



Green and Nuclear

Eternal Enemies or Perfect Match ?



EFN speaking
in AtomEco



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

Nuclear waste and reprocessing

Perspectives on radiation in nature

Energy independence

Risks: 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





The life of an independent scientist - Scientific background



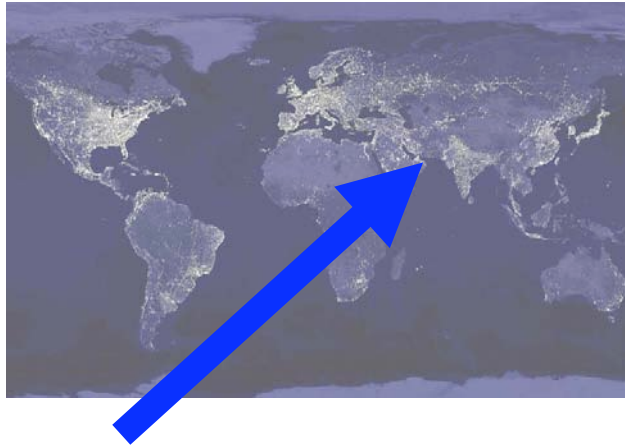
Graduate in nuclear physics (Ecole Polytechnique Paris + National University of Technical Sciences)

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

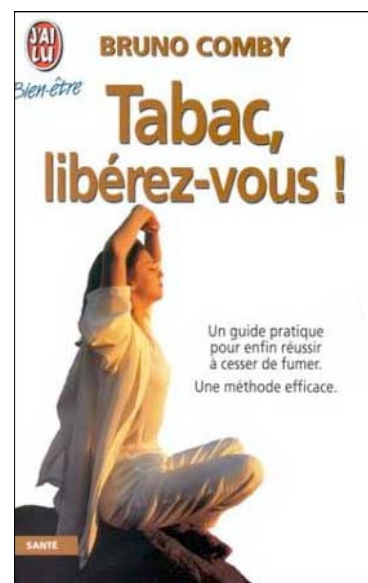
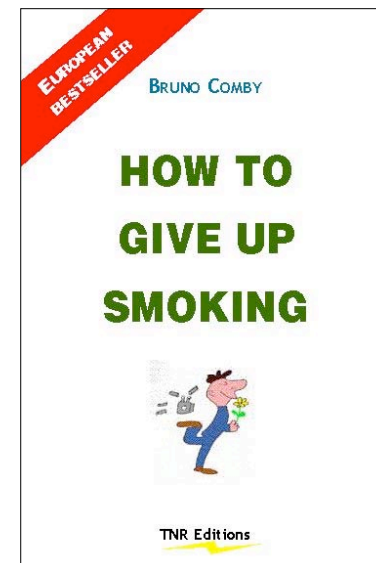


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25 years dedicated to pioneer work in fundamental research, publications, and teaching the public about energy, natural health and protection of the environment.

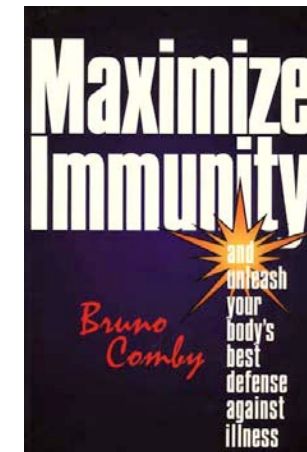


Bruno Comby - a non smoking pioneer





Bruno Comby - Research on natural nutrition



An ecologist promoting alternative sources of protein

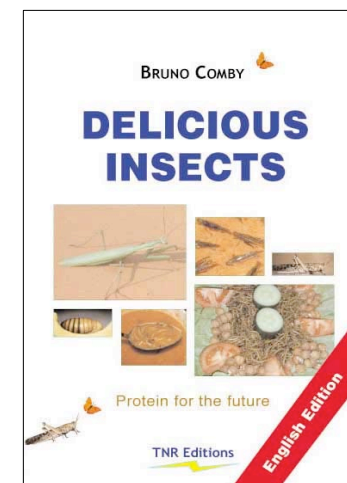
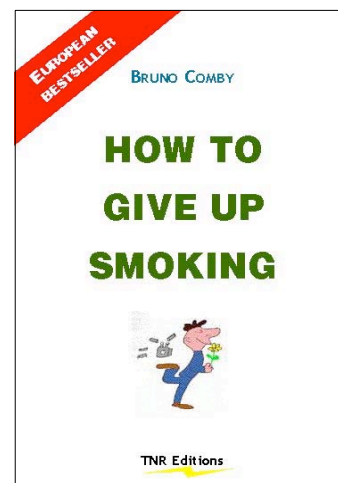
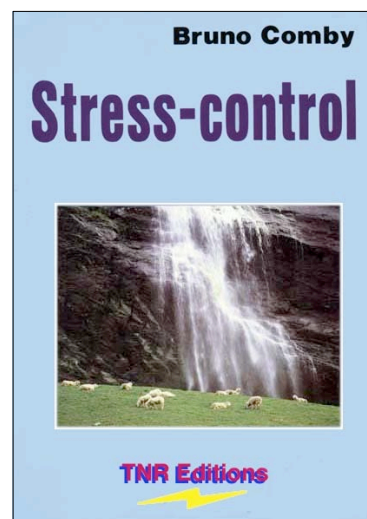
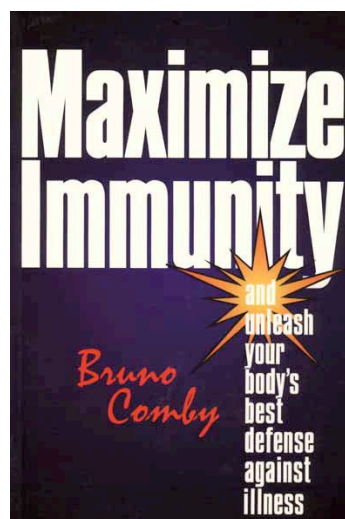




The life of an environmentalist - research and books

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

8 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

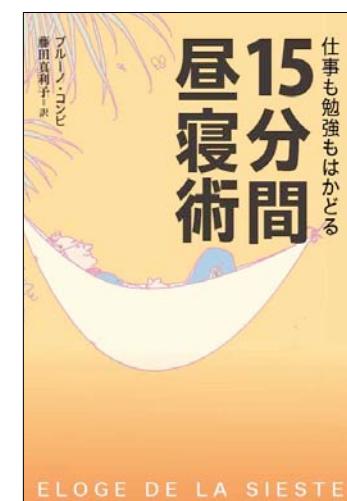
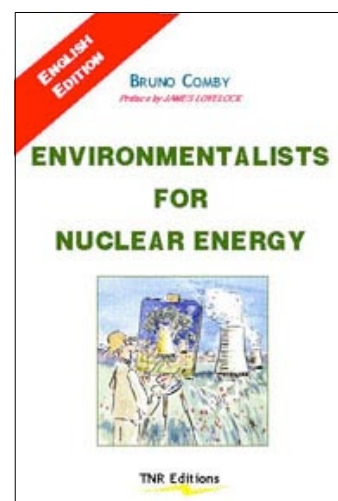


