

# *Green and Nuclear*

## *Eternal Enemies or Perfect Match ?*



EFN speaking at  
ENELA in Munich

by Bruno Comby

Director of the Comby institute (IBC)

Founder and President of EFN  
(Environmentalists For Nuclear Energy)





## **Introduction**

### **The life of an environmentalist**

### **Nuclear and Green : eternal enemies?**

### **Information on energy**

### **Climate change**

### **What can we do?**

### **Energy conservation**

### **Renewable energies**

### **Nuclear energy**

### **Waste and reprocessing**

### **Radiation in nature**

### **Energy independence**

### **Tchernobyl Fukushima...**

### **EFN : Presentation and history**

### **Communicating on nuclear energy**

### **Conclusion : perfect match**

# Nuclear and Green : eternal ennemies? Why an environmentalist is in favor of nuclear energy





EFN

# The life of an environmentalist - childhood in nature



France



Gabon



United States



Canada ...



## The life of an independent scientist - Scientific background



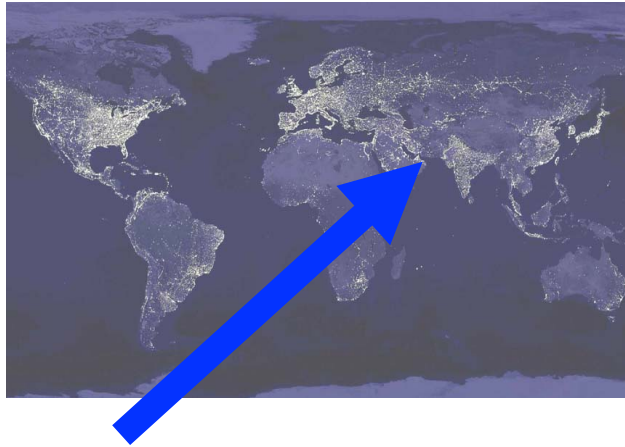
Graduate in nuclear physics (Ecole Polytechnique Paris + National University of Technical Sciences)

My eco-house near Paris :

- Passive and positive energy
- CO2 emissions cut by factor 400



## The life of an independent scientist - Military service



War zone :  
Persian Gulf  
Hormuz strait

Problem :  
Safety of oil tankers

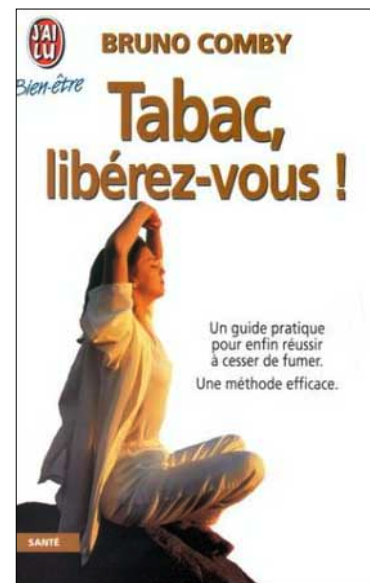
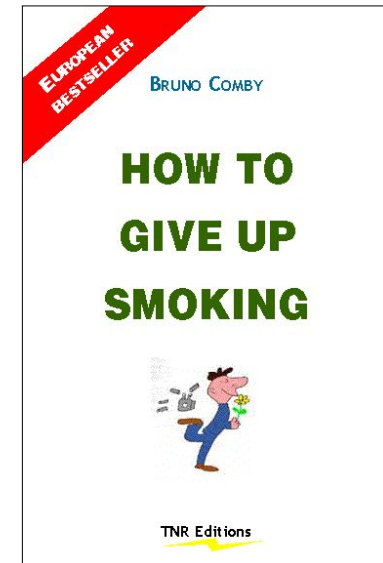
# Bruno Comby - The life of an Environmentalist



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25 years dedicated to pioneer work in fundamental research, publications, and teaching the public about energy, natural health and protection of the environment.

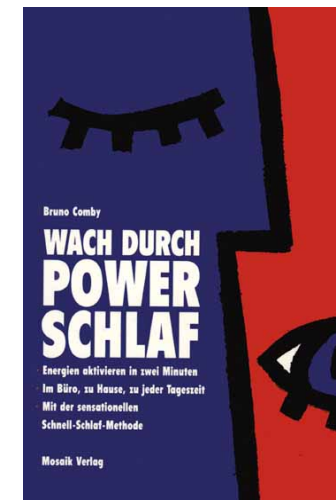
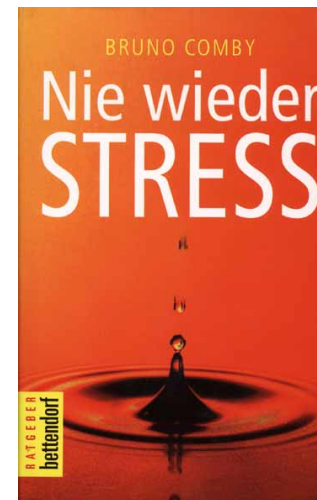
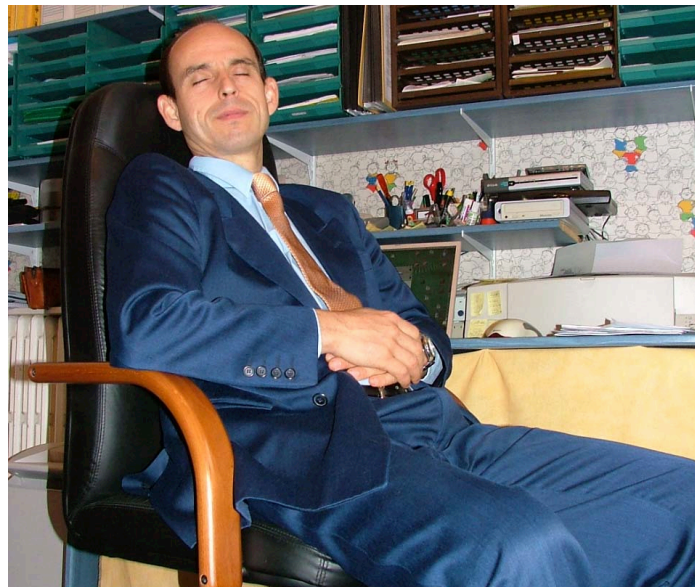
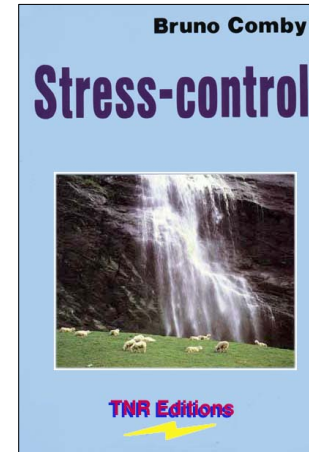
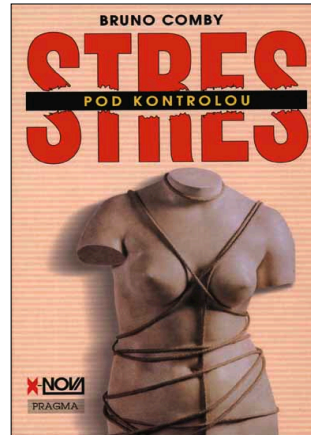
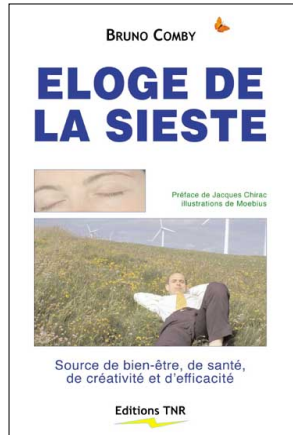
# Bruno Comby - a non smoking pioneer



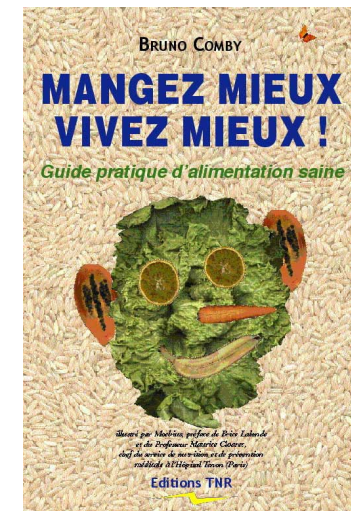
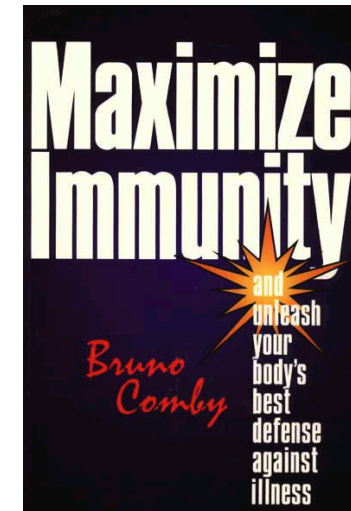


# Natural sleep-natural lifestyle

## Siesta-napping



# Bruno Comby - Research on natural nutrition



# Germinated grains for better nutrition



- Concentrated natural vitamins develop during germination process

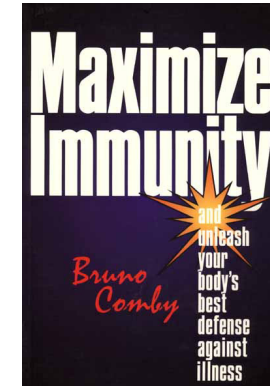


# An ecologist promoting alternative sources of protein

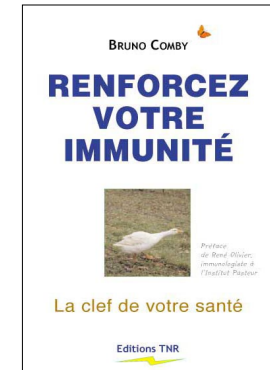
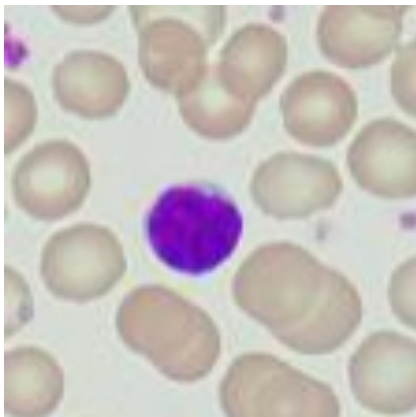




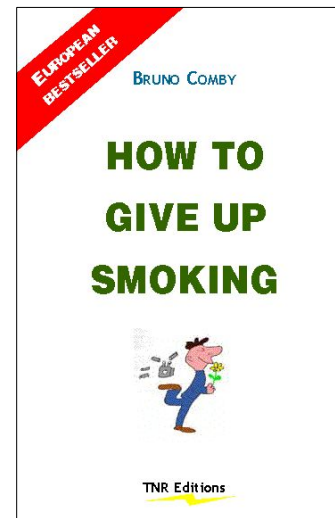
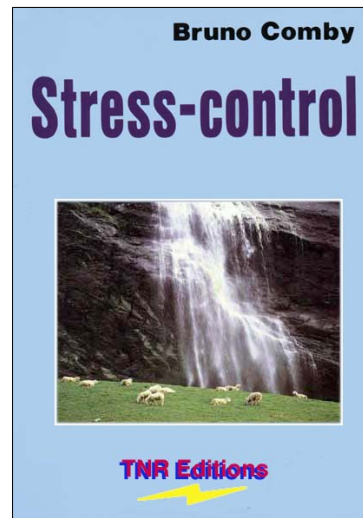
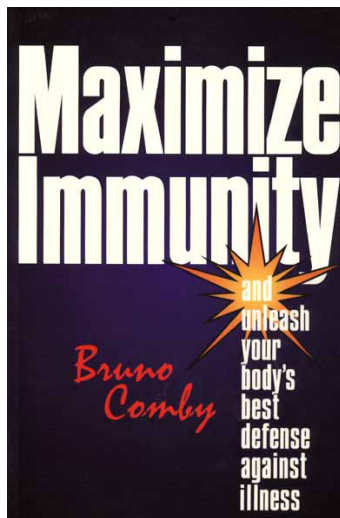
# Research on natural immunity



- With Pr Luc Montagnier



# Bruno Comby - Books on healthy living



10 books published in 15 languages with over 1 million readers  
More than 1500 TV and radio presentations and press articles  
Popular lecturer around the world

