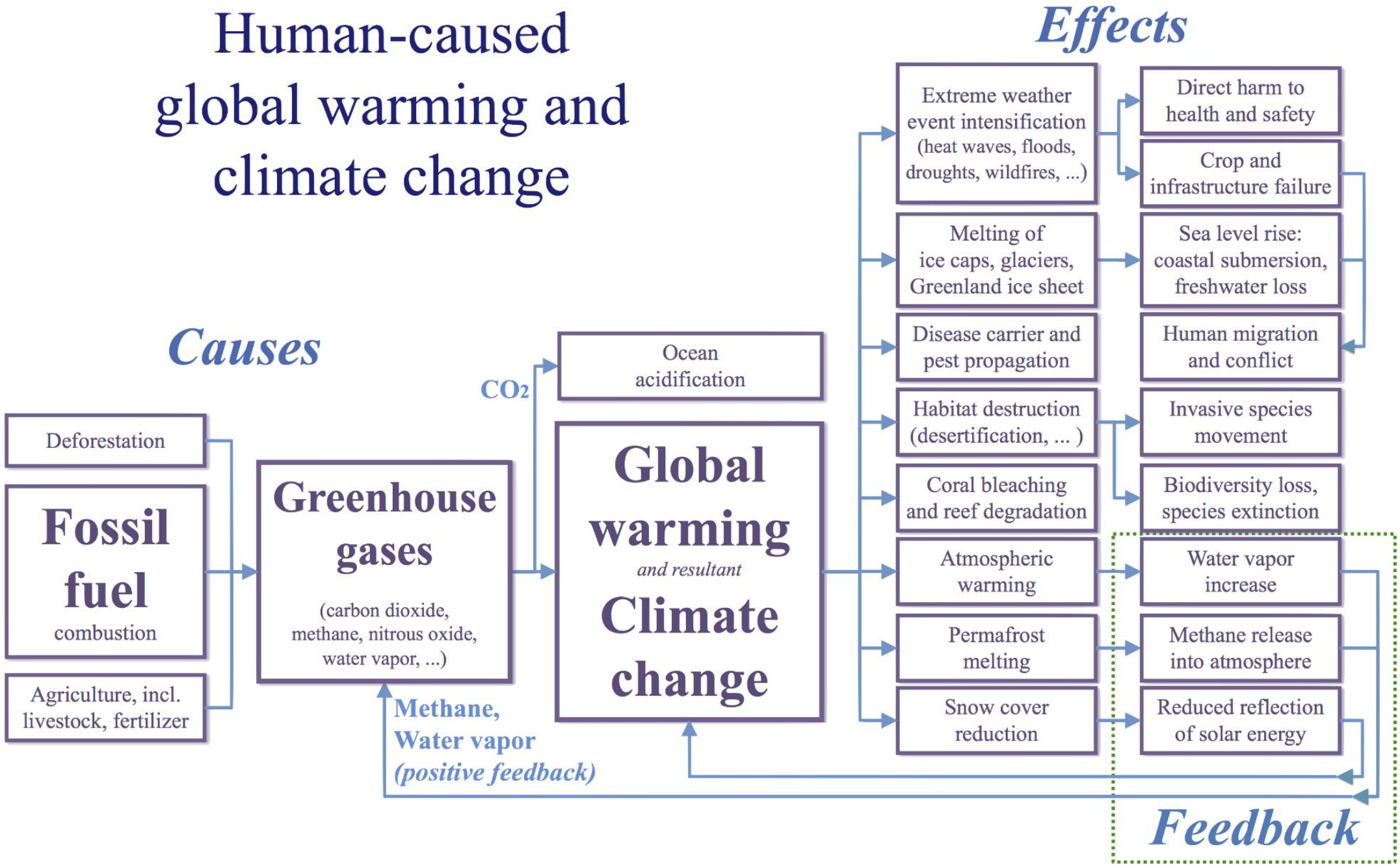
Section IV:
Alternative Energy

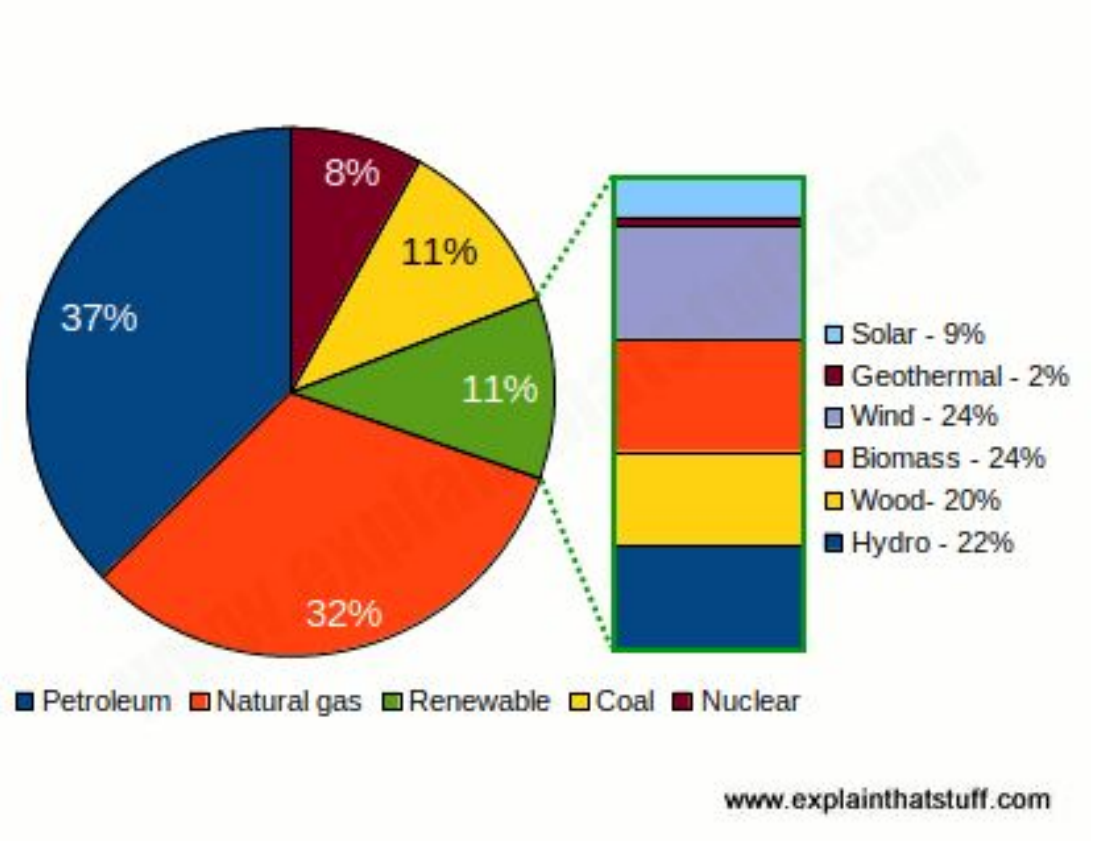
Greenhouse effect

https://www.bgs.ac.uk/discovering-geology/climate-change/how-does-the-greenhouse-effect-work/#:~:text=The%20greenhouse%20effect%3A%20some%20of,surface%20and%20the%20lower%20atmosphere.

