Installation of solar panels in Eastern France in March 2009. The energy produced will supply electricity to a town of 4,000 people.

ALEXANDROV ARTUR/AFP

Resources and Environment

KEY MESSAGES

Climate change, which could potentially cause more frequent and more severe natural disasters, seems inevitable within the time frame under consideration, but the scope of its environmental, economic, health and strategic repercussions will depend on international mobilisation. These issues are highly politicised and controversial, most notably causing disagreement between developed and developing countries.

Under the combined effects of increasing demand and the deterioration of the environment in particular, access to natural resources such as fresh water, foodstuffs, and raw materials, especially energy and mineral sources, will be one of the greatest challenges facing humanity.

During the next 30 years, the growing scarcity of natural resources could heighten tensions *that turn into crises* and degenerate into armed conflicts to seize control of resources. Such conflicts could take three forms:

- Internal rioting caused by difficult access to resources (such as 'cost of living riots') leading to civil unrest and violence;
- Indirect strategies to apply pressure or seize resources, particularly during their transportation, with continual, almost inevitable, scattered and progressive clashes;
- A direct confrontation between states competing for a resource area; on land in the case of border clashes, or at sea for the extraction of resources (the continental shelf problem).

Our present-day ability to grasp the environmental challenges and the scarcity of resources will affect their impact 30 years from now. The scale and complexity of these issues could result in states being relatively powerless, oscillating between inaction, inability to apply in-depth reform, and withdrawal into isolation. Conversely, the risks associated with environmental deterioration could also lead to growing individual, national, and international awareness, helping to create a new attitude of citizenship and/or a new form of collective governance.

1 Deterioration of the environment

The deterioration of the environment should continue in the coming decades, in parallel with the industrialisation and urbanisation processes, because the current development model is likely to progress only very slowly.

1.1 – Inevitable climate change, whose scope is the subject of controversy

Climate change will change the environment in the long term, whilst the urbanisation, industrialisation, overfarming and overfishing contribute to its deterioration (deforestation, water shortage, pollution) in the short term.

Although the scope and rate of climate change are the subject of debate amongst scientists[1], there is a certain prevailing consensus concerning the reality of global warming, which seems inevitable in the time frame under consideration, and concerning its causes, which are largely attributable to human activity (mainly from greenhouse gas (GHG) emissions). Whichever figures are used, even if the warming could be stemmed by voluntary measures applied on a worldwide basis, the inertia of the climate system is such that this trend could not be reversed in the next 30 years.

The International Panel on Climate Change (IPCC)[2], which is not the most alarmist body in existence, has put forward many climate change scenarios, which converge to suggest a global increase of 0.4°C to 1.2°C by 2025, and 1.8°C to 6.4°C by 2100. According to the experts, a temperature rise of more than 2°C compared to the pre-industrial era could cause disrupt the climate to such a degree that human life would be jeopardised in many regions of the planet.

Climate change, which could result in a worsening and proliferation of extreme climatic events (heat waves, hurricanes, tornadoes, drought, flooding, etc.), will have repercussions on:

- the environment: deforestation, desertification, soil salination, rising sea levels, unbalance of the polar regions;
- the world's economies: reduction of habitable and farmable areas, impact on the availability of energy, mineral, food and water resources;
- health: consequences of natural disasters, extension and displacement of the areas in which certain diseases spread;
- strategies: increased tensions in already unstable zones, increased risk of occurrence of conflicts between states or asymmetric conflicts, displaced populations and mass movements of 'climate refugees', excessive militarisation of certain strategic zones (straits, the Arctic).

1- Note: uncertainty on the statistical reliability, related to inadequacies in the scientific model and power issues underpinned by potential instrumentalisation of the figures, increases the risks of overestimation or underestimation of some trends and prompts caution. Most assessments in the context of climate change are the subject of debate and dispute.

2- Data taken from the *Climate Change 2007 Assessment Report*. The IPCC is an intergovernmental body open to all member countries of the United Nations. It reviews risks posed by climate change and proposes adaptation and mitigation strategies. Like the other figures, the estimates given herein are the subject of debate.

Temperature changes expressed in degrees centigrade
(based on the value for 1990)

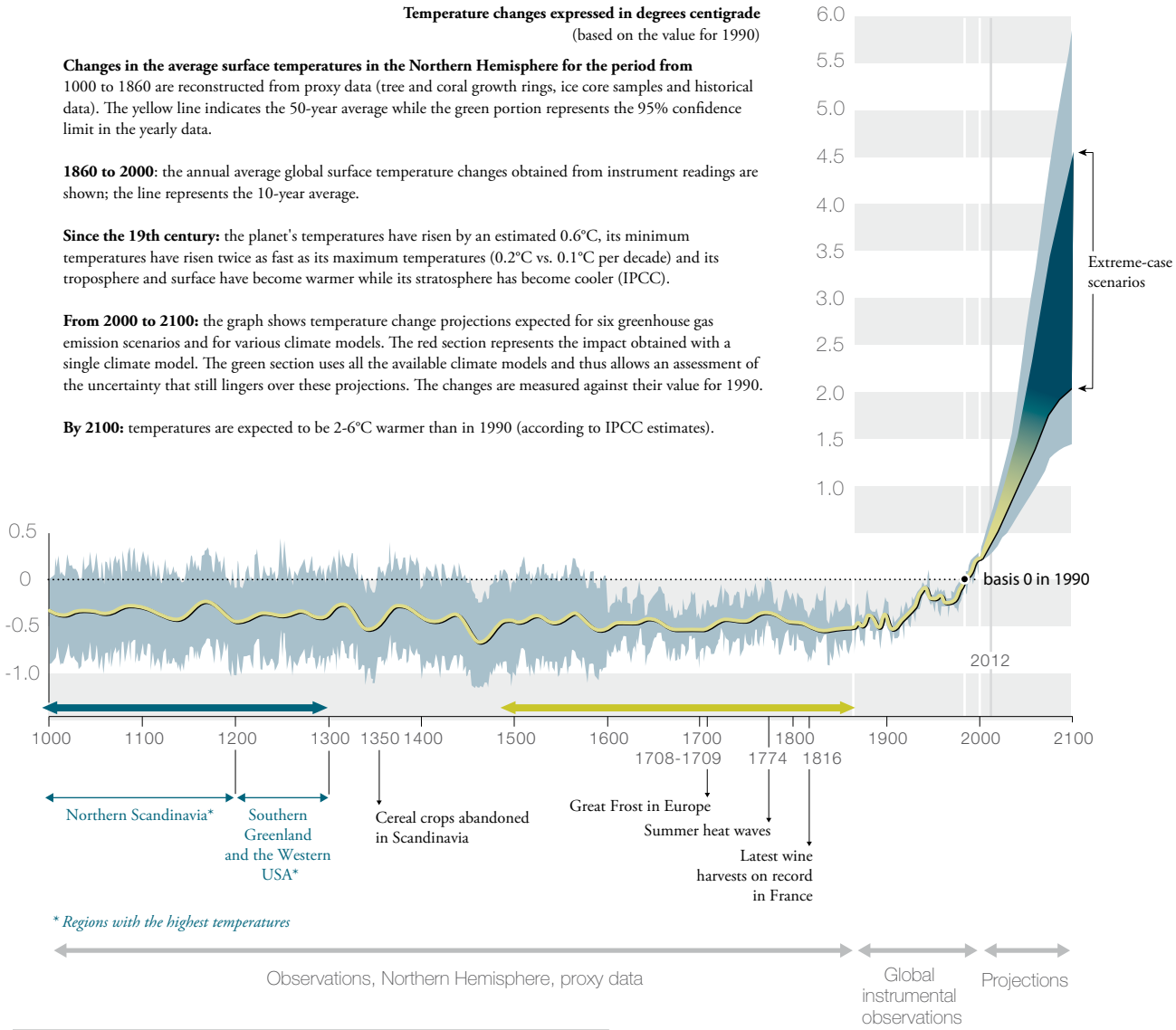
Changes in the average surface temperatures in the Northern Hemisphere for the period from 1000 to 1860 are reconstructed from proxy data (tree and coral growth rings, ice core samples and historical data). The yellow line indicates the 50-year average while the green portion represents the 95% confidence limit in the yearly data.

1860 to 2000: the annual average global surface temperature changes obtained from instrument readings are shown; the line represents the 10-year average.

Since the 19th century: the planet's temperatures have risen by an estimated 0.6°C, its minimum temperatures have risen twice as fast as its maximum temperatures (0.2°C vs. 0.1°C per decade) and its troposphere and surface have become warmer while its stratosphere has become cooler (IPCC).

From 2000 to 2100: the graph shows temperature change projections expected for six greenhouse gas emission scenarios and for various climate models. The red section represents the impact obtained with a single climate model. The green section uses all the available climate models and thus allows an assessment of the uncertainty that still lingers over these projections. The changes are measured against their value for 1990.

By 2100: temperatures are expected to be 2-6°C warmer than in 1990 (according to IPCC estimates).



Temperature changes in the Northern Hemisphere since the year 1000

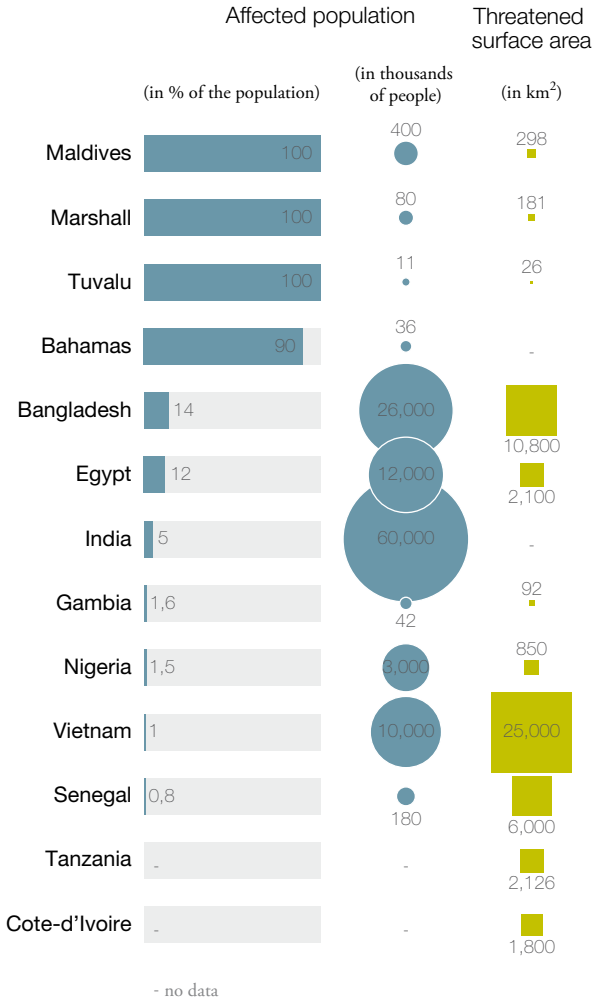
Sources: Form E. Le Roy Ladurie, *Le réchauffement de 1860 à nos jours*, vol. 3, Fayard, Paris, 2009, and the IPCC's 2001 assessment report, which reconstructs temperature variations in the Northern Hemisphere since the year 1000 in a hockey-stick graph. This graph has been removed from the IPCC's 2007 report, www.ipcc.ch.

Map Department of Sciences Po, 2011

These consequences will occur on a variable time scale and will affect the various regions of the planet unequally: certain arid or semi-arid zones should be the most affected. This applies in particular to Africa, Asia, and the Middle East, and even the Arctic where, according to some reports, the temperature rise in recent decades has been double the rise seen in other parts of the world.

STEP CHANGE

The Arctic should become a new strategic issue. The shrinking of the Arctic ice cap would open up new trade routes in the Arctic Ocean and shorten sea routes between Europe and Asia by 4,000 km. These channels would open up new commercial and industrial possibilities, allowing the exploitation of new oil fields and various mineral and gas deposits. The Arctic will thus constitute a major strategic issue, which will lead to repositioning by the bordering states, which will wish to enforce or demand their sovereignty over certain territories or exclusive economic zones, as well as distant countries, such as China and India, which demand a right of access to these resources.



