A blue-tinted photograph of a large industrial facility, likely a refinery or chemical plant. The image shows a complex network of pipes, metal structures, and scaffolding. In the foreground, several large, horizontal pipes run across the frame. In the background, there are tall distillation columns and various platforms with ladders. The sky is a clear, pale blue.

Chapter 4

Resources and environment

Questions about permanent access to resources and the inevitable degradation of the environment accelerated by human activity are not recent. Currently, they are well represented in the media and taken into account by political, administrative and economic role-players. As a result, these questions reflect the effects of internationalization and the interdependencies in question, as well as our capacity to manage a changing world.

These questions represent the major challenges for the next three decades.

Our ability to come to terms with these questions will affect their impact thirty years from now.

The current issues have been identified:


- geopolitical and strategic issues: defining the different actors'¹ strategies and positions on energy and food concerns;
- conflict issues: access to resources as a factor for instability, where tensions arise or are orchestrated to exacerbate pre-existing tensions and confrontations;
- peace issues: driving States and new actors to rethink their modes of cooperation in a government vacillating between ineffectiveness and maximum constraints;
- civilization issues: by contributing to a review of modes of public and private management as well as lifestyles, and restructuring human organizations or highlighting the fragility of social cohesion, notably in developed countries.

All of these problems must be approached with caution due to uncertainty about the statistics' reliability, due to the scientific model's insufficiency and the issues of power underlying the manipulation of the figures. Two extreme paths result: an "apocalyptic vision" or an underestimation of the problems.

On the one hand, the amplitude and complexity of the global issue could translate into relatively helpless states, fluctuating between inaction, an inability to implement in-depth reform, and withdrawing inward. On the other hand, the scope and associated risks could give rise to a real increased consciousness both individually and internationally, and even bring about a new citizenship or a new form of collective government.

I - CONFRONTATIONS ABOUT RESOURCES AND THE ENVIRONMENT

The tendencies described below carry the seeds of destruction: bitter constraints on human activities, violence generated by new allotments and new shortages. Though here they are referred to in the future tense, their effects are already at work on the planet, particularly in regions where climactic constraints are the strongest and where there is a strong economic attractiveness of subsoil resources.

 **Conflicts and instability, civilian violence and wars will still be generally preceded by crises in resources** (shortages or inequalities, real or felt). These crises will be caused primarily by food or water shortages or to rivalry concerning access to mineral resources. They will be intensified in vulnerable areas.

¹ States, industry leaders, consumer groups, NGOs.

I.1 - Food crises

☐ **Food crises will notably affect vulnerable areas.** They will arise in geographical regions which predominantly have a rural economy: mainly in Asia and in Africa, particularly in coastal and delta populations; this risk will affect about half of the world's population. These crises will also emerge around large cities where peri-urban areas exploited for developing the city will create tensions². Finally, these crises will hit semi-arid regions, where there is conflict between populations with different lifestyles. Following droughts, the lack of water would drive nomads or extensive livestock farmers towards lands already occupied by sedentary farmers³.

☐ **Sharing drinking water resources on the global scale will be an increasing international issue.** Due to the expected sharp increase in population growth, half of the world's population will be in a position of hydric stress⁴. While the planet has 1,385 million km³ of water, only 34 million is fresh water (about 2.5%). These reserves could be enough on the global scale, but are diminishing due to irrigation⁵, waste and pollution. States are reluctant to abandon procedures like irrigation that brought them positive economic consequences, if not food independence. This resource's unequal distribution makes water a geostrategic issue: as of today, 40% of developing regions only receive 2% of the world's drinking water supply. This allotment appears even more unequal in light of the fact that water resources are most abundant in areas where conditions are not well suited for habitation: Amazon Rainforest, Canada, Alaska, Siberia, the Arctic and Antarctic.

☐ The concentration of nearly 60% of the world's population in megalopolitan areas will cause **major water provision problems**. One billion people will have no access to drinking water and 3 million people will have health risks due to a lack of hygienic treatment of wastewater, which creates conditions for widespread epidemics and development of different pathologies.



☐ **Management of transborder reservoirs could intensify the risk of conflict.** Up to now, it has been possible to manage, defuse or contain potential conflicts; however, in the future this resource's increasing scarcity could lead to exacerbated tensions between neighbouring countries or the use of water as an economic weapon.