Photo of the world at night

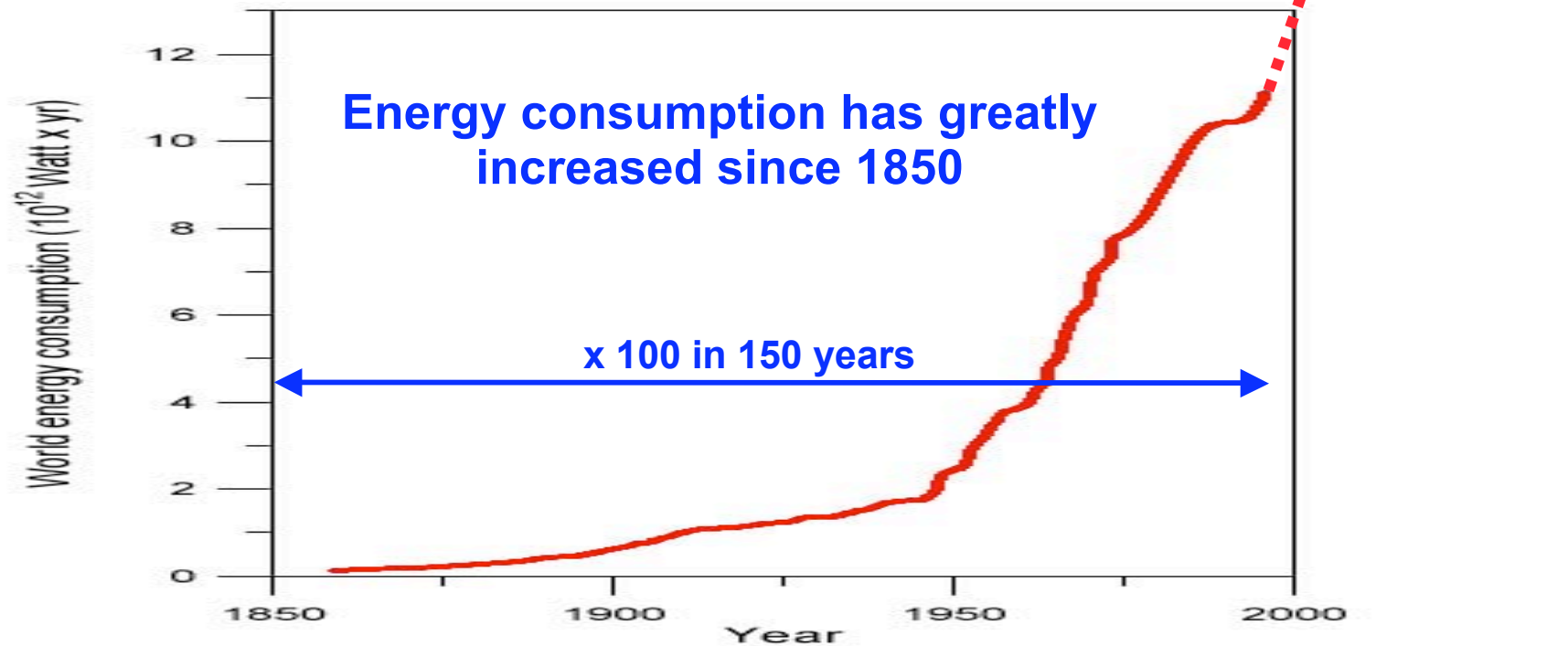


**Today, 20% of the world's population
consumes 60% of the energy**

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



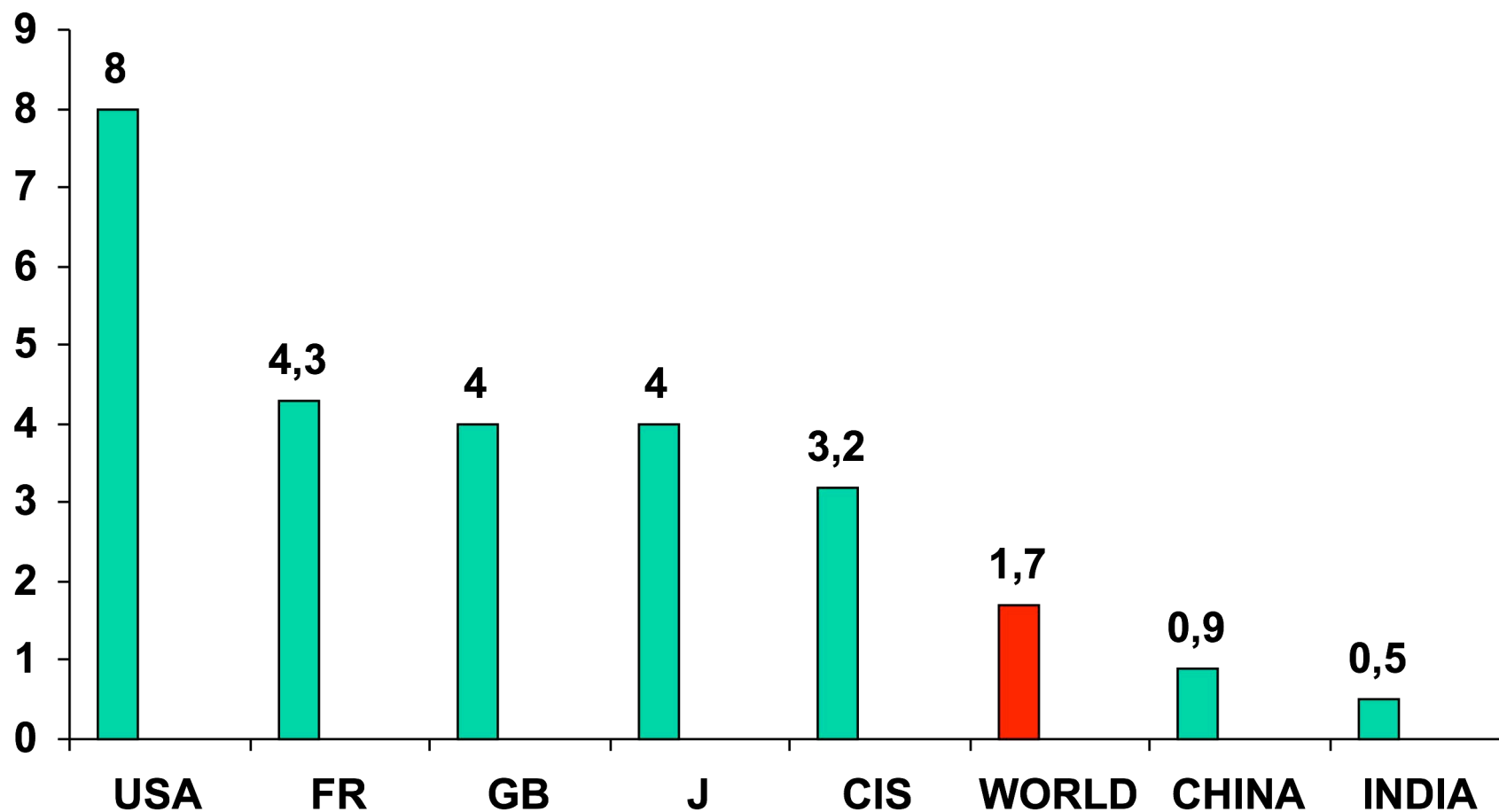
World Energy Consumption since the Industrial Revolution



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



ENERGY CONSUMPTION (toe/capita/year)



