



# *The environmental benefits of nuclear energy*

8th International  
School of Nuclear Power  
in Warsaw  
October 28th, 2015



by Bruno Comby

Director of the Comby institute (IBC)

Founder and President of EFN  
(Environmentalists For Nuclear Energy)





## **Introduction : The life of an environmentalist**



### **Clean energy**

**Information on energy**

**What can we do?**

**Energy conservation**

**Renewable energies**

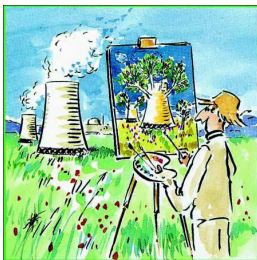
**Nuclear energy**

**Radiation in nature**

**Energy independence**

**Tchernobyl, Fukushima...**

**The future of energy**



**EFN : the pronuclear green movement**

**Conclusion : Green + nuclear = perfect match**



**The old and new vision of ecology :**  
**Considering the environmental benefits of nuclear energy**





# The life of an environmentalist - childhood in nature





## The life of an independent scientist - Scientific background



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

### Eco-house in Houilles :

- Passive and positive energy
- >100 times less CO<sub>2</sub>





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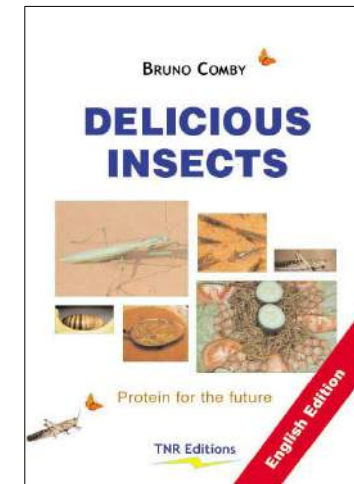
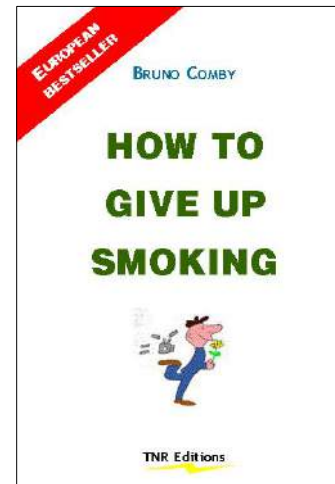
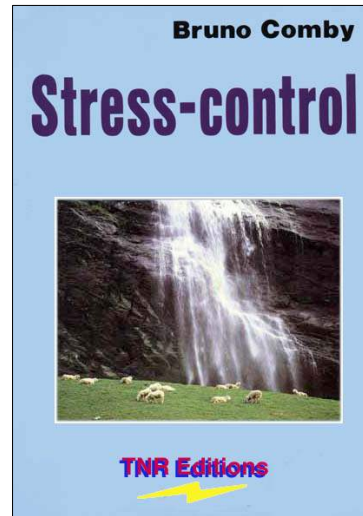
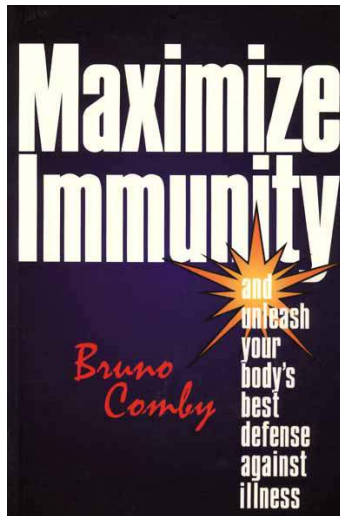
25 years dedicated to pioneer work in fundamental research, publications, and teaching the public about energy, natural health and protection of the environment.



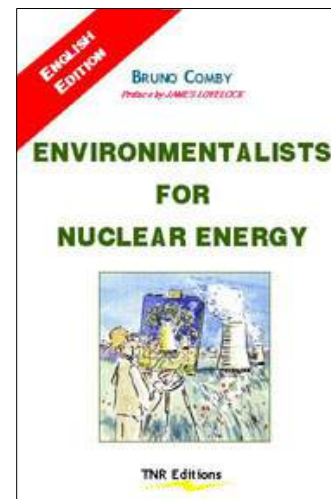
# The life of an environmentalist - research and books

