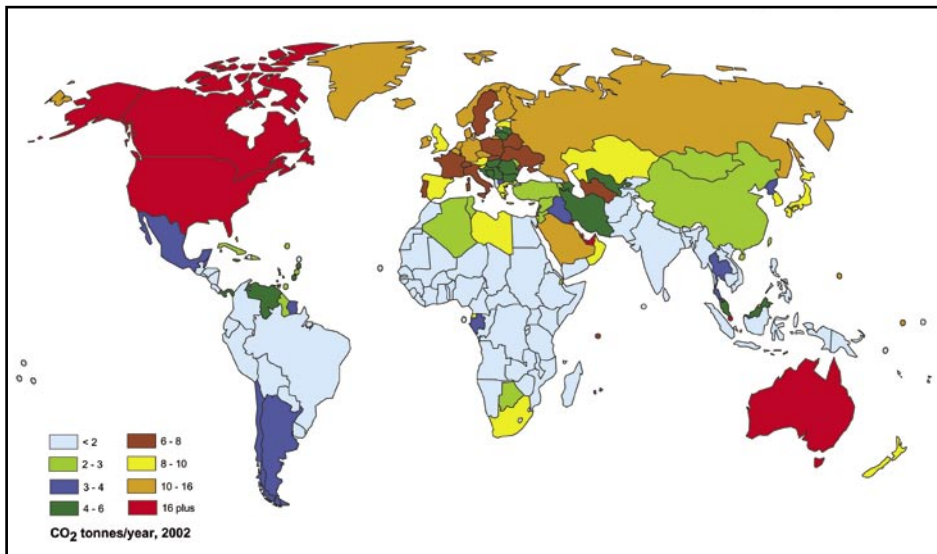


# ENERGIES

## savings for the Earth

It's hard to feed oneself, keep warm, get around, build or produce without energy. A source of innovation and progress, energy is one of the keys to development. Energy consumption, which has increased thirteen-fold in a century, reflects the vitality of a country's economy and is one of the most reliable indicators of growth. In developing countries, where work stops at sunset, health, social and economic development are hard to imagine. This is the reality of life for one in three people around the world, because of the uneven distribution of resources. A quarter of the global population consumes three-quarters of the energy produced. Fossil fuels – coal, oil and gas – still account for almost 80% of the energy used worldwide. These finite resources are also responsible for the latest massive oil spills, problems of deforestation and soil erosion and, more importantly, air pollution. On a global scale, fossil fuels generate almost 60% of carbon dioxide emissions, the most widespread of the greenhouse gases. Scientists and ecologists alike have repeatedly sounded the alarm to alert political and economic decision-makers to the problem of global warming. Their voice was heard for the first time in 1992 at the Earth Summit in Rio, which was formally acknowledged in 1997 by the Kyoto Protocol to reduce greenhouse gas emissions. Since then, multiple initiatives have been taken to develop new and sustainable energies using the sun, wind, water, biomass or gas. The way ahead.

### CO<sub>2</sub> EMISSIONS PER CAPITA FROM THE CONSUMPTION OF FOSSIL FUELS AND THE FLARING OF NATURAL GAS



Source: UN DESA/DSD, US Energy Information Administration

Over 40 years, carbon dioxide (CO<sub>2</sub>) emissions from the burning of fossil fuels have more than doubled. Developed countries account for the majority of these emissions. Australia and North America are the world's two biggest consumers of fossil fuels. With almost a quarter of carbon dioxide emissions, the United States release the equivalent of total emissions by the 78 poorest countries (including India and China).

→ **1/4**  
of energy in the world is used for transport

→ **442**  
active nuclear reactors produce 17% of the world's electricity



→ Intensive crop and vegetable production using modern agricultural techniques requires

**6 to 10**  
times more energy than with sustainable farming methods



### ENERGY CONSUMPTION

Each individual consumes an average 1.5 oet (oil equivalent tonnes) per year. There are however substantial differences between world regions.