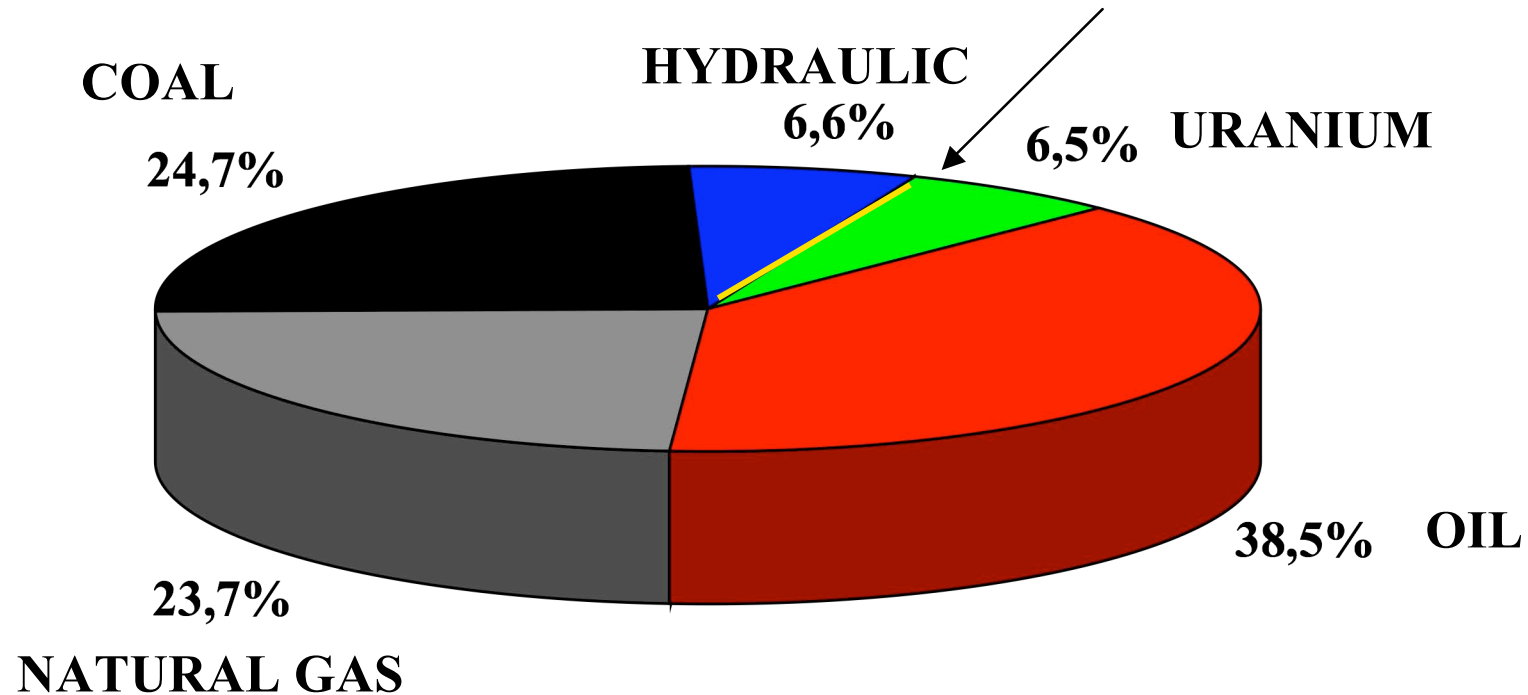


ENERGY SOURCES

excluding biomass - fire wood (world)

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

Wind + geothermal + solar = 1%



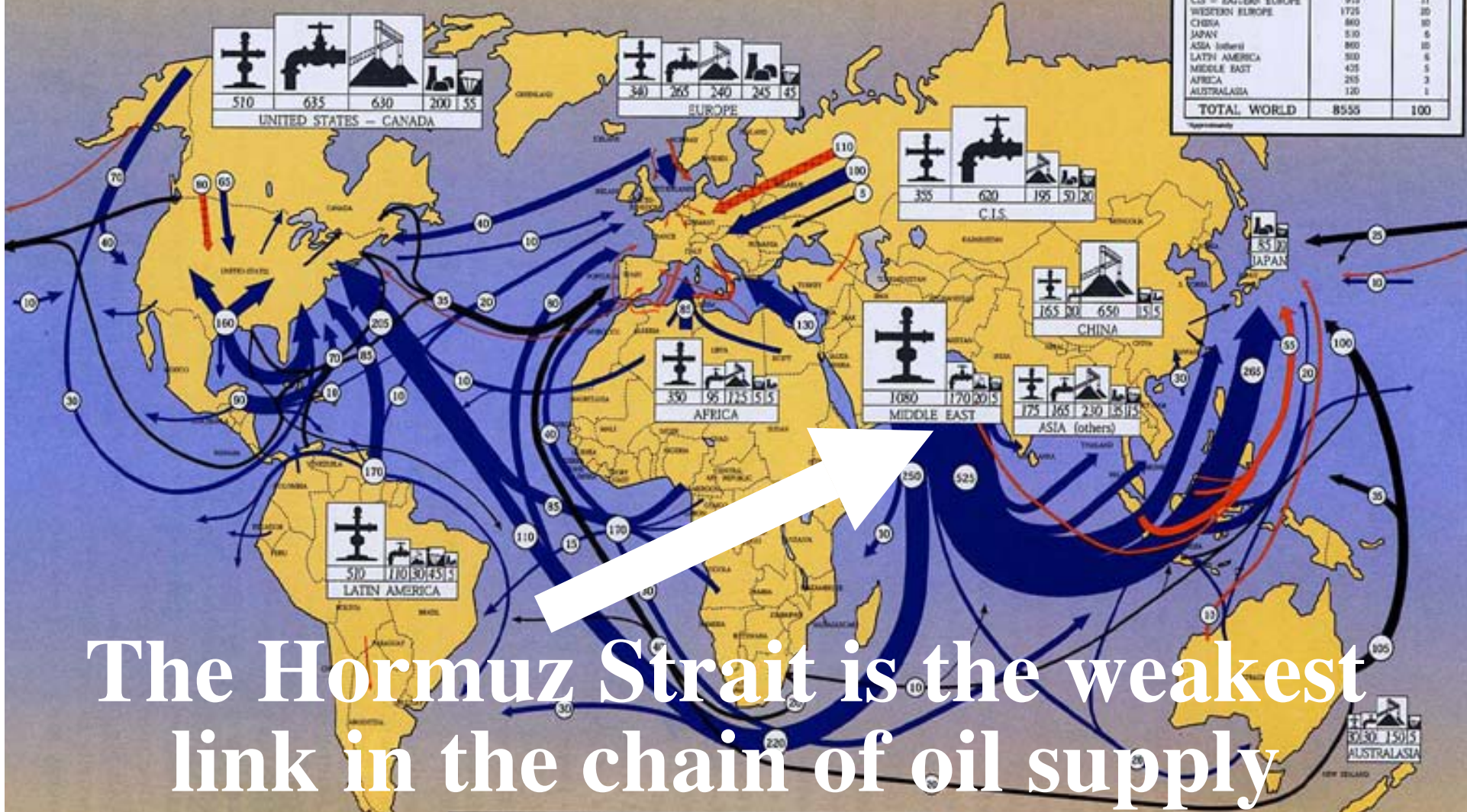
9,1 Gtoe/yr + biomass \sim > 10 Gtoe/yr

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 (Million tonnes oil equivalent)	Share (%)
UNITED STATES - CANADA	2365	28
CIS - EASTERN EUROPE	915	11
WESTERN EUROPE	1725	20
CHINA	860	10
JAPAN	510	6
ASIA (others)	860	10
LATIN AMERICA	350	4
MIDDLE EAST	425	5
AFRICA	265	3
AUSTRALASIA	120	1
TOTAL WORLD	8555	100