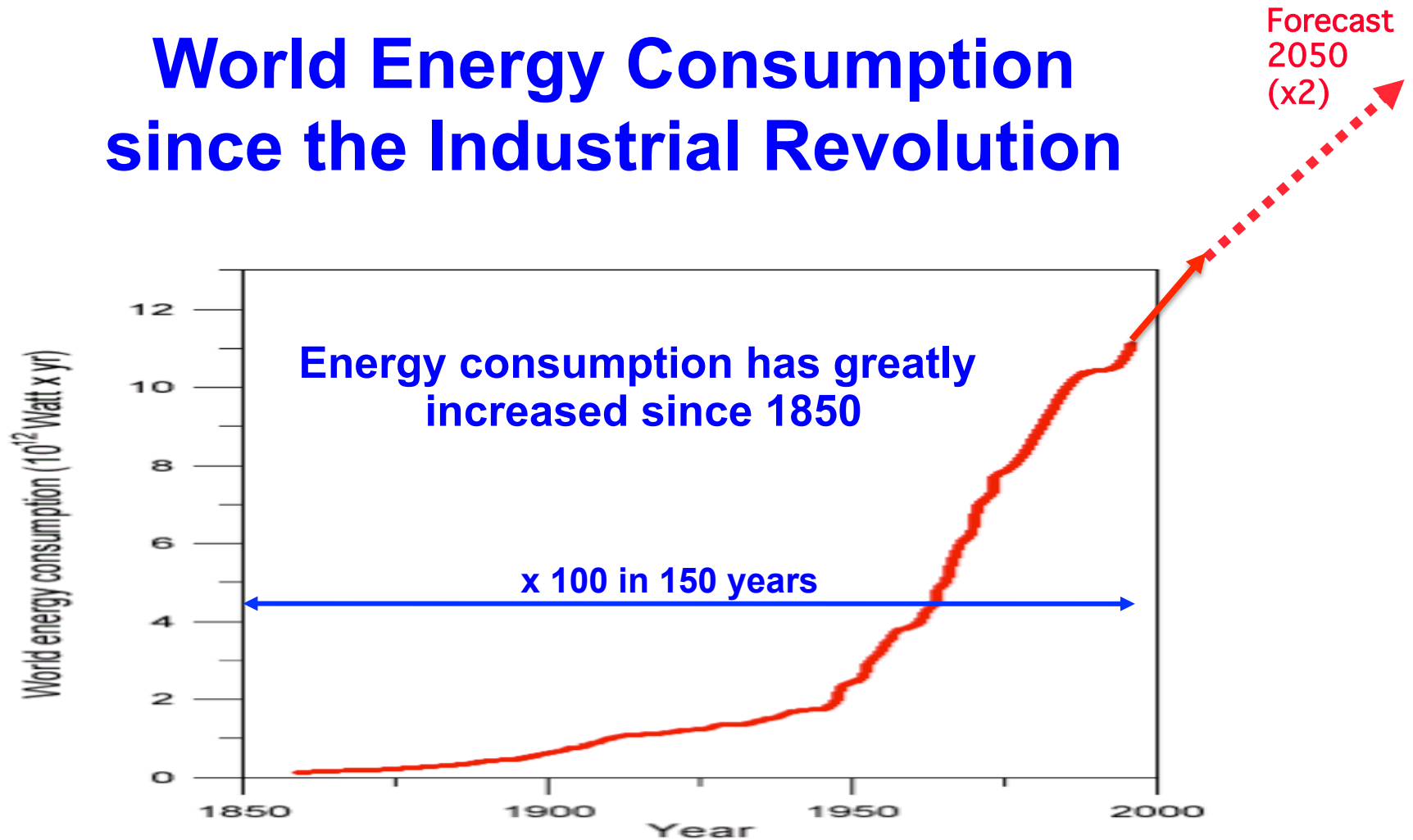
# Photo of the world at night



**Today, 20% of the world's population  
consumes 60% of the energy**

Planet Earth seen at night from outer space (reconstructed image) - © Nasa 2000

# World Energy Consumption since the Industrial Revolution



Today, energy consumption is increasing rapidly in developing countries, and moderately in industrial countries.

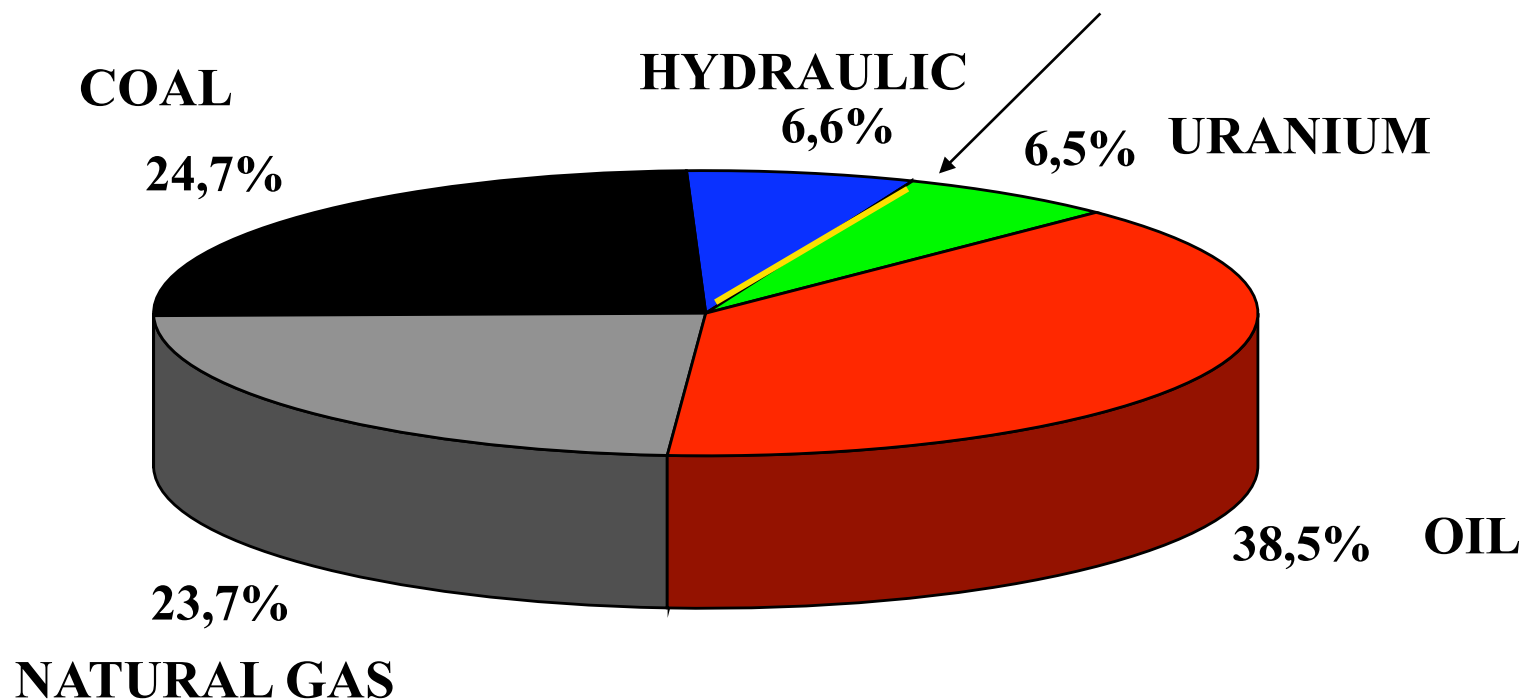


# ENERGY SOURCES

excluding biomass - fire wood (world)

**87% of the energy is fossil (coal, oil, gas) and contributes to the greenhouse effect**

**Wind + geothermal + solar = 1%**



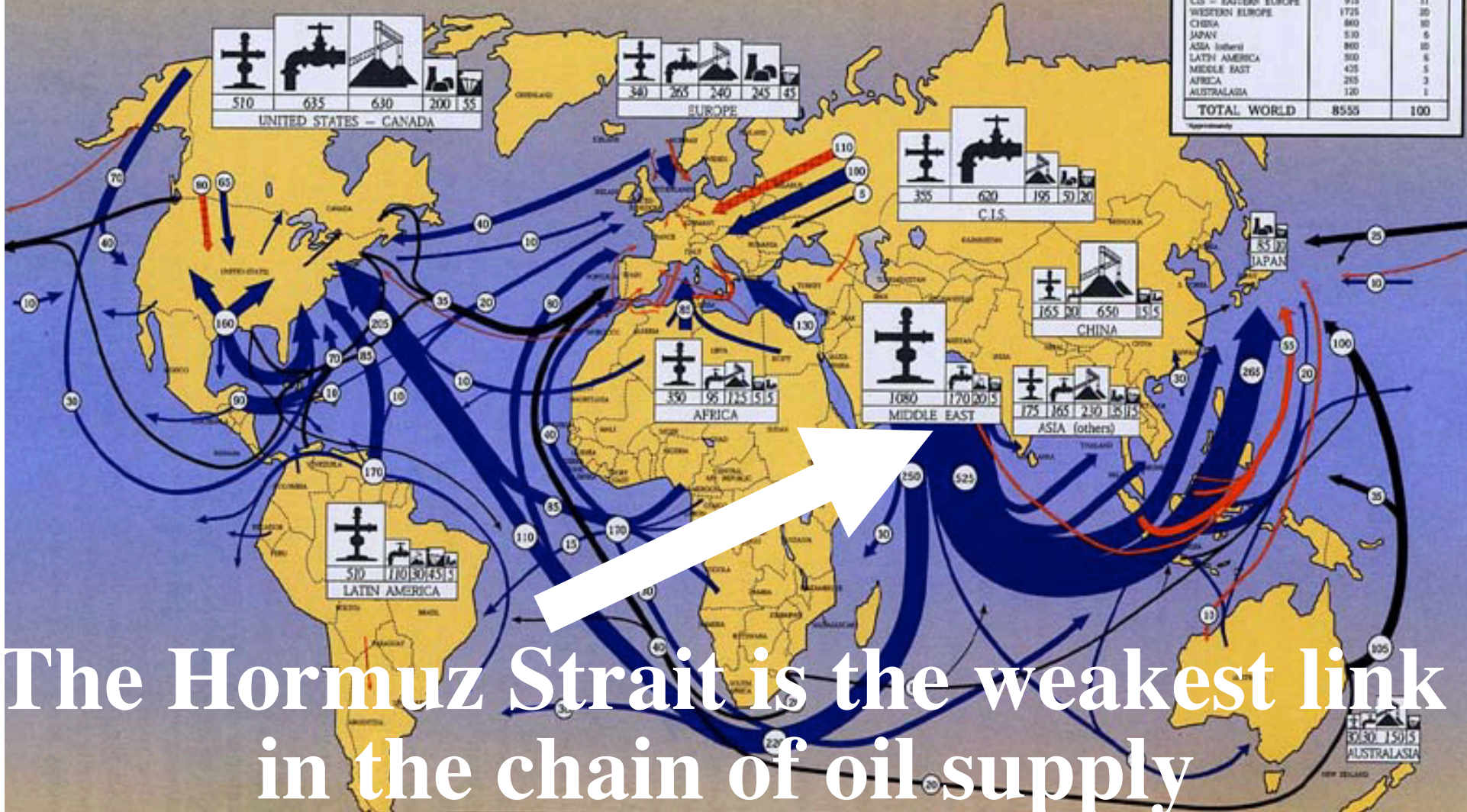
**9,1 Gtoe/yr + biomass  $\sim$  10 Gtoe/yr**

Source : BP 2002

# ENERGY WORLDWIDE

70% of the world's oil supply comes from the Middle East with all its geopolitical implications

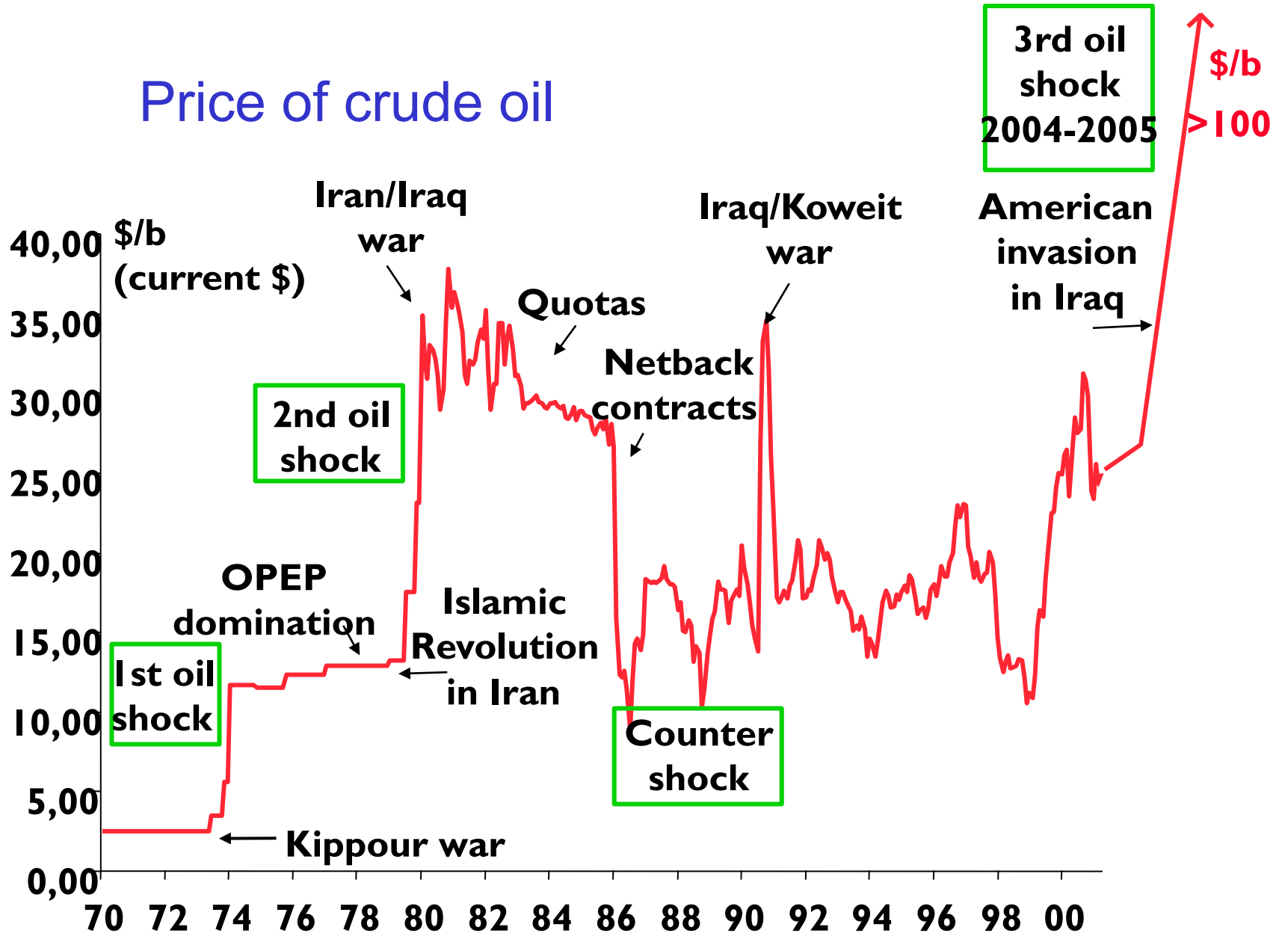
PRIMARY ENERGY CONSUMPTION*		
Area	Consumption (billion tonnes of oil equivalent)	Share (%)
UNITED STATES - CANADA	2365	28
CIS - EASTERN EUROPE	918	11
WESTERN EUROPE	1725	20
CHINA	860	10
JAPAN	510	6
ASIA (others)	860	10
LATH AMERICA	300	4
MIDDLE EAST	425	5
AFRICA	295	3
AUSTRALASIA	120	1
<b>TOTAL WORLD</b>	<b>8555</b>	<b>100</b>