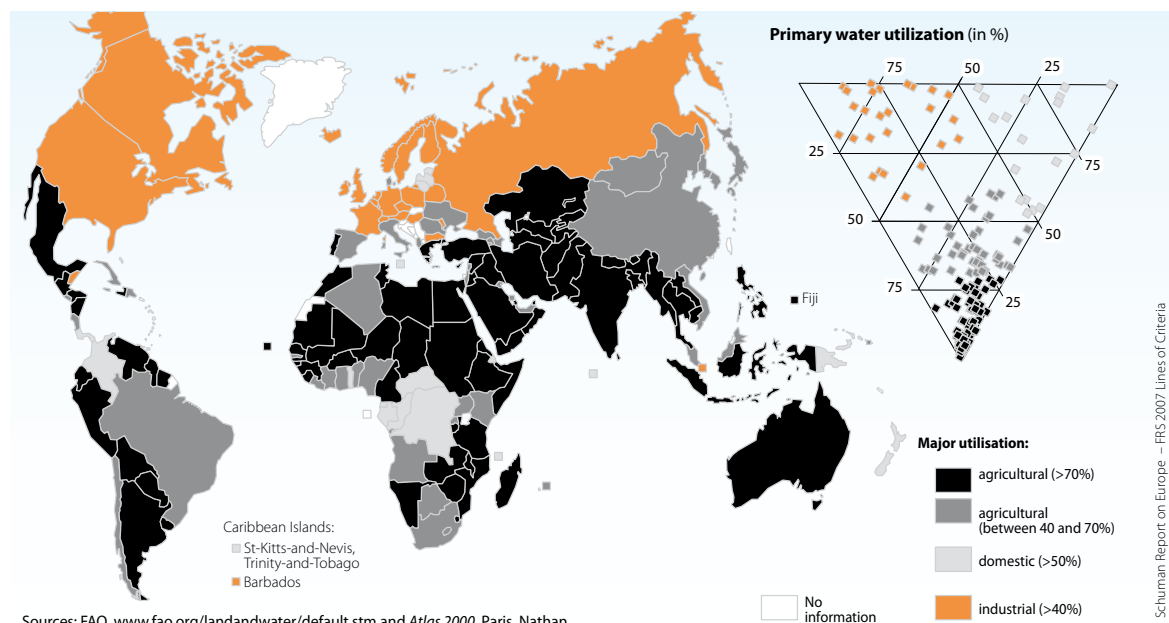
² An example is the peasant revolts in China linked to expanding urbanization from coastal areas to interior rural areas.

³ Instabilities like those in Sahelian Africa, Darfur, etc.

⁴ Hydrologic concept of confirmed insufficiency at less than 1,700 m³ of fresh water reserves per person and per year.

⁵ 70% of consumption.

Utilization of water by sector, data from 1995 to 2004 according to country



The “grey zones” could multiply due to loss of subsistence resources, climate crises and/or local or regional crises. The shortage of food resources (harvest or herd losses for example) will produce local conflicts about land or distribution of wealth. The failure of state services could create a strong instability and facilitate installation and development of criminal or terrorist networks. At that point the region will become a refuge for all types of illicit activities and a base to conduct violent acts in neighbouring areas and the rest of the world. Security of international exchanges could be put into jeopardy, notably from violent acts, as is the case today with piracy based in Somalia.

I.2 - Food crises and migration

In the recent past of climatic migration, the largest movements occurred in Bangladesh (12-17 million people) and in Sahel (10 million). Most of the forecast analyses conducted by competent international organizations⁶ point to a global scenario of Southern countries continuing their dependence on the North.

The growing population of developing countries and the rise of their standard of living will lead to a **strong increase in worldwide demand for food commodities**⁷, which their increased agricultural production will not be sufficient to meet. As a result, there will be a perceptible rise in imports from Northern countries and some countries in South America, such as Brazil. In addition, importing countries' solvency will face a subsequent increase in agricultural goods prices, linked to rising demand and growing production costs (notably the price of energy).

The deficiency in agricultural resources will accumulate along with tensions over fishing resources. The volume of the catch, estimated to be stable at 90 million tons, remains uncertain, as some states provided incomplete data. Overfishing of some fish stocks could also lead to their quasi-extinction.

⁶ FAO, World Bank, etc.

⁷ Fishing and agricultural products.



? As a result, fish-laden waters - particularly on continental plateaus - could become the object of escalating rivalries.

☐ **The food question will become an increasing factor for conflict.** It will be manifested in intrastate or inter-state crises. Food aid for the most needy will become a primary issue.

? **Reducing migratory pressures in developed regions will depend directly upon differentiated and controlled agricultural policies** (production, co-development, commercial exchanges) between developed and developing countries.

? **Stability on Europe's borders could deteriorate in the absence of agricultural growth in the Mediterranean and Africa.** The Mediterranean could be a fragile region: economic, demographic and social breakdown, unchecked urbanization, overpopulation of coastal areas, overexploitation of resources, environmental degradation, persistent conflicts (Near East, radical Islamist movements, etc.) and most notably, migratory pressures. A deficit in agricultural production could intensify *crisis-causing* factors. Political and migratory stability of sub-Saharan Africa depends on managing agricultural development. The challenge resides in maintaining an agricultural activity that could generate revenue, and thus stabilize populations and limit migratory pressure.

☐ **Maintaining food autonomy and autosufficiency management will partly depend on European agricultural policy.** Today the economic partnership agreements with Africa do not provide for protecting small-scale food producers from the adverse effects of too-rapid commercialization. Cotton production (moreover a water-intensive crop) in West Africa also has no aid, yet its downfall will engender increased migration to Europe⁸.