American	8 oet/year
European	4 oet/year
Japanese	3 oet/year
Indian	0.4 oet/year

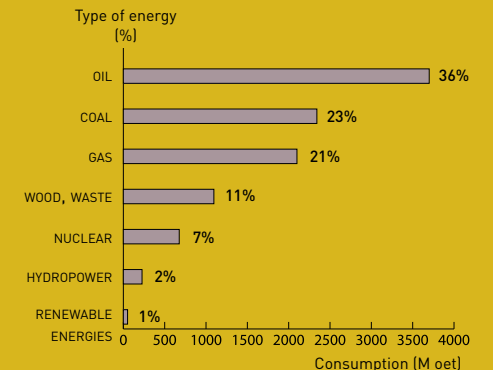


### COAL

Coal was a driving force behind the industrial revolution in developed countries. Today it is the energy behind two-fifths of the world's electricity. While coal continues to provide almost a quarter of the planet's energy, in most countries in the North, its use is becoming less widespread. Especially polluting, coal alone is responsible for half the CO<sub>2</sub> emissions of the electricity sector. For an identical amount of energy produced, it generates 70% more carbon dioxide than natural gas.

[www.fao.org/docrep/x5328e/x5328e00.htm](http://www.fao.org/docrep/x5328e/x5328e00.htm)  
[www.cordis.lu/ecsc-coal](http://www.cordis.lu/ecsc-coal)  
[www.wci-coal.com/web/bl\\_content.php?menu\\_id=0.0](http://www.wci-coal.com/web/bl_content.php?menu_id=0.0)

### WORLD ENERGY SOURCES





↓ Global warming is evident in the polar regions in the form of retreating glaciers and meltdown (reduction of the ice cap). In 2002 an iceberg covering 3,250 sq. km. –one and a half times the size of Luxembourg- detached itself from the Antarctic peninsula.



→ **50 %**  
the increase in greenhouse gas emissions over a century



↓ Illegal degassing and debalasting operations at sea are the main causes of hydrocarbon marine pollution. The damage they provoke represents several dozen oil slicks per year. Shipwrecked oil tankers are, to a lesser extent, also to blame for the world's polluted waters. The Atlantic Empress set a sorry record when in 1979 she spilled some 280,000 tonnes of crude oil off the Brazilian coastline. More recently, the Erika and the Prestige respectively leaked 20,000 and 30,000 tonnes of oil off the French and Spanish coasts.

AIR-CONDITIONING, WHICH CONSUMES LARGE AMOUNTS OF ENERGY, COOLS INTERIORS BUT WARMS THE ATMOSPHERE AND CONTRIBUTES TO INCREASED LEVELS OF GREENHOUSE GASES.



### DIMINISHING RESERVES

Since the two oil crises of 1973 and 1979, governments have woken up to the need to diversify sources of energy. Non-renewable sources (oil, gas, coal and uranium) currently account for virtually 90% of energy consumption. Based on current rates of use and known reserves, the International Energy Agency (IEA) forecasts that the world's oil supply will have completely run out in 40 years, natural gas in 60 years, and coal in 200 years.  
[www.iea.org](http://www.iea.org)

ACCORDING TO THE WORLD ENERGY COUNCIL, ENERGY CONSUMPTION MUST MORE THAN DOUBLE BY 2050 TO KEEP PACE WITH THE EXPANDING NEEDS OF THE WORLD'S POPULATION. OVER THE SAME PERIOD, OIL RESERVES WILL HAVE BEEN VIRTUALLY DEPLETED.



## IMPACTS

### Greenhouse gases and climate change

Human activities have largely contributed to the increase in greenhouse gases (GHG). At a stable concentration, these gases sustain life by regulating the temperature on Earth. Today though, we produce twice as much carbon as the biosphere can recycle. Road transport ranks as one of the most energy-hungry sectors. It burns fossil fuels that release 6 billion tonnes of carbon dioxide (CO<sub>2</sub>) into the atmosphere each year. As a result, the temperature on Earth is rising. An unprecedented phenomenon, the temperature of the Earth's surface, which had not varied by more than 4°C in 400,000 years, climbed 0.6°C by 2100. According to the Intergovernmental Panel on Climate Change (IPCC), it could increase by a further 1.4 to 5.6°C by 2100. All over the world, the climate is disrupted, the seasons are out of synch, and natural balance is under threat. Deserts are advancing, glaciers are shrinking, and sea level is rising. The cycles and territories of plants and animals have been altered. Meanwhile the intensity and frequency of extreme weather phenomena –storms, flooding, drought– are increasing.