The Hormuz Strait is the weakest link in the chain of oil supply

PRIMARY ENERGY PRODUCTION					TRADE FLOWS WORLDWIDE			
(billion tonnes of oil equivalent)								
					Petroleum		Natural gas	
							Coal	
								Liquefied natural gas

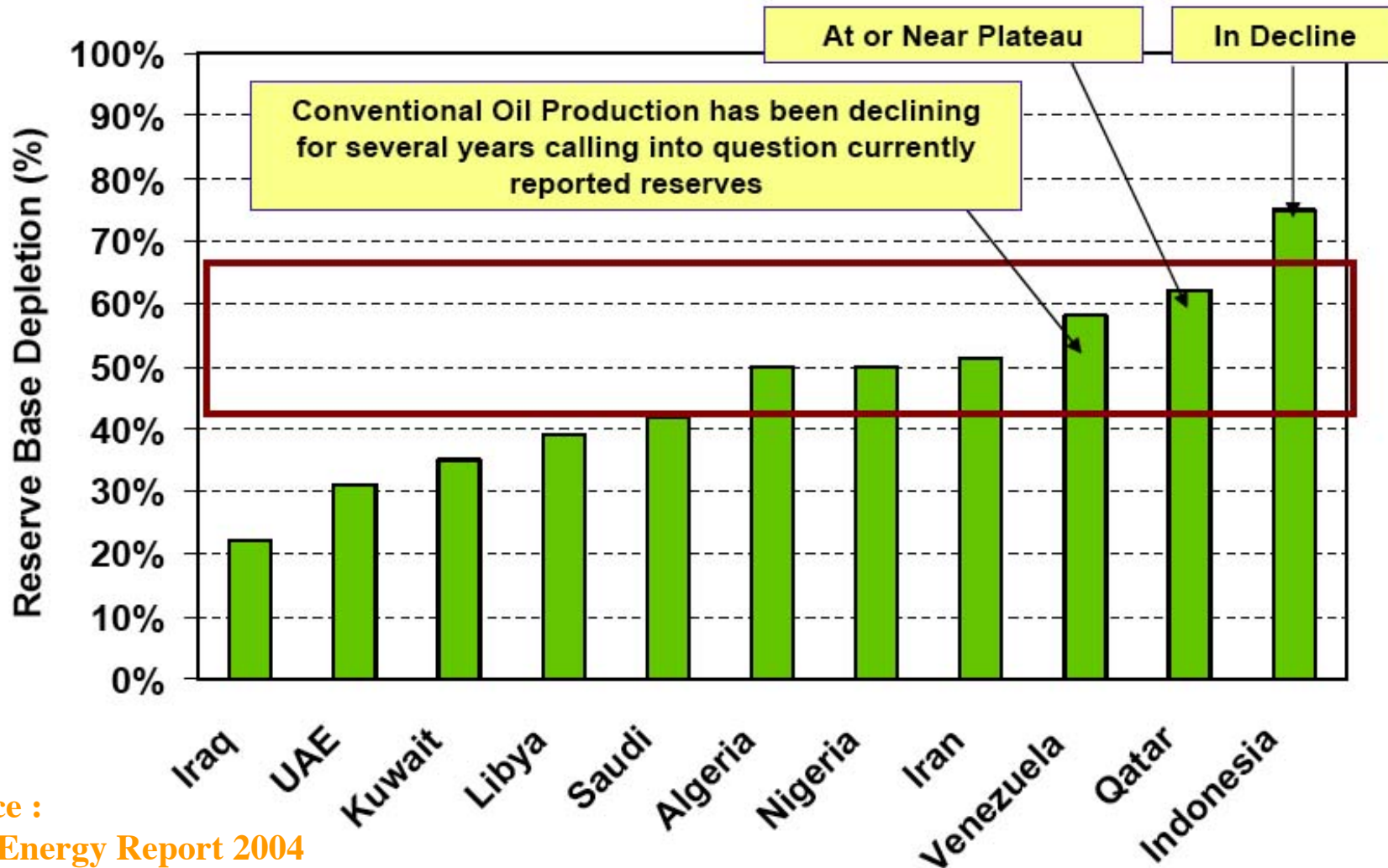
# Price of crude oil



Source : Platt's

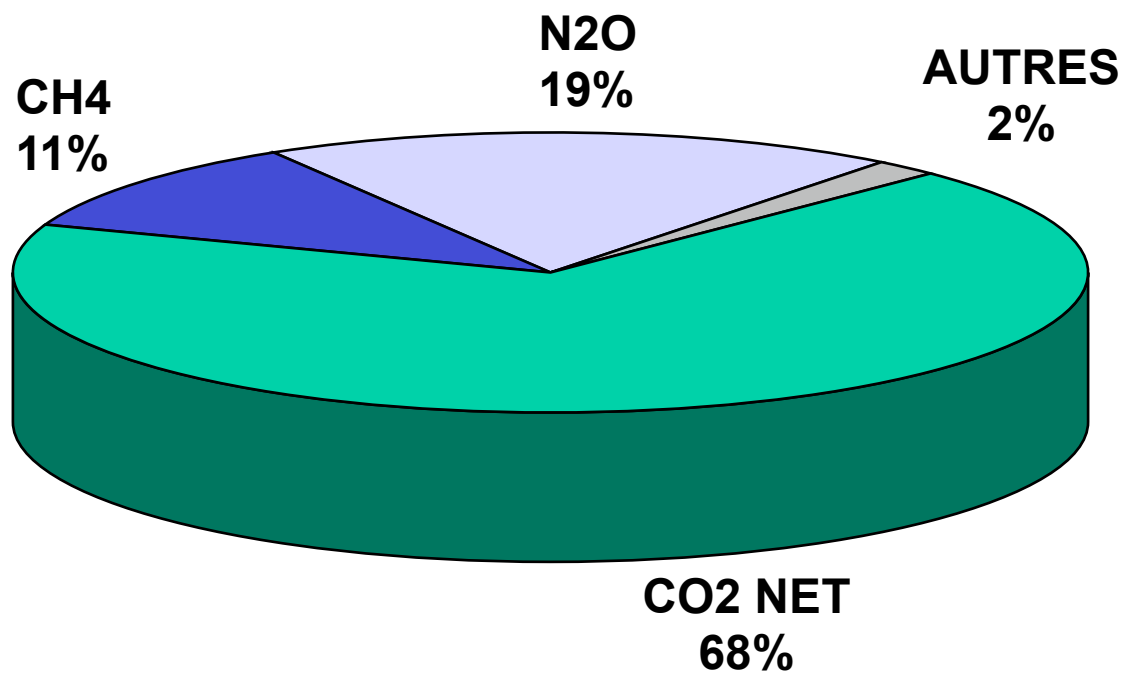
IFP

# OIL PRODUCTION PEAK IS IMMINENT - OIL PRODUCTION WILL START DECLINING SOON



Source :  
PFC Energy Report 2004

# CONTRIBUTION TO GLOBAL WARMING\*



\* Share in the increase of  
the greenhouse gas effect

Ref: GIEC 1995-X Environment  
Figures for France

# GreenHouse Gas Effect

20<sup>th</sup> century : +0.5 to 1°C

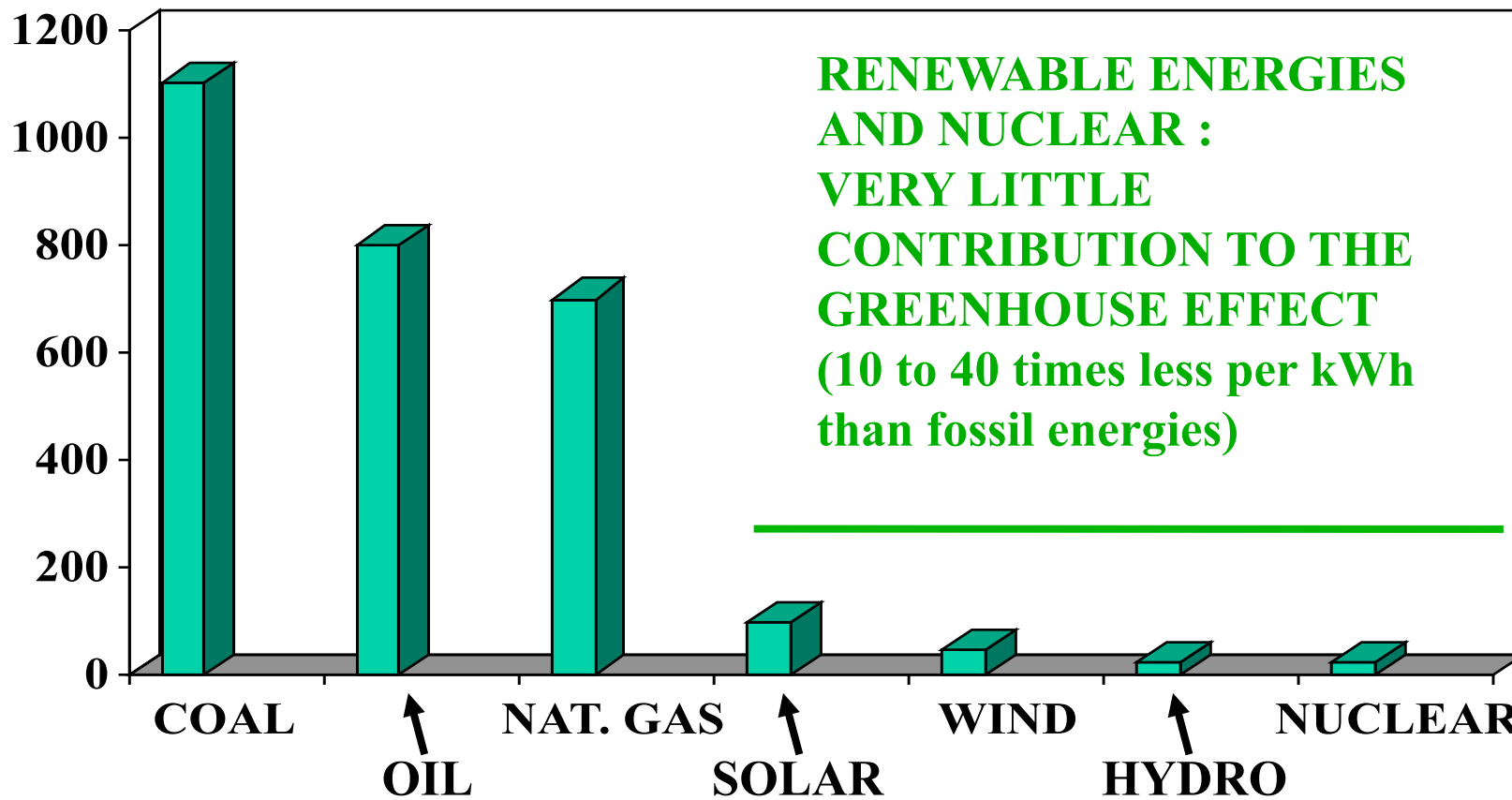
21<sup>st</sup> century : +3 to 10° C

Let 's suppose... : we stop emitting greenhouse gases today, what happens with global warming ?