? **Current international studies are also lacking and seem to underestimate the risk of a sharp break in the global food equilibrium.** They conclude with the notion of a global balance between the planet's food production and demand. However, there remains strong uncertainty, notably due to a very probable

⁸ In the coming years, 25 million people will live off this crop.

increase in demand for agricultural resources for non-food applications⁹, and the effects of climate change in the next thirty years. Other factors must be included, such as the price of energy, impact of scientific advances, etc.

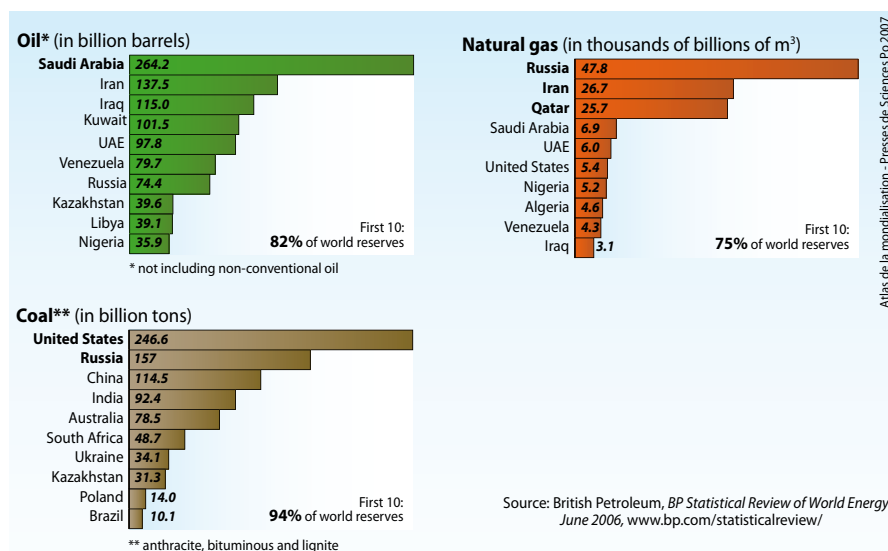
In addition, global agricultural markets will be very dependent on the economic evolution and strategies of the powers that are or are not emerging: United States, Brazil, India and China. While India and China would be applicants for food products, Russia and Ukraine could rely on their vast agricultural areas to reinforce their production.

1.3 - Mineral and energy resources

Increasing rarity and unequal allocation of hydrocarbons will lead to heightened tensions. With the development of emerging countries and rising transportation needs, the demand for energy and mining resources should significantly increase¹⁰, though they are generally located in regions which are unstable or difficult to access. Most of the domestic resources of industrialized or emerging countries are being exhausted, apart from some exceptions¹¹. It is possible that imbalances between supply and demand could result in interstate tensions which may potentially deteriorate into conflict. **This tendency could be aggravated by a lack of substitutions for certain minerals like beryllium and platinum metals, and weak investment in mining for them. Given the time frame between prospecting and commercialization, it would be difficult to respond to a sharp rise in demand.**

The demand for energy continues to increase, in line with rising transportation needs. It is not likely that technological advances or a change in habits would significantly reduce energy needs linked to transportation modes in the foreseeable future. At the same time, the need for transportation should skyrocket due to an increasingly urbanized world, the development of peri-urbanization and a geographically imbalanced dispersion of resources.

Fossil fuels: reserves as of late 2005



⁹ Resorting to biomass for energy and biomaterials.

¹⁰ Today 18% of the world's population consumes 50% of the energy.

¹¹ Canada for example.

❏ **There is a heightened probability of disturbances in energy supplies.** In the foreseeable future, half of the world hydrocarbon production will be concentrated in the Middle East. Instability factors will continue, if not increase, in this region. On other continents, like Africa, apart from local *crisis-causing* elements, a country's own increasing inequalities between a rural population and a ruling class with an oil income could worsen the risk of instability and thus discourage investors.

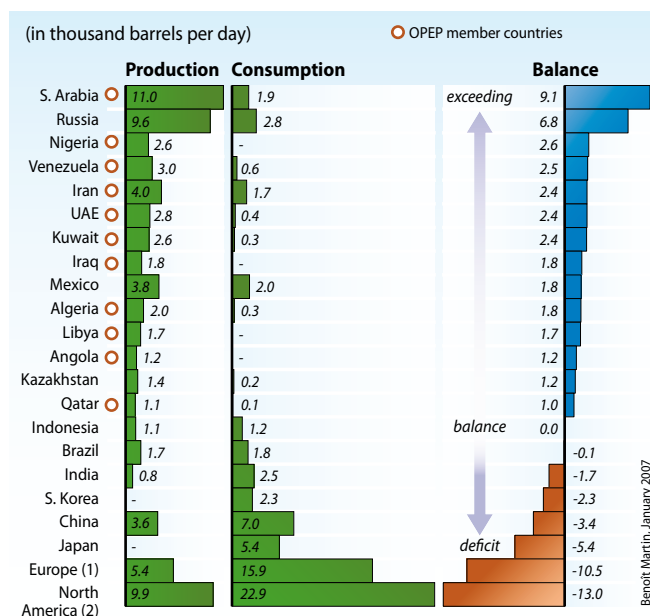
❏ **The uranium reserves should accommodate the demand.** Uranium reserves are ensured for the next sixty years, or even more than two hundred years when all the known resources are taken into account - including that requiring expensive extraction - without counting the possibility of mining very low grade uranium.