Territories affected by a 1-metre rise in sea level

Sources: United Nations, http://data.un.org ; IPCC Special Report, *The Regional Impacts of Climate Change: An Assessment of Vulnerability - Africa, 2007*, www.grida.no ; IPCC Special Report on the Regional Impacts of Climate Change; Report of the Working Group II on Climate Change: Impacts, Adaptation and Vulnerability, ww.ipcc-wg2.org

from M.-F. Durand, Ph. Copinschi, B. Martin, P. Mitrano, D. Placidi-Frot, *Atlas de la mondialisation*, Paris, Presses de Sciences Po - 2010

1.2 – Uncertain answers

Climate change is an issue that affects the preservation of the world's public assets. It creates new physical restrictions and challenges North-South balances as well as current modes of co-operation, and calls for new modes of governance to be invented: scarcity governance (management of energy, food, mineral and other resources) and international and national governance of solidarity between states that will not feel all the effects in the same way.

Environmental regulations—currently comprising more than 500 international treaties—will need to be strengthened. However, without the proactive commitment of governments and support from public opinion, and if institutional fragmentation continues, such regulations will be meaningless.

A proactive environmental policy implemented on a global scale and combining measures on mitigation, adaptation and the development of clean technologies could, if not control GHG emissions (which would require the concentration of GHG emissions to be divided by three), at least level them off. According to the IPCC, the cost of such a policy would be equivalent to 3% of world GDP by 2030[1].

Many studies have shown that the longer the delay in applying measures to mitigate climate change, the more restrictive the measures will need to be, and the higher their cost will be. Thus, according to the fairly alarmist report published in 2006 by British economist Nicolas Stern[2], this cost could be as high as 5,500 billion euros if no measures are taken in the next 10 years[3]. A temperature rise of more than 2°C between now and 2050 could lead to a 5 to 20% drop in world GDP, versus 1 to 2% if mitigation and adaptation measures were adopted.

However, 15 years after the Kyoto summit[4], and with the expiration of the resulting protocol looming, international climate negotiations still have not achieved a consensus to commit to binding numerical limits for all countries that would make it possible to limit global warming to 2°C by 2050[5].

More than just realising the magnitude of environmental issues, which seem to have been a subject of consensus in 2009, the difficulty today lies in convincing emerging countries—today's major GHG emitters—and developing countries, including the poorest—which will be hit hardest by climate change—to reduce GHG emissions, a burden perceived by them as hindering their economic development. The historic responsibility of industrialised nations[6] has thus become a central issue of debate at a time when these nations are feeling the brunt of multiple economic and financial crises.

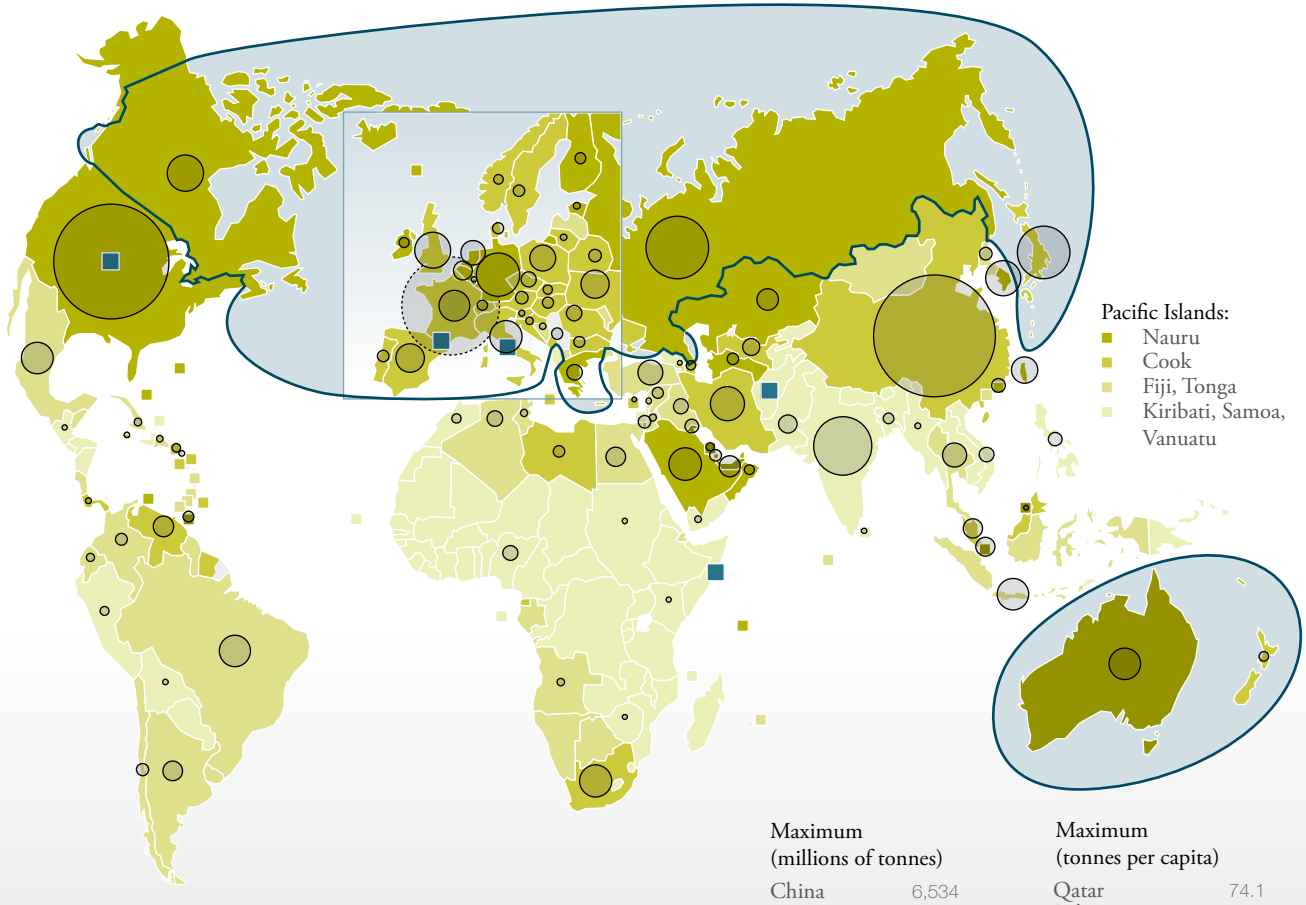
As a result, the effectiveness of the climate change mitigation will largely depend on the stance of emerging countries, where the increase in GHG emissions will be the most marked in the decades to come.

1- *Stern Review on the Economics of Climate Change*, HM Treasury, October 2006.
2- *Stern Review on the Economics of Climate Change*, op. cit.
3- For information on the—disputed—methods for calculating the cost of adaptation, see the OECD reports *The Economics of Climate Change Mitigation: Policies and Options for Global Action Beyond 2012*, March 2010, and *Economic Aspects of Adaptation to Climate Change: Costs, Benefits and Policy Instruments*, June 2008.
4- The Kyoto Protocol, whose groundwork was laid at the 1992 Earth Summit, entered into force in 2005 after being ratified by Russia. It set the first-ever numerical targets for the reduction of six GHGs (average worldwide reduction of 5.2% from 1990 emissions levels in an initial phase from 2008 to 2012). However, the protocol was limited to industrialised countries and did not impose any really legally binding emissions limits. The main reason behind the protocol's lack of success is its non-ratification by the USA, which had yet signed it.
5- In 2007, with the end of the first period of the Kyoto Protocol not far off (2012), negotiations were begun to reach a new international agreement to be signed at the 2009 Copenhagen Summit. The perception, widely circulated by the media and reinforced by a renewed rise of climate scepticism, that the Kyoto Protocol was a failure was instrumental in pushing climate change on the back burner. For example, it was decided at the 2011 Durban Climate Change Conference to push back negotiations on a new potentially binding international agreement to 2015 and its enforcement to 2020. As for the follow-up to the Kyoto Protocol, new emissions allowances are to be proposed by the next climate conference, which is scheduled to take place in late 2012. The rejection by Russia, Canada and Japan of new Kyoto commitments, followed by Canada's withdrawal from the protocol, have delivered a fresh blow to the only scheme in force.
6- According to *Human Development Report 2007/2008 – Fighting Climate Change: Human Solidarity in a Divided World*, published in 2007 by UNEP, the industrialised world is responsible for 70% of the increase in the concentration of GHGs in the atmosphere since 1970.

Strategic choices will therefore have to be made on a worldwide level. The attitude of states concerning the setting-up of global environmental governance, which remains uncertain, now opens up the possibility of several scenarios:

- An international impetus and an improvement to international governance systems, with the setting-up of efficient control and regulation mechanisms;
- Reinforcement and tightening of international governance systems, with criminalisation of environmental law;
- An international system subject to the interplay of influential powers (EU, USA, China, India, etc.), whose economic growth objectives gradually align themselves with a sustainable development logic;
- Reinforcement of the selfish behaviour and attitudes of states put under pressure by the quest for resources (raw materials, water, energy) and which adopt a 'lone ranger' attitude.

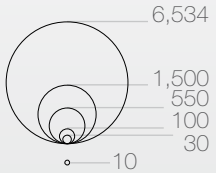
For private economic players, the sustainable development approach, which prompts multinational corporations to increasingly flaunt environmentally friendly policies, could give way to the 'green economy' approach. In this new approach, it is the appeal of financial profitability and the markets to be conquered that now stimulates an entire segment of industrial activity. The rising investment in 'cleantech' should confirm the progress of these technologies.



CO_2 emissions and ratifications of the Kyoto Protocol, 2010

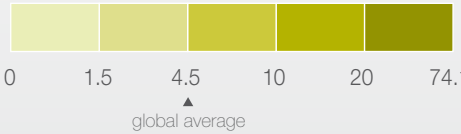
Maximum (millions of tonnes)		Maximum (tonnes per capita)	
China	6,534	Qatar	74.1
USA	5,833	Bahrain	43.2
EU (27)	4,234	UAE	43.1
Russia	1,730	Trinidad and Tob.	41.0
India	1,495	Singapore	34.6
Japan	1,215	Kuwait	31.6

CO_2 emissions, 2008
(in millions of tonnes)



Only values above 10 million tonnes are shown

(in tonnes per capita)



Kyoto Protocol of 27 July 2010

Countries that have pledged to limit or reduce their CO_2 emissions

Non-ratifying countries

Sources: Energy Information Administration, www.eia.doe.gov ; United Nations Framework Convention on Climate Change (UNFCCC), http://unfccc.int

from M.F. Durand, Ph. Copinschi, B. Martin, P. Mitrano, D. Placidi-Frot, *Atlas de la mondialisation*, Paris, Presses de Sciences Po, 2010

2 Facing the food challenge

In 2010, one billion of the 6.9 billion people on the planet—nearly one person in seven—were suffering from starvation. Given that the world's population could reach 8.8 billion by 2040, a consensus is emerging concerning the planet 's ability to feed 2 billion additional people, because the physical limitations of agricultural and water resources do not constitute an obstacle in and of themselves. The major problem concerning access to resources, the balance between supply and demand, will remain conditional on a certain number of factors, of which the main one involves the commitment of the states to strategies of co-operation.

2.1 – Access to drinking water: a major issue

Access to drinking water is a decisive factor in development, because a shortage has major repercussions on the economic sector (reduction of resources, economic slowdown, price rises), health (malnutrition, lack of sanitation, epidemics), and security (social tensions, displaced populations, emigration, conflicts).

Today, almost 2.5 billion people live in regions where water is in short supply, and more than one billion have no access to drinking water. This situation is responsible for more than 5 million deaths per year[1].

The combination of demographic factors (increased demand for food and irrigated crops), economic factors (urbanisation, industrialisation, increasing income) and environmental factors (climate change, soil depletion, desertification, pollution) should cause this situation to worsen, especially in arid and semi-arid regions.