## 25 years of pioneer research on healthy living and the protection of the environment

10 books published in 12 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

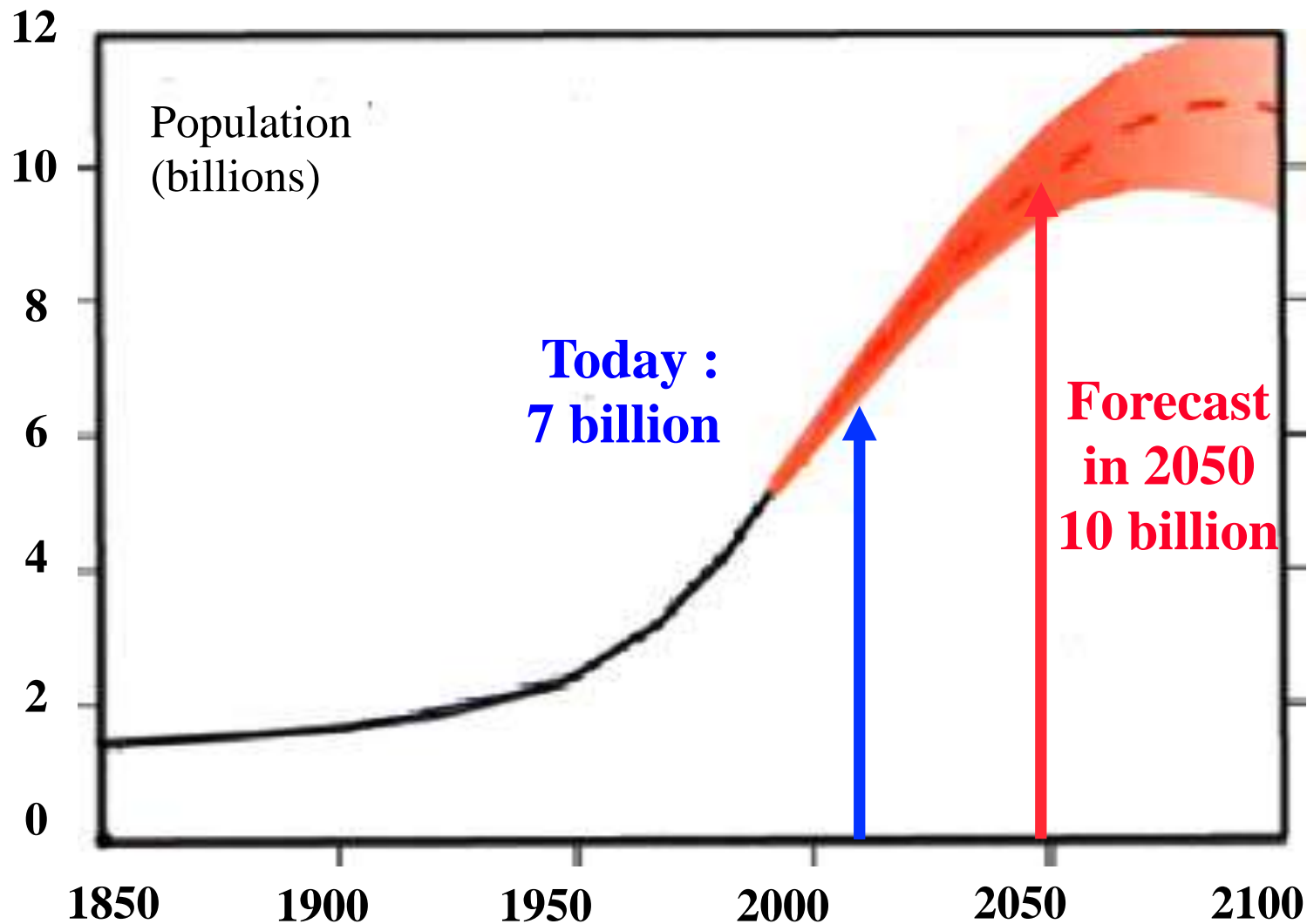


**Today, 20% of the world's population  
consumes 60% of the energy**

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

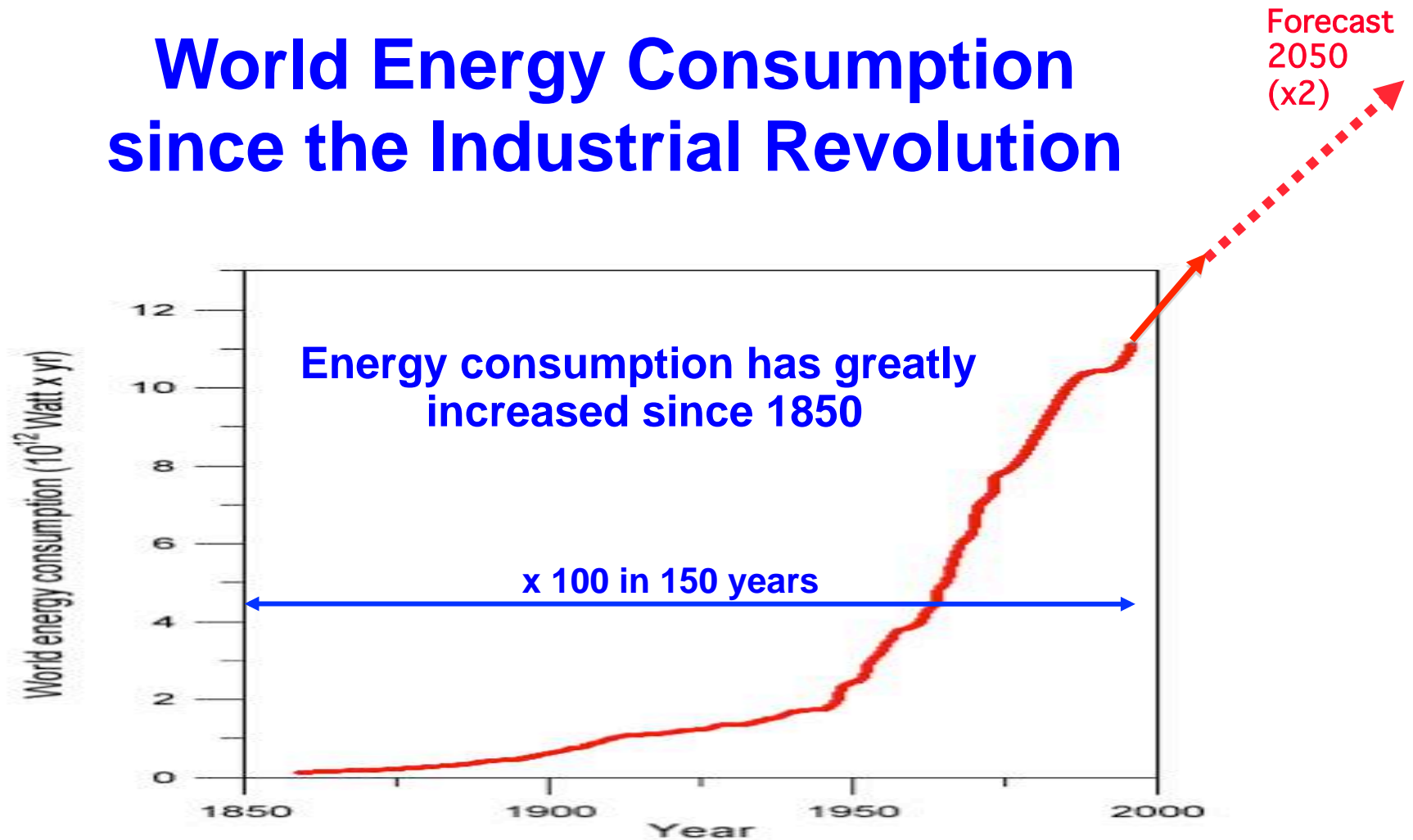


# World population





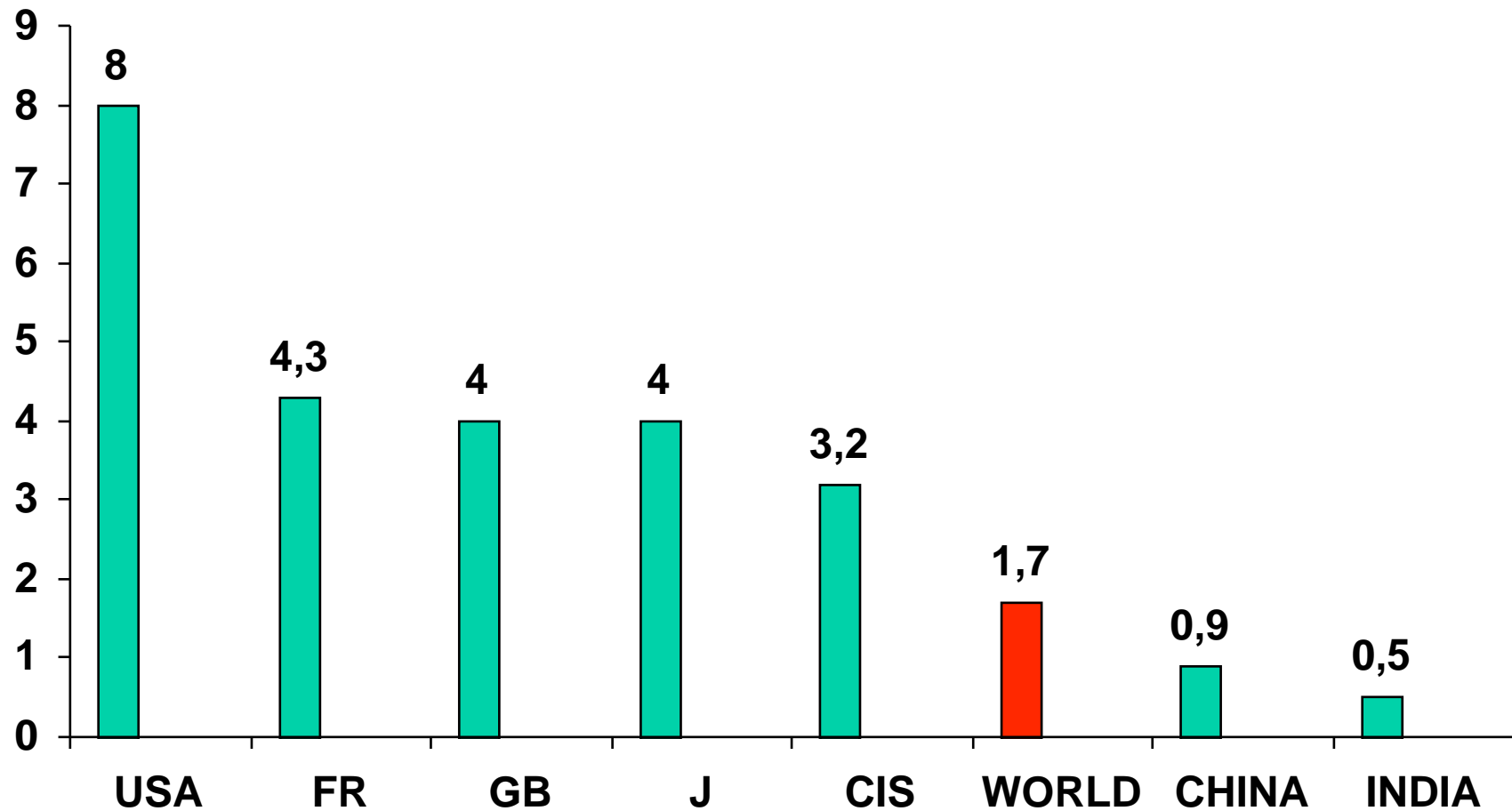
# World Energy Consumption since the Industrial Revolution



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



# ENERGY CONSUMPTION (toe/ capita/year)



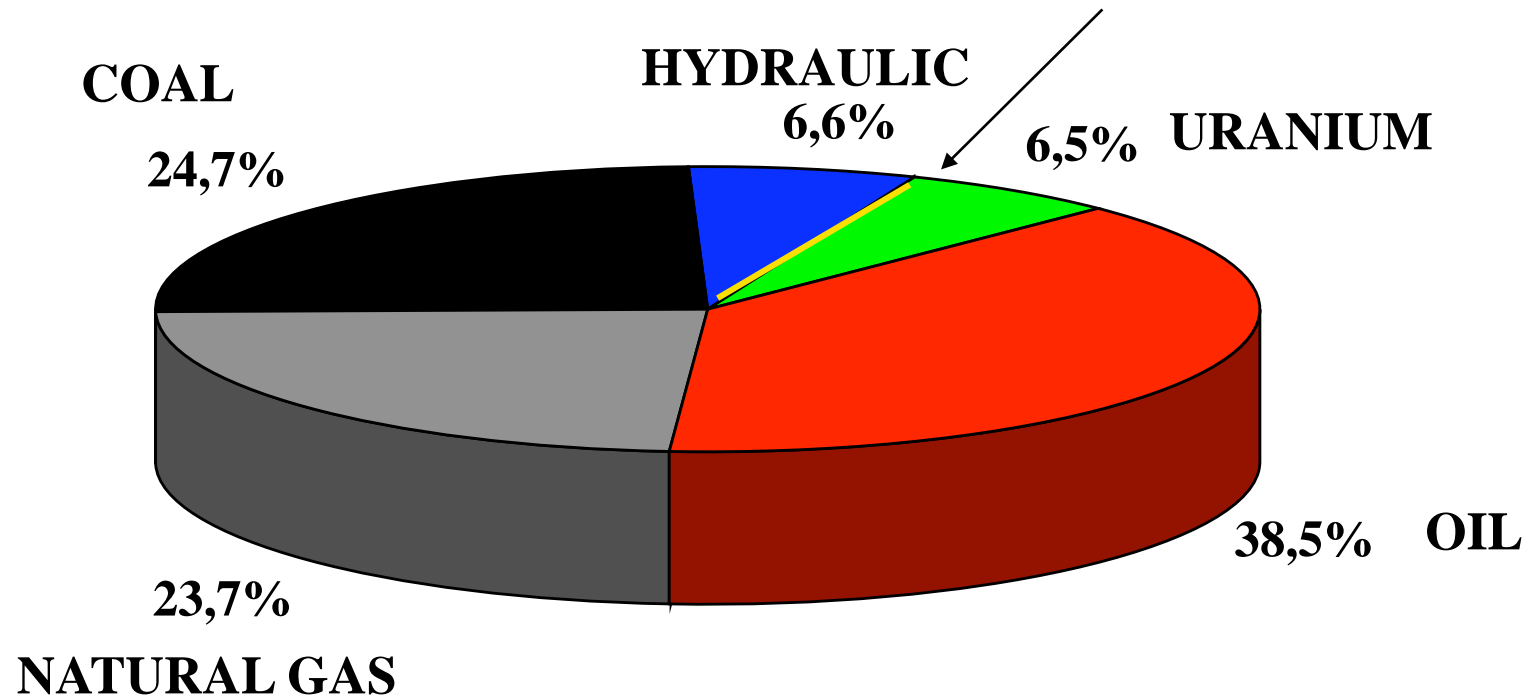


# ENERGY SOURCES

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 ~> 10 Gtoe/yr**

# 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 oil equivalent)	Share (%)
UNITED STATES - CANADA	2305	28
CIS - EASTERN EUROPE	915	11
WESTERN EUROPE	1725	20
CHINA	860	10
JAPAN	510	6
ASIA (others)	860	10
LATIN AMERICA	300	4
MIDDLE EAST	425	5
AFRICA	265	3
AUSTRALASIA	130	1
<b>TOTAL WORLD</b>	<b>8555</b>	<b>100</b>