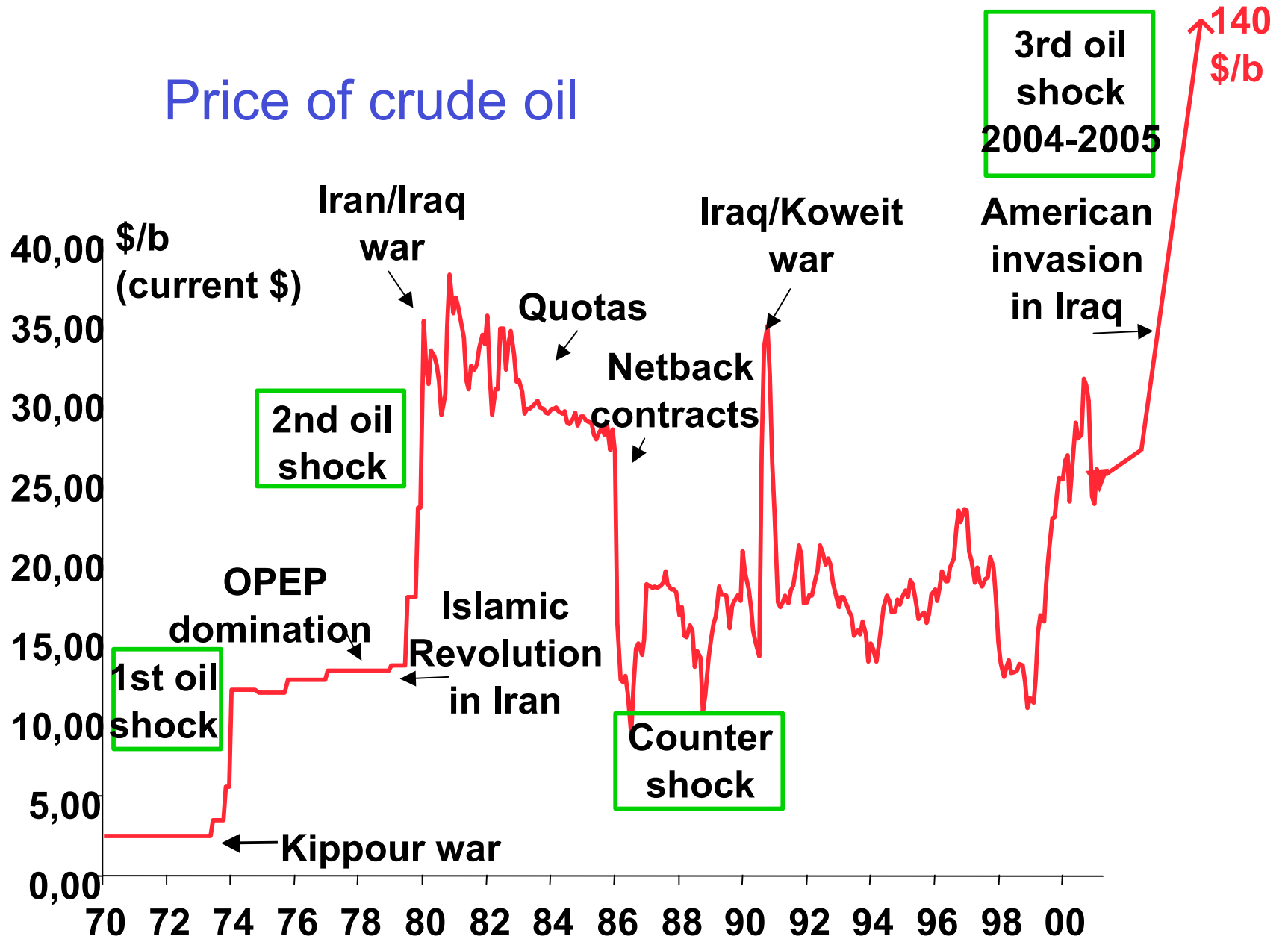
The Hormuz Strait is the weakest link in the chain of oil supply

PRIMARY ENERGY PRODUCTION					TRADE FLOWS WORLDWIDE		
(Million tonnes oil equivalent)					Petroleum	Gas line	Liquefied natural gas
Oil	Gas	Coal	Nuclear**	Hydroelectricity**			

*1990 100% = 0.25 toe for nuclear production
 **1990 100% = 0.001 toe for hydroelectricity



Price of crude oil

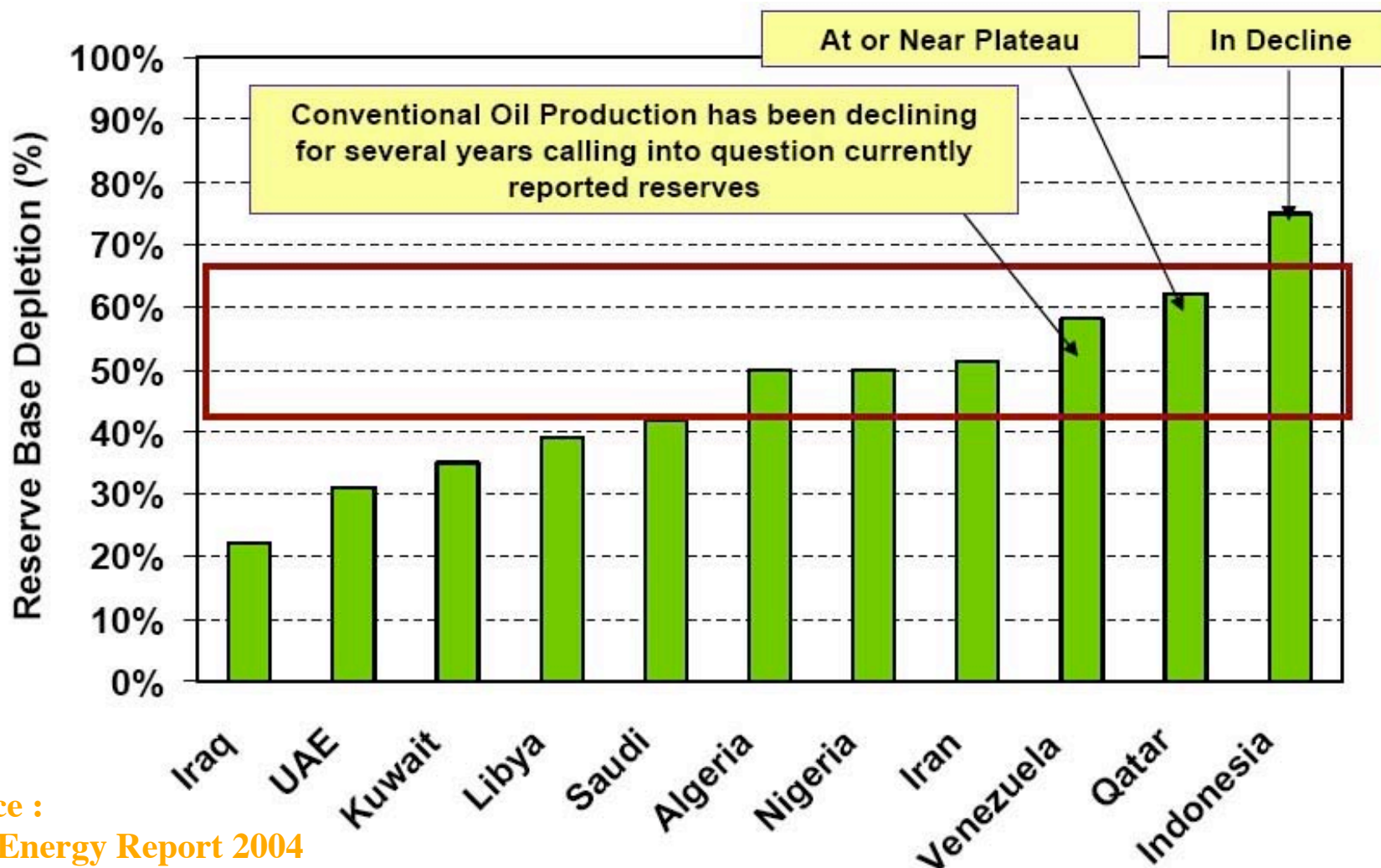


Source : Platt's

IFP



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



Source :
PFC Energy Report 2004

GreenHouse Gas Effect

The background of the slide is a photograph of an oil field at dusk. Several tall smokestacks are visible, each emitting a large plume of orange and yellow flames that rise into the dark blue sky. Thick black smoke billows from the stacks, partially obscuring the sky. The foreground shows a dark, flat landscape under a twilight sky.