❏ **Resource supplies could be an economic or political “weapon”** Producing countries could play on imbalances between supply and demand to increase prices, or even deliberately reduce supplies for political reasons. Disruptions could also come from blocking wells (ecological lobbies) or oil pipelines and maritime routes (terrorist or pirate threats). However, this inequality in distribution of reserves could be countered by an unequal access to key technologies for extraction and transformation.

❏ **The increase of major climatic phenomena (hurricanes or tornadoes) will affect the exploitation of reserves.** These events will produce additional hazards by destroying infrastructures. For example, in 2005, hurricanes Katrina and Rita in the United States cut oil production by about 100 million barrels.


❏ **Local instabilities will centre around resources.** In regions with rich subterranean resources, where agricultural crises will occur, there will be a strong temptation for communities to take advantage of more lucrative resources. Local conflicts, exploited by those seeking to incite violence, could develop over the control of resources.

Oil production and consumption, 2005



(1) European Union (25) and European economic area (Iceland, Norway and Switzerland)
(2) United States and Canada

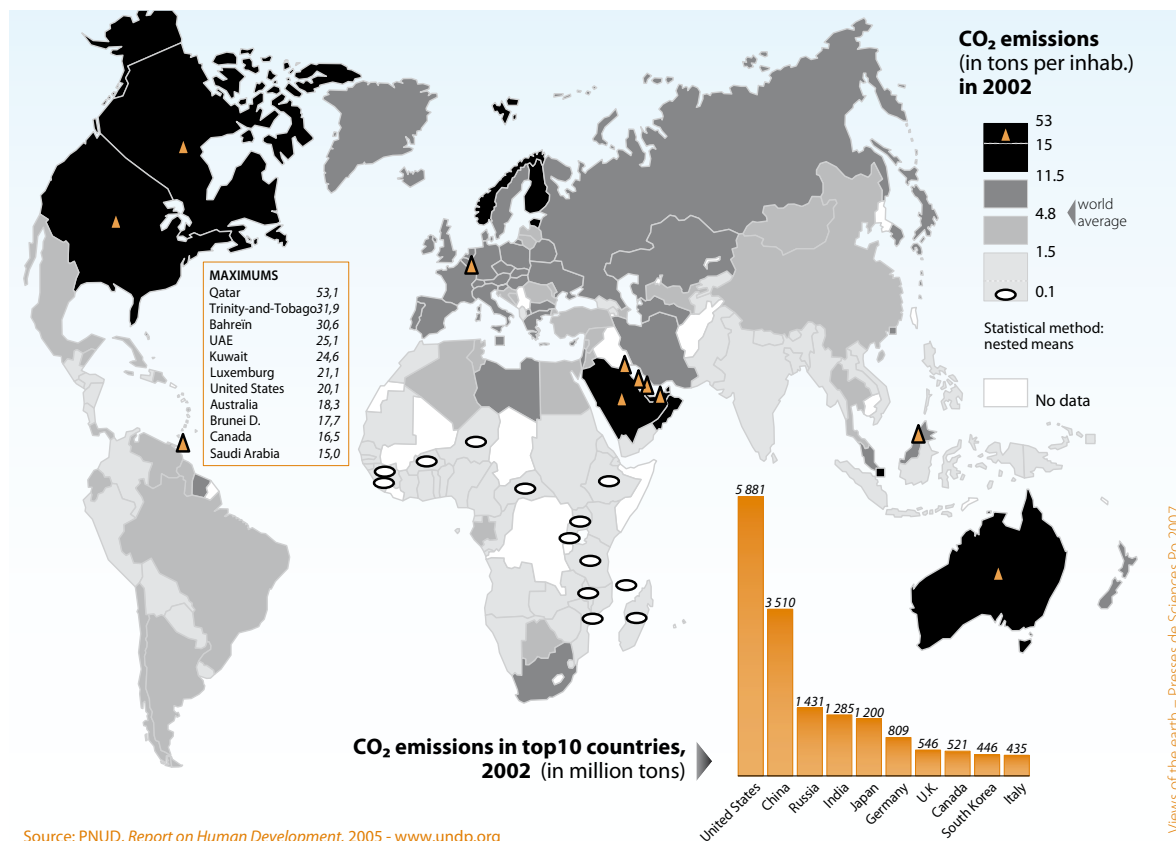
Source: BP, *Statistical Review of World Energy*, June 2006, www.bp.com

 **Natural resources will remain a major factor in unleashing conflicts.** The World Bank's analysis¹² of data on 78 confrontations between 1960 and 1999 thus shows the needs for financing all conflict and, in particular, the near-routine exchange of economic resources (opium poppies, oil, precious stones, ores, etc.) for financing or all forms for aid. Conflicts in Africa are one example (DRC, Rwanda, Liberia, Sierra Leone, Angola). The system of complex relationships and their intensity will persist, as established by global risk specialists working in the reinsurance sector¹³.