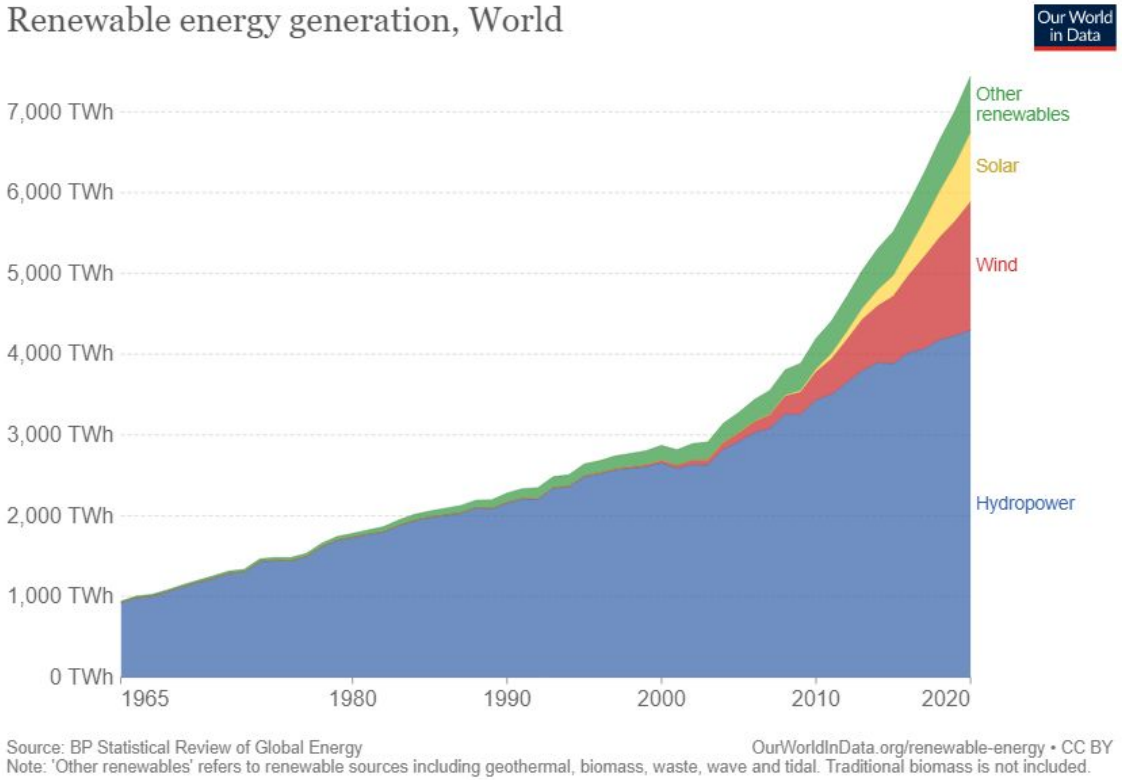
Human-caused global warming and climate change