20th century : +0.5 to 1°C

21st century : +3 to 10° C

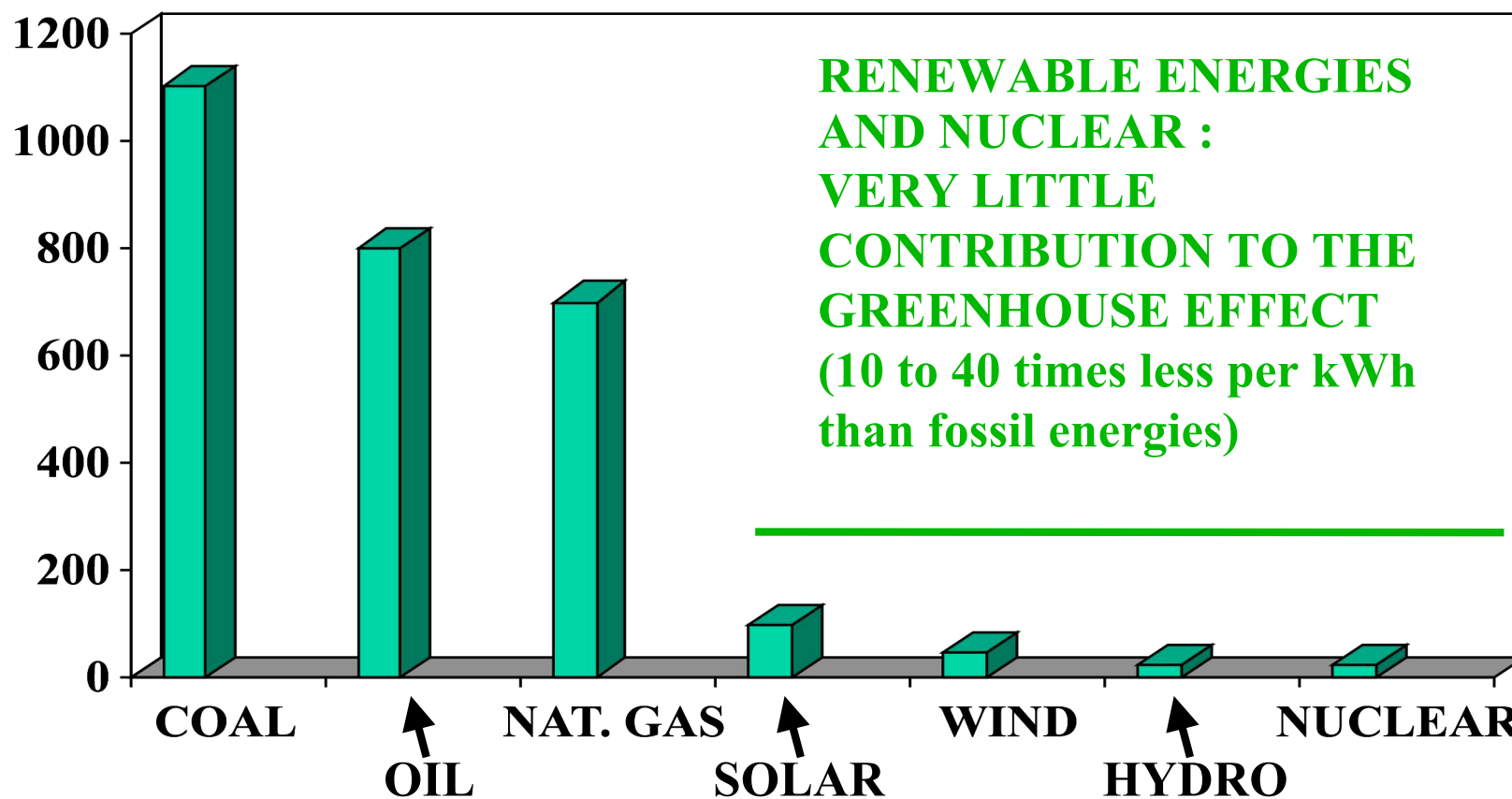
Let 's suppose... : we stop emitting greenhouse gases today, what happens with global warming ?

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



GREENHOUSE GAS EMISSIONS OF VARIOUS ENERGY SOURCES

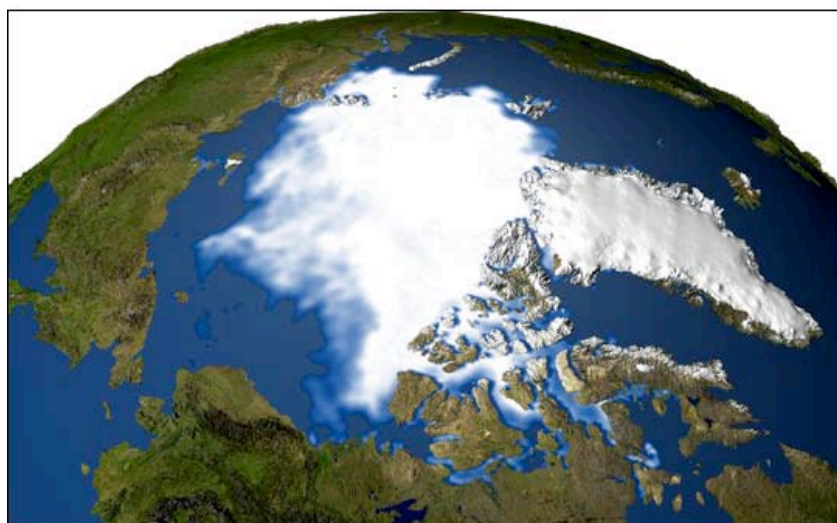
gr CO₂/kWh



Ref: NEW 01/96

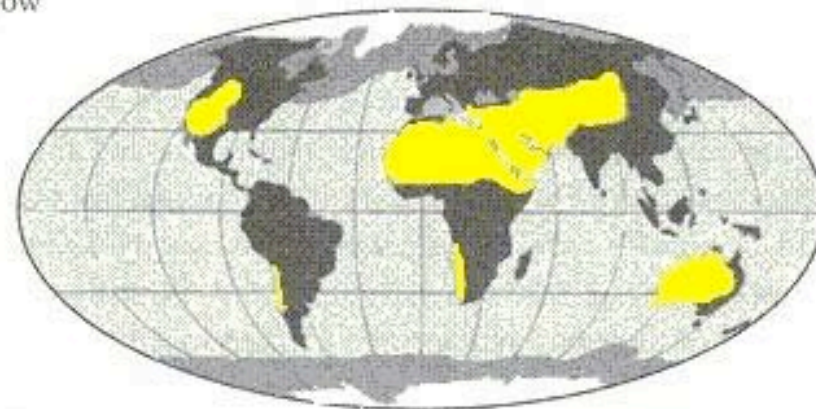


1979 SSMI Composite Data



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 divide in developed countries:

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





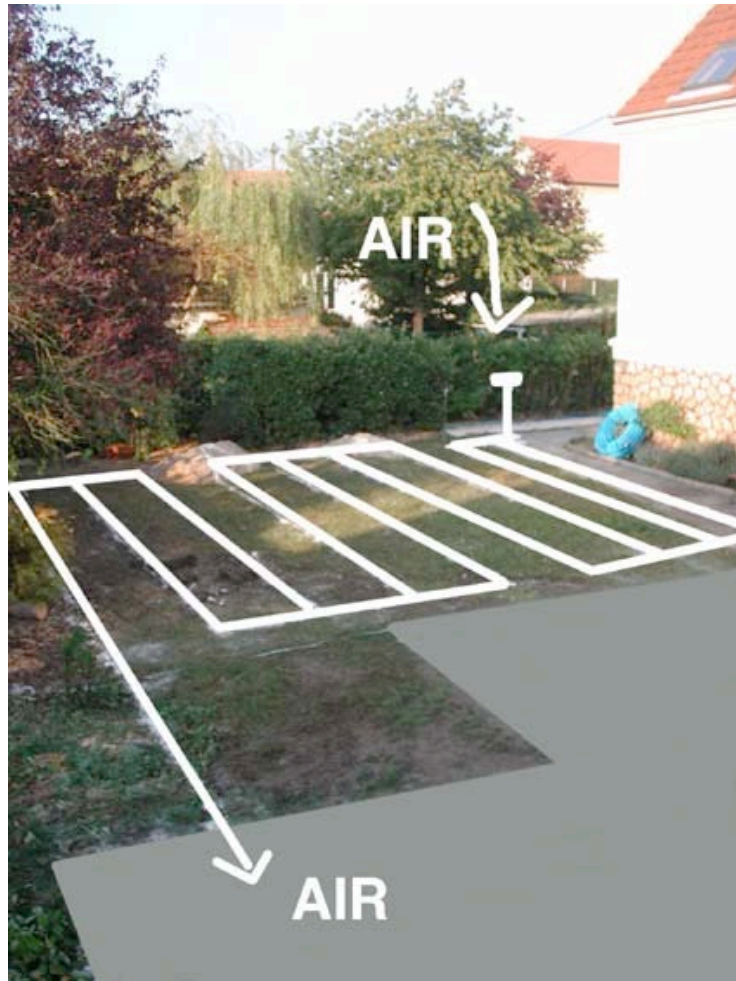
Ecological construction

A standard eco-house that requires 20 times less energy and emits 400 times less CO₂.