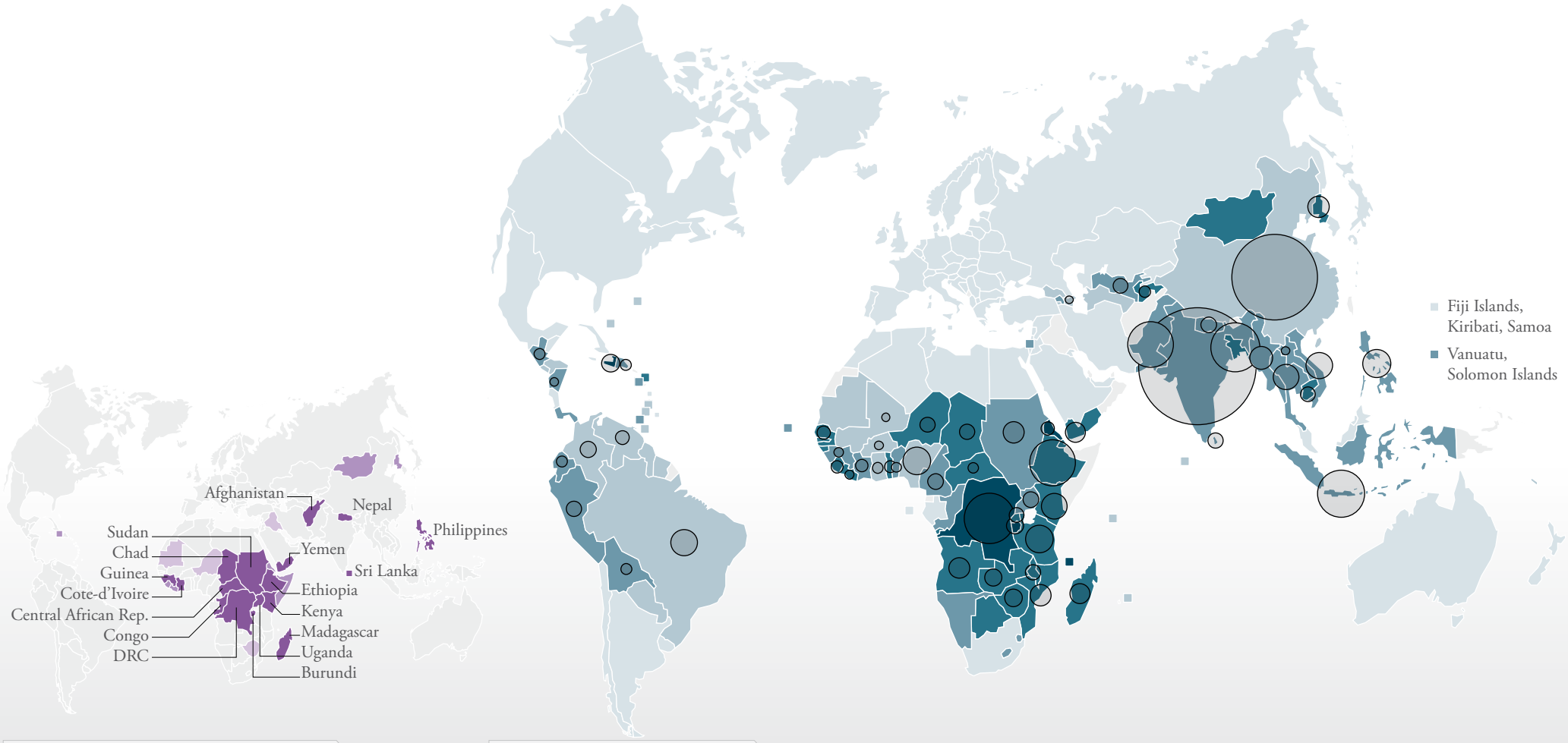
According to UN estimates, 2.8 billion persons are therefore at risk of being affected by a water shortage by 2025[2], whilst 47% of the world's population could live in an area with severe water stress by 2030.

The water problem is more a case of unequal distribution and conditions of access (the problem of purification) rather than a matter of reserves: 40% of the world's land masses receive only 2% of the world's water flow, whilst water is abundant in less-inhabited regions (Amazonia, Canada, Alaska, Siberia, the Arctic and the Antarctic).

The regions worst affected by water shortages are the Horn of Africa, North Africa, the Middle East, and Central and East Asia (particularly Northern China). According to the most alarmist estimates, in the absence of measures, the entire North Africa/Middle East region (except Iraq) could suffer from a water shortage by 2050.

1- *The State of Food Insecurity in the World*, FAO, 2008.

2- Data taken from 'Coping with Water Scarcity', World Water Day, UN-Water, FAO, 22 March 2007. Also see *Water in a Changing World*, the latest report issued by UN Water and presented at the 5th World Water Forum in Istanbul on 16 May 2009.



Countries in crisis requiring external assistance for food, 2010

- Exceptional shortfall in food production
- Widespread lack of access to food
- Severe localised food insecurity

Malnutrition

Number of undernourished persons in 2004
(in millions)

231
40
5
1

Only values above 1 million are shown

(in % of the population)

<5 | 6 | 14 | 25 | 50 | 76

▲ global average

Lack of data

Statistical method: nested means with isolation of outliers

Sources: FAO, online database, www.fao.org ; FAO, *Global Information and Early Warning System on Food and Agriculture (GIEWS)*

from M.F. Durand, Ph. Copinschi, B. Martin, P. Mitrano, D. Placidi-Frot, *Atlas de la mondialisation*, Paris, Presses de Sciences Po - 2010

FOCUS

Water-related security issues

The question of sharing the world's drinking water resources in increasingly becoming a geopolitical issue. The possibility of a conflict motivated solely by the appropriation of water resource is an unlikely scenario (no historical precedents), but water is becoming a major area for strategic co-operation by a growing number of countries, whilst the emergence of strategic doctrines devoted to it attests to the importance the states attach to this threat and to the protection of their vital infrastructures.

The availability of the resource in the form of fresh water, its use and its distribution will remain crucial issues in the decades to come, particularly with regard to dependency situations created by access to the resource.

Two hundred and sixty river basins are thus shared by several states and 145 countries share water basins.

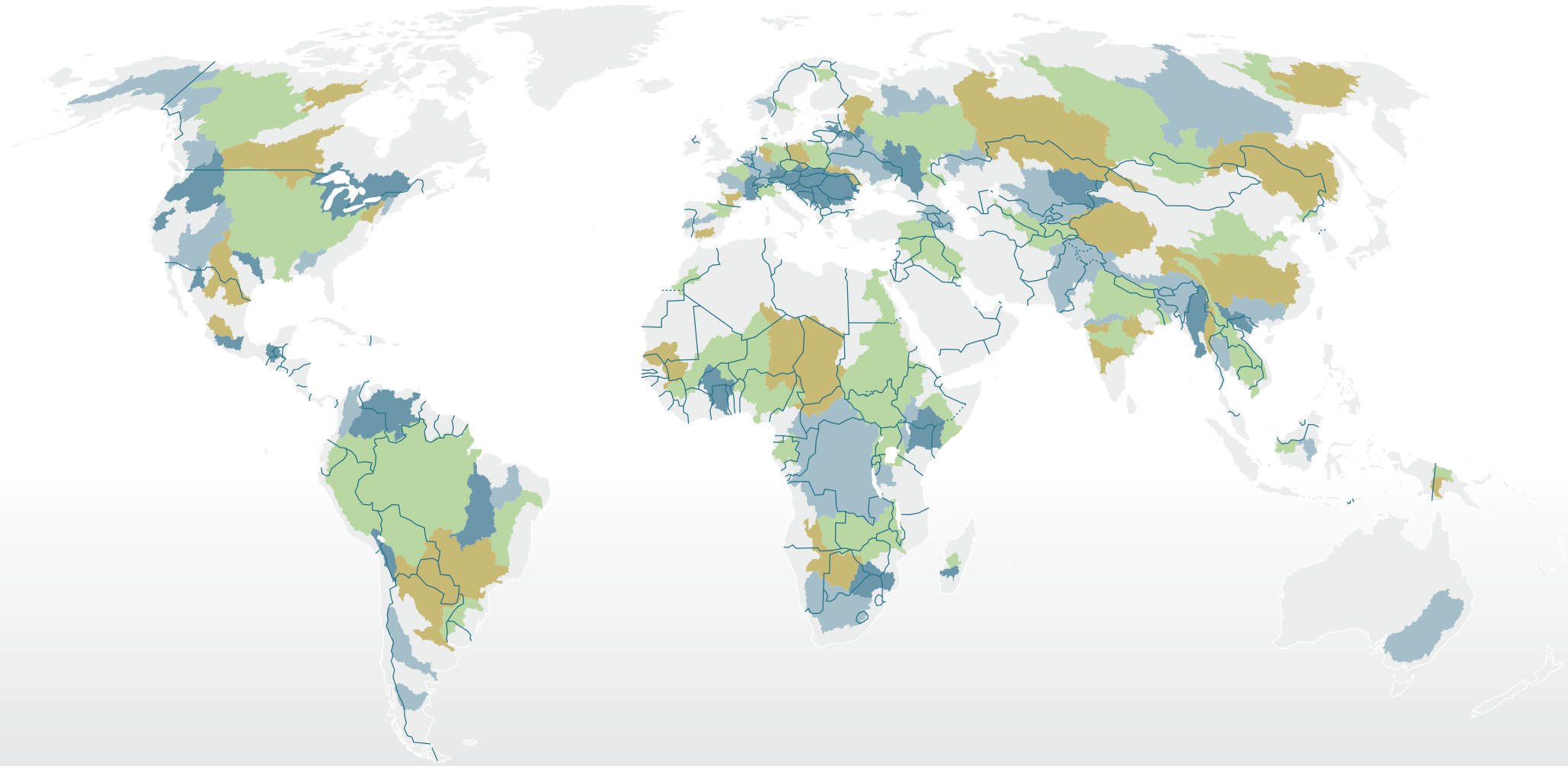
Many states in North Africa and the Middle East—the driest regions on the planet—depend entirely on neighbouring countries for their water supply (Egypt is dependent for 97% of its water resources, and Syria for 70%)[1].

The management of cross-border water basins, which are a source of tension in crisis zones (Israel and the surrounding area, India/Pakistan, etc.) could heighten the risk of conflict.

Up to now, it has been possible to defuse or contain the risks, but the increasing scarcity of this resource in the future could lead to the exacerbation of tensions amongst neighbours or could cause water to be used as an economic, political, or strategic weapon.

These interdependency situations could lead to the widespread management of this resource on a regional basis and, increasingly, an international basis.

1- United Nations, Food and Agriculture Organisation, Aquastats. Or Gleick Peter H., *Water in Crisis: a Guide to the World's Fresh Water Resources*, 1993.