АЛЬТЕРНАТИВНЫЕ ИСТОЧНИКИ ЭНЕРГИИ: ДИНАМИКА РАЗВИТИЯ



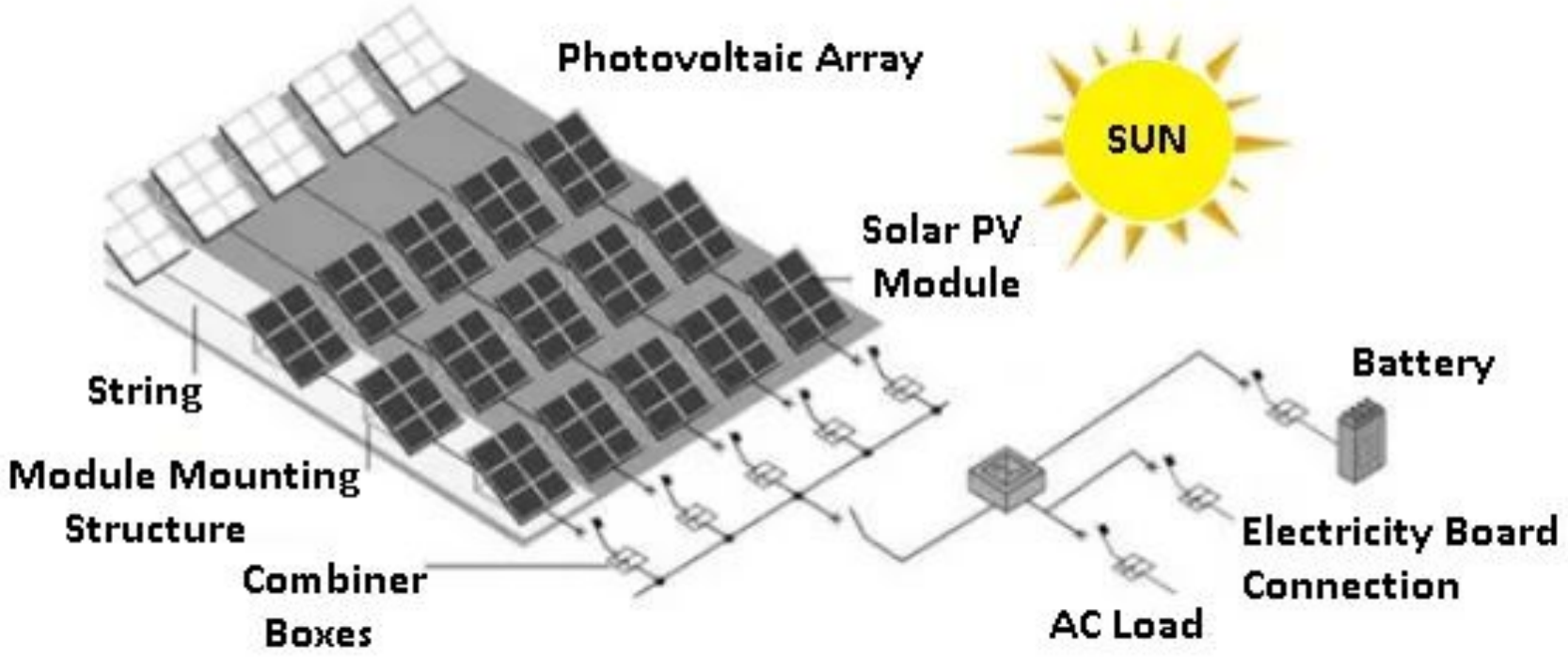
US energy supply in 2019



World's renewable energy generation

СОЛНЕЧНАЯ ЭНЕРГИЯ

https://www.viridiansolar.co.uk/resources-2-0-different-forms-solar-energy.html
https://youtu.be/xKxrkht7CpY
https://www.greenmatch.co.uk/blog/2014/08/5-advantages-and-5-disadvantages-o



ВЕТРОВАЯ ЭНЕРГИЯ

https://www.energysage.com/about-clean-energy/wind/pros-cons-wind-energy/

Hydroelectric dams/Hydropower plants

How do hydroelectric plants generate energy?
Is hydropower cheap? Which industries can be found near hydropower plants?
Does hydropower have any environmental drawbacks?

ЭНЕРГИЯ ПРИЛИВОВ И ОТЛИВОВ (Tidal Power Plants)