[www.greenfacts.org/studies/climate\\_change/index.htm](http://www.greenfacts.org/studies/climate_change/index.htm)  
[www.eia.doe.gov/oiaf/1605/ggcebro/chapter1.html](http://www.eia.doe.gov/oiaf/1605/ggcebro/chapter1.html)  
[www.icbe.com/emissions/calculate.asp](http://www.icbe.com/emissions/calculate.asp)  
[www.ec.gc.ca/climate/overview-e.html](http://www.ec.gc.ca/climate/overview-e.html)

CARBON DIOXIDE EMISSIONS FROM FOSSIL FUELS HAVE MORE THAN DOUBLED SINCE 1965.

### Air pollution

Because they have no access to modern energy, developing regions often make use of local sources. Wood, coal and dung are used to warm houses and for cooking. Collecting these resources is time-consuming, fastidious and destructive, while burning them is especially dangerous and polluting. The toxic fumes released by combinations of biomass, coal and plastic waste kill over 2 million people each year.

[www.who.int/docstore/peh/Vegetation\\_fires/vegetation\\_fires.htm](http://www.who.int/docstore/peh/Vegetation_fires/vegetation_fires.htm)

### Acid rain

Several tonnes of polluting substances are released into the atmosphere each day. Vehicle exhaust fumes and industry are among the two biggest sources. This chemical cocktail which contains harmful substances –nitrogen oxide (NO<sub>x</sub>) and sulphur dioxide (SO<sub>2</sub>)– is carried thousands of kilometres by clouds before returning to the four corners of the globe as acid rain. This caused severe damage to European forests in the nineteen-eighties. Despite current attempts to eradicate this phenomenon, in Poland 3 out of 5 trees are believed to have been damaged by the combined impact of acid rain and drought.

[www.ec.gc.ca/acidrain](http://www.ec.gc.ca/acidrain)  
[www.policyalmanac.org/environment/archive/acid\\_rain.shtml](http://www.policyalmanac.org/environment/archive/acid_rain.shtml)

### Disrupted landscapes and ecosystems

Dams supply low-cost hydroelectric power. They account for 19% of total world electricity production, and provide vast expanses of water for farmland irrigation. However, such infrastructures can substantially modify the landscape, displacing thousands of people, damaging forests and natural habitats, and impacting the diversity of aquatic species. Insurmountable obstacles for aquatic animals, dams also interfere with fish migration during reproduction, and diminish fishing opportunities downstream. Over recent years, elevator-type devices have been installed at dams to enable fish to freely ascend and descend the waters and reproduce. The Three Gorges dam in China –the biggest in the world– is expected to swallow up 13 towns and 116 rural hamlets and displace 724,000 inhabitants, most of them to new towns.

[www.dams.org](http://www.dams.org)



↓ Insignificant in size, batteries contain highly toxic heavy metals that infiltrate the food chain and pollute land and water for decades. Manufacturing and recycling batteries necessitates far more energy than they produce when being used.

# ON THE RIGHT TRACK

## → Finance for renewable energy projects

Only renewable sources –solar power, water, wind, biomass and geothermal– can meet the energy needs of the world's population without jeopardizing its natural resources. With backing from the United Nations Development Programme (UNDP), UNEP, and the World Bank, the Global Environment Facility (GEF) supports and funds projects related to these non-polluting energies. In India, the GEF helped finance the production of 41 Mega Watts from wind turbines and 45 MW from small hydroelectric plants. In China, Peru and Ghana, it has contributed to the widespread deployment of solar energy. With each project, the GEF works alongside energy suppliers to help them, through a compensation scheme, make the transition from conventional to renewable energies.