Major river basins and national borders, 2011

Major river basins

Borders

Disputed borders

(United Nations nomenclature)

Sources: World Resources Institute, *Earth Trends, Environmental Information*, http://earthtrends.wri.org

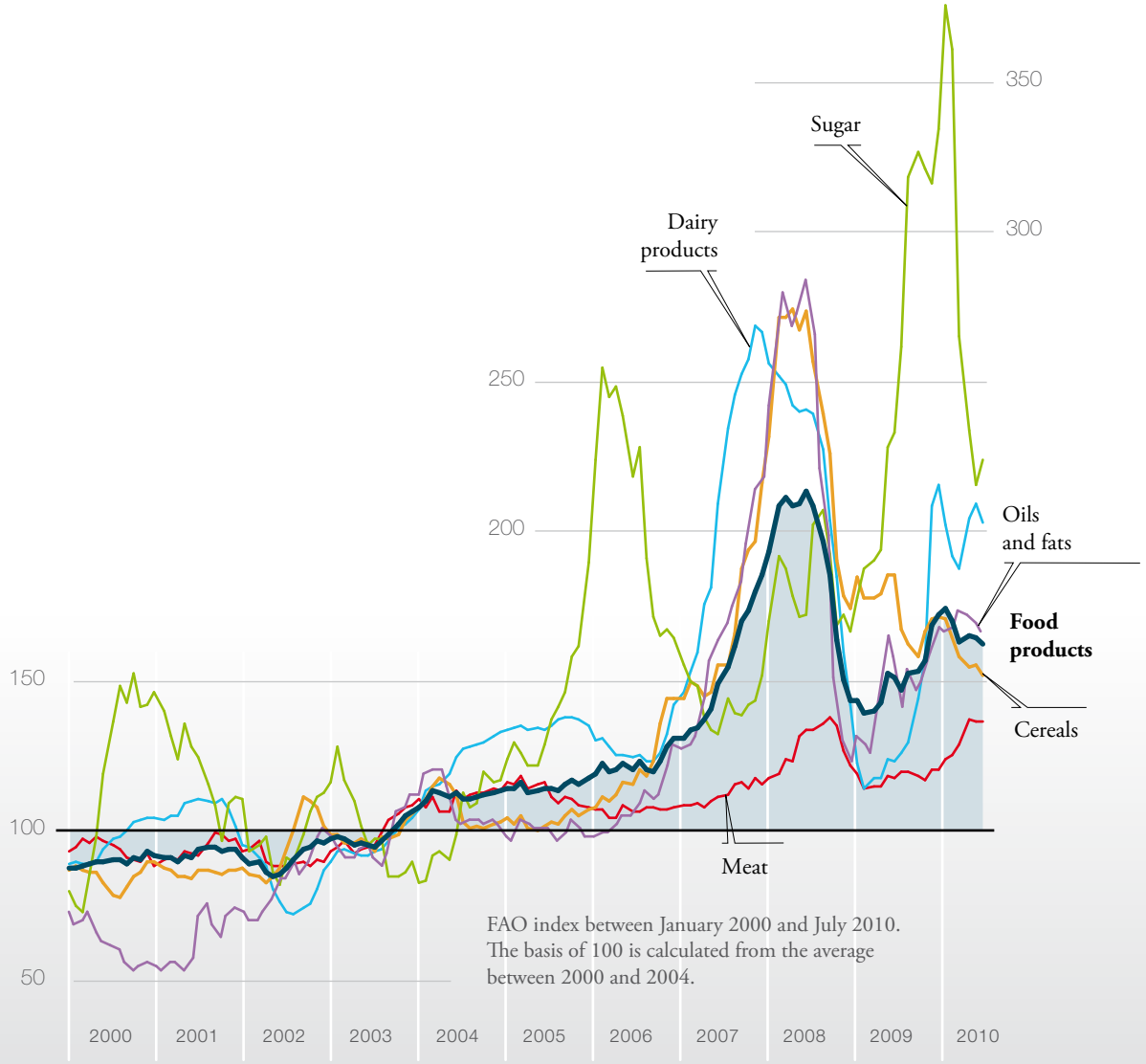
from M.F. Durand, Ph. Copinschi, B. Martin, P. Mitrano, D. Placidi-Frot, *Atlas de la mondialisation*, Paris, Presses de Sciences Po - 2010

2.2 – A food equation that is difficult to solve

Under the dual impetus of demographic growth and the increase in per capita income, particularly in emerging countries, worldwide demand for agricultural and agri-food products (including fish) will increase strongly and quickly in the coming decades, whilst the steadily increasing uniformity of diets will make the demand for animal-based products and the demand for cereals grow accordingly.

Even if a global balance between food requirements and agricultural production can eventually be achieved, the risks of a sudden shift in the world's food balance should not be underestimated. These risks remain chiefly dependent on:

- The effects of climate change;
- Solving the food equation—demographic growth/availability of arable land/increase in yields. This could be held back by antagonistic approaches and competition, or even usage conflicts, likely to worsen by 2040:
  - Competition between food security and energy security, which will lead to a rise in the production of biofuels, will likely take up 4% of the world's arable land and thus reduce the amount of land used for food production by the same amount;
  - Competition between food security and the climate change mitigation, which could jeopardise livestock farming, the livelihood of around two billion people and a considerable source of GHGs;
  - Increasing water requirements, whereas often unrestricted irrigation depletes the water table;
- The fact that states find it difficult to commit themselves to co-operative strategies: Whilst major agricultural policies have been built on the idea of food self-sufficiency, the proportion of public development aid devoted to agriculture has collapsed from 19% in 1980 to 5% today;
- The volatility of prices, which should persist. World agricultural markets will be highly dependent on economic developments and the strategies of the major producing and consuming powers: the USA, the EU, India, China, Brazil, etc. The solvency of importing countries will be confronted with the upward trend in demand for agricultural products and rising production costs (energy in particular).



FAO price index, 2000-2010

Sources: FAO, *World Food Situation*, July 2010, www.fao.org

from M.F. Durand, Ph. Copinschi, B. Martin, P. Mitrano, D. Placidi-Frot, *Atlas de la mondialisation*, Paris, Presses de Sciences Po - 2010

FOCUS

Climate change and agriculture

Agriculture, because it is extremely sensitive to climate change, will be the activity most affected by these phenomena, with negative impacts, especially in the subtropical regions, as well as positive impacts, in certain Russian regions and near the North Pole.

Higher temperatures reduce the yield of useful crops whilst leading to a proliferation of weeds and parasites. Changes in precipitation patterns increase the probability of bad harvests in the short term and a drop in production in the long term.

Increased water stress is liable to limit irrigation possibilities, particularly in certain regions of Asia, Africa, and the Middle East, whilst increasingly frequent extreme climatic events will result in greater variability of agricultural production.

Although certain regions of the world may obtain an improved yield of some of their crops and increased production capacities (Northern Asia, Russia, and Canada, thanks to the thawing of the permafrost), the net impact of climate change on worldwide agriculture should be negative, and this phenomenon will pose a threat to world food security.

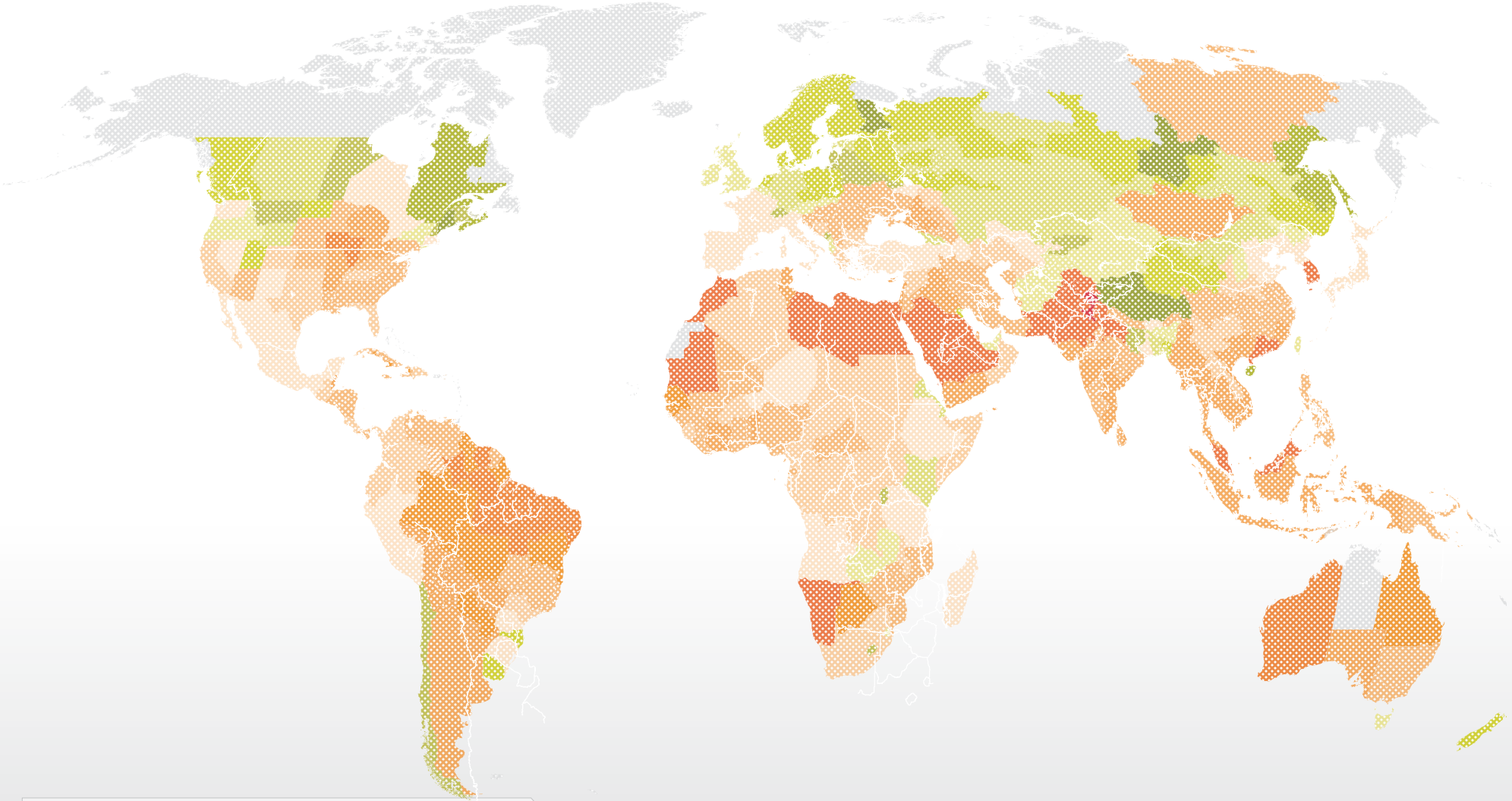
The populations of the developing world, already vulnerable and exposed to food insecurity, are likely to be the worst affected by climate change: According to the FAO, developing countries could experience a 9% to 21% decline in total potential agricultural productivity by 2050 (because of the increased frequency of extreme events). The negative effects will be especially pronounced in Sub-Saharan Africa and in South Asia. In Africa, climate change could reduce the agricultural production potential of the continent by 15% to 30% by 2080-2100, and could increase the dependence of many countries on food imports.

As a result, there is a risk that climate change will amplify the increase in prices of staple foods (most notably: rice, wheat, maize and soybeans), which is already driven by increases in population, income, and demand for bioenergy sources.

According to a study by the IFPRI (International Food Policy Research Institute)[1], in a scenario incorporating climate change, fewer calories would be available in the entire developing world in 2050 then there were in 2000. Climate change would also lead to a 20% increase in child malnutrition compared to a scenario not including its effects.

The IFPRI estimates the investment necessary in terms of research, rural infrastructures, and irrigation to neutralise the negative impact of climate change at $7 billion per year.

1- *Food security, farming and climate change to 2050* report, 2010.



Shift in crop yields due to climate change by 2050

-50% 0 +100% Data unavailable

Source: World Bank, "Impact of Climate Change on Crop Yields by 2050", World Development Report 2010. Development and Climate Change, preliminary version, 2009.

2033, Atlas des futurs du monde, by Virginie Raisson (Éd. Robert Laffont) © www.lepac.org

Most analyses tend toward the same conclusion, i.e. that of an overall scenario in which Southern countries remain dependent on Northern countries. The growth in agricultural production in developing countries alone will no longer be sufficient to cope with their demand if it is not accompanied by an increase in the volume of exchanges and the implementation of appropriate policies concerning access to food resources for the populations of the poorest countries.

A number of current trends are expected to continue:

- The progressive concentration of agricultural production factors in a few countries or regions with comparative advantages and competitiveness that cannot be matched (Brazil);
- The growing financialisation of the agricultural sector, with food security becoming a victim of speculation and exploitation of the intrinsic volatility of agricultural food prices.

If no action is taken to regulate the international free market trading of agricultural goods in the next 15 years, the volatility of agricultural raw material prices will increase. The consequences would be dangerous for world food security, because this instability would ruin the efforts of poor countries and weaken the agricultural potential of developed countries. This instability may also lead to the risk of food crises that could grow larger and larger.