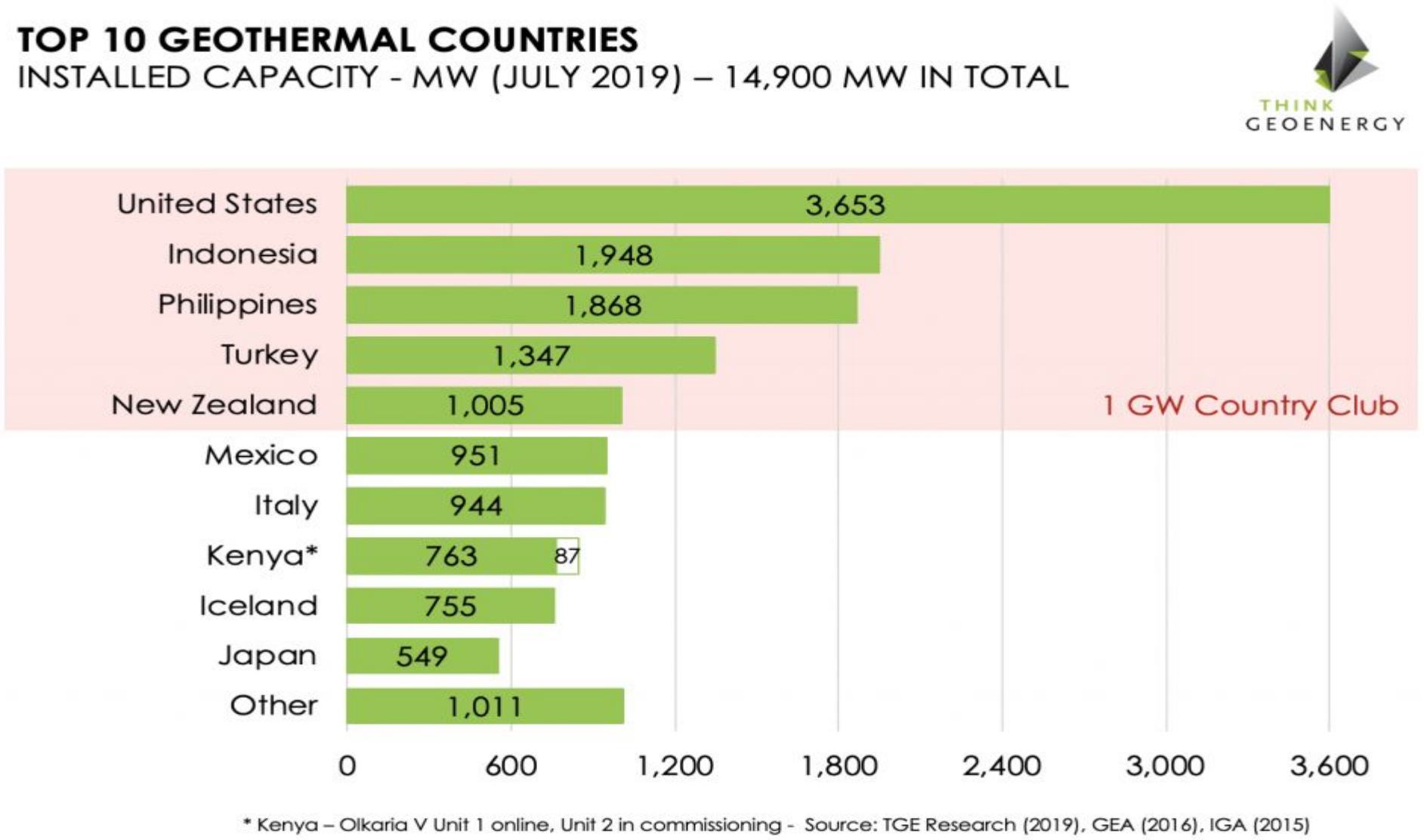
https://en.wikipedia.org/wiki/Tide (Tarbuck: Tides)
https://www.power-technology.com/analysis/featuretidal-giants-the-worlds-five-biggest-tidal-power-plants-4211218/

АТОМНАЯ ЭНЕРГЕТИКА

https://www.eia.gov/energyexplained/nuclear/data-and-statistics.php
https://www.power-technology.com/analysis/nuclear-power-pros-cons/
https://www.youtube.com/watch?v=KC7YD98HixM&pp=ugMICgJydRABGAE%3D
https://www.youtube.com/watch?v=s3ScJ_FwaZk
https://www.youtube.com/watch?v=poPLSgbSO6k

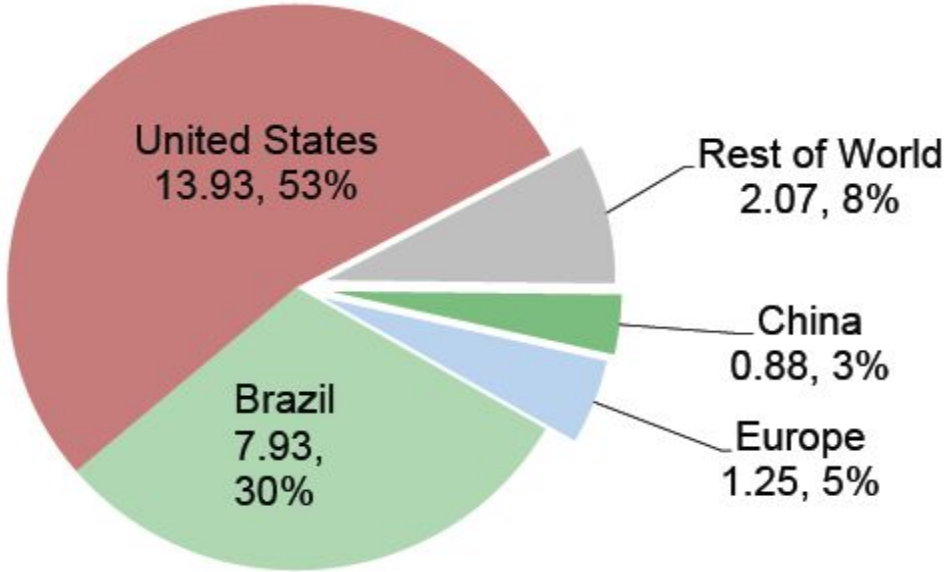
https://www.youtube.com/watch?v=LTv6RkFnelM&t=22s *(on floods)*