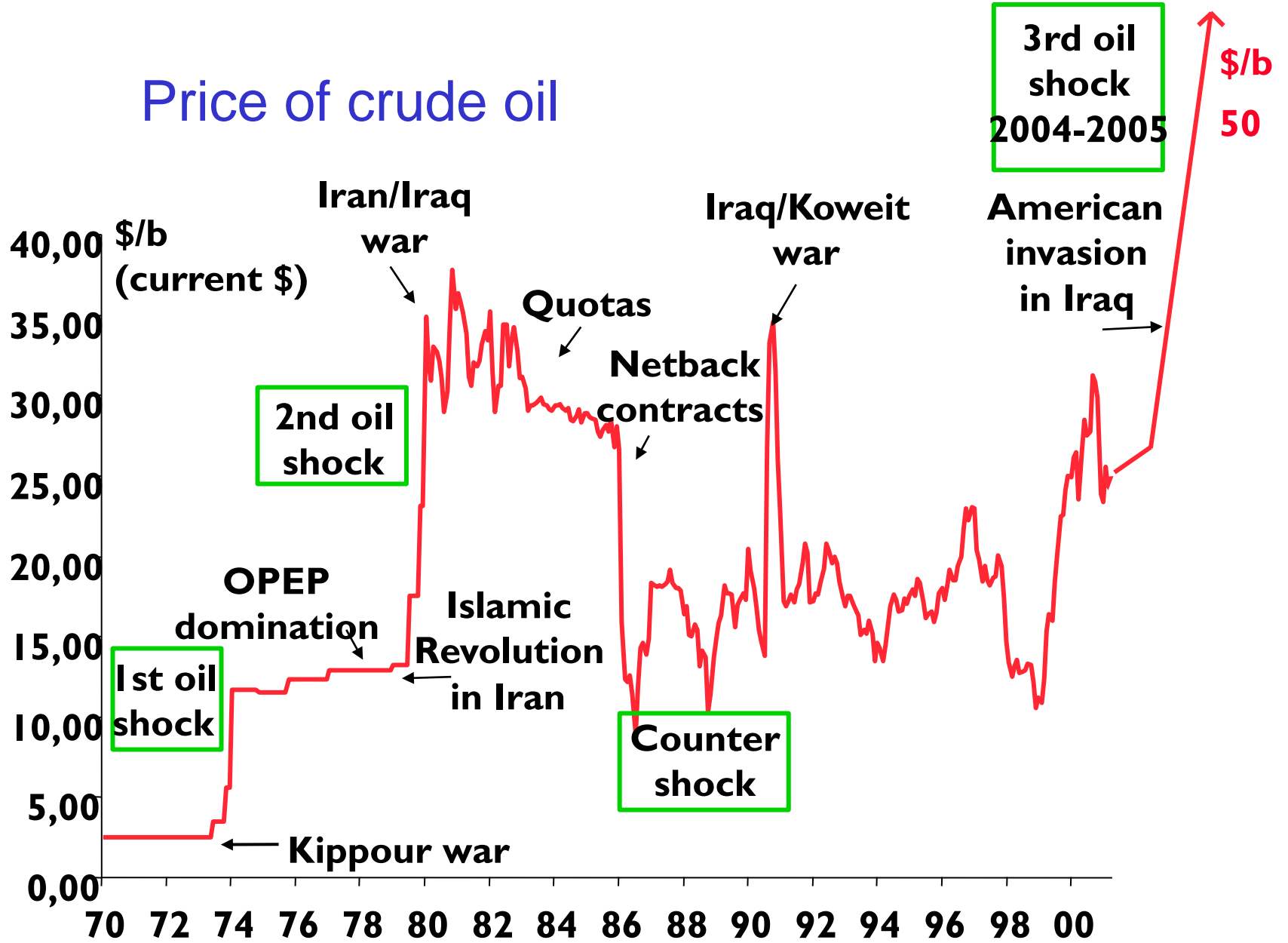
The Hormuz Strait is the weakest link in the chain of oil supply

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

\*1995 LHV = 0.21 toe for nuclear production  
 \*\*1995 LHV = 0.001 toe for hydroelectricity



# Price of crude oil

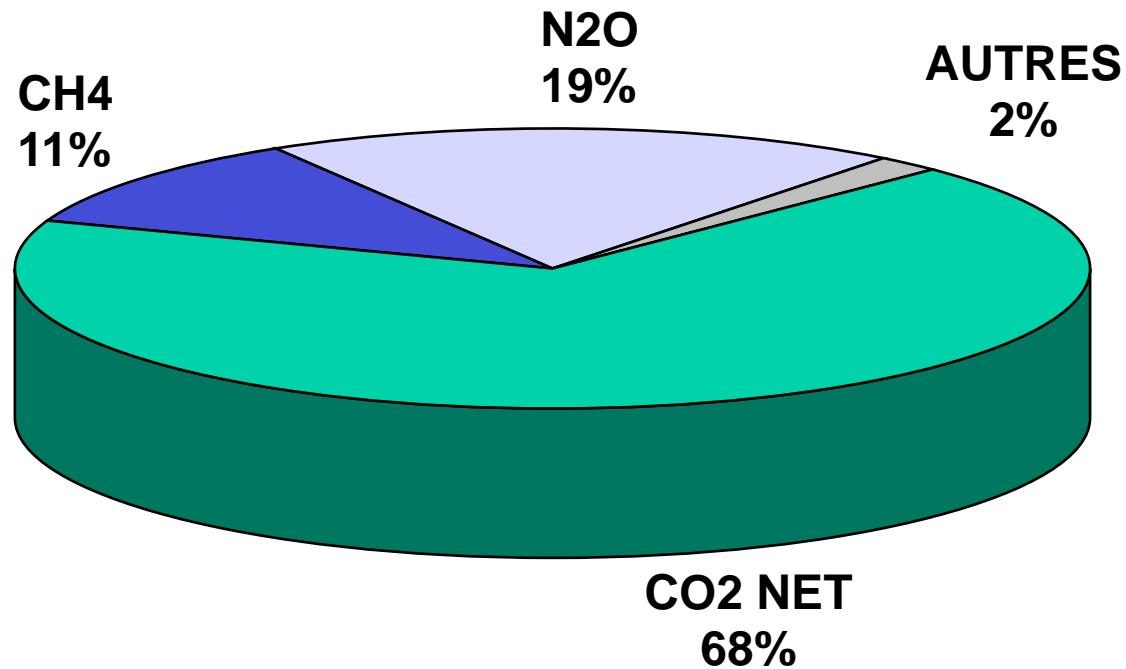


Source : Platt's

IFP



# 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

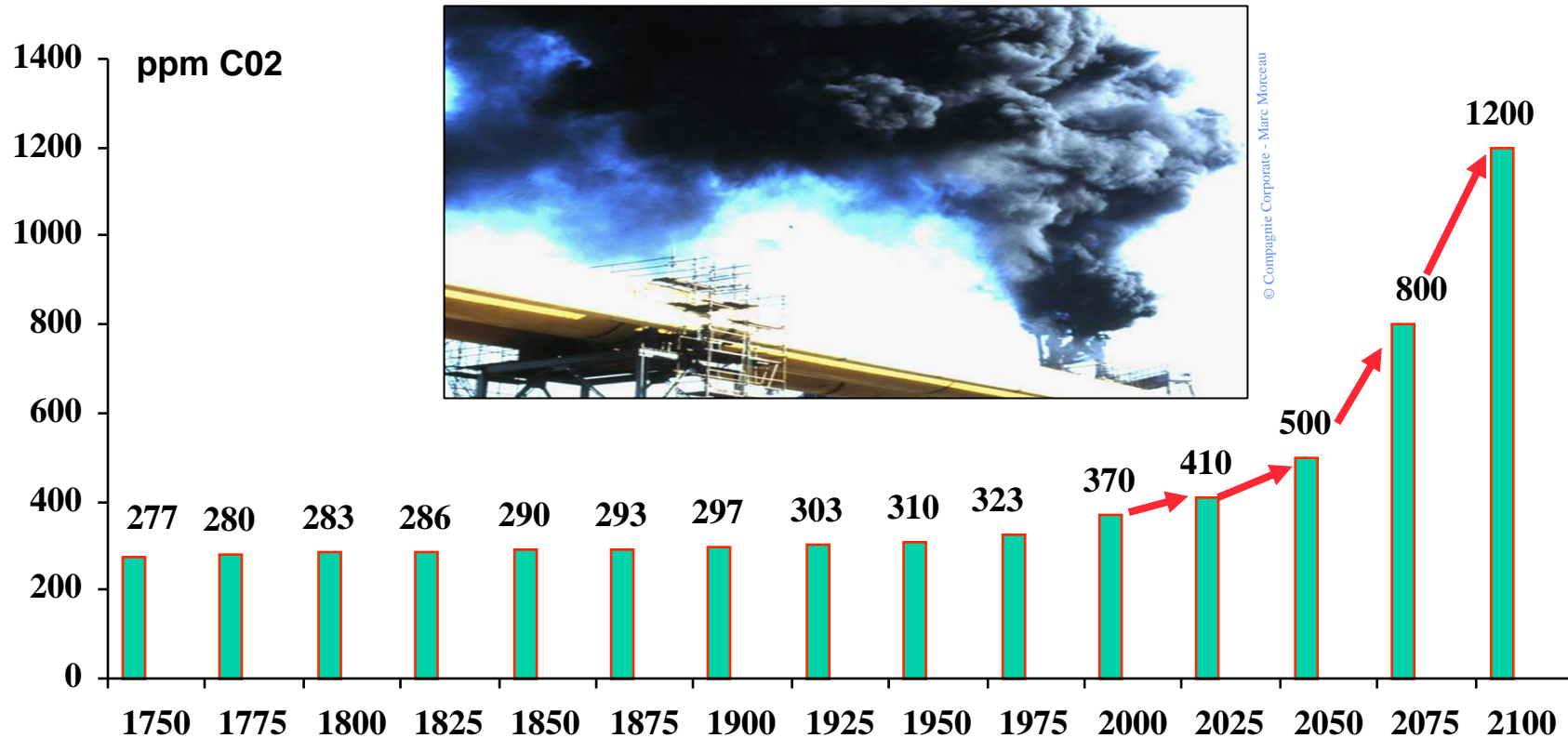
21<sup>st</sup> century : +3 to 6° C

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.**



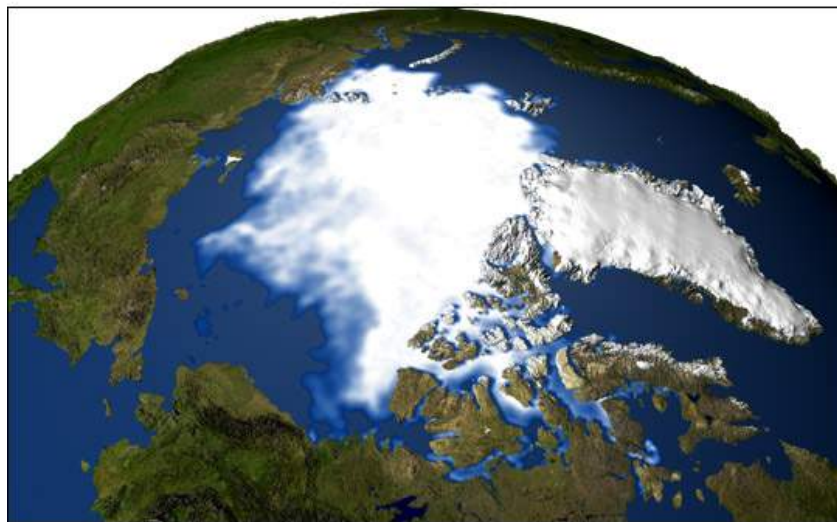
# CO<sub>2</sub> concentration in the atmosphere