Preventing these changes would require the creation of a new, sustainable agricultural model that takes into account the preservation of ecosystems.

Purchasing country

Selling country

Libya: 264,000

Ukraine: 247,000
Liberia: 17,000

South Korea: 1,075,000

Sudan: 774,000
Mongolia: 270,000
Argentina: 21,000
Indonesia: 10,000

Japan: 12,317,262

China: 12,000,400
USA: 216,862
Brazil: 100,000

Egypt: 860,127

Uganda: 860,127
Ethiopia: 20,000

India: 765,000

Ethiopia: 765,000

Saudi Arabia: 2,695,117

Indonesia: 2,185,000
Tanzania: 500,000
Sudan: 10,117

United Arab Emirates: 742,470

Sudan: 378,000
Pakistan: 364,470

China: 2,179,571

Philippines : 1,240,000
Laos : 705,000
Zimbabwe : 101,171
Russia: 80,400
Australia: 43,000
Cameroon: 10,000

International acquisitions, both public and private, of agricultural land in 2008 and 2009 (rental or sale, in hectares)

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FOCUS

International real estate investments, a new sharing of resources?

Although this is not a recent phenomenon, it is currently accelerating and the arrival of new investors (the Gulf states, China, India, South Korea, North African countries such as Libya and Egypt), as well as a diversification of target countries (essentially in Africa and South-Eastern Asia).

With the sharp rise in agricultural prices in 2007-2008, international real estate investments were booming, under the combined effects of:

- The desire of countries that are highly dependent on imports to fulfil their needs to guarantee their future food security;
- The idea, which was exacerbated by the financial crisis, of land being a 'defensive security' providing a high return on investment;
- The development of bioenergy crops, where investments take the form of purchases or, more often, rental of agricultural land (including very long-term rental) in foreign countries.

According to the IFPRI, 15 to 20 million hectares of agricultural land around the world—equivalent to the entire agricultural surface area of France—were rented, purchased, or the subject of negotiations between 2006 and 2009. According to the private investors, the sums involved could double or treble in the next five years. Private capital makes up the vast majority of the amounts invested (almost 90%), and sovereign funds are still a small proportion. Public investment (10%) can take the form of state-to-state agreements or be made by public companies.

However, the boundary between private and public investments may be ill-defined, because states sometimes provide strong diplomatic and financial support to private investors.

A geographical profile already seems to be emerging, and with regard to international real estate investments, it is dominated by emerging countries. This South-South dynamic causes some to fear a new dividing up of land and natural resources to the detriment of the Western countries, which will nonetheless remain clearly dominant in terms of private international real estate investment.

These investments can compensate for chronic under-investment in the agricultural sector of countries that still possess enormous farmable land potential, and can therefore contribute to covering future food demand. They are also, however, instability factors. NGOs regularly act as an intermediary in cases of expropriation and displacement of hundreds of thousands of subsistence farmers. These projects therefore face a strong risk of unrest caused by massive land buy-ups. The iconic example is that of Daewoo in Madagascar, which contributed to the fall of President Ravalomanana in 2009.

An attempt at the international regulation of international real estate investments is now being set up: the World Bank, the United Nations Food and Agriculture Organisation (FAO), the International Fund for Agricultural Development (IFAD) and the United Nations Conference on Trade and Development (UNCTAD) reached an agreement in late 2009 on a series of principles for 'responsible agricultural investment', based on the recognition and compensation of customary rights, transparency, and consultation of stakeholders. The idea of creating a quality certification for responsible approaches is also under consideration.

2.3 – Growing tensions and food risks

Food and water problems could become growing factors of conflict by contributing to exacerbate existing tensions, fuelling internal economic and social crises, and becoming a decisive factor in destabilisation or conflicts within or between states.

Food crises will affect vulnerable zones, characterised by a predominantly rural economy, mainly in Asia and Africa. The most sensitive regions are the coastal regions and deltas, megacities, or semi-desert regions, where nomadic stockbreeders cohabit with sedentary farmers. A total of nearly half the world population will be affected by this risk.

Food crises could degenerate into violent civil unrest ('cost of living riots'). Land appropriation conflicts and the disputing of wealth redistribution systems will remain a factor of social and political instability, or even a major source of conflict. The number of grey areas could increase due to a loss of subsistence resources or due to a climatic crisis.

The unequal distribution of agricultural resources should combine with tensions concerning fishing resources, because seafood accounts for 20 to 40% of the animal protein consumed by humans. According to estimates, the total catch, estimated at 90 million tonnes, seems to have stabilised, but there is doubt concerning the reliability of these figures because certain states provide incomplete data. Nevertheless, over-exploitation of the determined fish stock is likely to lead to their near-disappearance in the coming years. Fishing waters will therefore be at the centre of growing rivalries in countries where small-scale fishing is the backbone of the local economy.

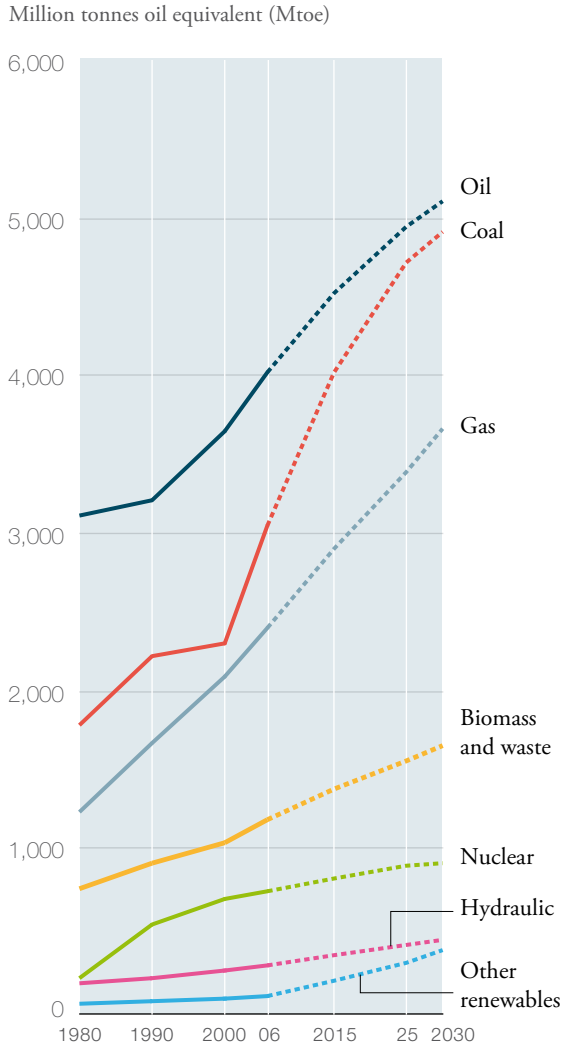
Finally, in addition to the crisis-generating factors it carries, a deficit in agricultural production could contribute to amplifying population movements. A billion persons could be forced to flee from their habitat because of climatic upheavals, shortage of food resources, and the resulting conflicts.

The stability of certain zones could deteriorate in the absence of agricultural growth. The political and migratory stabilisation of Sub-Saharan Africa and the Mediterranean region in particular will depend largely on the control of agricultural development. The issue lies in the maintenance of an agricultural activity likely to generate the income required to hold populations in place.

3 The challenge of energy and mineral resources

Thanks to the rise of emerging countries, globalisation and increasing transport requirements (greater number of exchanges, more cars, greater distances between places of production, manufacture and consumption), the demand for energy and mineral resources should increase significantly in the next 30 years.

The increasing scarcity and unequal distribution of hydrocarbons and minerals, which are often found in unstable or inaccessible areas, could exacerbate existing tensions. The prospects for growth in demand, particularly for fossil fuels, will not make it easy to implement measures aimed at reducing GHG emissions. As regards economic and environmental issues, learning how to adapt energy usage and lifestyles as energy supplies dwindle will, in the years to come, become a crucial challenge that no society will be able to ignore.

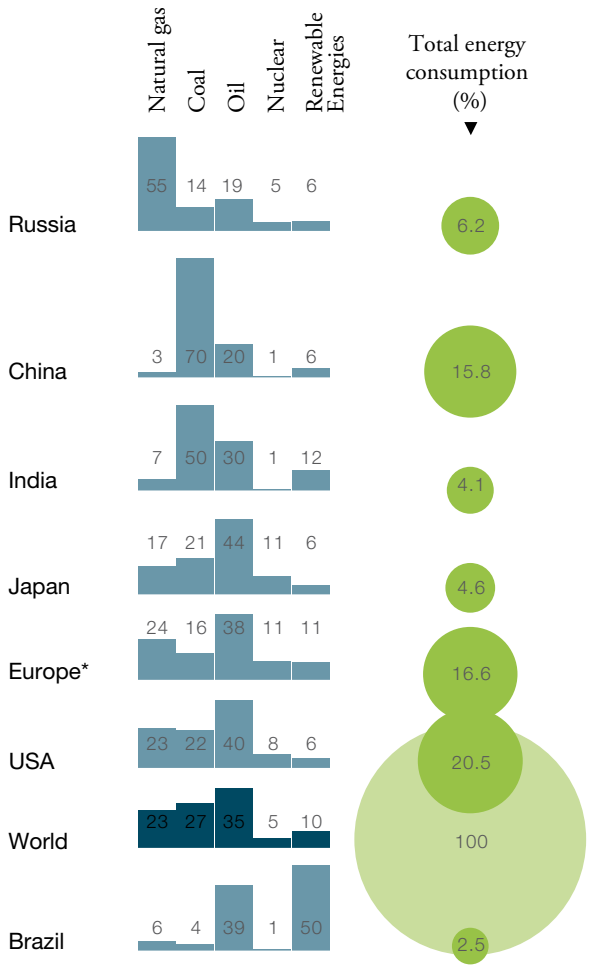


Total primary energy demand 1980-2030

Sources: IEA, *World Energy Outlook 2008*

from M.F. Durand, Ph. Copinschi, B. Martin, P. Mitrano, D. Placidi-Frot, *Atlas de la mondialisation*, Paris, Presses de Sciences Po - 2010

Distribution of energy consumption by source (in %)



*OECD countries only

Energy mix of a few countries, 2007

Sources: Energy Information Administration, *International Energy Outlook 2008*, Washington D.C., June 2008, www.eia.doe.gov

from M.F. Durand, Ph. Copinschi, B. Martin, P. Mitrano, D. Placidi-Frot, *Atlas de la mondialisation*, Paris, Presses de Sciences Po - 2010

3.1 – Growing energy needs[1]

While energy consumption doubled in the last 30 years[2], worldwide demand for energy will continue to grow strongly, at an average rate of around 2% a year.

The increase in energy consumption will, however, not be the same in all regions. Although demand is expected to double in America, it will increase at a rather slow pace in Europe and Japan. It will be high, however, in developing countries, which should account for more than 90% of the additional demand even though their consumption levels will still be less than those of OECD countries (except for coal). For example, between 2004-2030, consumption in China, which has just overtaken the USA as the world's top energy consumer, should double (22% of global demand in 2035) and India's consumption should almost treble. Both countries will account for 45% of the total increase in energy demand.

In the absence of any decisions imposed by sudden and/or external events, it is unlikely that technological advances or a rapid change in habits in the most highly developed countries will produce any significant reduction in energy requirements related to modes of transport and lifestyle (urbanisation, suburbanisation, etc.).

3.2 – Towards an energy transition?

By and large, the energy sources currently in use should be able to meet the rise of around 50% in worldwide demand that will occur by 2030. However, according to some estimates, demand will increase faster than supply and lead to price rises.

Towards the exhaustion of fossil fuels

Fossil fuel sources should cover around 80% of requirements by 2040, including 30% for oil, 29% for coal, and 22% for gas[3].