[www.gefweb.org](http://www.gefweb.org)  
[www.agores.org](http://www.agores.org)  
[http://europa.eu.int/comm/energy/res/index\\_en.htm](http://europa.eu.int/comm/energy/res/index_en.htm)  
[www.green-e.org](http://www.green-e.org)



↓ The solar cooker, increasingly in use in developing countries, concentrates the sun's rays to cook food. An economical system, it functions both as an oven and a hotplate.  
[www.solarcooking.org](http://www.solarcooking.org)

## → Active citizens

The vast majority of investment in renewable energies comes from commercial concerns. In Northern Europe, however, some projects are financed by groups of citizens, with Denmark and Germany leading the field for this type of initiative. In 2002 in Denmark, 15% of wind energy consumption was fulfilled by local schemes. Meanwhile, some 340,000 German citizens have put around €12 billion into alternative projects. These include a biomass energy investment fund. Entirely devoted to the production of biogas, this fund provides opportunities to make ecological investments.

[www.cler.org/predac/wp1](http://www.cler.org/predac/wp1)  
[www.renewables2004.de/pdf/tbp/TBP05-financing.pdf](http://www.renewables2004.de/pdf/tbp/TBP05-financing.pdf)



## → Low energy lighting

Low energy light bulbs, also known as energy-saving bulbs, cost a little more to buy but use 80% less electricity than a conventional filament bulb and 25 to 50 times less than a halogen light. They are recommended for rooms where lights stay on for long periods (bedroom, living room, kitchen) and last 6 to 8 times longer than a traditional bulb.

[www.homeenergy.org/consumerinfo/lighting](http://www.homeenergy.org/consumerinfo/lighting)



→ Discreetly blending in with roof tiles, solar panels offer numerous advantages. [www.ata.org.au/basics/bassolar.htm](http://www.ata.org.au/basics/bassolar.htm)

## → New fuels

An additional 11,000 cars take to China's roads each day. Worldwide, almost 41 million vehicles rolled off the production lines in 2003: five times more than in 1950. Diesel, petrol and super are still the most widely-used fuels and are largely responsible for atmospheric pollution. Alternatives to traditional energy sources are however being developed around the globe. Biofuels, made from esters, ethanol or plant oils (rapeseed, sunflower, copra, palm, soya, peanut) are finding their first real applications, primarily in the public sector. Furthermore, European automakers have pledged to reduce average CO<sub>2</sub> emissions for new cars to 140 g/km by 2007 (which is 30 g less than today).

[www.nps.gov/renew/transportation.htm](http://www.nps.gov/renew/transportation.htm)



↓ Biomass energy, or the transformation of organic matter into energy, provides farming with new outlets while transforming waste into fuel for the transport sector.

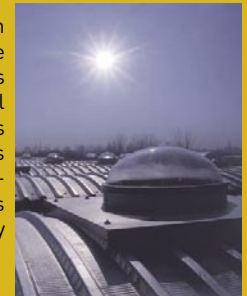
**THE TALLEST WIND TURBINE IN THE WORLD STANDS AT 180 M. IT WAS BUILT IN MARCH 2004 IN EMDEN (GERMANY).**

**OVER A MILLION HOUSEHOLDS WORLDWIDE FUNCTION ON SOLAR ENERGY.**

## CHANNEL LIGHT

Channelling light from its natural source to then diffuse it inside an old or new building is a simple way to save energy. The system, which comprises a dome on the roof of the building and an "optical funnel" made up of micro-prisms, concentrates light irrespective of the angle of the ray. This light is then channelled along an aluminium-lined pipe, up to 20 m in length. Up to 80% of this light is released via an optical diffuser into any room and at any time of day or night.

[www.solarspot.it](http://www.solarspot.it)



## PUTTING IDEAS INTO PRACTICE

Industry is not the only polluter. Transport, homes and offices create their share of greenhouse gases too. Air-conditioning, excessive heating and energy-hungry appliances are the main culprits.