**A GLOBAL EFFECT with a long time constant : URGENT action is required.**

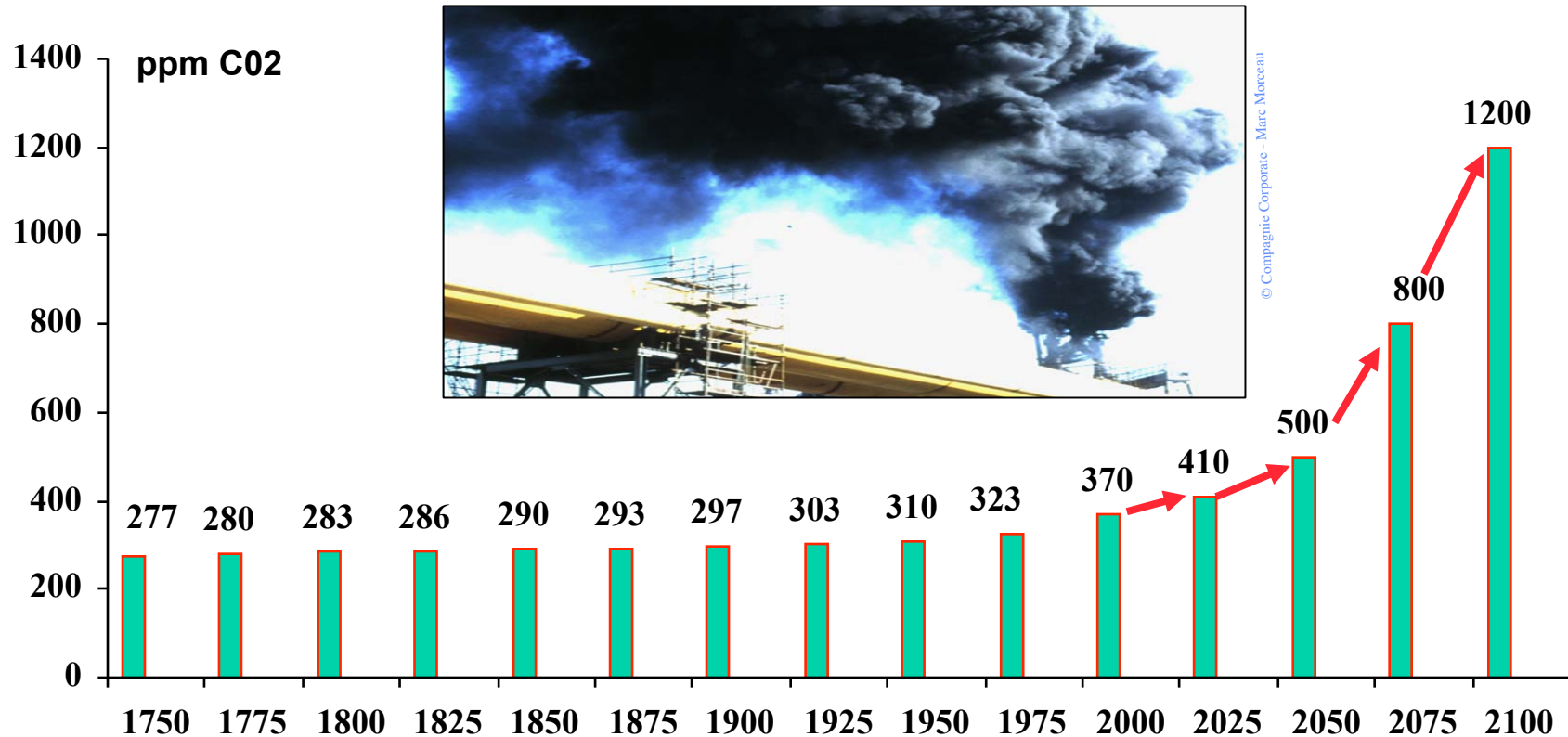
# GREENHOUSE GAS EMISSIONS OF VARIOUS ENERGY SOURCES

gr CO<sub>2</sub>/kWh



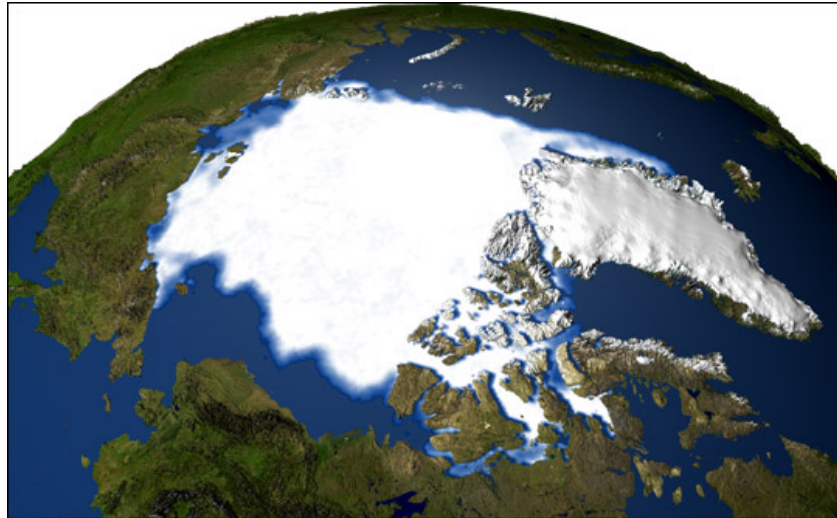
Ref: NEW 01/96

# CO2 concentration in the atmosphere

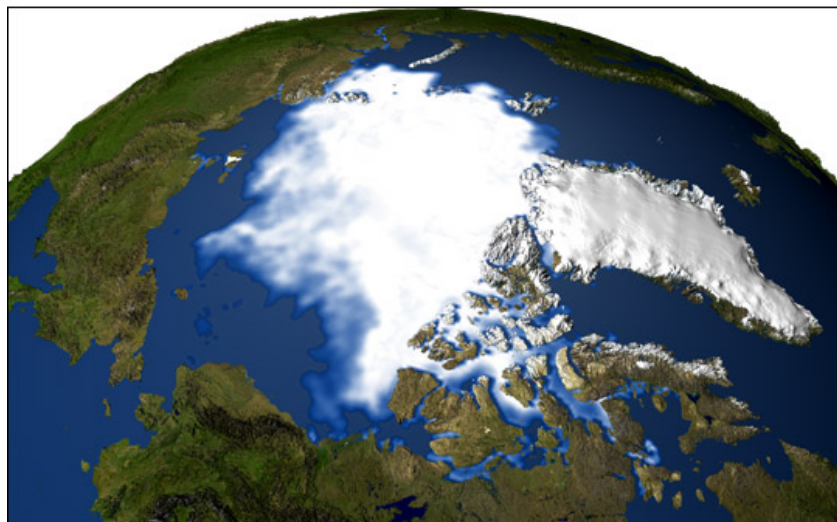


**The CO2 content of the atmosphere is higher than it has ever been in the last 400 000 years, and it continues to rise.**





1979 SSMI Composite Data

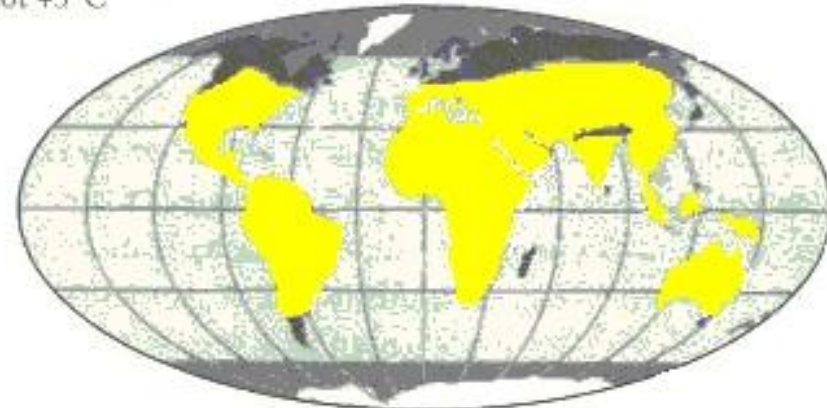


2003 SSMI Composite Data






Now



Hot +5°C



Nature of surface

-  Ice
-  Ocean with life
-  Ocean desert
-  Forests
-  Scrub and desert

# WHAT CAN WE DO ?

**1 - ENERGY CONSERVATION**

**2 - ENERGY EFFICIENCY**

**3 - CLEANER ENERGIES**

In 20 years, to divide in developed countries:

- energy consumption by factor 2
- CO2 emissions by factor 4.

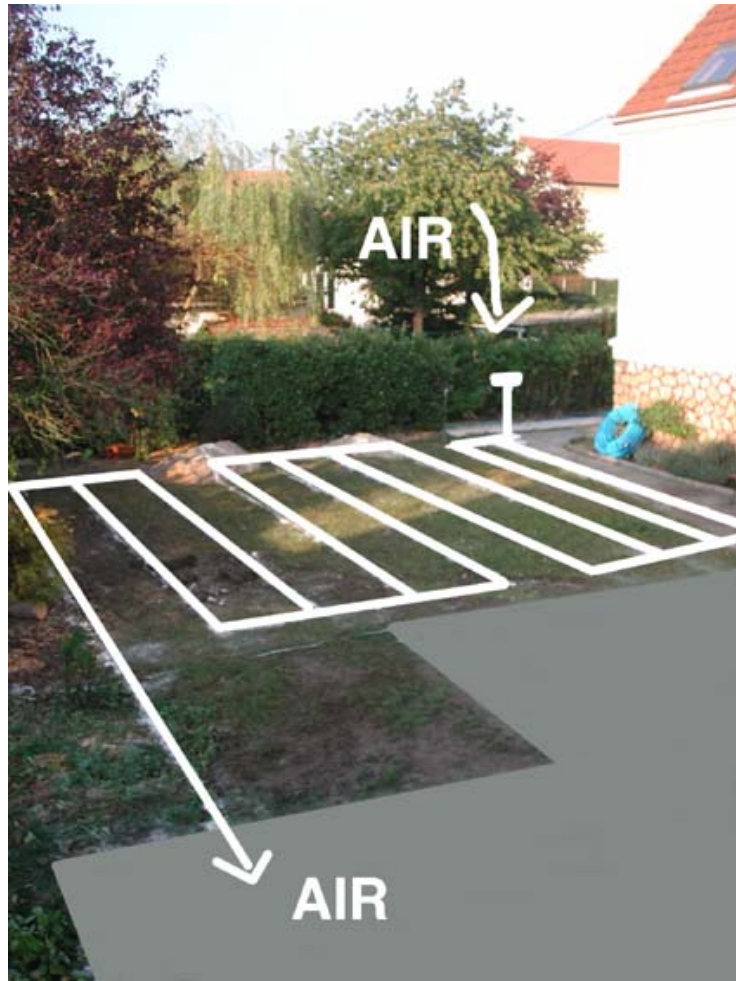


# Eco-construction

**A standard eco-house requires 20 times less energy and emits 400 times less CO<sub>2</sub>.**

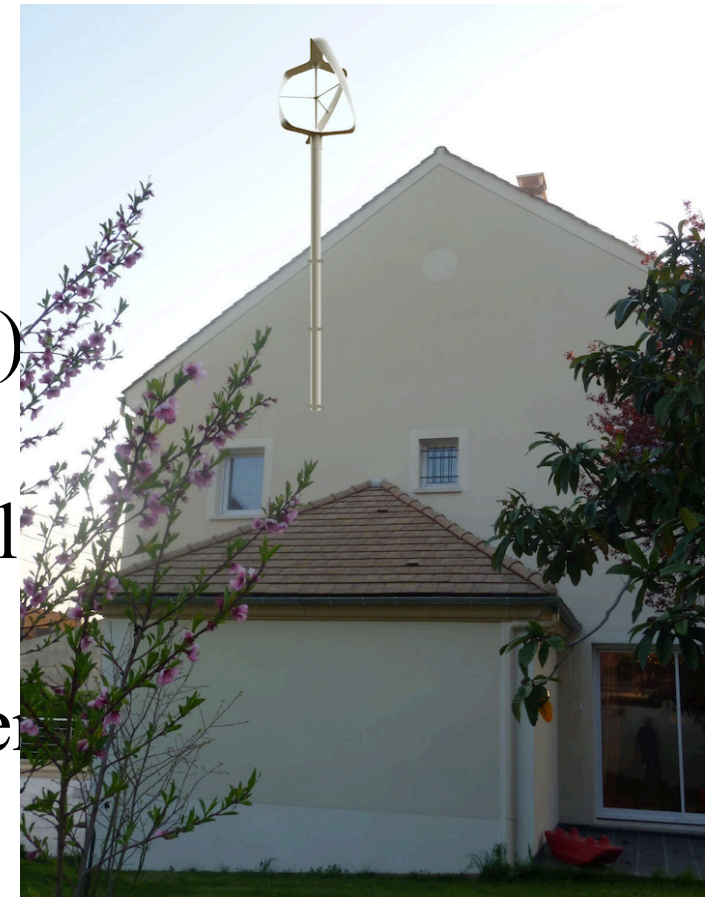


# Geothermal air conditioning (free air conditioning)

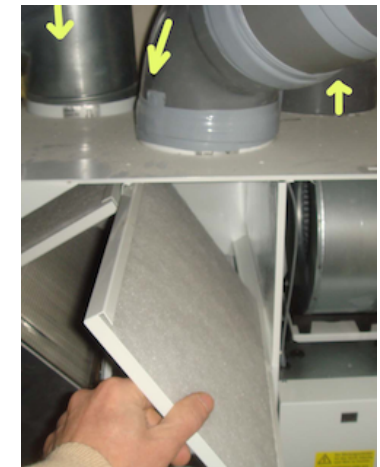
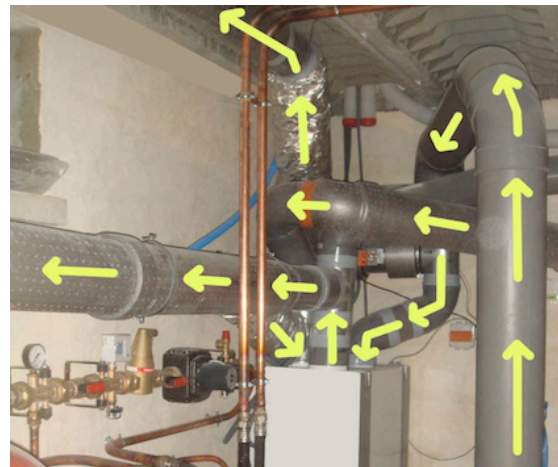


# Clean construction

- Superior insulation (passive house)
- thermally efficient materials
- bioclimatic design, thermal control
- geothermal air circulation
- heat-pump: floor heating+hot water
- hot water heat recycling (unique)
- double-flux ventilation



Total energy cost : 1 € /day for 400 m2, including heating, air Conditioning in summer, and all business and transportation energy costs



# Consumer's choices make a huge difference

- Produce and consume less, better and locally
- less transportation
- less wrapping / recycle
- more durable products.