Oil should remain the primary source of energy, with transportation accounting for two-thirds of the increase. It is, however, possible that the supply might not be able to keep up with demand. Although the estimated date of peak oil [1]—the point in time when the availability of oil is expected to start diminishing—varies from study to study, most studies place it at between 2020 and 2030.

1- Note: the projected figures in this section are presented for illustrative purposes only. As they are related to different scenarios, they are relative and highly variable.

2- *World Economic Outlook*, International Energy Agency (IAE), 2008.

3- Data taken from Total's 2009 report *Énergie, notre vision 2030*.

STEP CHANGE

In view of the estimated growth rate of consumption, proven oil reserves are likely to dry up between 2030 and 2035. The oil industry has anticipated this situation, and is preparing to exploit probable and possible reserves.

Against the backdrop of peak oil, natural gas, which has proven reserves estimated at 70 years, should undergo a significant increase in production and use (almost 90% increase in worldwide demand between now and 2030), most notably for the production of electrical power. Natural gas could account for more than a quarter of worldwide energy demand by 2035[1]. Almost 80% of the increase in demand for gas between 2010 and 2035 should come from countries that are not members of the OECD[2].

It is difficult to determine an exact date when the oil and gas reserves will run out. In any case, this will depend more on economic factors (cost of available energy sources) than natural factors.

As the production of easily accessible oil and gas (including in terms of cost) struggles to satisfy worldwide demand, the absolute and relative proportion of coal in the worldwide energy mix should increase, particularly due to the increased demand for electricity (with coal covering 40% of global production).

Coal is abundant in high-consumption countries such as Germany, Australia, Canada, China, the USA, and Russia, and its price competitiveness could improve considerably with respect to gas and oil. In the long term, coal could therefore take hold as a relatively economical alternative to gas and nuclear power, provided a number of major technological developments (clean coal, improved electricity yield, capture and storage of CO_2, synthetic fuels, etc.) are made to limit its environmental impact (CO_2 emissions). Beyond 2040, the contribution of coal to the world energy balance could equal that of liquid hydrocarbons, both conventional and unconventional.

The uncertain future of nuclear energy

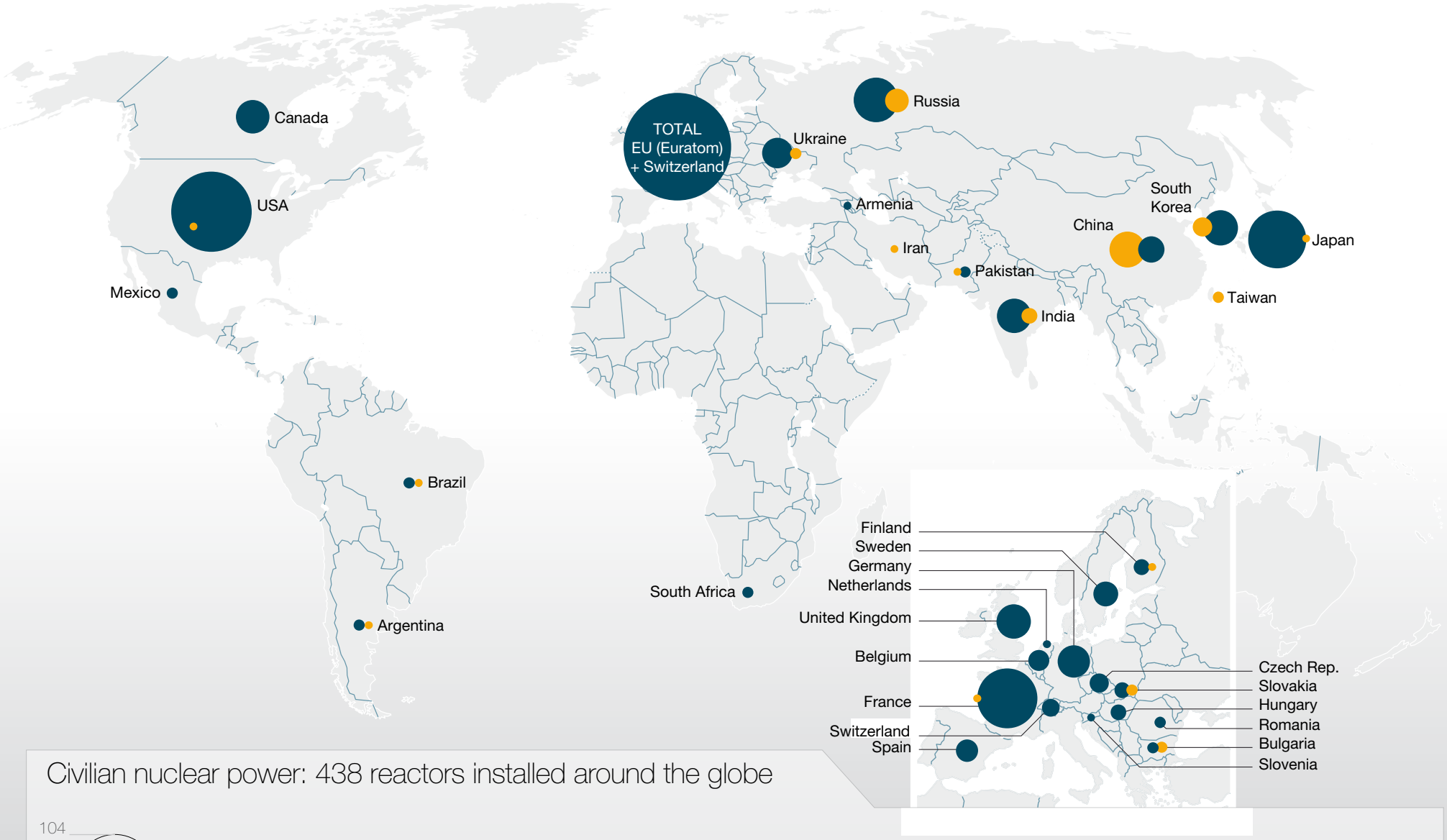
In a context where environmental issues are taking on increasing importance, nuclear power, which makes only a small contribution to the greenhouse effect, could grow significantly, particularly since uranium reserves, sufficient to last the next 60 years, are expected to satisfy worldwide demand between now and 2025[3].

The electricity produced from nuclear energy could virtually double between now and 2040, but in that time frame it is expected to cover only around 8% of the world's energy requirements. By that time, more than 40 countries might have nuclear power plants, with a total of around 600 reactors, provided that the Fukushima disaster does not abruptly and permanently put a damper on the development of civil nuclear power.

Nuclear energy cannot therefore become a substitute energy, on the one hand because it does not solve the problem of energy consumption due to transportation (60% covered by oil), a sector which could account for two-thirds of the rise in worldwide consumption in the next 20 years, and it cannot be an alternative to coal either; on the other hand, because of its cost (investments in power plants, processing of radioactive waste), and finally, because of the nuclear risk, whose serious nature was recently illustrated by the catastrophe at Fukushima, not to mention the accidents at Three Mile Island in the USA (1979), and Chernobyl in the Ukraine (1986).

1- *World Energy Outlook, Are We Entering a Golden Age of Gas?*, IAE, June 2011.
2- The same report states that emerging powers are large consumers of gas. For example, in 2035, China's demand for gas should match that of the entire European Union.
3- After peak uranium is reached sometime around 2025, when uranium production will rise to 70,000 tonnes, uranium production could drop to 34,000 tonnes in 2050 and then decrease even further.

Resources and Environment



Civilian nuclear power: 438 reactors installed around the globe

104
58
32
10
5
1

Number of reactors (as of 11 June 2010)

In operation

Under construction

Borders

Disputed borders

(United Nations nomenclature)

Sources: AIEA, http://nucleus.iaea.org

Map Department of Sciences Po. 2011

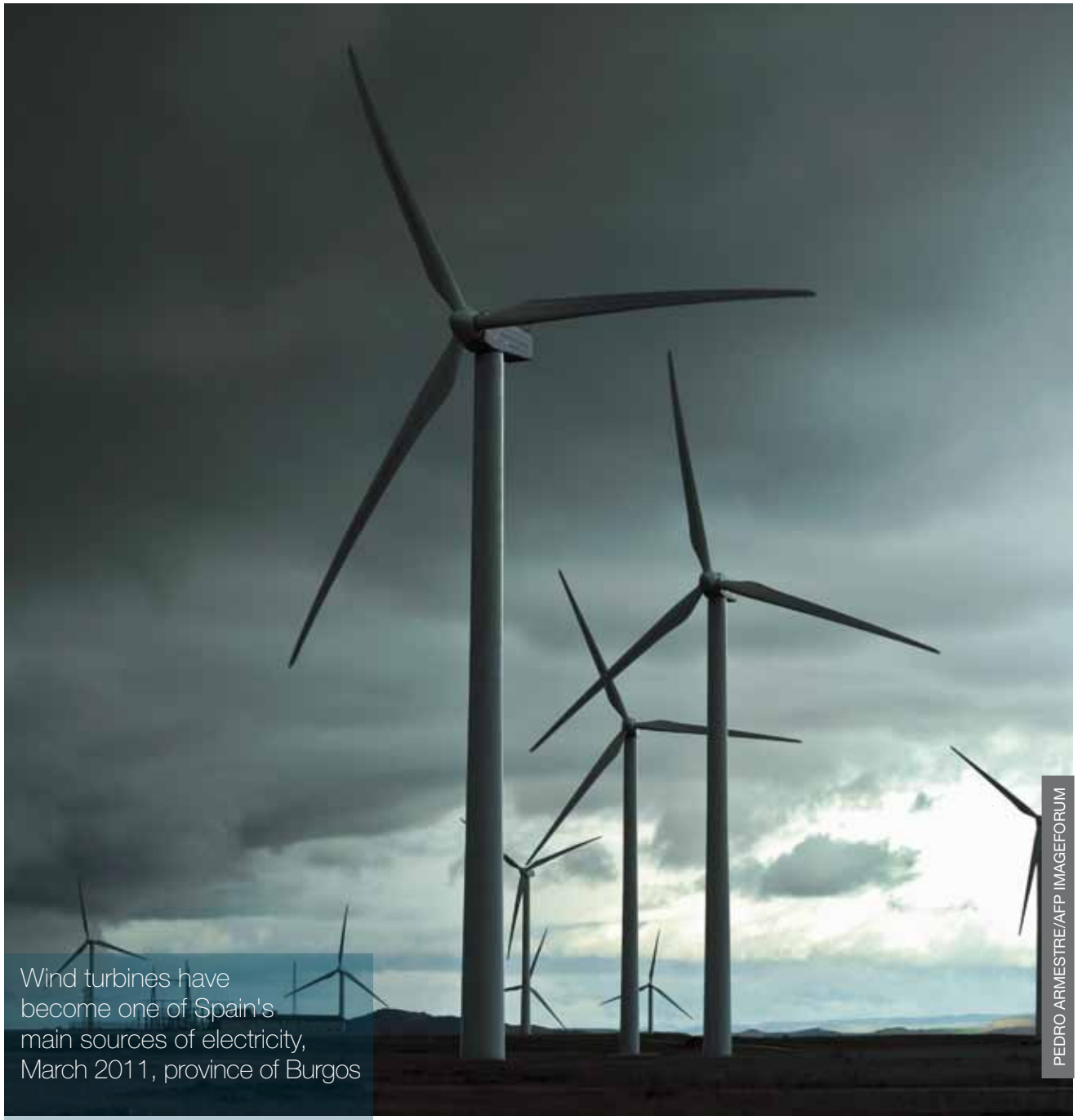
STEP CHANGE

The global trauma caused by the disaster at Fukushima has revived public awareness of the scale of the human, economic, and environmental risks associated with nuclear power. Although it is too early to ascertain whether this event will constitute a strategic step change, it has caused nuclear power to be called into question in several countries, with some governments already announcing plans to phase out nuclear power in the medium term (Germany) or suspend current projects (Italy, Switzerland). Whatever the final choice, no country will be able to avoid a certain amount of discussion and investment concerning nuclear safety. In any case, whatever its scope and its extent on a global scale, a nationwide reduction in the reliance on nuclear power could only happen in the long term.