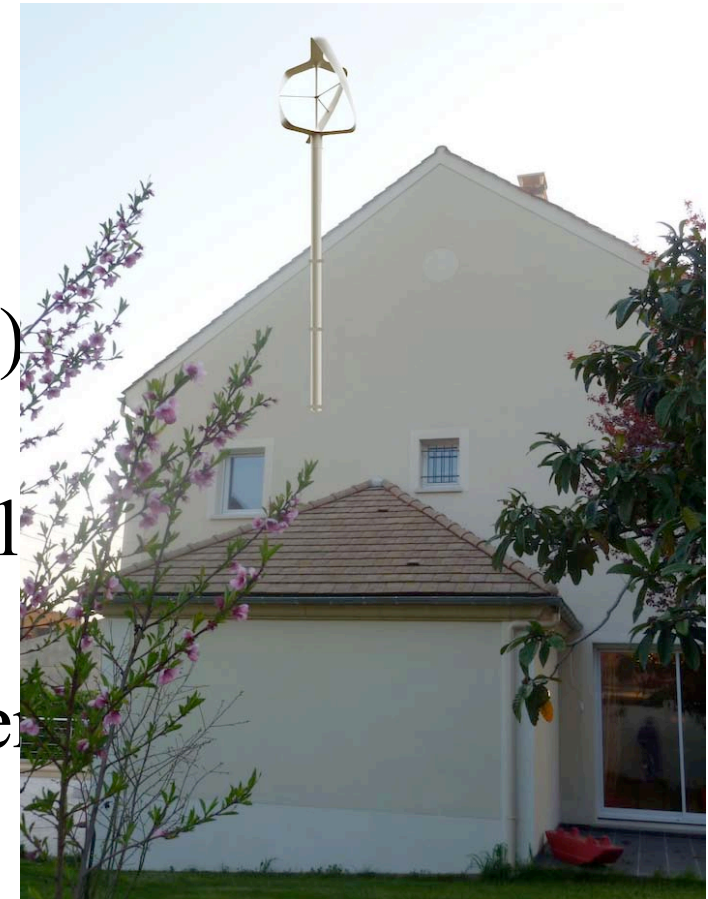
Geothermal air conditioning (free air conditioning)



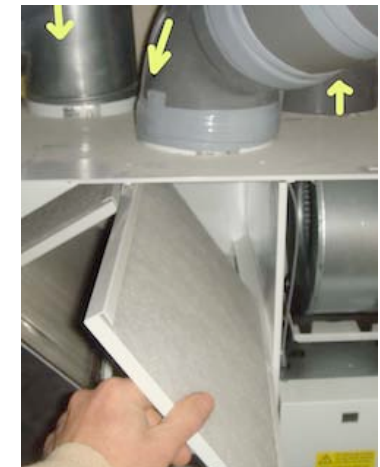
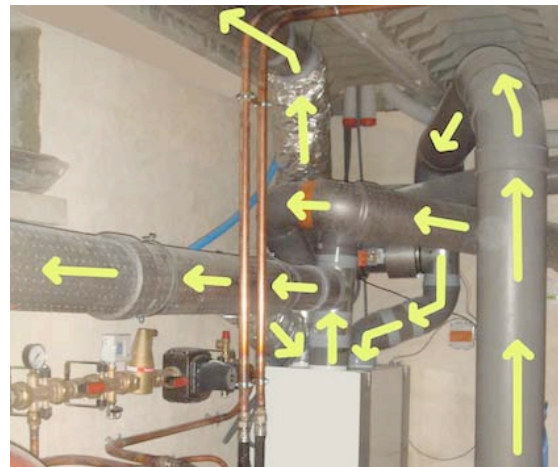


Clean construction technology

- 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 !



Clean industry :



- stop burning carbon
- electrify
- produce clean electricity



Clean transportation electric vehicles



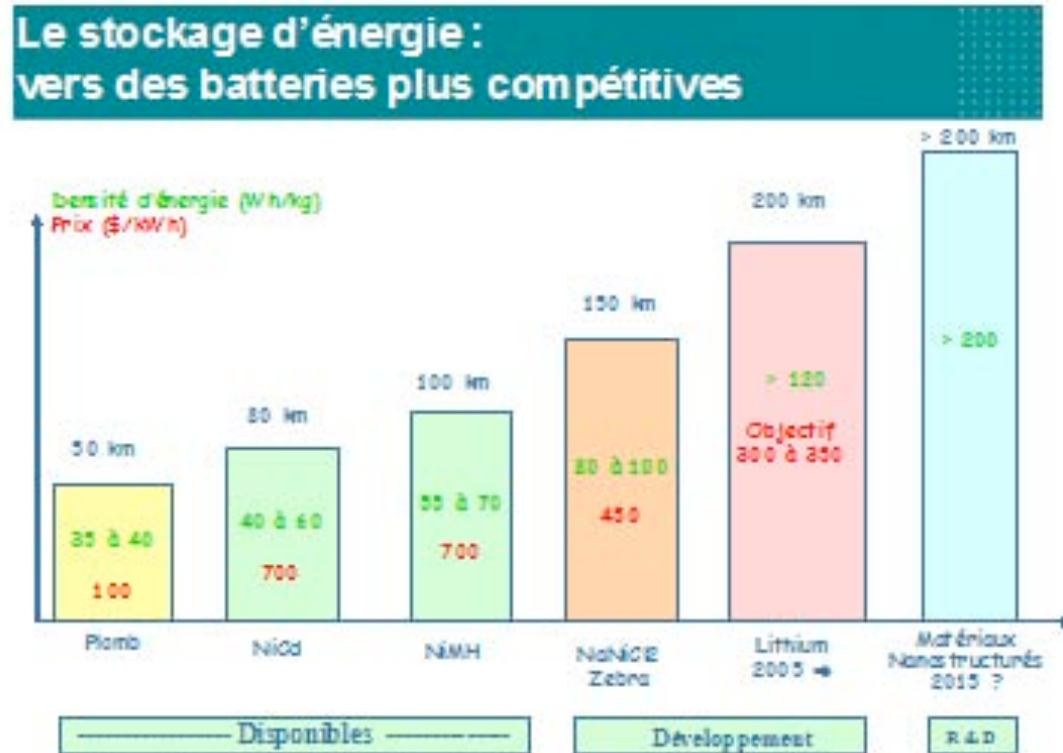
- Electric cars
- train, public transports
- nuclear ships
- electrify (clean)