II - EXACERBATING FACTORS: ENERGY AND CLIMATE

Energy and climate problems are inextricably linked: the major challenge in the next few years will be to face growing needs while reducing CO₂ emissions.

Carbon dioxide emissions (CO₂)



¹² Paul Collier report.

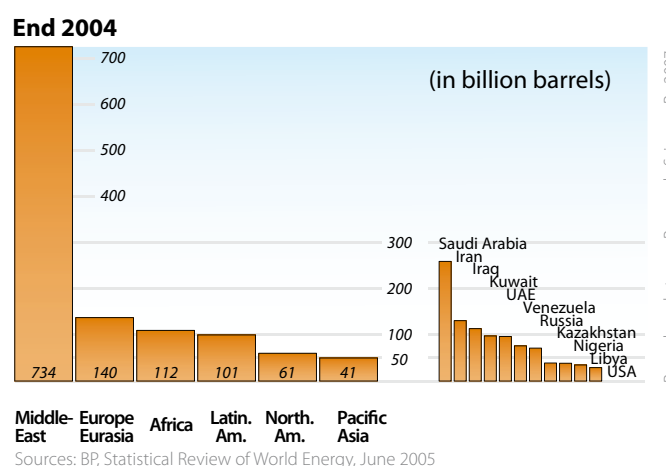
¹³ 2007 *Global Risk Report*.

II.1 - Access to energy resources

II.1.1 - The oil supply

? **The energy supply is based on an uncertain amount of reserves.** The idea of reserves is flexible, based on both the (volatile) price and technology, and so must be viewed with caution. The level of “proven reserves” is published according to a regulated procedure. Adjustments in the figures have already been noted over the last few years. Before being corrected by international organizations, the data is declared by each oil company or state. Some declared reserves are or have since been shown to be unreliable.

Oil reserves



? **Access** to the reserves will depend on the producing countries' investment, technological evolution and political conditions. The investment level is dependent upon the countries' openness, risks and financial profitability.

? **Exploiting new resources is conceivable**, provided that there is technological progress and attractive market prices. This could be the case with the hydrocarbons located in the Arctic subsoil, off-shore exploitation and in tar sands, notably in Venezuela and Canada. Expiration could therefore be pushed back at the cost of heavy investments.

? **A production deficit is likely in the next thirty years.** The International Energy Agency has stated¹⁴ that investments and the dissemination of technology are not sufficient to ensure continuous global supply. This insufficiency is applicable to the research, exploration, transportation and transformation of oil. Experts anticipate a worldwide production deficit and a sharp price increase in the foreseeable future. Daily oil production could peak in 2020 at 100 million barrels a day, and the price per barrel could reach 150 dollars (2015-2025).

Given the lack of projected investments, global refinery facilities will be overexploited and will therefore deteriorate from now into the near future. The average age of global oil refinery facilities currently corresponds to half of their utilization period. Investors who would provide funding for 15 to 40 years could be reluctant due to the prospect of political instability and the risk that their investment would be nationalized, once the infrastructures are paid for and installed. Given the instability factors, it is likely that this underinvestment will persist, notably in Africa and the Middle East. In addition, it will also be necessary to have personnel skilled in oil technologies. In terms of investments, there is a sharp disparity among oil companies: while private international companies are the biggest investors, national companies -- who control more than 50% of production - are characterized by underinvestment. Additionally they