The development of alternative energies

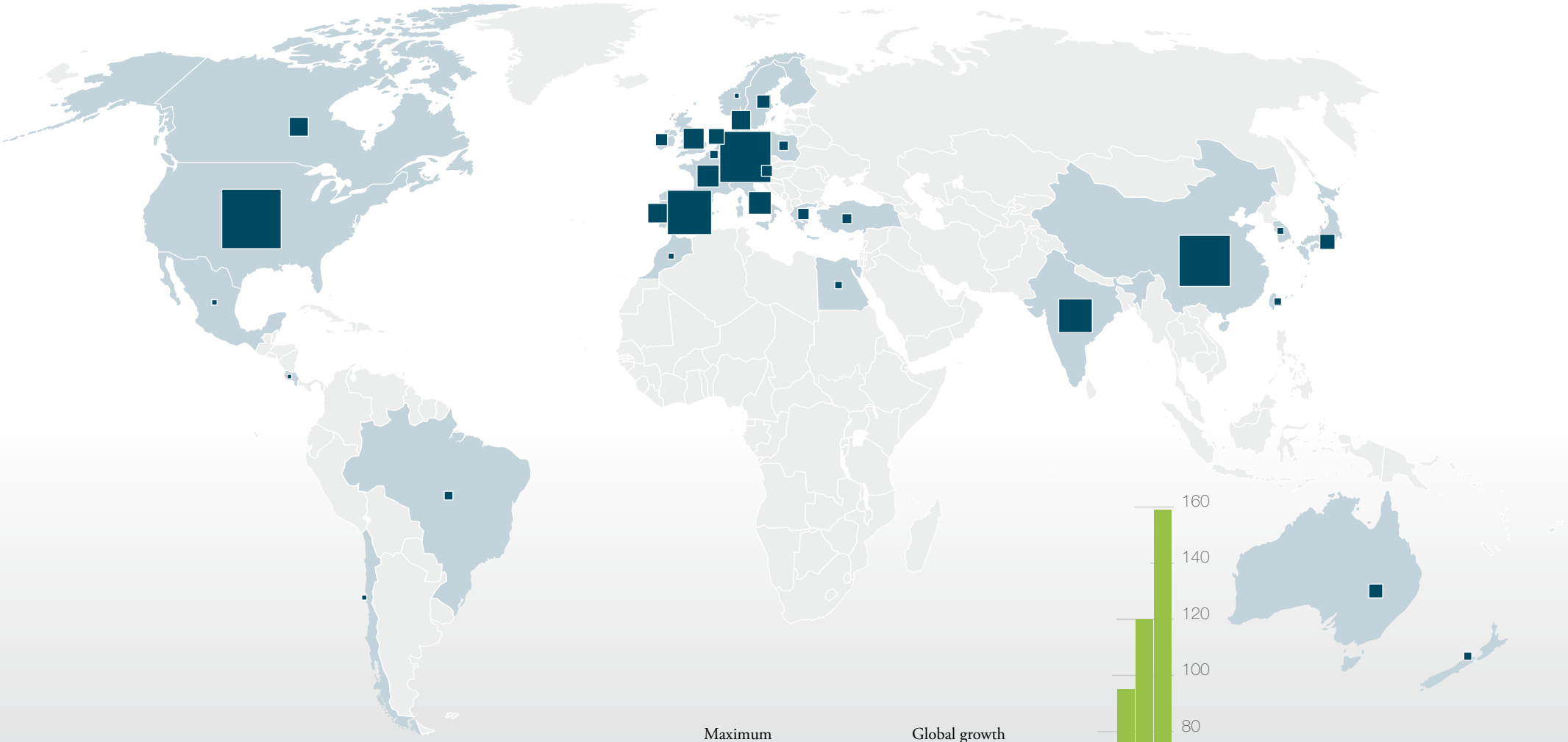
The combination of economic and environmental factors will oblige the world to develop alternative, renewable and/or less polluting energy sources.

Peak oil, which should result in an upsurge in the price of crude oil, could be a turning point in the development of alternative energies, which could become economically profitable and justify, or even impose, the transformation of energy practices.



Wind turbines have become one of Spain's main sources of electricity, March 2011, province of Burgos

PEDRO ARMESTRE/AFP IMAGEFORUM



Wind power production, 2009

Installed capacity, in thousands of MW

Only values above 100 MW are shown

Maximum	
USA	35.1
China	25.8
Germany	25.8
Spain	19.1
India	10.9

Sources: Global Wind Energy Council (GWEC), *Global Wind 2009 Report*, www.gwec.net

Global growth

Cumulative installed capacity, in thousands of MW

from M.F. Durand, Ph. Copinschi, B. Martin, P. Mitrano, D. Placidi-Frot, *Atlas de la mondialisation*, Presses de Sciences Po - 2010

By 2040, renewable energies (biofuels, solar energy, geothermal energy, hydraulic energy, sea power, wind power), currently accounting for 13% of world production, should have increased considerably. There are extremely variable estimates of the proportion of world energy production that they will constitute. In the latest IPCC report[1], more than half of the 160 scenarios envisaged estimate this at 17% in 2030 and 27% in 2050.

Biofuels (ethanol, biodiesels), which are essentially used in the transport sector, have the advantage of being inexpensive and creating little pollution. They will become more popular and could make up 10 to 15% of energy alternatives to petroleum. Nonetheless, in developing countries with insufficient forest management, they contribute to deforestation and affect the climate[2] and food security.

Hydroelectric power and wind power will constitute the majority of the increase in the renewable energy supply. Hydraulic energy, the main source of electricity generated from renewable energy sources, is increasing steadily, and this should continue because of the scale of its untapped potential (particularly in Africa, India, and Latin America).

The human costs, however (population displacement) and the environmental costs (modification of ecosystems and climatic effects) are still very high. The use of wind and solar power will certainly grow quickly, but their proportion in the energy mix worldwide should remain modest at around 20% in 2030[3].

As stated by the IPCC[4], it is not the availability of resources (97% of which are still unexploited), but public policy that will or will not make it possible to develop renewable energies. According to all assumptions, the amount of investment required in the electricity sector (between US $2,700 billion and $13,300 billion) will be less than 1% of global GDP.

STEP CHANGE

New energy sources are likely to emerge, but it seems that they will not replace fossil fuels in the next 30 years. Most experts consider that a step change in terms of technological progress is unlikely to occur in this field within the next 20 or so years*. Some, however, envisage an optimistic scenario in which hydrocarbons and nuclear power, in view of the crisis in both sectors, are replaced by renewable energies by 2040-2050. According to this scenario, solar energy (which will be made more profitable, particularly with the arrival of nanotechnologies) will cover the entire world's energy needs.

* *Atlas des futurs du Monde*, Virginie Raisson, Paris, 2010.

1- *Special Report on Renewable Energy Sources*, May 2011.
2- According to some estimates, in addition to their environmental impacts, biofuels could increase GHG emissions by 50% depending on the source plant used and the quantities of energy required to extract and produce them. *Science Magazine*, 29 February 2008.
3- According to some scenarios described in the report published by the Global Wind Energy Council and Greenpeace, *Global Wind Energy Outlook*, 2010
4- *Special Report on Renewable Energy Sources*, May 2011.

3.3 – Growing tensions on the main energy sources and supply channels

A certain number of factors could lead to tensions on energy supplies and spur a rise in energy prices:

- The renewed concentration of world hydrocarbon production in the Middle East, where the longest-term reserves (beyond 2025) are located. The Middle East, however, like the other hydrocarbon-producing regions (Gulf of Guinea, Ecuador, Bolivia, Venezuela), will cover almost two-thirds of the world's energy needs by 2040, and should remain regions of instability;
- The border and regional problems in Central Asia and the growing tensions concerning pipelines, particularly in Central Asia and the Black Sea, should at times make it more difficult to export the resources from this part of the world;
- The costs of extraction of oil and gas should be increasingly high because of an extension of offshore deep-water drilling and the increasing use of unconventional resources such as bituminous shale and tar sands;
- The temptation by certain countries that possess energy resources to raise prices to cope with their internal political and social needs;
- The aspiration of populations in developing countries to adopt the consumption modes and lifestyles of developed, more *energy-hungry* countries, will contribute to the isolation of the poorest countries that do not have the means to satisfy their own energy needs;
- The increased number of extreme climate phenomena (storms, hurricanes) could affect the exploitation of reserves by destroying the infrastructures[1] and/or by disrupting offshore and coastal production (refining, liquefaction, and storage capacities), in particular in the Gulf of Mexico, East Asia, and the coasts of the Indian Ocean that are most subject to monsoons;
- The disappearance of excess fossil resource production capacities that were used to cope with occasional sharp increases in worldwide consumption will lead to a fear of shortages that will generate potentially violent economic and political tensions in cases of local or regional epiphenomena (geopolitical, natural or financial);
- Insufficient investment in infrastructure, favoured by energy-related nationalism (reserves granted in priority to national companies and increasing state intervention), may lead to supply problems in certain countries, particularly developing ones.

In this context, secure access to energy resource production zones, particularly in the Middle East and Africa, and the securing of transport (sea routes, straits, particularly Ormuz, Bab-el-Mandeb and Malacca), and oil pipelines, most notably in Central Asia, Russia, and Iran) will become increasingly crucial strategic issues for the dependent countries, starting with France (where 99% of the oil consumed is supplied via sea routes).

1- For example, around 100 million barrels were lost in the USA to hurricanes Katrina and Rita in 2005.

FOCUS

Raw materials, an additional source of dependence: case of the EU

Because of a marked concentration of resources, particularly fossil fuels, and the increase in consumption, the dependence of emerging and developed countries should increase. It is increasingly the focus of defence strategies in a growing number of countries.

The European Union in particular will be increasingly dependent on external sources to satisfy its raw material needs. Its external energy dependence is expected to rise from its current level of 50%, to 70% in 2030. By 2025, it is expected to import 90% of its oil and 80% of its gas. The diversification of energy sources will not prevent the continuation of a long-term dependence on Russian gas, which should account for almost 60% of its imports in 2030, whilst Russia should preserve a near-monopoly on the transit from the Caspian Sea and Central Asia towards Europe.

With the drying up of the North Sea resources, to supply its oil requirements, Europe will need to go even more often to OPEC, especially the Middle Eastern countries and Algeria, as well as the Gulf of Guinea and Russia. Nevertheless, the proportion of oil in energy consumption should fall, whilst the trends concerning the demand for gas and coal—rising for gas and falling for coal—could be reversed between 2020 and 2030.

In this context, the gradual implementation of a European energy policy will be essential in order to secure the supplies. Europe must concentrate its efforts along four priority lines: diversifying its energy sources and supply channels, setting up partnerships with suppliers, improving the interconnection of energy networks, reinforcing R&D and energy efficiency policies.

Environmental concerns and the desire to limit the EU's energy dependence were converging in favour of reopening the debate on the nuclear option, but the Fukushima disaster might impede that process. Although estimates predicted a 3% drop between 2000 and 2030, this drop could be even bigger as some countries have announced that they will phase out nuclear power (Germany) while others have put current projects on hold (Italy, Switzerland).

World economic overheating or geopolitical tensions could threaten the strategic supply of rare metals, which are essential for the European defence industry. The EU is therefore currently pushing for the creation of a European policy and strategy concerning critical materials [1].

1- Following the publication, in November 2008, of the Raw Materials Initiative, the European Commission requested an expert report on highly critical raw materials in 2010. The report proposes a number of measures aimed at establishing a global strategy.