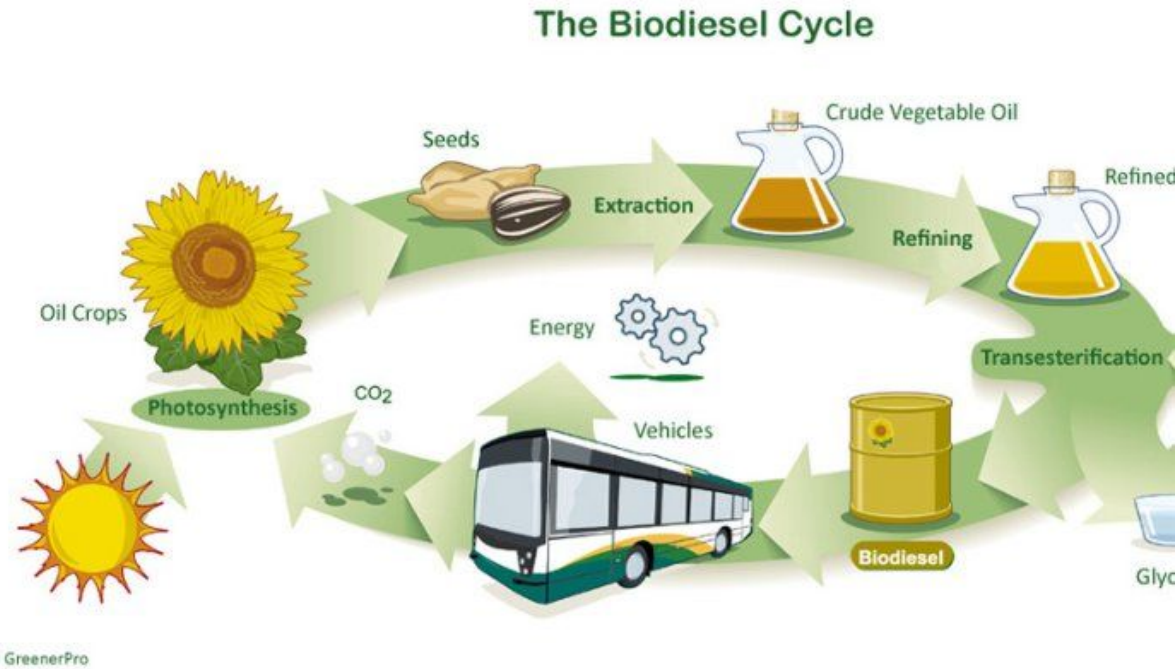
ГЕОТЕРМАЛЬНАЯ ЭНЕРГИЯ



BIOFUEL

Biofuel is a fuel that is produced over a short time span from biomass,
rather than by the very slow natural processes involved in the
formation of fossil fuels, such as oil. Since biomass can be used as a
fuel directly (e.g. wood logs), some people use the words biomass and biofuel interchangeably. However, the word biofuel is usually reserved for *liquid* or *gaseous* fuels, used for transportation. The U.S. Energy Information Administration (EIA) follows this naming practice.
More: https://en.wikipedia.org/wiki/Biofuel





Renewable energy: success stories

https://www.climatecouncil.org.au/11-countries-leading-the-charge-on-renewable-energy/