**The CO<sub>2</sub> content of the atmosphere is higher than it has ever been in the last 800 000 years, and it continues to rise.**

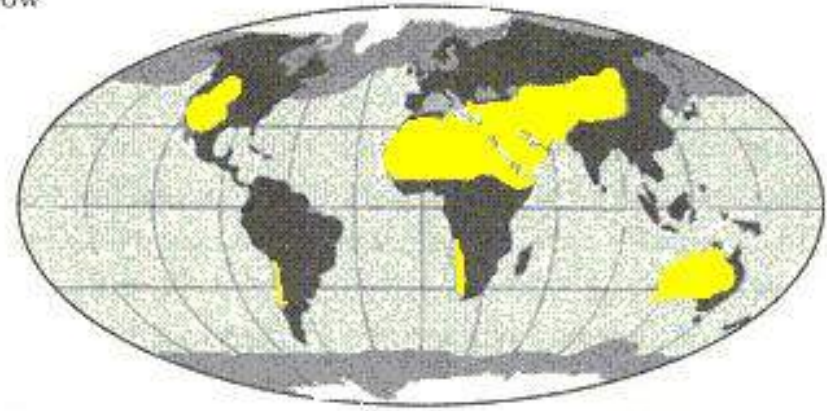


1979 SSMI Composite Data



2003 SSMI Composite Data






Now



Hot +5°C



Nature of surface

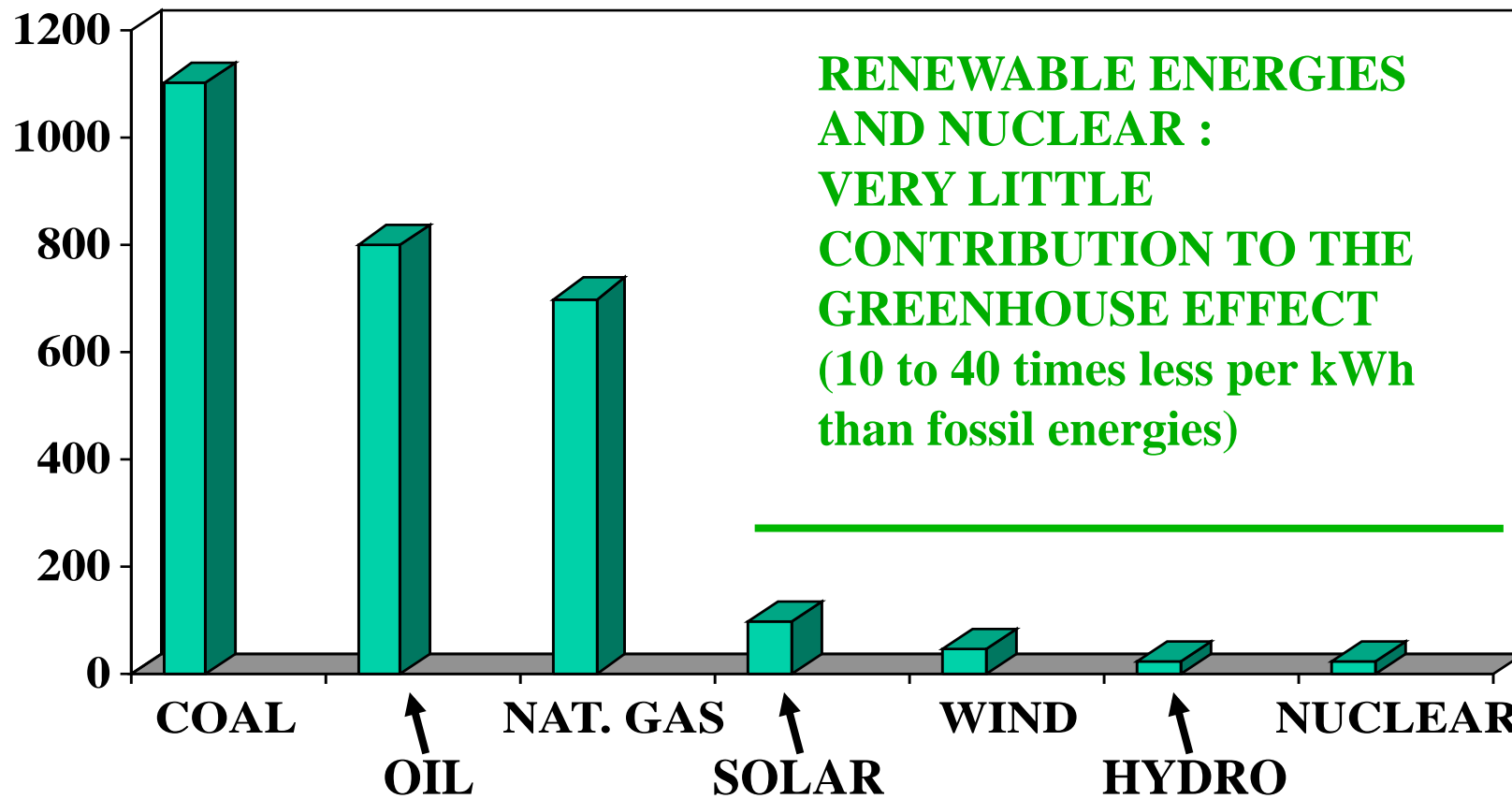
-  Ice
-  Ocean with life
-  Ocean desert
-  Forests
-  Scrub and desert

Source: The Revenge of Gaia / James Lovelock



# GREENHOUSE GAS EMISSIONS OF VARIOUS ENERGY SOURCES

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



Ref: NEW 01/96



# WHAT CAN WE DO ?

**1 - ENERGY CONSERVATION**

**2 - ENERGY EFFICIENCY**

**3 - CLEANER ENERGIES**

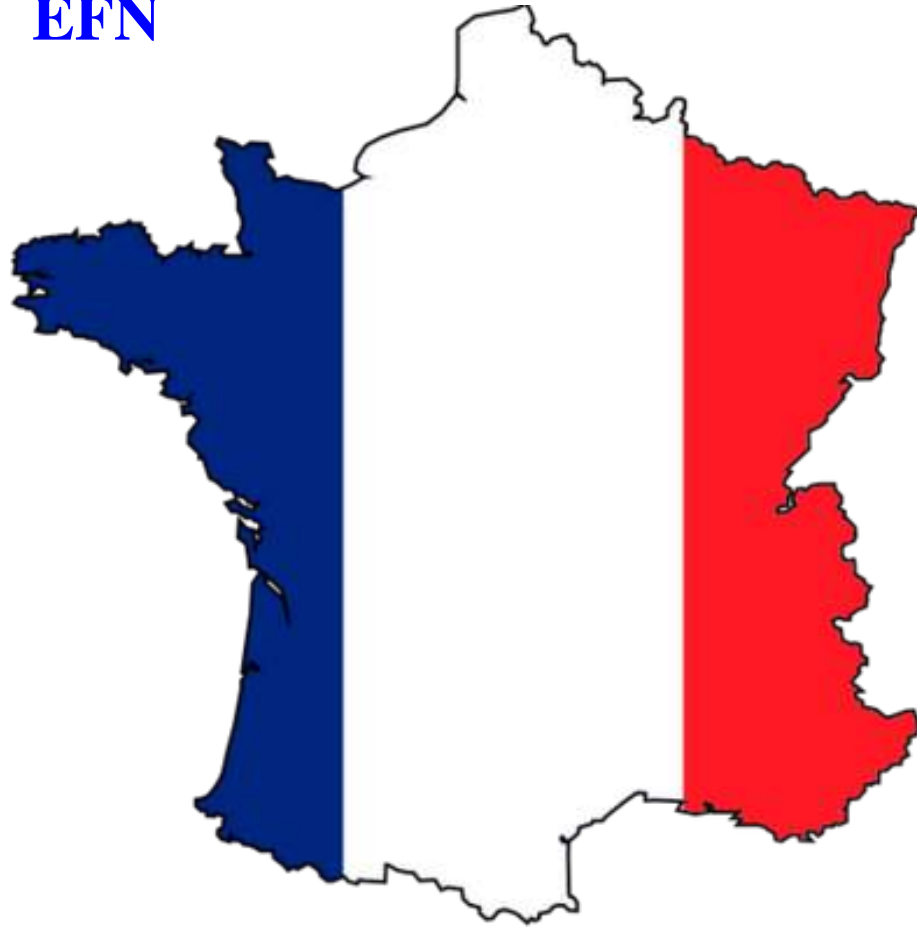
In 20 years, to divide in developed countries:

- CO2 emissions by factor 4 in Europe.