Make the  
right choices !

# Be clean



- stop burning carbon
- electrify
- produce clean electricity

# Electric vehicles



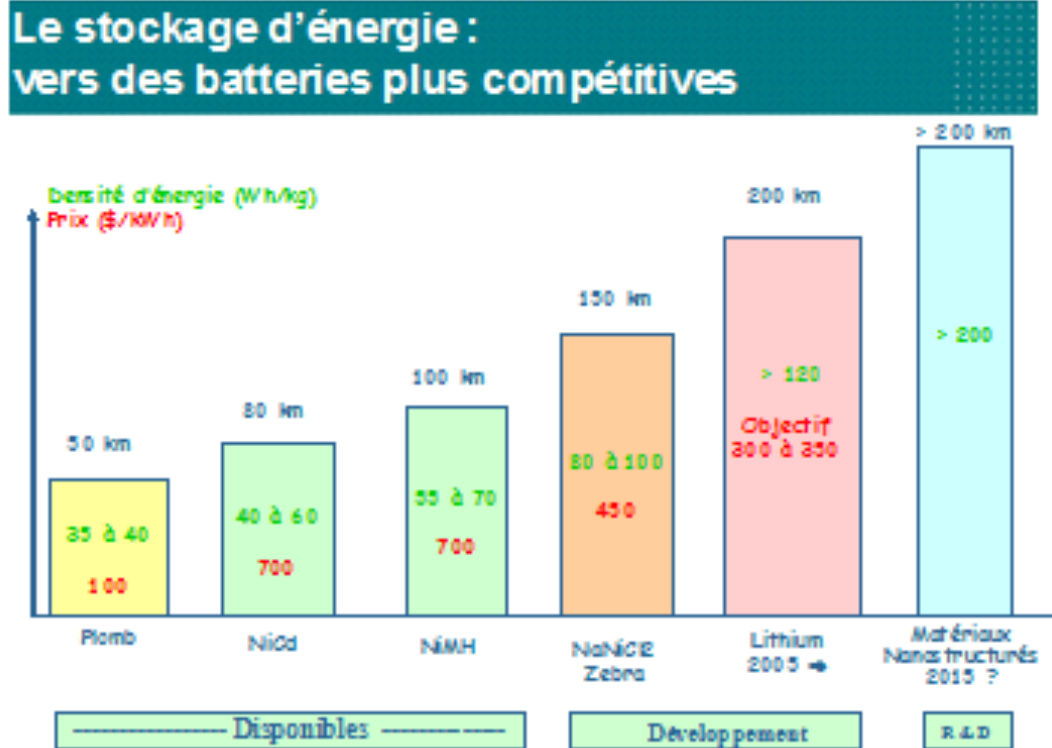
- Electric cars, trucks, trains...
- nuclear ships
- electrify (clean)





# Electric batteries

Pb : 35 Wh/kg 50 km  
 Ni-Cd : 50 Wh/kg 80 km  
 NiMH : 60 Wh/kg 100 km  
 NaNiCl : 100 Wh/kg 150k  
 Lith : 120 Wh/kg 200 km  
 Nano : 200 Wh/kg 320 km



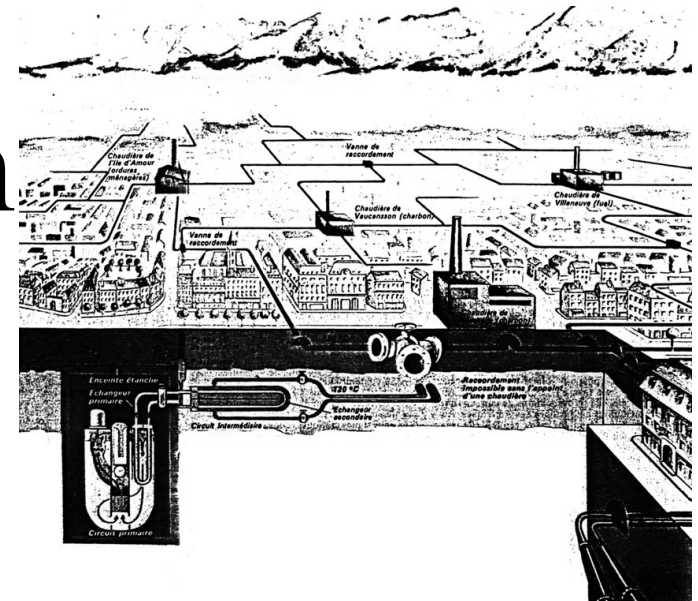
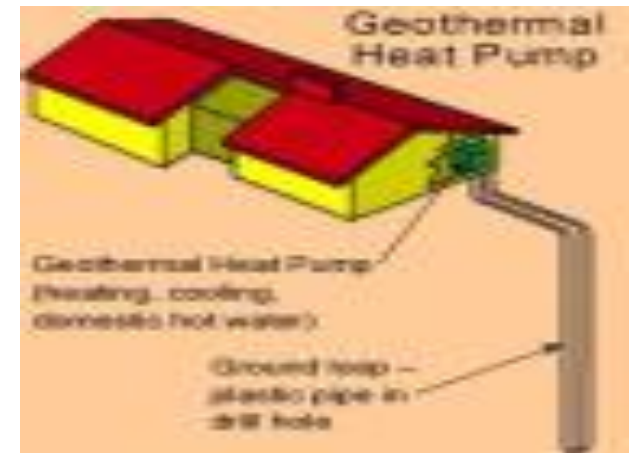
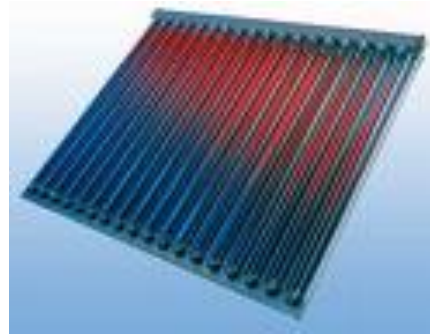
Progress in the performance  
of batteries

# Long distance transportation: high-speed trains, piggy-back trucks and hybrid vehicles or trailer generator or battery swaps



# Clean heat :

- Heat pumps
- solar heating (50% only)
- nuclear cogeneration
- clean electricity



# Clean agriculture

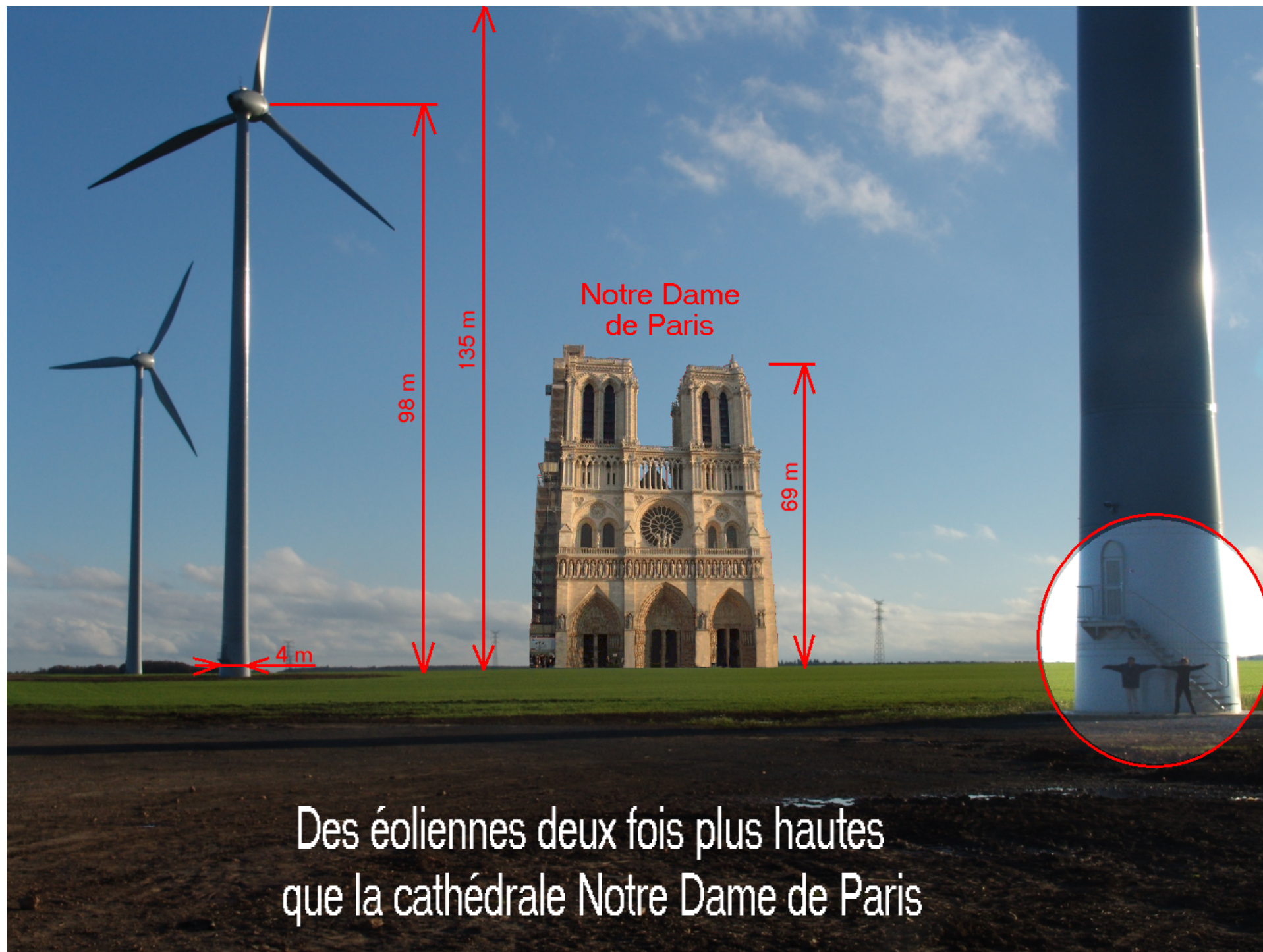


- Less fertilizers
- less oil; be energy conscious
- improve the methods
- electric tractors
- more (clean) electricity.

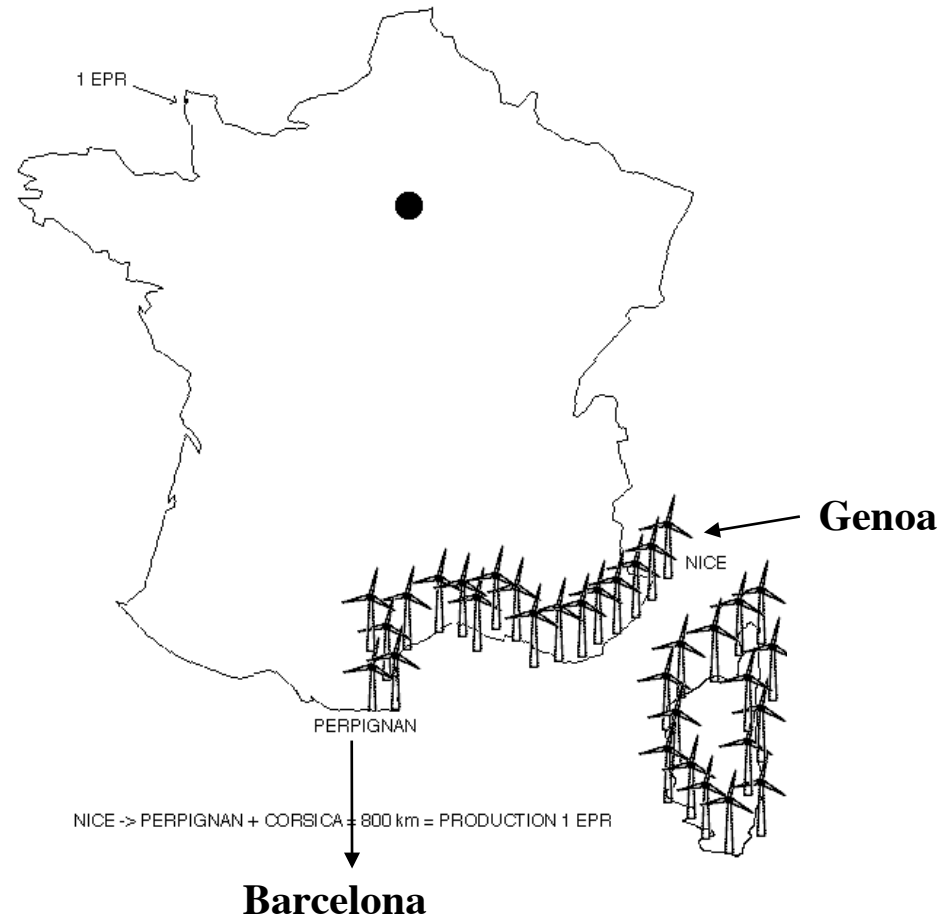
# Clean electricity

- ban carbon from electricity production
- leaves us with :
- renewables
- nuclear