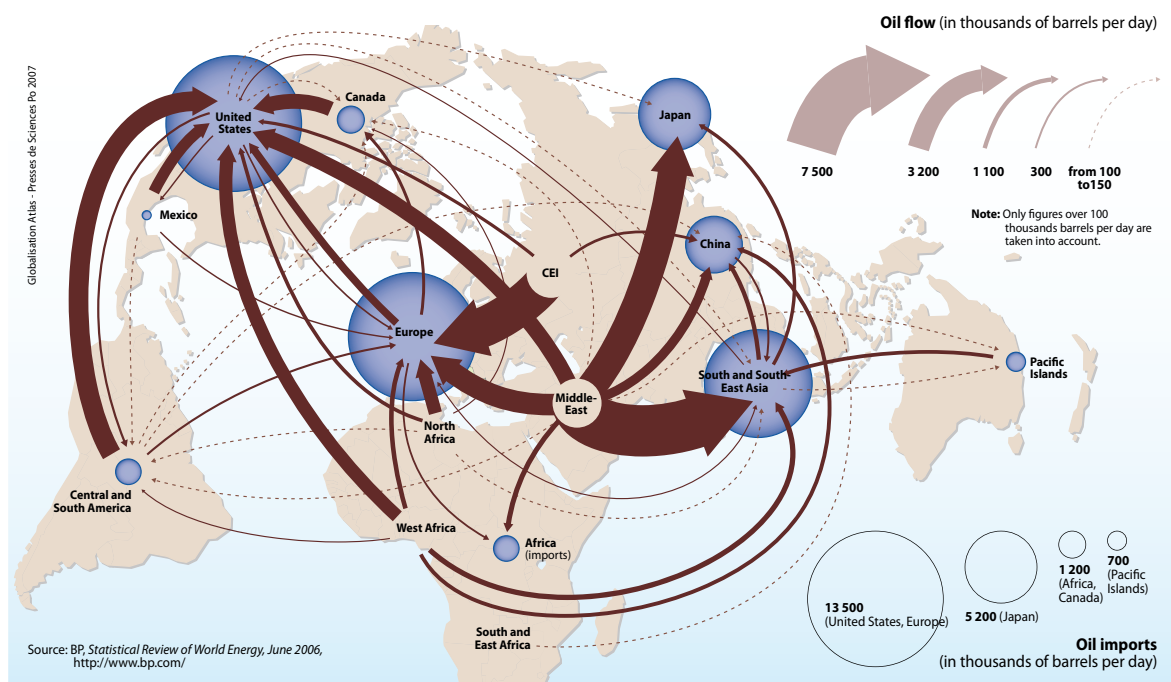
¹⁴ World energy outlook 2006.

do not have the technology that could provide access to oil fields that would be opened after the current ones have been depleted. The top ten private international companies account for 15% of the world's oil and gas production, with only 5% of these reserves under exploitation contracts. Yet they provide 25% of the investments.

II. 1. 2 - The pace of increasing demand

In the very long term, demand cannot be fulfilled. Since the beginning of commercial oil extraction, world consumption has risen to a terabarrel.¹⁵ There remains just as much to extract from underground. Annual world consumption is 30 billion barrels. Current proven reserves will therefore enable 33 years of consumption at the present rate. The rise in demand, linked to demographics and changes in commercial production, would bring consumption to 45 billion barrels in the near future.¹⁶

Principal oil flow and imports, 2005



The change in consumption will be unevenly distributed. The increase will be relatively low in Europe, but high in emerging countries which account for two-thirds of the total consumption increase.¹⁷ Over 2004-2030,¹⁸ China's current oil consumption tendency should double (from 26 to 52 million barrels/ day), that of India nearly triple (11 to 29 million barrels/ day), and Latin America's nearly double (13 to 24 million barrels/ day).

A proven depletion of reserves is probable between 2030 and 2035, given the estimated rate of consumption increase. Oil industries have anticipated this situation and have prepared to exploit likely and possible reserves.

¹⁵ A thousand billion barrels.

¹⁶ International Energy Agency (IEA).

¹⁷ Source: *The new global puzzle* European Union Institute for Security Studies.

¹⁸ Source: Exxon *energy outlook* 2004 quoted by *DCDC strategic trends*. The same tendency was updated in 2004 for 2020 in *Mapping the global future 2020* of the National Intelligence Council.

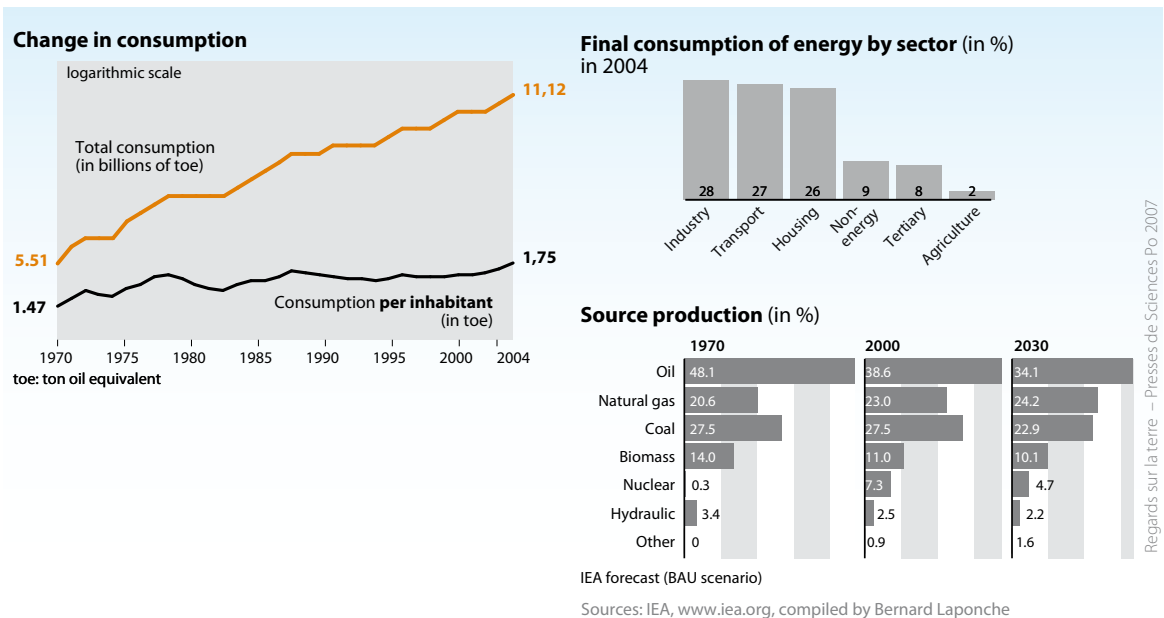


Two problems will become more acute:

- Secure access to production zones, particularly the Middle East and Africa;
- Transportation security: maritime routes, the straits notably of Hormuz, Bab El-Mandeb and Malacca, but also oil pipeline routes (Central Asia, Russia and Iran).

States will continue to diversify their sources of supply. The United States aims to import 25% to 40% of their oil from Africa by 2015. In this manner they are faced with rival claims from China, which takes 30% of its supply from Africa.

Energy forecasts



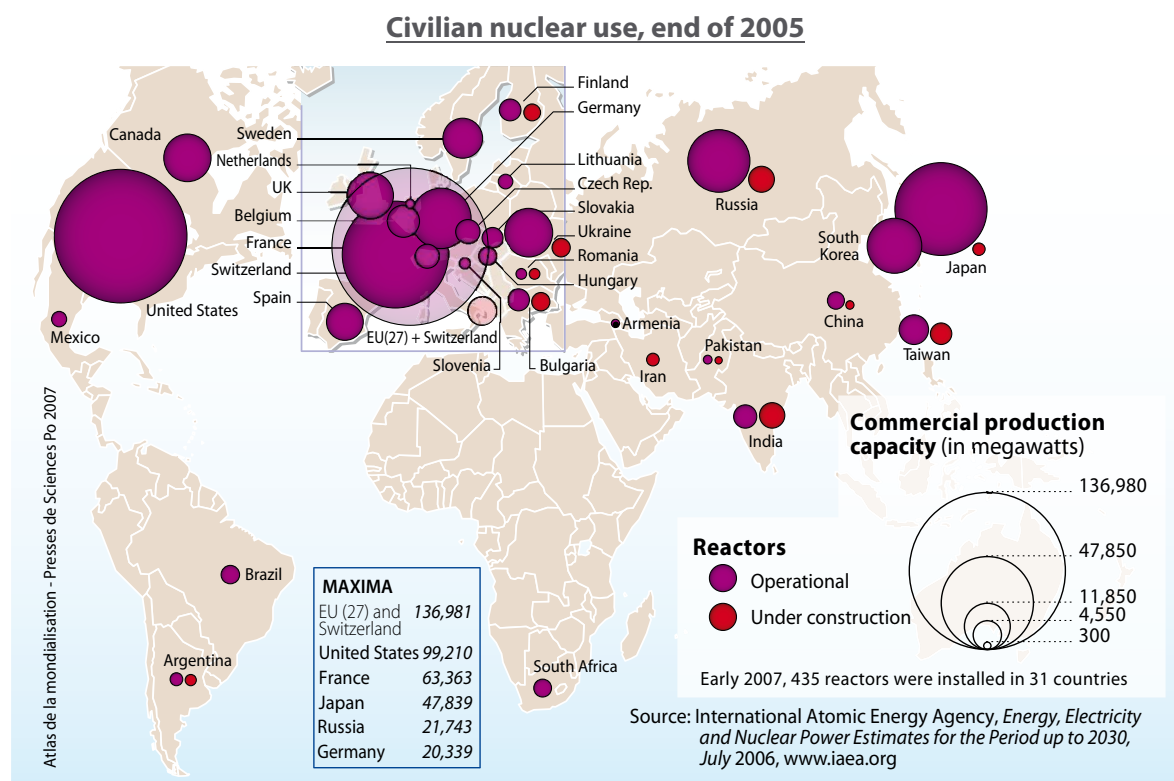
II.1.3 - Energy transition

Today **nuclear energy** represents 7% of the world's energy production. Even if it **remains attractive** up to 2030, its share could drop by about 5%.¹⁹ Competitive and not contributing to global warming, nuclear energy could potentially generate 400 orders for reactors from now until 2030. Currently ten countries export 95% of uranium resources; an increase in the civilian nuclear industry will lead to tensions over the price of uranium, especially since, in the near future, over forty countries will have access to nuclear means for civilian needs. However, nuclear energy cannot replace oil since it does not solve the problem of energy consumption attributed to means of transportation. 80% of the world's energy will still come from fossil fuels (oil, gas, coal).

Gas cannot replace oil. The latter will remain the primary energy source for, among others, transportation and use in petrochemistry (plastics, etc.). By 2030, the share of oil in total energy consumption should remain around 35%, while gas should not increase beyond 25%.

Renewable energy should develop in the next 30 years. Nevertheless, its share in worldwide energy production will not appreciably change (2% in 2030, versus less than 1% in 2007). It will be the same for biofuels.