## Electricity in France



15% hydraulic (dams)

80% nuclear plants

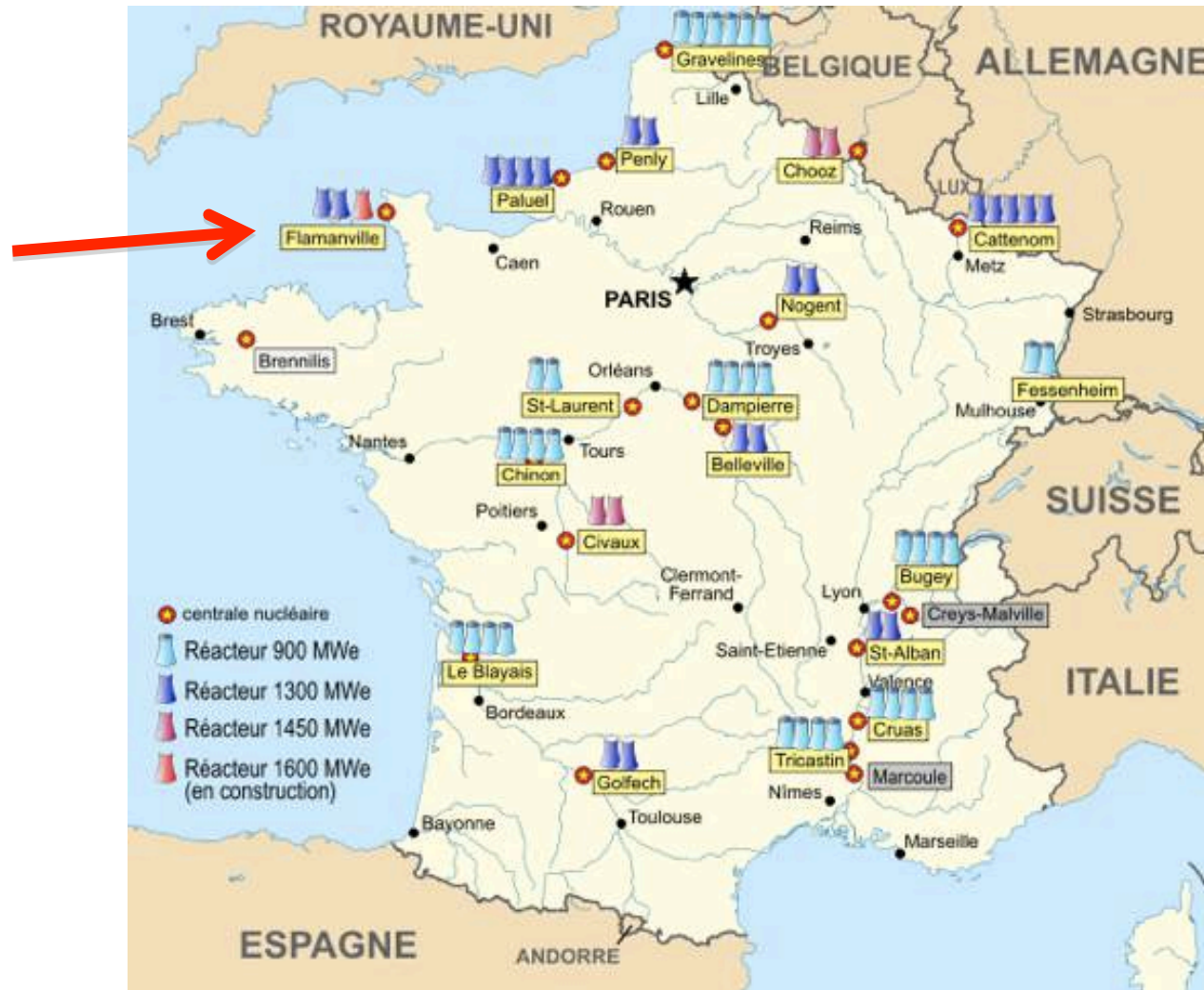
5% coal and gas

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95% clean, without atmospheric emissions



# Nuclear in France : 58 reactors + 1 EPR in construction





# FLAMANVILLE NPP site : 2 reactors + 1 in construction

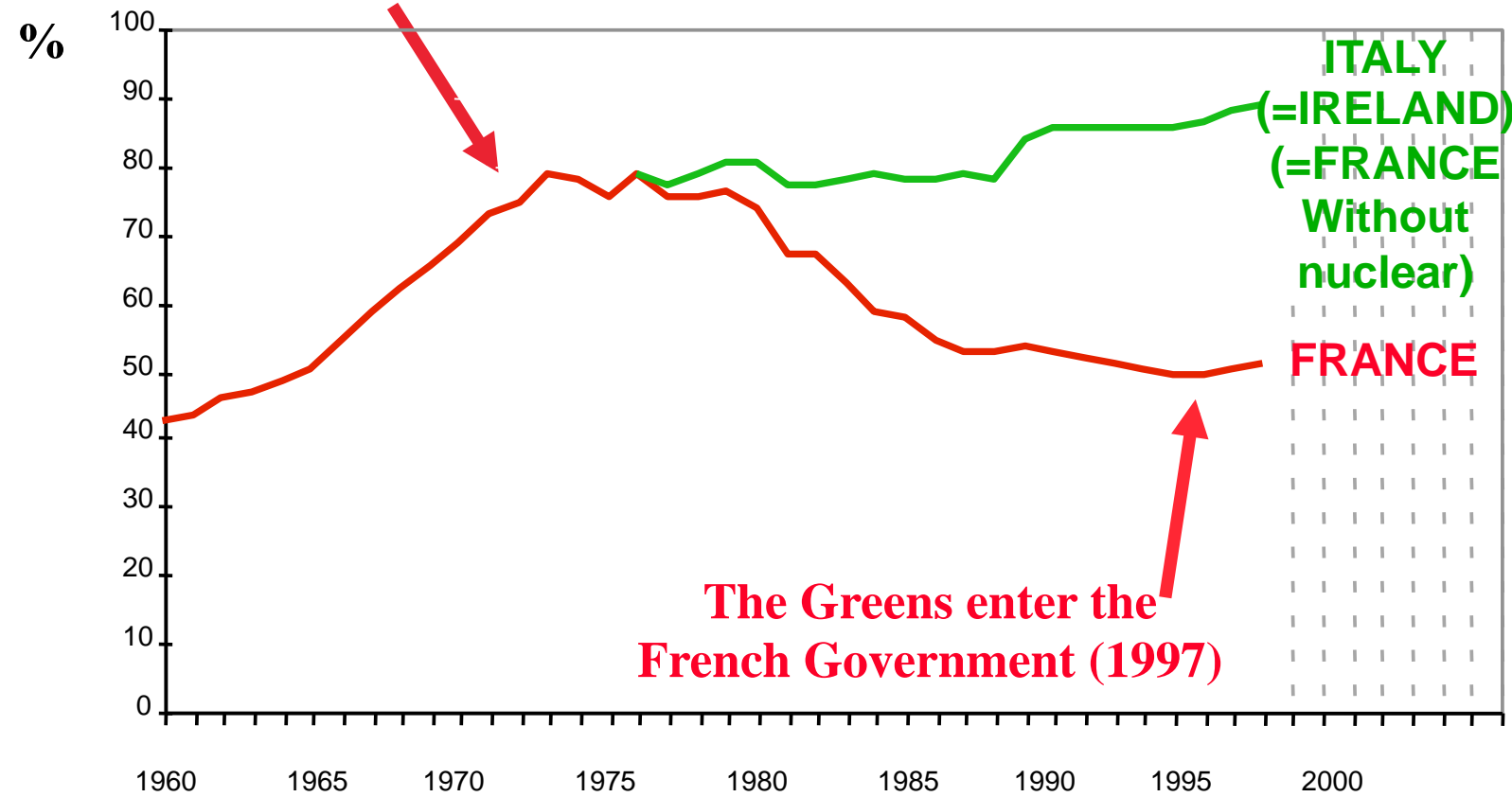






# Dependance on imported energy in France and Italy

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



**The Greens enter the French Government (1997)**



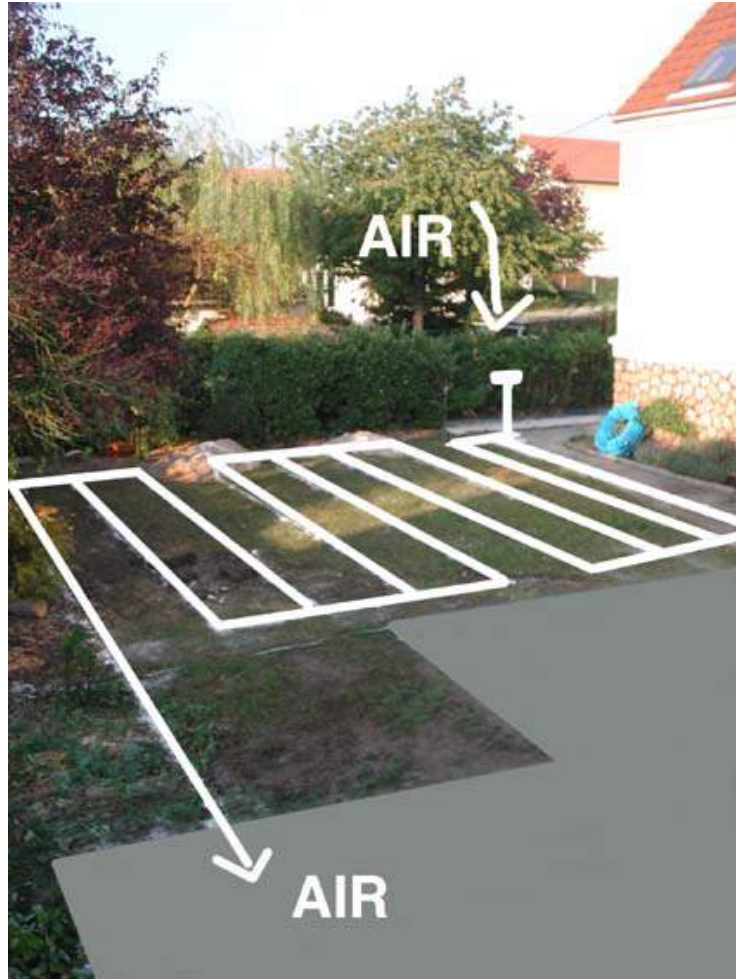
# Eco-construction

**A standard eco-house requires much less energy and emits 100 times less emissions.**





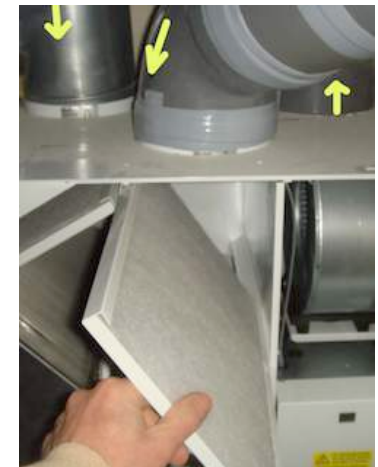
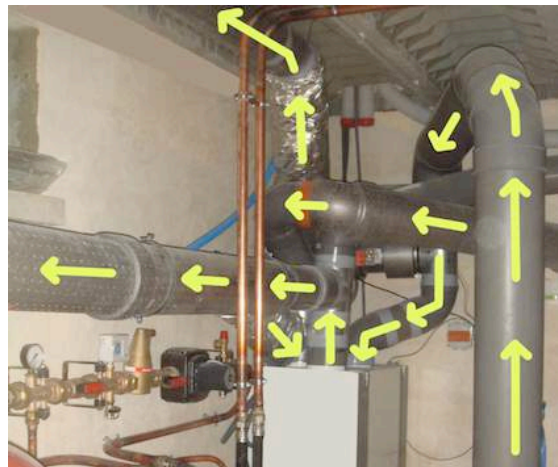
# Geothermal air conditioning (free air conditioning)