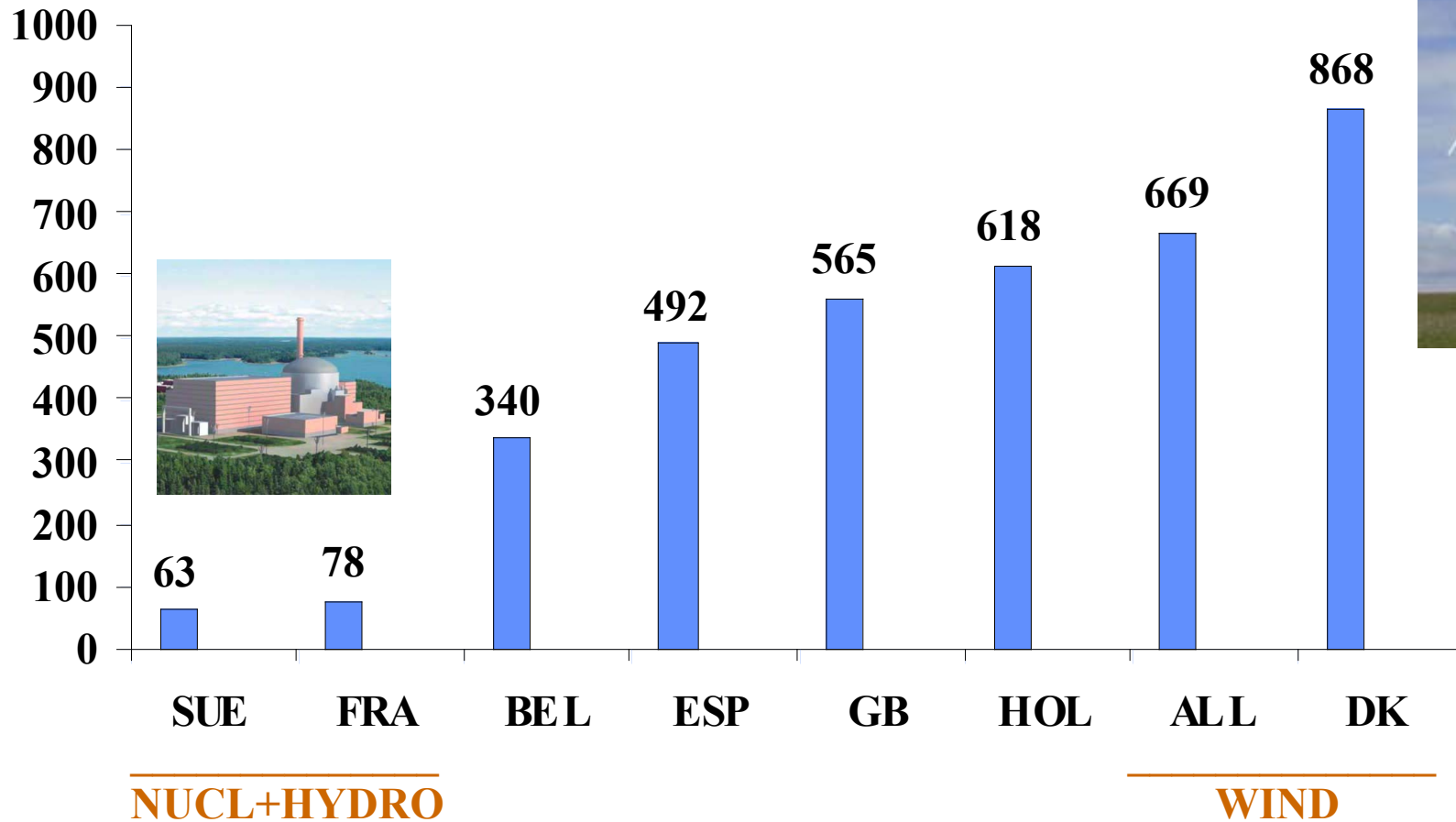


# WIND ENERGY CAN HELP, BUT WILL NOT SAVE THE PLANET

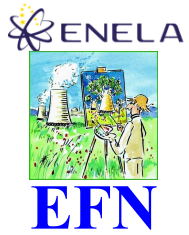


# CO2 EMISSIONS IN EUROPE

(TONS of CO2 /GWh)







# SOLAR ENERGY CAN HELP, BUT ONLY WHEN SUN SHINES



# NUCLEAR ENERGY SITUATION IN EUROPE

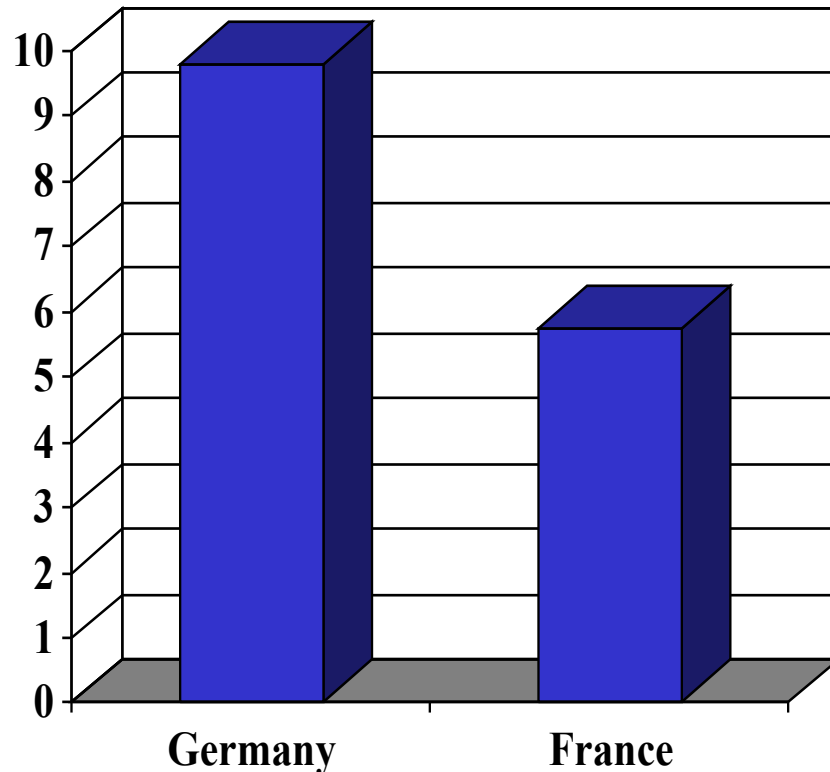


## Some news from :

- France
- Germany
- Belgium
- UK
- Sweden
- Finland...

# FRENCH AND GERMAN CO2 EMISSIONS

(per person / per year)



Germany is certainly not an ecological example to be followed for electricity :

CO2 emissions (source IEA 2008)

DE = 9.79 Tons CO2/hab

FR = 5.74 Tons CO2/hab

■ Tons CO2/hab

Cost of electricity to families

DE = 23.6 cts/kWh

FR = 12.0 cts/kWh

Cost of electricity to industry

DE = 12 cts/kWh

FR = 8 cts/kWh

Source for costs : Observatoire des Energies 2010

# All clean energies and efforts are necessary



**No fundamental contradiction between  
energy conservation, eco-construction, eco-transportation  
eco-thinking, nuclear energy and renewable energies  
All clean efforts should be developed**

**Perfect match !**

# NUCLEAR ENERGY

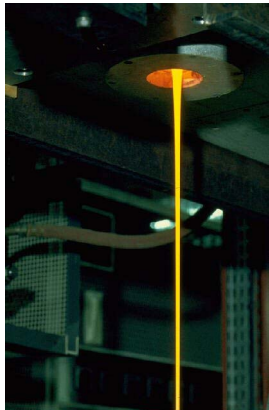


- Is quite compact
- Factor 1 million  
(1g U = 1 Ton oil)
- Consumes very little uranium  
(20 T=1m<sup>3</sup> per year)
- Produces very small volumes of waste

# NUCLEAR WASTE IS NOT A PROBLEM

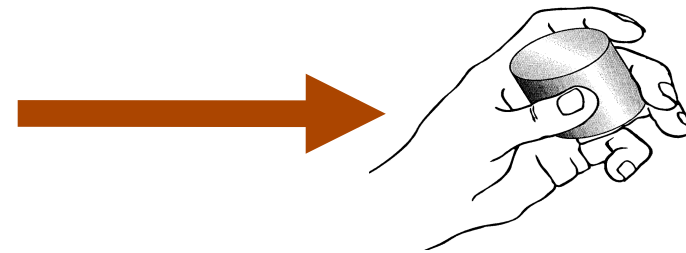
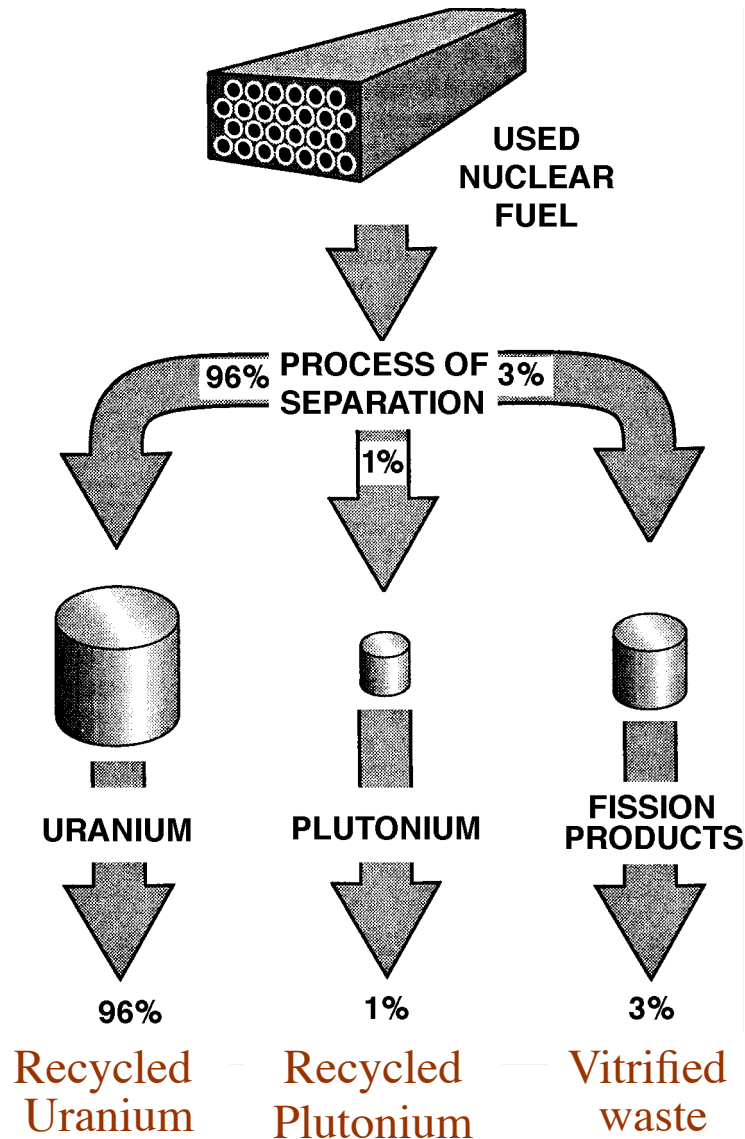


- The volume of the waste is small
- Nuclear waste is confined - not rejected
- Nuclear waste decays spontaneously



- Initial toxicity decreases very rapidly
- Few meters of earth stops the radiation
- Used fuel can be reprocessed

# REPROCESSING OF NUCLEAR FUEL IS HIGHLY ECOLOGICAL



Volume of  
vitrified waste  
produced by a typical  
French family  
in 30 years

# Perspectives on radiation in nature

Radiation is everywhere around us since our planet was born.

## Understanding radiation (0-10 scale) :

EFN proposes a logarithmic scale to measure radiation (in rc: radiation cats) similar to the Richter scale for earthquakes :

1 Bq = 0 rc (by definition, and Bq x 10 -> +0,5 rc)

100 Bq = 1 rc = radiation in a cat (photo)



0.1 rc



1.9 rc



2.8 rc

TMI = 5.5 rc  
Fukushima = 8.0 rc  
Chernobyl = 8.5 rc

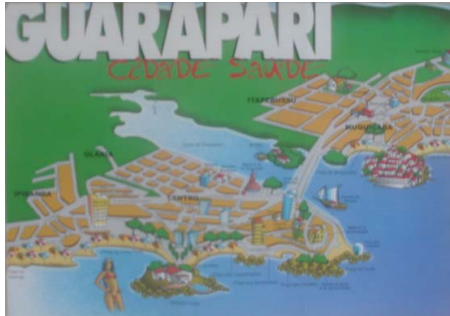


1 kg cat = 1 rc





# Radioactivity is natural



Airplane : 5  $\mu\text{Sv}/\text{hour}$

In Guarapari (Brazil) :

up to 50  $\mu\text{Sv}/\text{hr}$  on beach

In Ramsar (Caspian Sea) :