European Energy Programme for Recovery (EEPR):

- Pipelines
- Cross-border interconnectors
- A Slovakia-Hungary interconnector (Velký Krtíš-Vecsés)
- B Gas transmission system in Slovenia between the Austrian border and Ljubljana (excluding the Rogatec-Kidricevo section)
- C Bulgaria-Greece interconnector (Stara Zagora-Dimitrovgrad-Komotini)
- D Romania-Hungary gas interconnector
- E Expansion of gas storage capacity in the Czech hub
- F Slovakia-Poland interconnector
- G Hungary-Croatia interconnector
- H Bulgaria-Romania interconnector
- I Reinforcement of French gas network on the Africa-Spain-France axis
- J Gas interconnection Western Axis Larrau Branch

- Countries with infrastructure and equipment allowing reverse gas flow in the event of short-term supply disruption
- Other main planned gas import infrastructure
- LNG terminal (Świnoujście)
- Current main gas import infrastructure

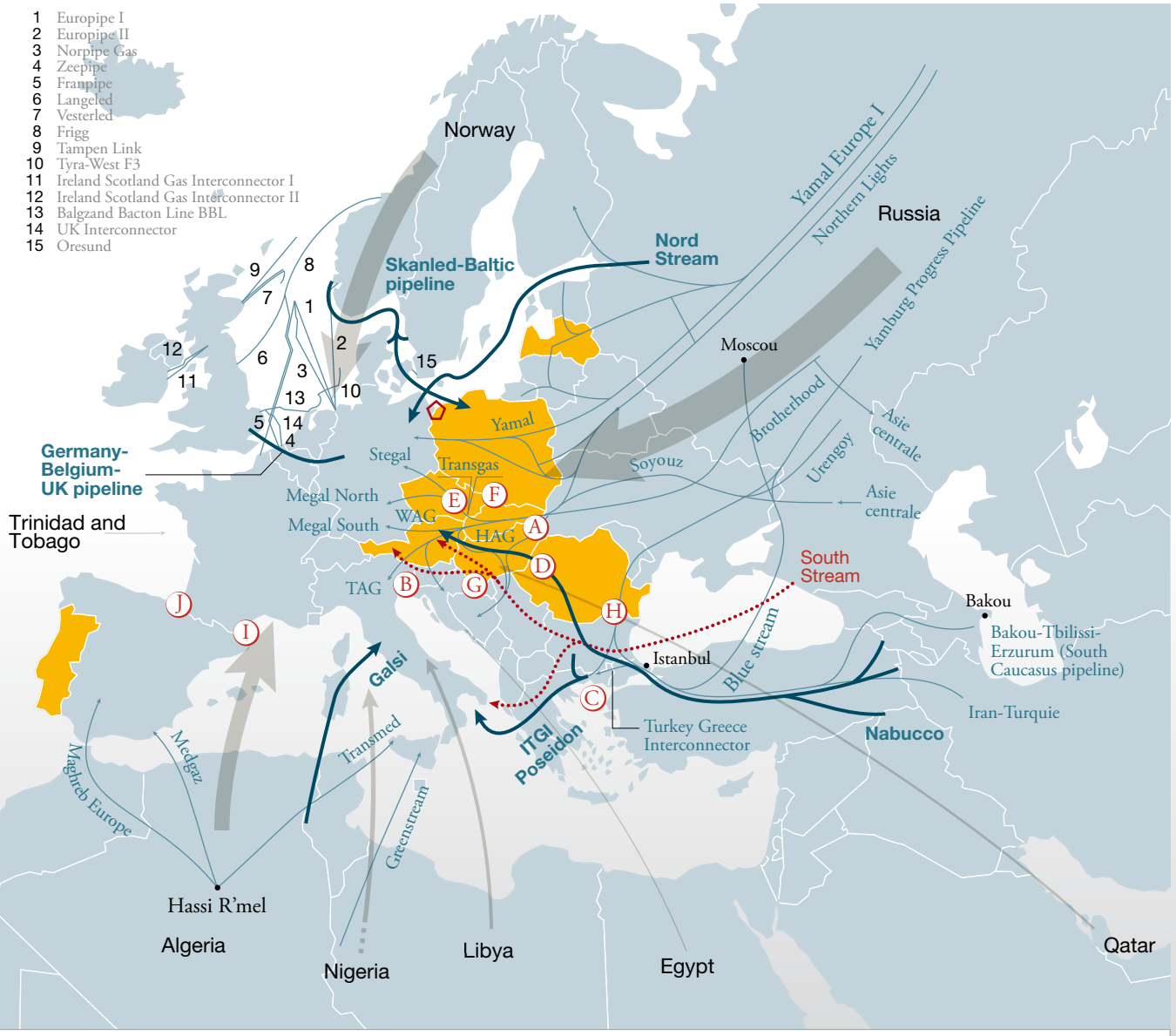
Main suppliers of gas to the EU by source country, 2007 (%)

- 31 (Russia)
- 20 (Norway)
- 13 (Algeria)
- 4 (Nigeria)
- 1 (Trin. and Tob.)

Other sources of imports: 26%

	Transit through:
Algeria	Pipe-line+LNG
Egypt	LNG
Libya	LNG
Nigeria	LNG
Norway	Pipe-line
Qatar	LNG
Russia	Pipe-line
Trin. and Tobago	LNG

1 Europipe I
2 Europipe II
3 Norpipe Gas
4 Zeepipe
5 Franpipe
6 Langeled
7 Vesterled
8 Frigg
9 Tampen Link
10 Tyra-West F3
11 Ireland Scotland Gas Interconnector I
12 Ireland Scotland Gas Interconnector II
13 Balgzand Bacton Line BBL
14 UK Interconnector
15 Oresund



Main EU gas supply infrastructure, 2010

Sources:

Import sources: http://epp.eurostat.ec.europa.eu/portal/page/portal/energy/data/database

Existing pipelines: Nies, Susanne. *Oil and Gas Delivery to Europe: an Overview of Existing and Planned Infrastructures*. Paris: Ifri, 2008. 149 p.

European Energy Programme for Recovery: Regulation (EC) No 663/2009 of the European Parliament and of the Council of 13 July 2009 establishing a programme to aid economic recovery by granting Community financial assistance to projects in the energy field. Brussels: *Official Journal of the European Union*, L200/31, 31.07.2009, 13 p.

Verena Seiler and Map Department of Sciences Po, 2010

3.4 – Non-energy mineral resources

Like hydrocarbons, metals are ubiquitous in industrial and electronic products. They are essential components of everyday objects (television sets, computers, mobile phones, etc.), and demand for them is increasing.

On a world scale, it is expected that in 20 years' time, the existing reserves of non-energy mineral resources will not meet global industrial demand.

STEP CHANGE

However, at the rate of worldwide iron processing in 2009, the depletion of the known reserves could occur in 30 years*, whilst the disappearance of many other metals that are less abundant than iron is predicted to occur in the 21st century.

* US Department of the Interior/US Geological Survey, Mineral Commodities Summary 2010.

Although mining resources are highly concentrated—the countries with the largest deposits are Australia, Brazil, Russia, South Africa and the USA—the risks of depletion will persist because of the strong growth in demand, driven by technological developments (increased presence of rare metals in equipment, particularly electronics), insufficient investment in mines, and increasing control of the export sources of certain minerals by key players in the market, such as Russia and China.

Emerging countries should continue to develop ambitious policies for access to or control of resources because certain players holding a near-monopoly are likely to use them as economic or political weapons. An example of this is China, which currently controls 97% of the world's production of rare earth metals, which are strategic resources for new technologies.

FOCUS

Critical materials and rare earth metals: a strategic weapon

According to European Union projections, the demand for certain critical raw materials[1], including rare earth metals, could more than treble by 2030 compared to 2006 figures[2], under the combined effects of growth in developing countries and the rise of emerging technologies, such as cutting-edge technologies and so-called green technologies (production of low-energy light bulbs, hybrid car engines, and permanent-magnet wind generators).

Used in highly strategic sectors, particularly defence (missiles, lasers, optics, etc.), these materials are the source of increasingly exacerbated competition, especially since they are concentrated in a small number of countries and likely to be used as an economic and strategic weapon. Thus, with approximately one-third of the known world reserves, China dominates the rare earth metals market, with production representing 97% of the world total.

This near-monopoly situation is a source of growing concern in consumer countries, since China decided in 2005 to restrict access to its rare earth metals. This situation is not likely to improve, given that Beijing wishes to build up a strategic stock in response to growing demand in its internal market.

The consumer countries, and Europe in particular, should find a solution (re-opening mines in certain countries, resuming search operations, etc.) to the dependence equation (greater needs and a limited resource on the road to depletion). Scarcity management, as with other natural resources such as water, oil, and arable land, calls for an inexorable change in our modes of consumption, production, etc.

1- Critical materials are materials that are almost entirely imported, are not recycled in large quantities and for which there are few alternatives. In the defence sector, rare earth metals are used in many highly strategic applications (missiles, lasers, optics, etc.).

2- See *Critical Raw Materials for the EU, Report of the Ad-hoc Working Group on Defining Critical Raw Materials*, June 2010. In addition, the Industrial Minerals Company of Australia forecasts that global demand for rare earth metals will rise to 205,000 tonnes a year in 2013.

CONSEQUENCES FOR DEFENCE

A change in the strategic environment

defence and the armed forces must also face these challenges. A more restricted environment caused by scarcity will create new asymmetries: the positions of the states concerning the exploitation of natural resources or the protection of the environment and biodiversity will be more and more directly connected to their power interests.

Whilst the climate, the economy, and strategic control of resources are now at the centre of the new defence doctrines of such diverse states as the USA, China, and India, this trend will grow and spread. To reduce the uncertainties related to scarcity, states will implement access, control, and conservation strategies for what they consider to be essential strategic resources: oil, gas, uranium, fresh water, foodstuffs, and strategic minerals.

In view of the increased volume of exchanges and the interdependence this generates, our armed forces will need to take the following steps in order to defend our national interests and implement our defence agreements:

- Contribute to the stability of regions where the resources under the most pressure are produced. This stability will be achieved through visibility, possibly presence, and prevention;
- Guarantee access to energy and raw materials whose sources are most often located in unstable regions, These missions will require a prepositioning capability, with security patrols along at-risk zones (deltas, gas pipelines, oil pipelines, fishing zones, etc.), security missions and low-grade interventions, and the capability to scale up when confronted with hostile parties;
- Secure transportation channels as and when required: gas pipelines, oil pipelines, and maritime channels.

Conditions of engagement, deployment, and operation of more constrained armies

The armed forces could be called upon to intervene in conflicts related to the control of key natural resources in the context of restoring peace or protecting civilians. The legitimacy of these interventions could be questioned very quickly, especially if there is any ground intervention. Resource conflicts will involve the armed forces right across the intervention spectrum: stabilisation and security actions, with build-up capability to deal with higher-intensity combat. Military deployment must increasingly provide for extreme climatic risks and their consequences.

The tightening of environmental standards will affect the operation of armies, which will be obliged to implement a sustainable development approach, to a certain extent. The special status of defence could be weakened by this tightening of environmental standards. The military tool will therefore have to adapt, particularly due to the risks of the protection of nature reserves likely to lead to a ban on some military operations[1].

An effort must be made to apply foresight to the planning of arms programmes in order to prepare equipment that complies with environmental standards. The armed forces must improve their energy efficiency and identify possible alternatives to hydrocarbon fuels.

The increased number of extreme climate phenomena should lead to an increase in natural and human disasters. In addition to civilian security services, which will have to take better account of the risks posed by climate change, armed forces will be called upon more often to assist in, for example, establishing partnerships to help states manage internal population movements as well as increasingly frequent health crises.

The navy should also be regularly called on for missions aimed at prevention and the fight against marine pollution, as well as the protection of fishing resources in the context of controlling fishing activities.

The increased risk of natural disasters and the demands placed on armed forces could generate debate concerning the function of the armed forces, their interventional capability (at a time when interventions are more and more frequent in the context of humanitarian missions and crisis management), or concerning the relevance of the concept of a European gendarmerie force or a European civil protection force.

1- Marine protection zones, limitations in the use of firing ranges (nesting of birds), restrictions on flyovers by fighter aircraft to limit noise pollution.

Water from the March 2011 tsunami engulfing the coast near Minamisoma, in Japan's Fukushima Prefecture

SADATSUGU TOMIZAWA/AFP IMAGEFORUM