## Better 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



# Electric vehicles



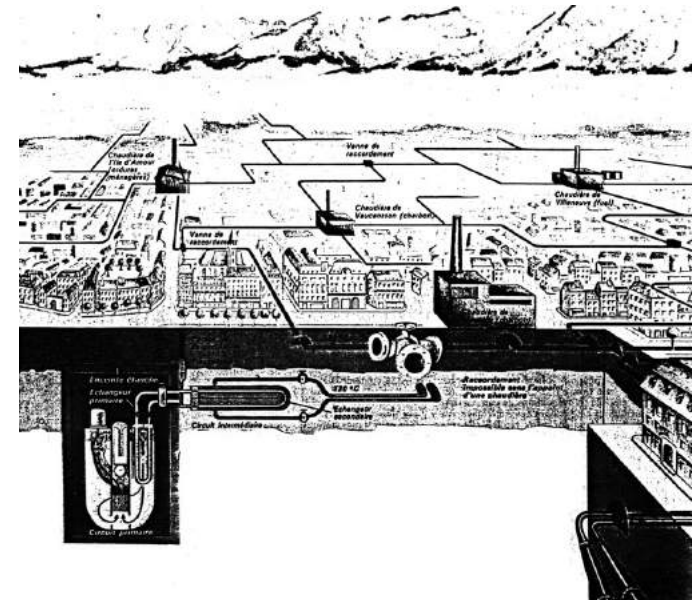
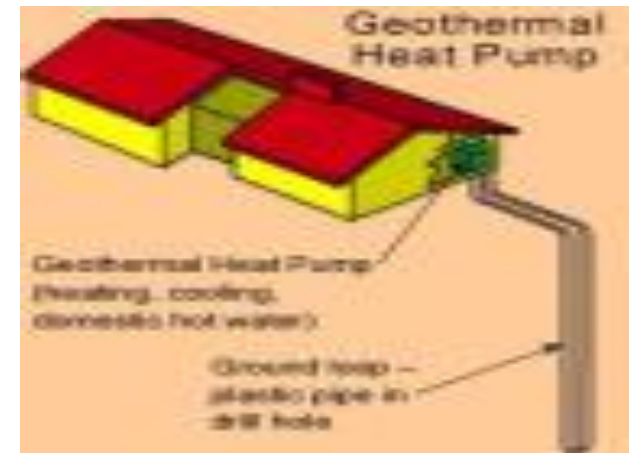
Electric cars, trucks, trains, bus, ships : electrifying them is the key !

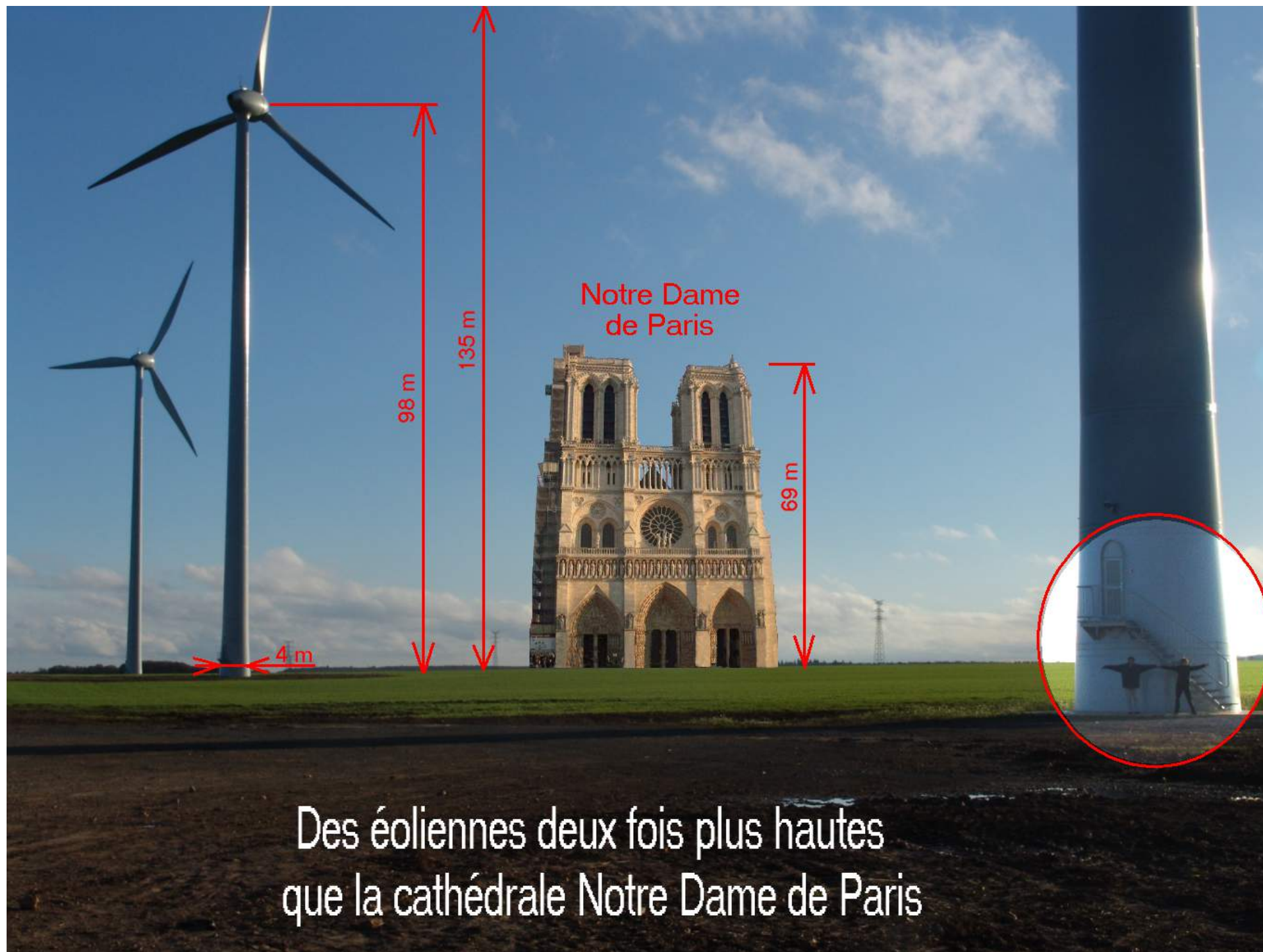




# Better use of energy

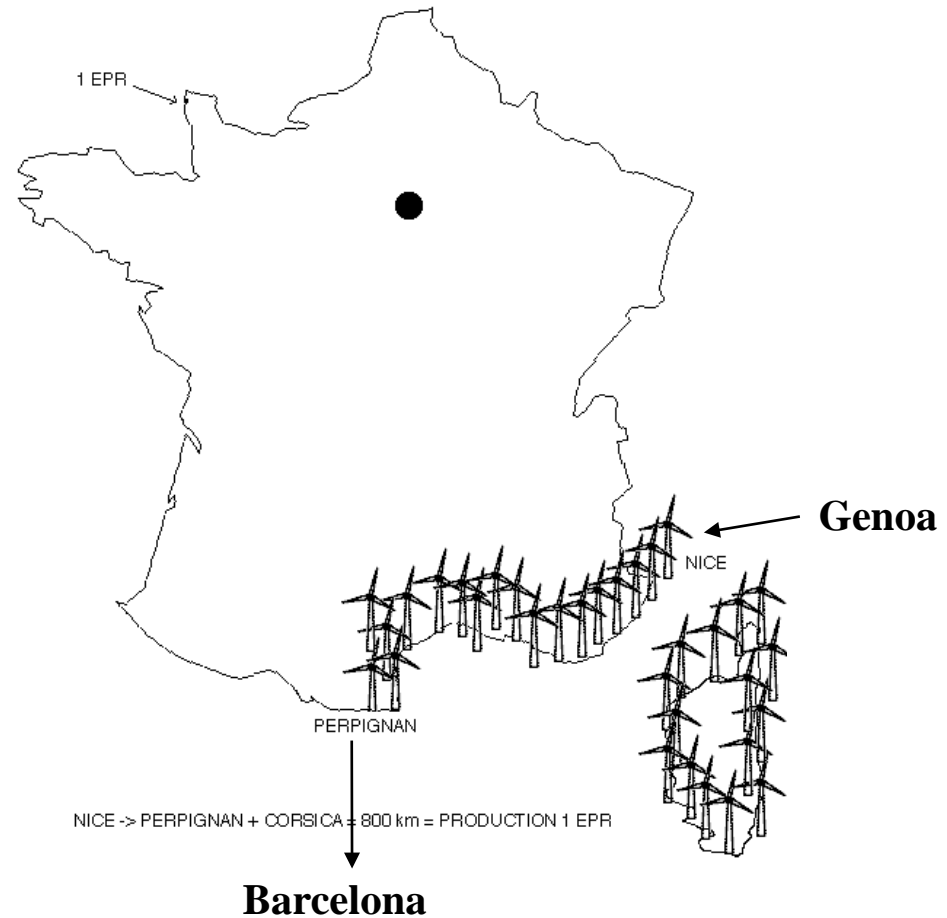
- Heat pumps (x6)
- Nuclear cogeneration (x3)







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







# SOLAR ENERGY CAN HELP, BUT ONLY WHEN SUN SHINES





# NUCLEAR ENERGY GROWING WORLDWIDE



## Positive news from :

- France
- UK
- USA, Russia
- China, India
- Canada
- Poland
- Emirates, Turkey,  
Bulgaria, Vietnam
- Finland...