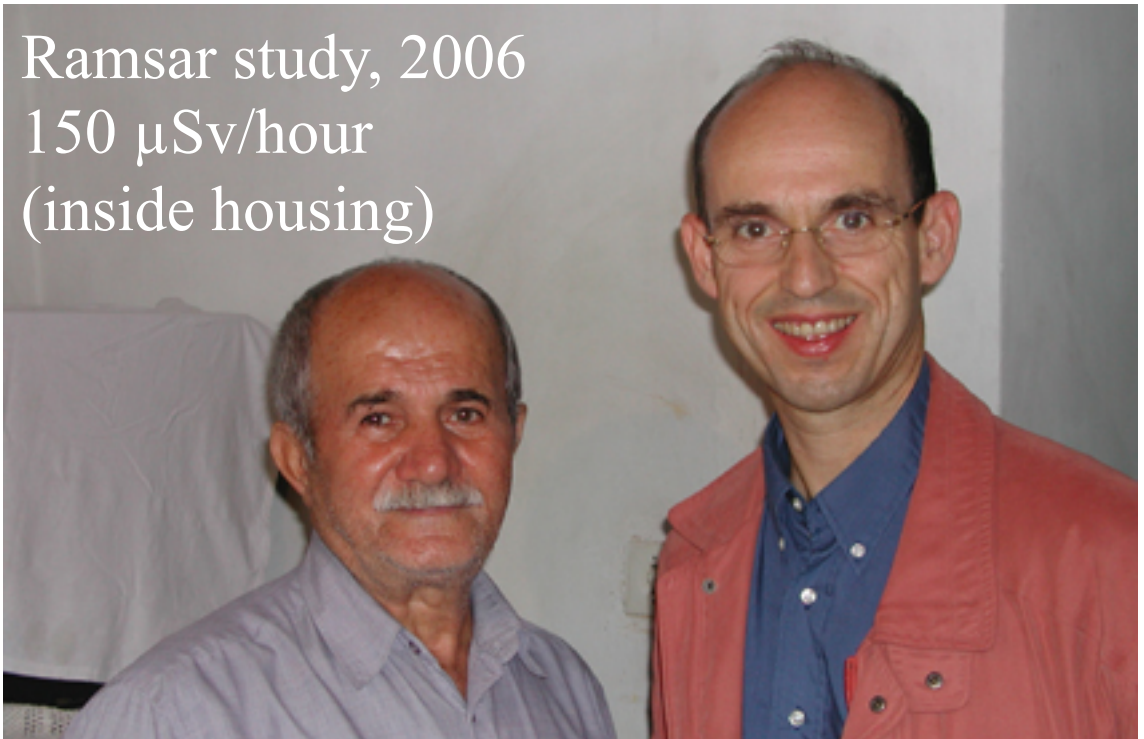
up to 150  $\mu\text{Sv}/\text{hr}$  in houses

La Hague NPP : 0.001  $\mu\text{Sv}_{\text{eq}}/\text{h}$

La Bourboule : 0,2 to 3  $\mu\text{Sv}/\text{h}$

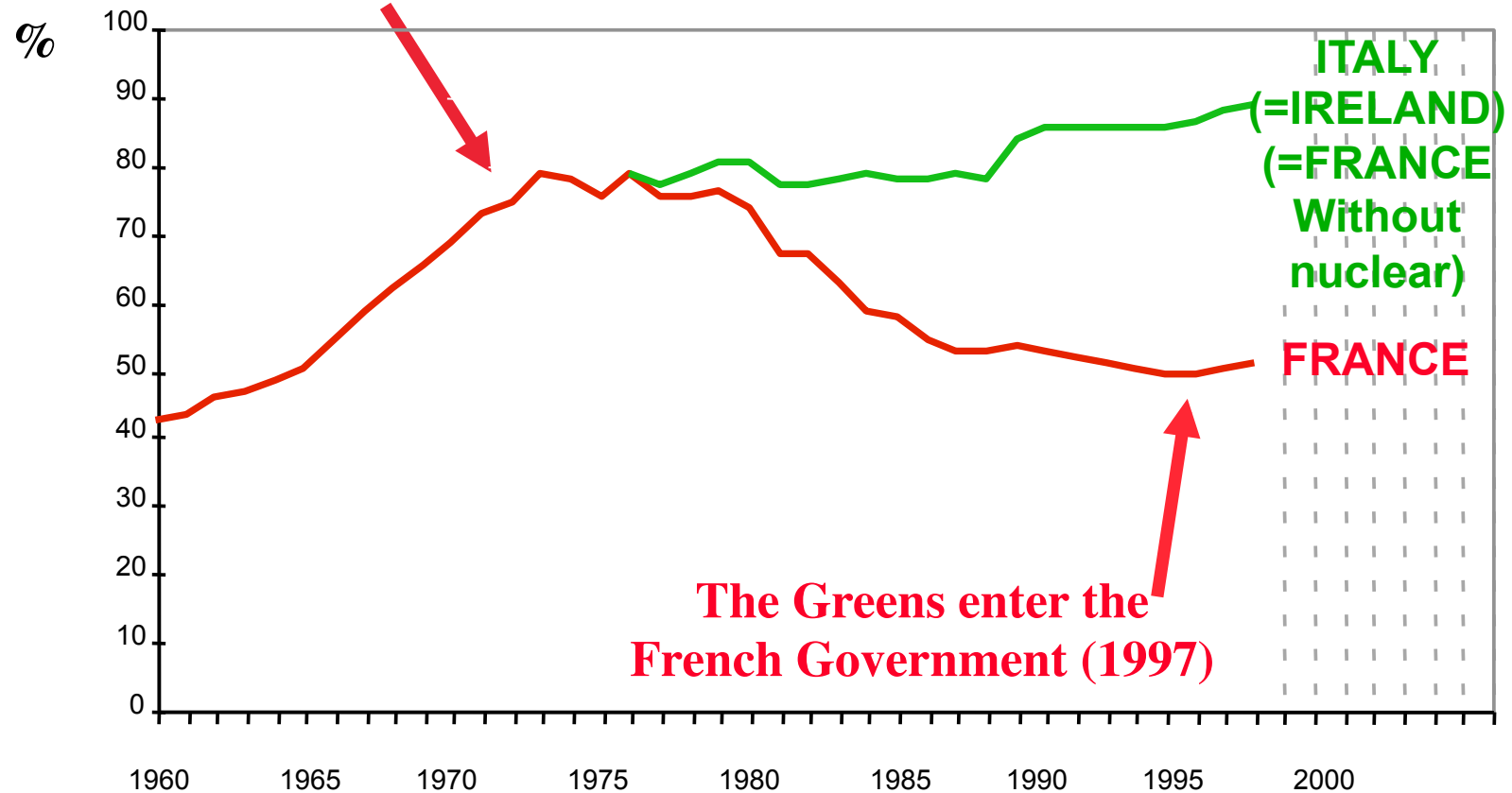
U@home : 10 kg/meter (3ppm)

To protect the populations more efficiently, radioprotection rules should include natural radiation, not just industrial exposure

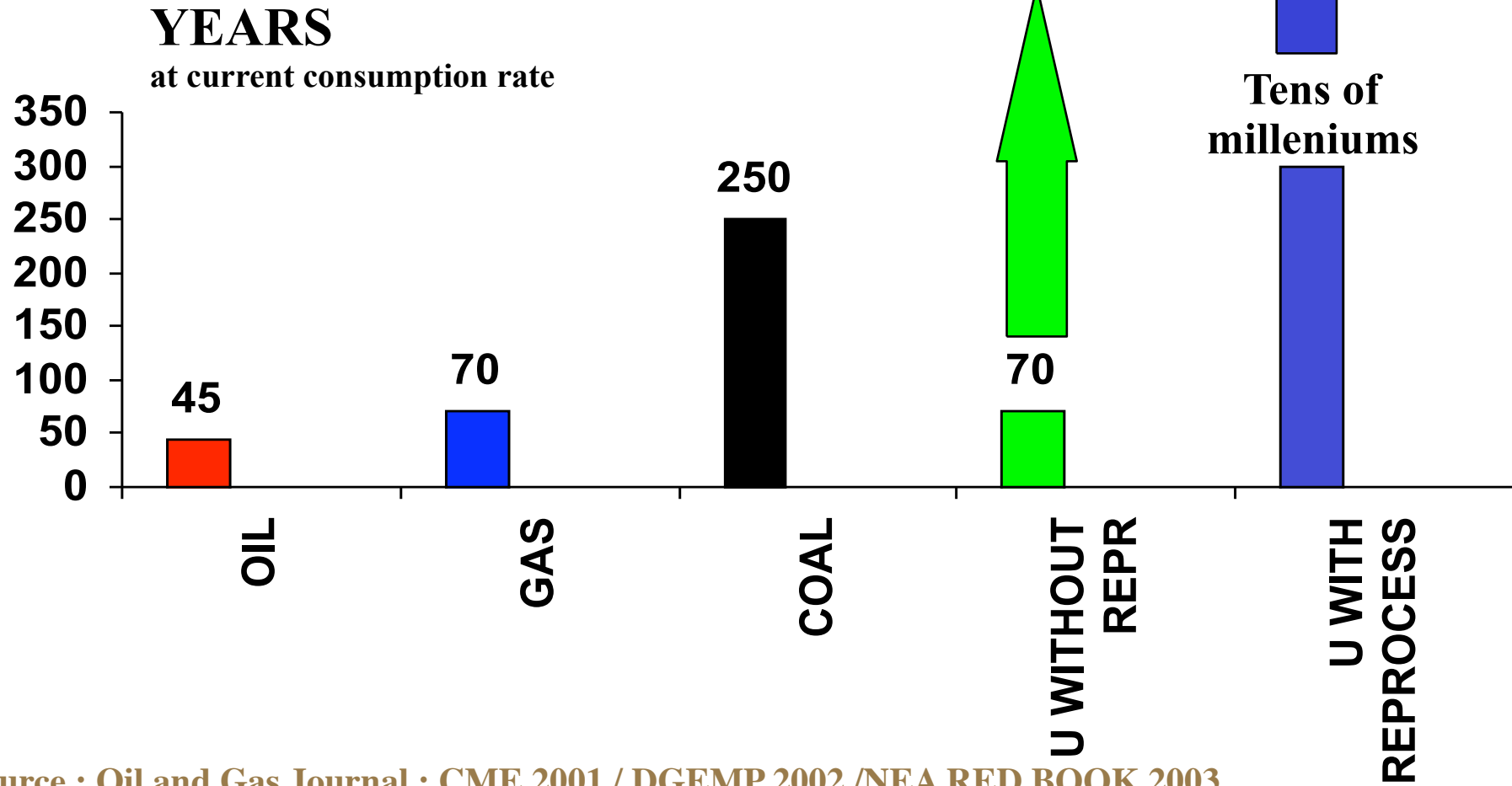


# Energy dependence (%)

**Start of the French nuclear program (1973)**



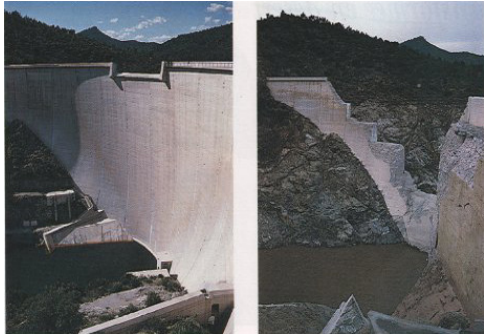
# PROVEN RESERVES



# Risks and accidents



# No energy is risk-free



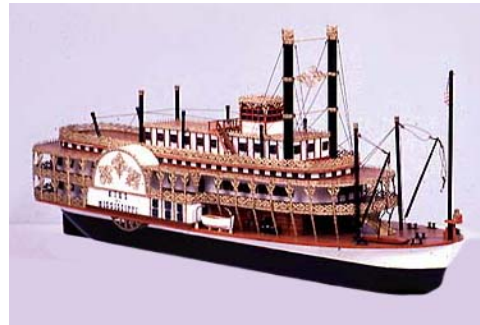
Hydro : Malpasset - 423 died  
2 December 1959  
Morvi : 30 000 died (1979)  
World average=hundreds/year



Mihama : 5 died 10 Aug 2004  
INDUSTRIAL accident  
Fukushima : 4 died in 2011  
NATURAL disaster  
(none from radiation)



Ghislenghien  
30 July 2004  
22 died (gas  
explosion)



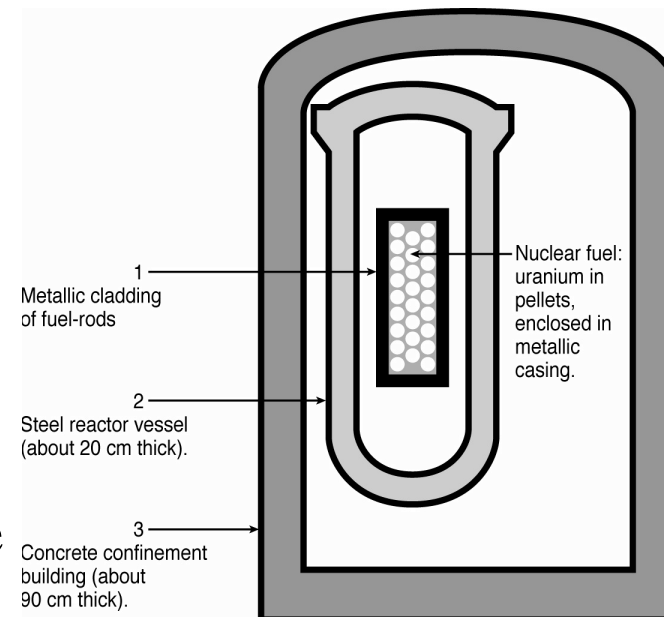
Steam explosion - 1865  
Mississippi -> 1547 died

350 000 die in work accidents each year -> only 1 in nuclear industry

# Basic concepts of nuclear safety

Risks are minimized by:

- Multiple & redundant safety systems
- Multi-level safety
- Multiple confinement barriers
- Discipline is important - safety culture



Well built nuclear energy  
is by far the safest energy available



# The Chernobyl accident

- Man-made disaster, perfect example what not to do:
- Major mistakes: faulty design, no containment, safety systems bypassed, inadequate training, a forbidden test...
- <100 died (smoking = 6 million/yr = 300 Chern/day = 1 Chern/4 min)