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



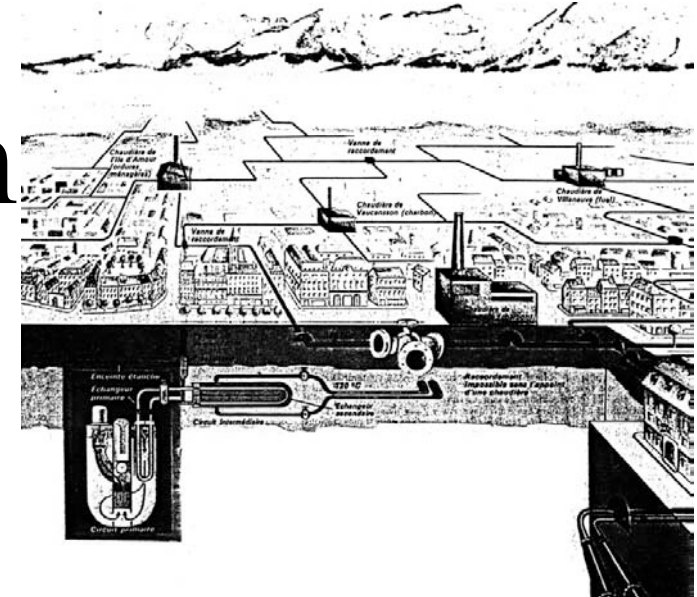
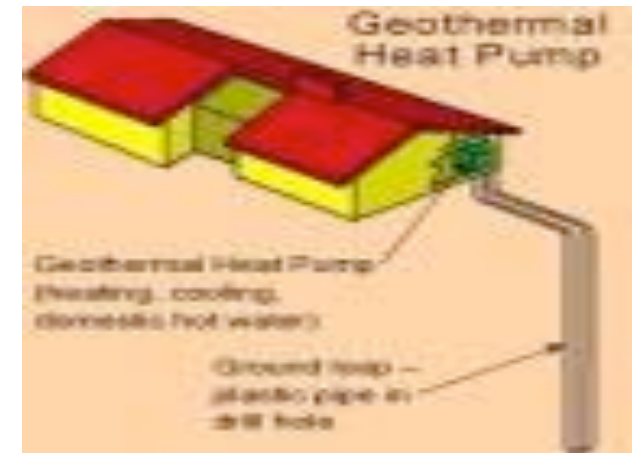
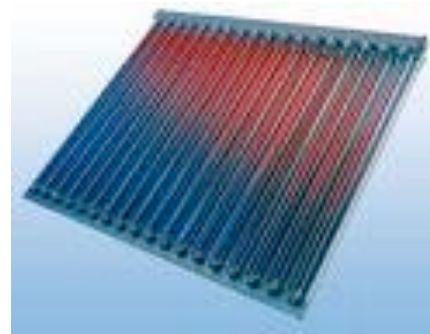
Long distance transportation: high-speed trains, piggy-back trucks and hybrid vehicles or trailer generator or battery swaps





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 :

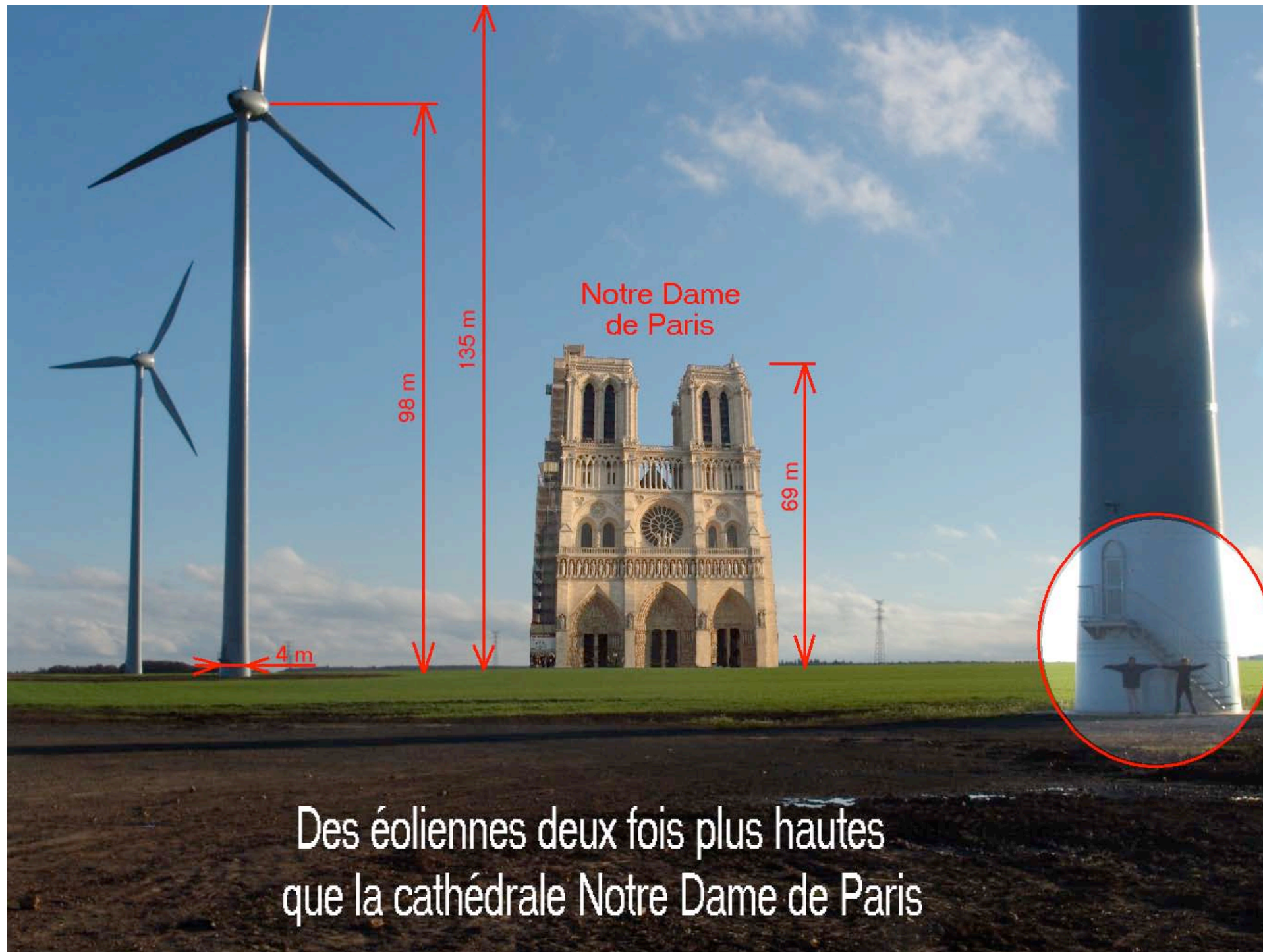
- renewables
- nuclear





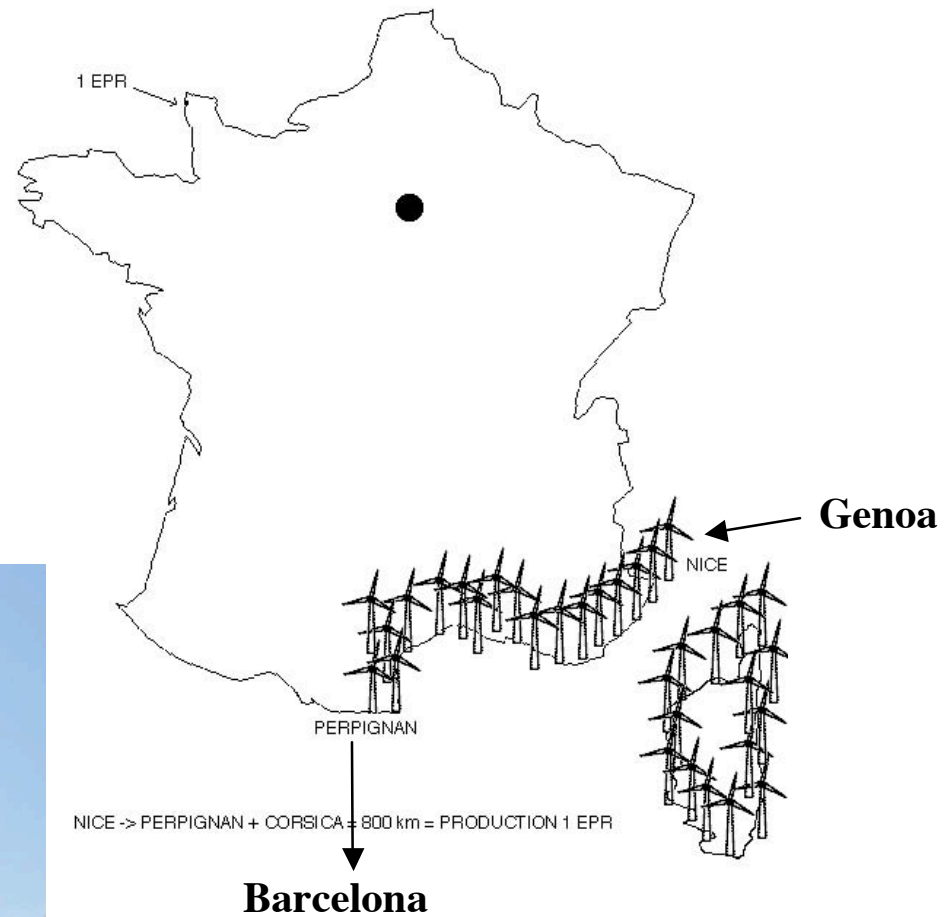
SOLAR ENERGY CAN HELP A LITTLE, BUT IS NOT ENOUGH