Germany ?



# NUCLEAR ENERGY



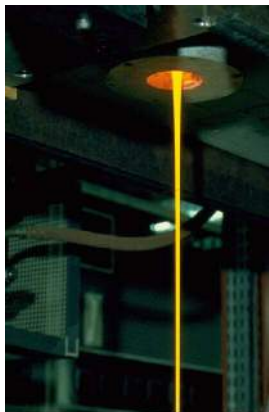
- **Is quite compact**
- **Factor 1 million  
(1g U = 1 Ton oil)**
- **Consumes very little  
uranium  
(20 T=1m<sup>3</sup> per year)**
- **Produces very small  
volumes of waste**



# NUCLEAR WASTE IS NOT A PROBLEM



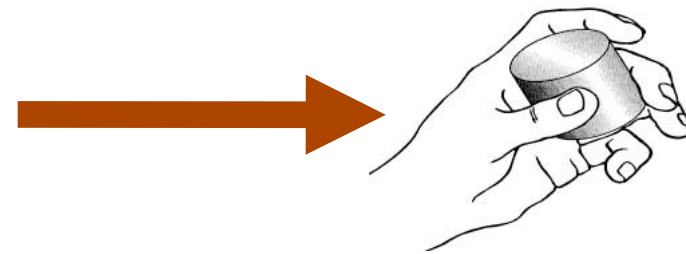
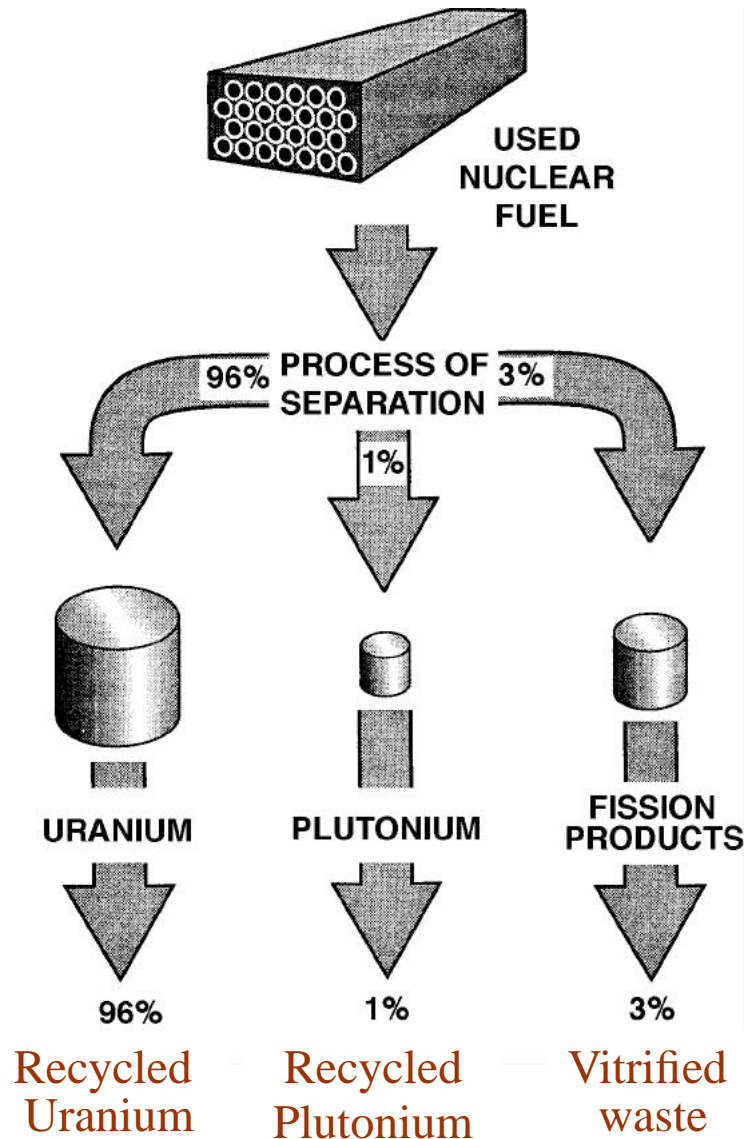
- **The volume of the waste is small**
- **Nuclear waste is confined - not rejected**
- **Nuclear waste decays spontaneously**



- **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



# Radioactivity is natural

Background : 0.05  $\mu\text{Sv}/\text{hour}$

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  $\mu\text{Sv}/\text{h}$

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

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

Radioprotection rules should include natural radiation, not just industrial exposure, and both the beneficial and detrimental effects



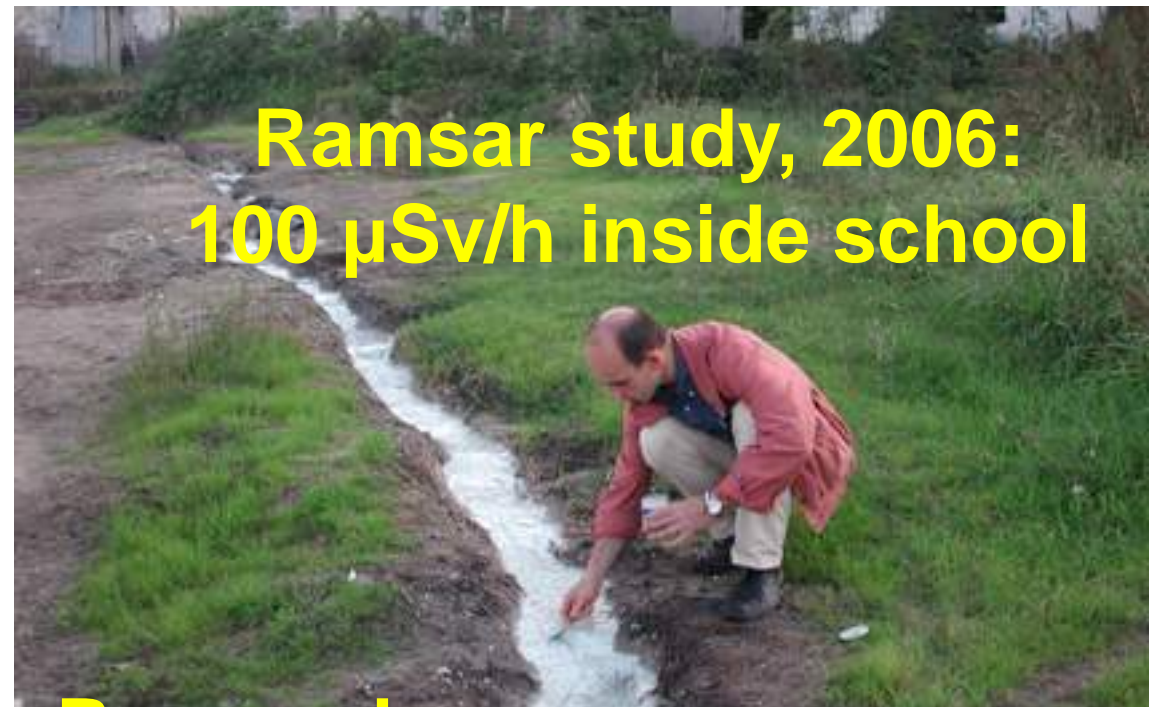


HBRS study  
in RAMSAR :

The highest background radiation school in the world and the health status of its students and their offspring