### Individuals

→ INSULATE BUILDINGS (SEE "HOUSING") → INSTALL EFFICIENT AND APPROPRIATE THERMOSTATS → AVOID SYSTEMATICALLY SWITCHING ON THE AIR-CONDITIONING → WHENEVER POSSIBLE, USE RENEWABLE ENERGIES → SWITCH OFF LIGHTS THAT AREN'T NEEDED → REPLACE FILAMENT AND HALOGEN BULBS WITH ENERGY-SAVING ONES IN THE MAIN ROOMS OF THE HOUSE → DON'T LEAVE APPLIANCES ON STANDBY → FIT CERTAIN APPLIANCES WITH A TIMER → ADAPT LAMPS' WATTAGE TO ACTUAL NEEDS → USE ALTERNATIVE TRANSPORT (SEE "MOBILITY") → CHOOSE ENERGY-SAVING APPLIANCES, KEEP THEM IN GOOD WORKING ORDER AND USE THEM WISELY

### Companies

→ OPTIMIZE HEATING AND LIGHTING IN OFFICES → PREFER NATURAL LIGHT, ENERGY-SAVING BULBS AND AUTOMATIC LIGHT SWITCHES → ENCOURAGE STAFF TO FIND WAYS TO REDUCE ENERGY COSTS → SET UP A COMPANY TRANSPORT PLAN FOR STAFF (SEE "MOBILITY")

### Local authorities

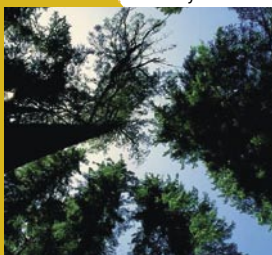
→ ENCOURAGE BIOCLIMATIC ARCHITECTURE: INSULATION, ENERGY MANAGEMENT (SEE "HOUSING") → OPTIMIZE STREET LIGHTING → OPTIMIZE VEHICLE FLEETS → PROPOSE COLLECTIVE HEATING USING RENEWABLE ENERGIES → GIVE GRANTS TO INDIVIDUAL AND GROUP PROJECTS THAT PROMOTE RENEWABLE ENERGIES → RECYCLE WASTE TO PRODUCE ENERGY

**ESTABLISHED IN 1988 BY THE WORLD METEOROLOGICAL ORGANIZATION AND UNEP, THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE (IPCC) IS TASKED WITH ASSESSING SCIENTIFIC, TECHNICAL AND SOCIO-ECONOMIC INFORMATION RELEVANT TO THE RISKS OF CLIMATE CHANGE CAUSED BY HUMAN ACTIVITIES.**  
[WWW.IPCC.CH](http://www.ipcc.ch)

## CONVENTIONS AND PROTOCOL

After repeated warnings from the scientific community, national governments have gradually grown aware of the serious consequences of climate change. In 1992 in Rio, 153 nations adopted, as a precautionary measure, the Framework Convention on Climate Change. This text marked the first step in an international movement to coordinate actions to "anticipate, prevent or minimize the causes of climate change and mitigate its adverse effects". In 1997 in Kyoto, the signatories, who meet regularly, put forward an application protocol to the convention. The Kyoto Protocol sets out quantitative objectives for the reduction of greenhouse gases by industrialized countries (-8% for the European Union by 2010 versus 1990 emissions). Certain countries have still to ratify the protocol. Were it to come into effect, the Kyoto Protocol would only concern around a third of global greenhouse gas emissions.

<http://unfccc.int>



→ Because plants use photosynthesis to store carbon, forests are regarded as "carbon wells". Oceans also absorb carbon across their entire surface. However, taken together these "wells" absorb just 3 of the 7 gigatonnes of CO<sub>2</sub> that can be directly attributed to human activities.