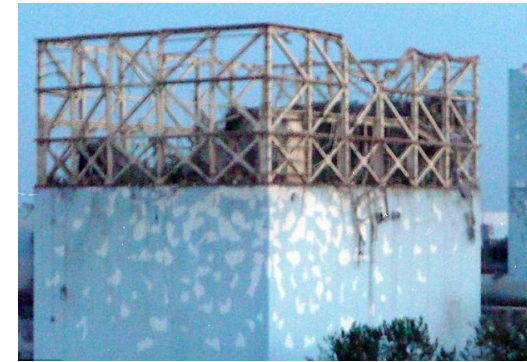
**TMI** : reactor lost, but 0 deaths

PWR: with containments, no graphite to burn

COAL MINES: 10,000 deaths per year (10 Chernobyls/month)



# FUKUSHIMA



- A NATURAL disaster
- 20 000 died from TSUNAMI (only 2 in NPP)
- All reactors stopped (as they should)
- 4 reactors destroyed, 3 melted cores, 2 H2 explosions
- Early evacuation < 15/3/2011: no public health impact
- 4 workers died (but none from radiation)
- <10 workers above authorized limit: 250 mSv

## Lessons learned : nuclear will be even safer

- Tsunami predictions inadequate (wave 5.7m -> 14 m)
- Emergency cooling systems not sufficient
- Stress-tests : safety is now improved around the world

# Risk of terror attack

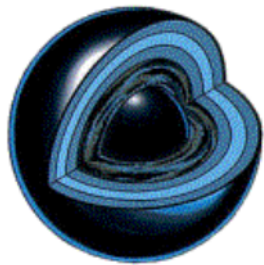
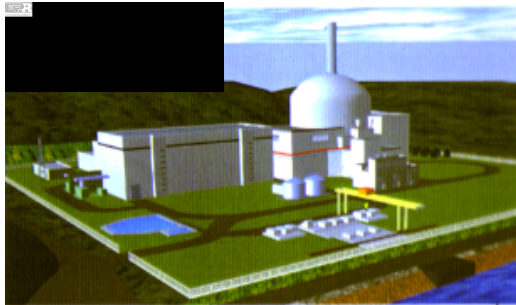
WTC  
tower

Relative size

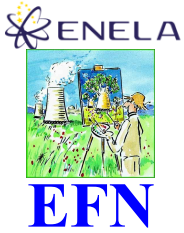


**CONCLUSION :**  
Frightening for the  
mass media, but  
**NOT AN EASY TARGET**

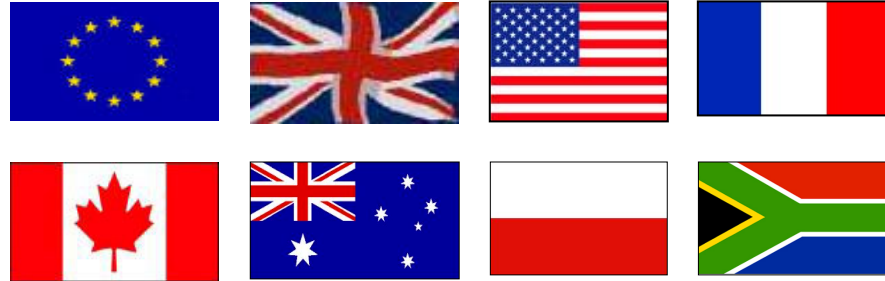
# Reactors of the future



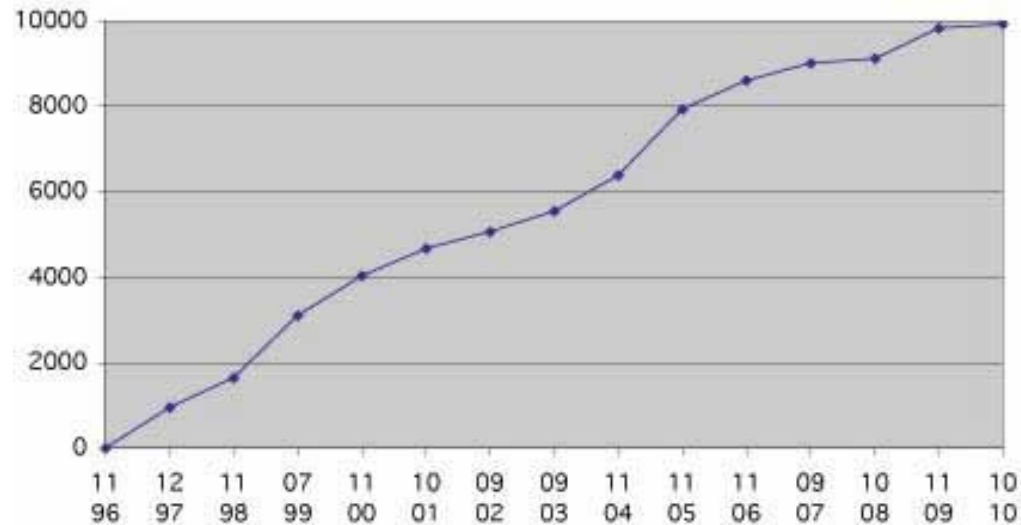
- Advanced reactors :
- EPR, AP-1000, ACR, ABWR
- New small reactors :
- Small, very safe reactors
- For developing countries
- Worst case not dangerous
- Terapower, PBMR, Flexblue, ships, barge...
- Generation IV :
- Resources x100, less waste
- 6 concepts (SFR, LFR, GFR, VHTR, MSR, SCWR)



# EFN : Environmentalists For Nuclear Energy



- An international network gathering over 10,000 members and supporters in favor of clean nuclear energy
- Growing rapidly
- In 60 countries
- On all 5 continents.



**EFN's mission :**  
**information about energy and the environment**

# EFN web site

in 15 languages : [www.ecolo.org](http://www.ecolo.org)



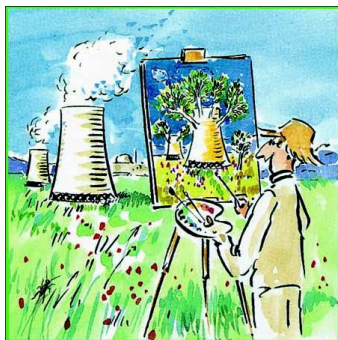
**Offers free information, thousands of documents  
1/2 million visitors per year - Free mailing lists - Make a donation !**

# EFN

## Communicating on nuclear energy

### The 3 historical ages in nuclear communication:

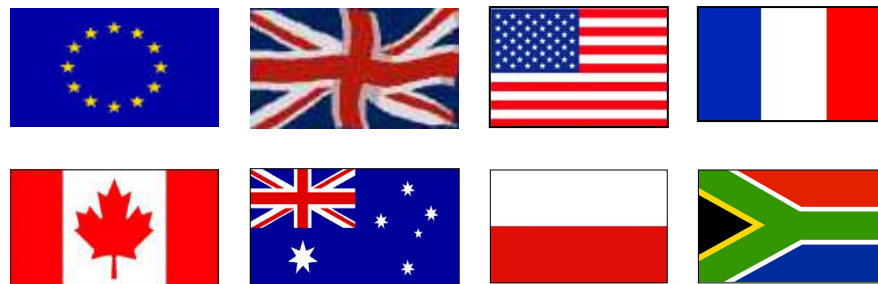
- institutional/governmental nuclear communication  
(1950-1970, often military, cold war)
- industrial/corporate nuclear communication  
(1970-1990, utilities)
- societal/third party communication (since 1990' s) :  
NGO' s, environmentalists, independent scientists



# EFN : Lecture tours and creation of new branches

Creation of new local branches and affiliates of EFN, to organize lecture tours, site visits, press conferences, special prints or new editions of the book, TV interviews and to open new local offices of EFN:

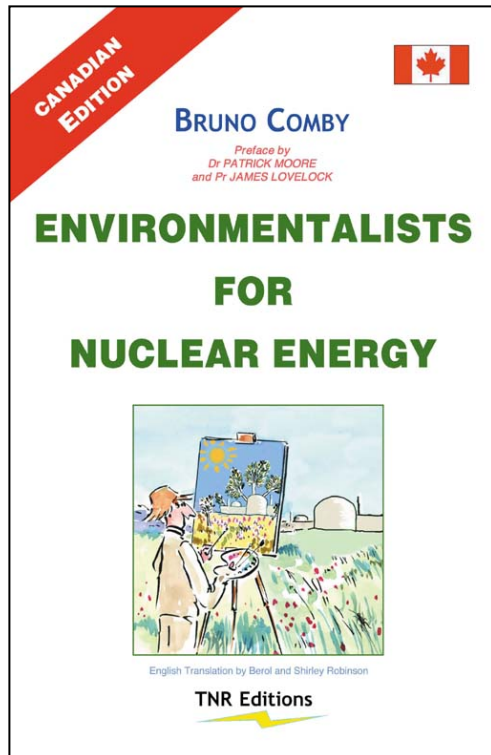
Contact [efn\[at\]ecolo.org](mailto:efn[at]ecolo.org)



**Over 1,500 TV/radio/press interviews and >1,000 lectures given around the world**

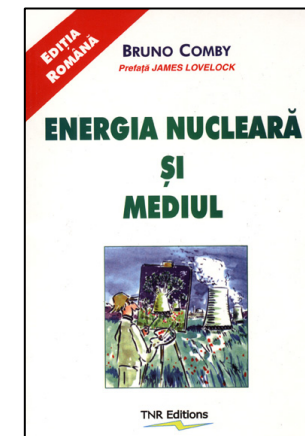
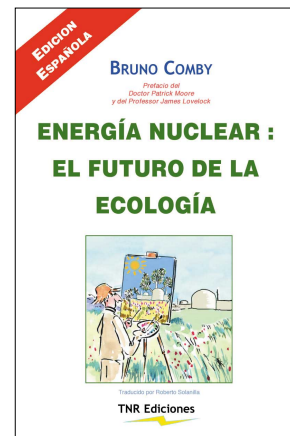
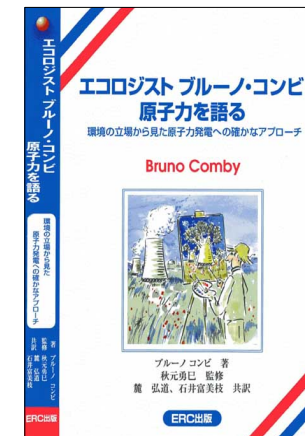
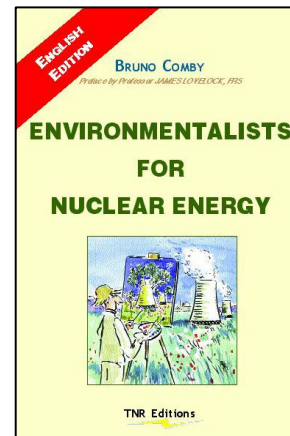
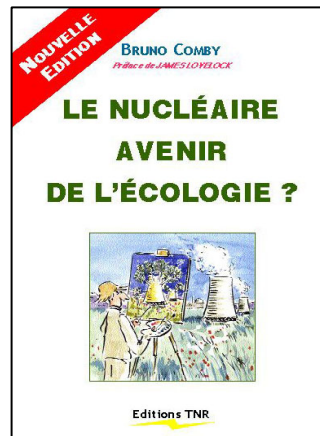
# The book:

Bruno Comby's books have informed over one million readers on ecology and the environment published in French, English, Japanese...



**Preface**  
by Pr. James Lovelock  
and Dr. Patrick Moore

Special prints on demand



Also published in: Chinese, Russian, Turkish, Czech; yet to be published in: Korean, German

[www.comby.org](http://www.comby.org) -> click on « books »





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## Pr. James Lovelock

- **Historical father of environmental thinking since the 1960' s**
- **author of the Gaia theory**
- **member of EFN**

**« Nuclear energy is THE ONLY ecological solution »**

“ The dangers of continuing to burn fossil fuels as our main energy source (...) threaten not just individuals but civilization itself (...) I hope that it is not too late for the world to emulate France and make nuclear power our principal source of energy.” (in his preface to Bruno Comby' s book)

# Eco-life in Houilles



# Other Environmentalists For Nuclear (members of EFN)

Patrick MOORE, EFN-Canada 

Founder of Greenpeace, former President of Greenpeace-Canada and director of Greenpeace international, Honorary chairman of EFN-CANADA



Bishop Hugh MONTEFIORE, UK

Former member of the Board of Friends of the Earth

Yumi AKIMOTO 

Survivor of Hiroshima explosion

GuI GOKTEPE

Award of UN Black Sea Medal environmental prize



# We have only one planet



© Luc Massart/ IBC

# A livable future



for  
our  
children

and future generations...

A photograph of a nuclear power plant with two large cooling towers, set against a blue sky with light clouds. In the foreground, there is a field of bright yellow sunflowers. The text is overlaid on the image in various colors and fonts.

**CONCLUSION :**

**A MAJOR ENERGY CRISIS IS  
DOWN THE ROAD**

**THE WORLD NEEDS  
MORE CLEAN ENERGY**

**CONSERVATION, RENEWABLE  
ENERGIES AND CLEAN  
NUCLEAR ENERGY ARE**

**A PERFECT MATCH**



**You are kindly invited to  
visit the ecohouse in  
Houilles (near Paris).**

**More information :  
[www.ecolo.org](http://www.ecolo.org)**

**The book : [www.comby.org](http://www.comby.org)**

**Contact : [bruno\[at\]ecolo.org](mailto:bruno[at]ecolo.org)  
[efn\[at\]ecolo.org](mailto:efn[at]ecolo.org)**

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