*(Comby & al., Isotopes in Environmental and Health Studies, oct 2013)*

**-> No negative health effects observed**





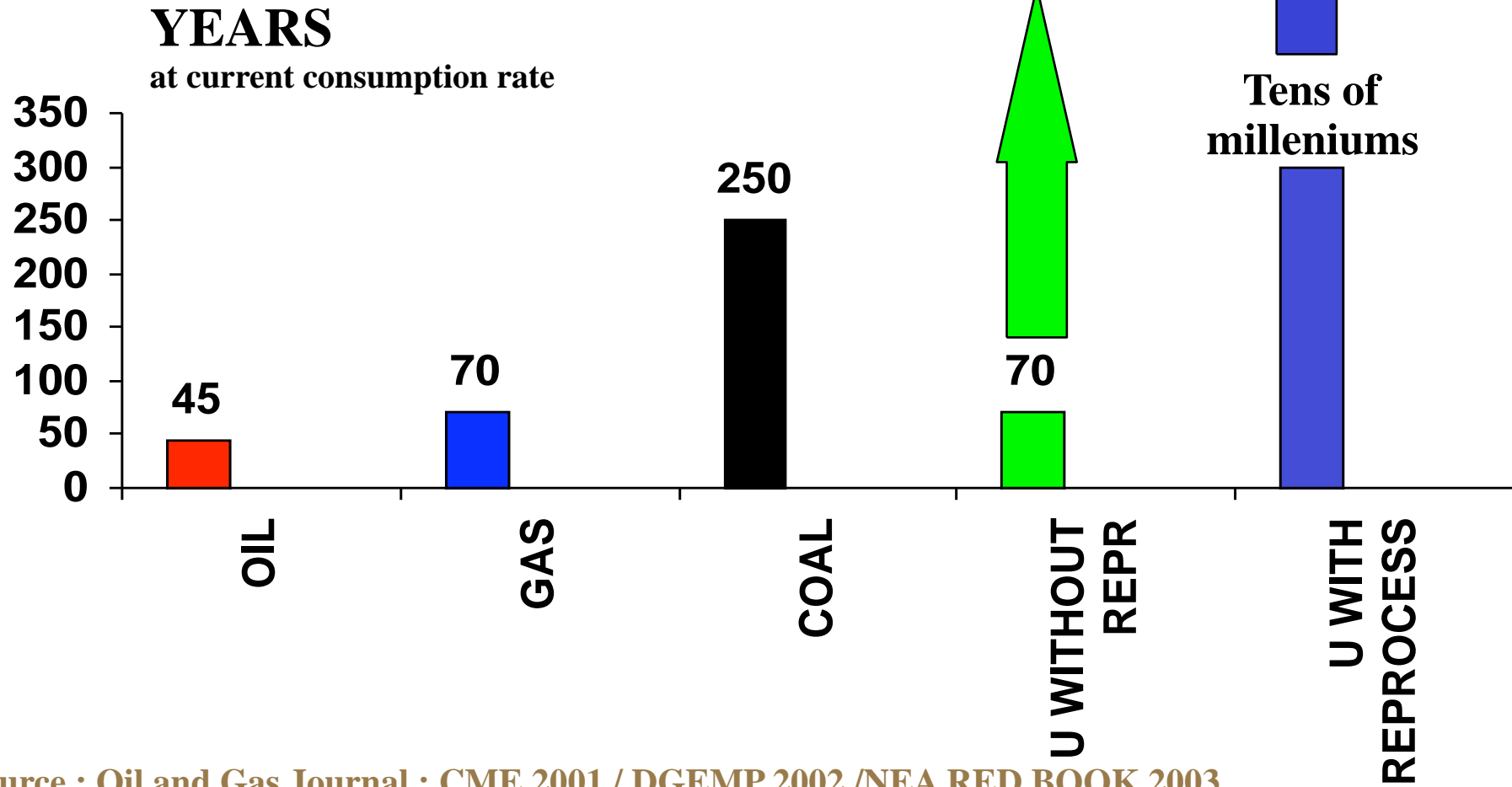








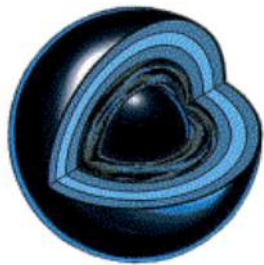
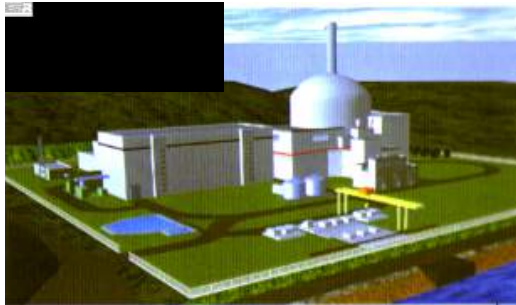
# PROVEN RESERVES



Source : Oil and Gas Journal : CME 2001 / DGEMP 2002 / NEA RED BOOK 2003



# Reactors of the future

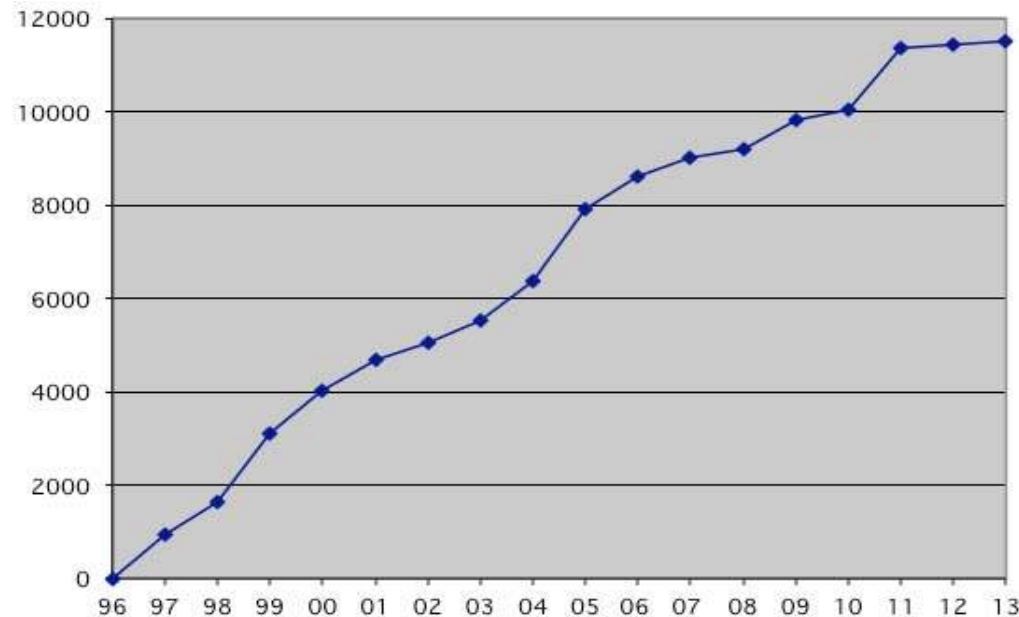
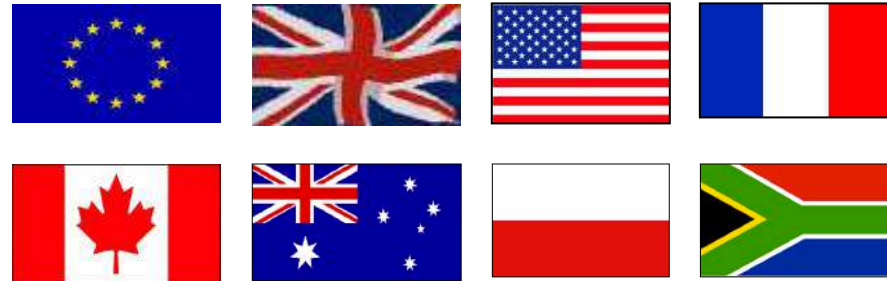


- Advanced reactors :
- EPR, AP-1000, ACR, ABWR
- New small reactors :
- Small, very safe reactors
- For developing countries
- Worst case not dangerous
- Terapower, PBMR, Flexblue, ships, barge...
  
- Generation IV :
- Resources x100, less waste
- 6 concepts (SFR, LFR, GFR, VHTR, MSR, SCWR)



# EFN : Environmentalists For Nuclear Energy

- An international network gathering over 12,000 members and supporters in favor of clean nuclear energy
- Growing rapidly
- In 65 countries
- On 5 continents.

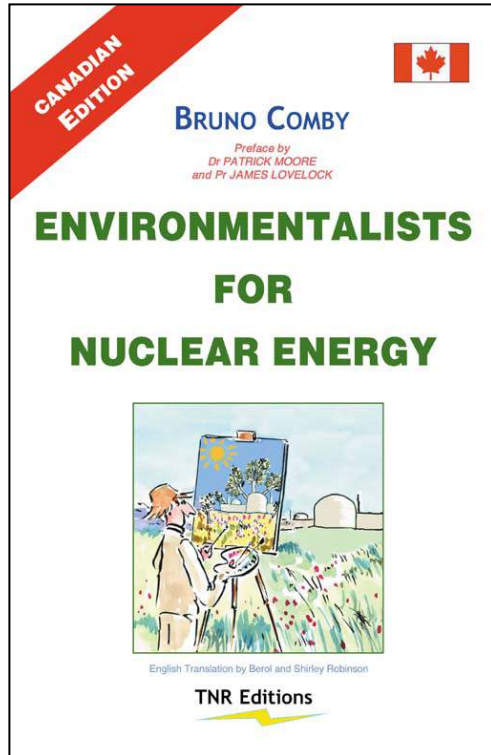


**EFN's mission :**  
**information about energy and the environment**



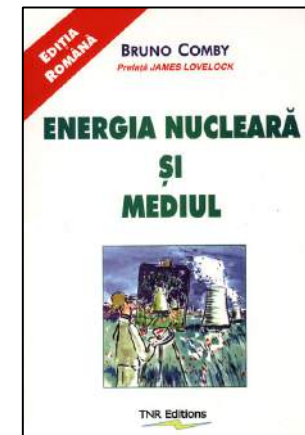
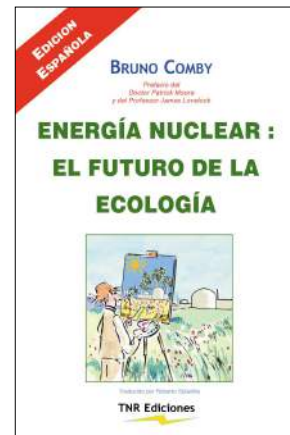
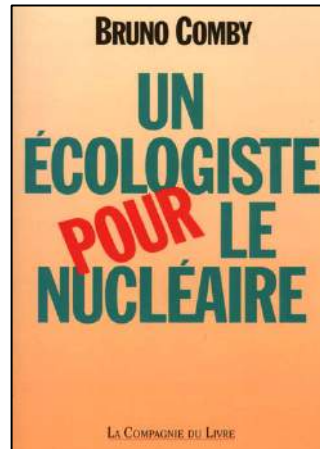
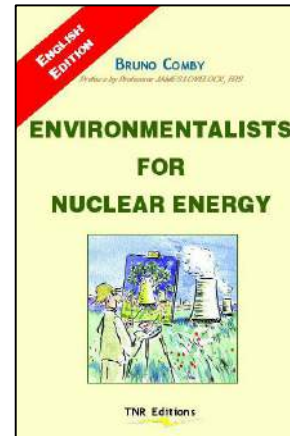
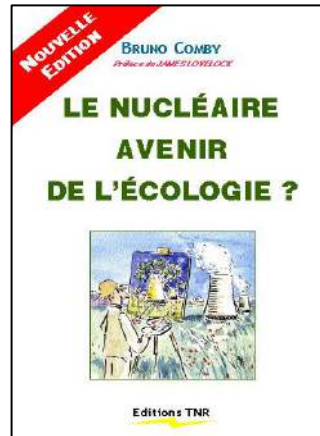
# The book:

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)



# 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 this image.

**CONCLUSION :**

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

**nuclear energy is abundant and has  
numerous environmental benefits**

**THE WORLD NEEDS**

**MORE CLEAN NUCLEAR**

**ENERGY**

**A PERFECT MATCH**



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



**More information :**

**[www.seren.org.pl](http://www.seren.org.pl)**

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

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

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

**[andrzej\[at\]ecolo.org](mailto:andrzej@ecolo.org)**

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**Your local correspondent**