## FIND OUT MORE

European Commission energy-related useful links:

[http://europa.eu.int/comm/energy/home/link/index\\_en.htm](http://europa.eu.int/comm/energy/home/link/index_en.htm)

Intergovernmental Panel on Climate Change (IPCC): [www.ipcc.ch](http://www.ipcc.ch)

Climate Action Network Europe: [www.climnet.org](http://www.climnet.org)

UNEP activities in sustainable energy:

[www.unep.org/themes/energy](http://www.unep.org/themes/energy)

UNDP energy for sustainable development: [www.undp.org/energy](http://www.undp.org/energy)

Map of global warming: [www.climatehotmap.org](http://www.climatehotmap.org)

Mappemonde des impacts du changement climatique:

[www.climatehotmap.org](http://www.climatehotmap.org)

European Federation of Regional Energy and Environment Agencies:

[www.fedarene.org](http://www.fedarene.org)

Association of European local authorities promoting local sustainable energy policy: [www.energie-cites.org/index.php/lang/en](http://www.energie-cites.org/index.php/lang/en)

European Renewable Energy Council: [www.erec-renewables.org](http://www.erec-renewables.org)

European Renewable Energy Federation: [www.eref-europe.org](http://www.eref-europe.org)

Canadian Association for Renewable Energies: [www.renewables.ca](http://www.renewables.ca)

Energy star: [www.energystar.gov](http://www.energystar.gov)

Light up the world foundation: [www.lightuptheworld.org](http://www.lightuptheworld.org)

Energy efficiency: [www.saveenergy.co.uk](http://www.saveenergy.co.uk)

# RENEWABLE ENERGIES, LOCAL SOLUTIONS

Environmentally-friendly renewable energies, derived from wind, water, the sun and the earth, create neither atmospheric pollution nor lasting waste. They can even be used as a complement to conventional energy, provided they are chosen rationally according to the characteristics of the region in question.

## WIND ENERGY

On the same principle as the windmill, revolving propellers drive a rotor that is connected to a generator which converts mechanical energy to electrical energy. Whether on land (fields, farms, parks, wind farms) or offshore, all winds have the potential to generate energy.

[www.ewea.org](http://www.ewea.org)

## HYDROPOWER

This energy is produced by the movement of falling or flowing water which often, before it can be exploited, must be concentrated. This can be achieved by taking advantage of natural waterfalls or by building a dam to obtain a flow of water at sufficient height and rate to install a hydroelectric plant. The water is channelled towards a turbine that drives an electric generator.

[www.wvic.com/hydro-works.htm](http://www.wvic.com/hydro-works.htm)

<http://hydroelectric.com>

## SOLAR POWER

Solar energy reaches the atmosphere in the form of electromagnetic rays that produce light and heat. Photovoltaic cells convert this energy directly to electricity.

[www.ises.org](http://www.ises.org)

## BIOMASS ENERGY

This consists in the transformation of renewable organic matter (plant or animal) into energy. Biomass energy provides agriculture with new outlets and is a means of recycling waste. Various processes exist for producing heat, electricity or fuel, each of which calls upon a different conversion intermediary such as combustion, pyrolysis or gasification.

[www.vtt.fi/virtual/afbnnet/index.html](http://www.vtt.fi/virtual/afbnnet/index.html)

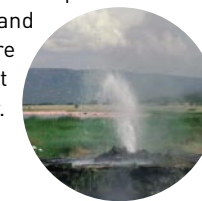
[www.eere.energy.gov/biomass](http://www.eere.energy.gov/biomass)

<http://bioenergy.ornl.gov>

## GEOTHERMAL ENERGY

This energy is produced by recovering heat from underground sources. Two techniques exist to produce energy. In a low-temperature system, cold water is injected deep underground (between 500 and 1,500 m) and recovered as hot water. A high-temperature system recovers very hot water as it spurts out of volcanic zones and converts it to electricity.

<http://geothermal.marin.org/pwrheat.html>



## AT UNEP

### → SEFI: SUSTAINABLE ENERGY FINANCE INITIATIVE

In 2003, UNEP launched SEFI to encourage financiers to consider investment in sustainable energy projects. This partnership with financial institutions promotes opportunities for joint investments, to reduce costs and financial risks, and to benefit from tools, networks and support.

[www.sefi.unep.org](http://www.sefi.unep.org)

[www.unep.tie.org/energy](http://www.unep.tie.org/energy)