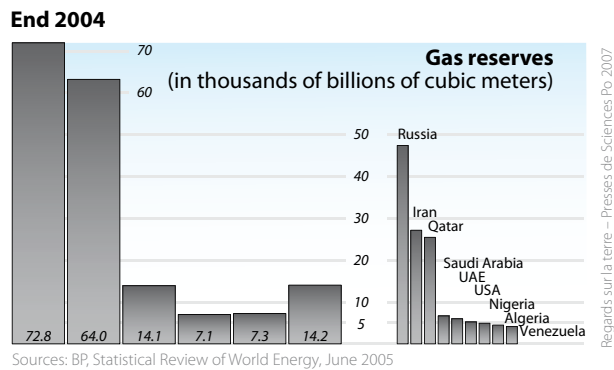
? New energy sources may emerge. However, in the next thirty years they most likely will not replace fossil energy.




Tension over oil supply will also apply to gas. The International Energy Agency predicts an increase in world gas demand of around 90% from now until 2030. One of the major problems in gas is its transport (8 to 10 times more expensive than that of oil). The principal transport issues will therefore be similar to those of oil: straits, maritime routes and gas pipeline routes.

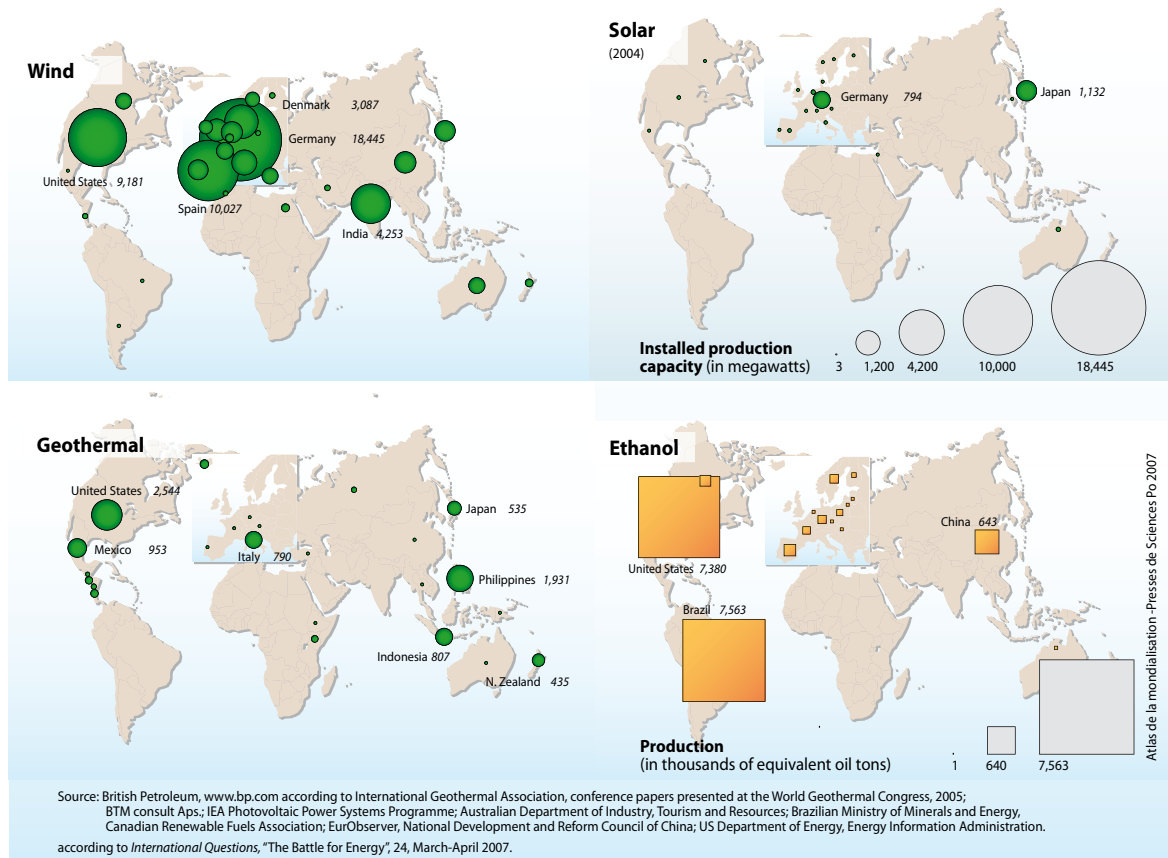
¹⁹ Source: IEA. *World energy outlook 2005*.

Gas reserves



 **The EU will be more and more dependent upon energy.** This energy dependency should move from 50% today to 70% in 2030²⁰. The internal energy offer will diminish while demand will increase. Europe must notably diversify its suppliers to limit risks. Over 60% of its gas imports come from Russia, doubtlessly only from the Gazprom company. OPEC countries (mainly from the Middle East) should, eventually, cover 80% of the world's oil needs.

Some renewable energy, 2005



20 Source: IEA. 90% dependency on oil.