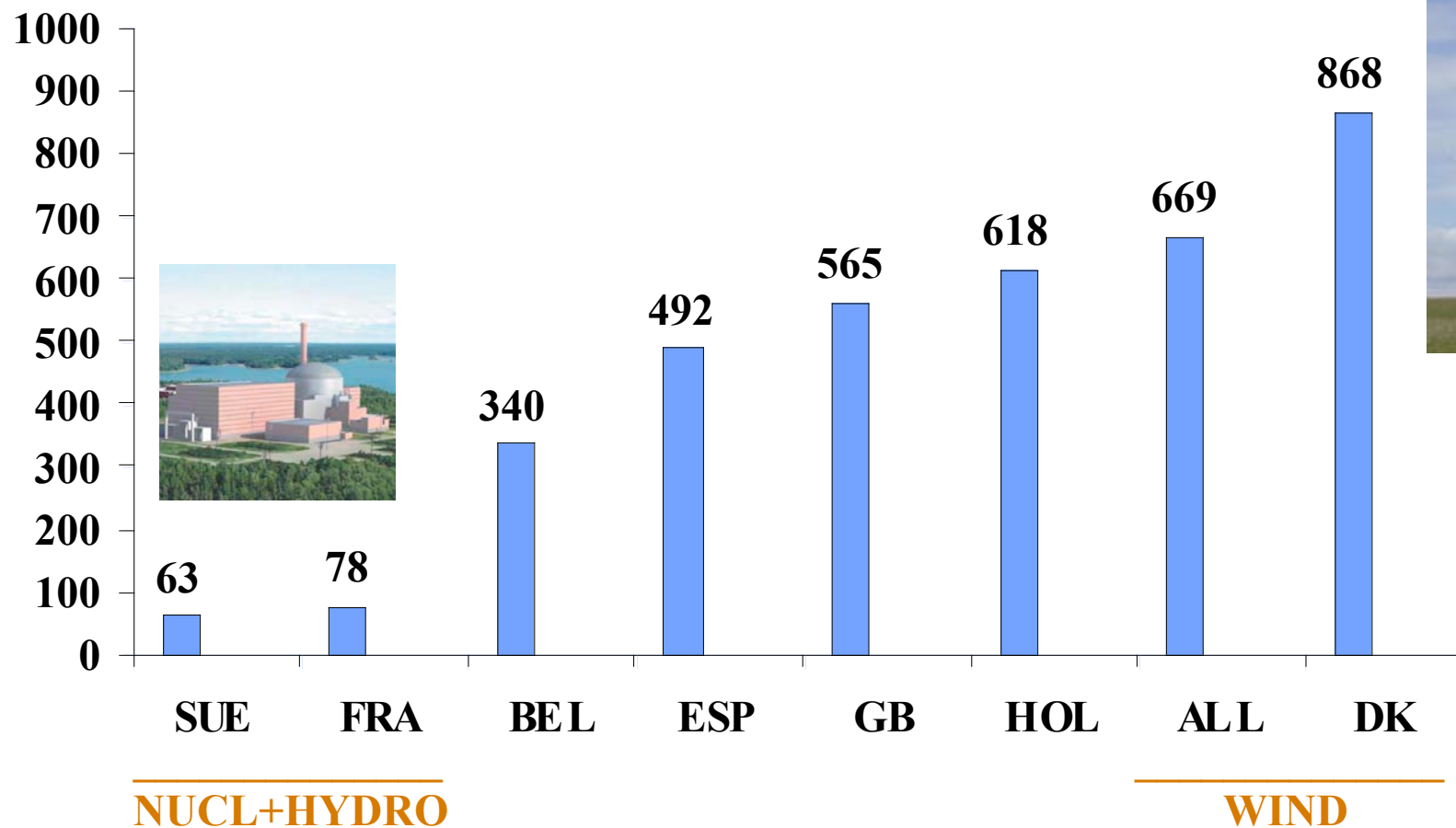


WIND ENERGY CAN HELP, BUT WILL NOT SAVE THE PLANET



CO2 EMISSIONS IN EUROPE

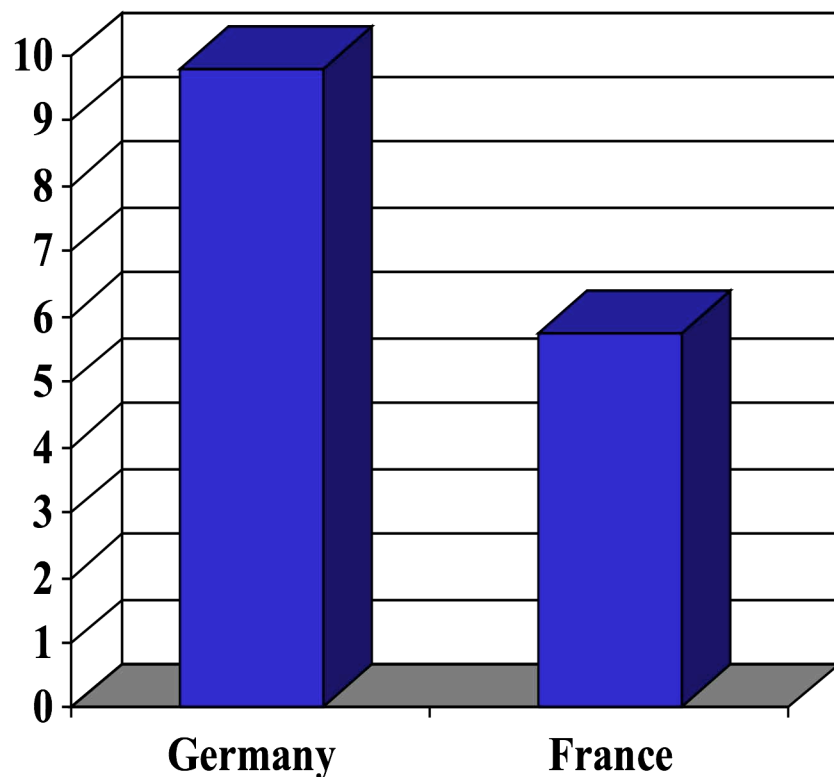
(TONS of CO2 /GWh)





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=1m³ per year)
- Produces very small volumes of waste

NUCLEAR WASTE IS NOT A PROBLEM

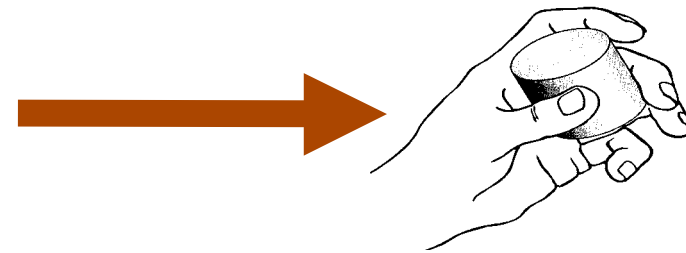
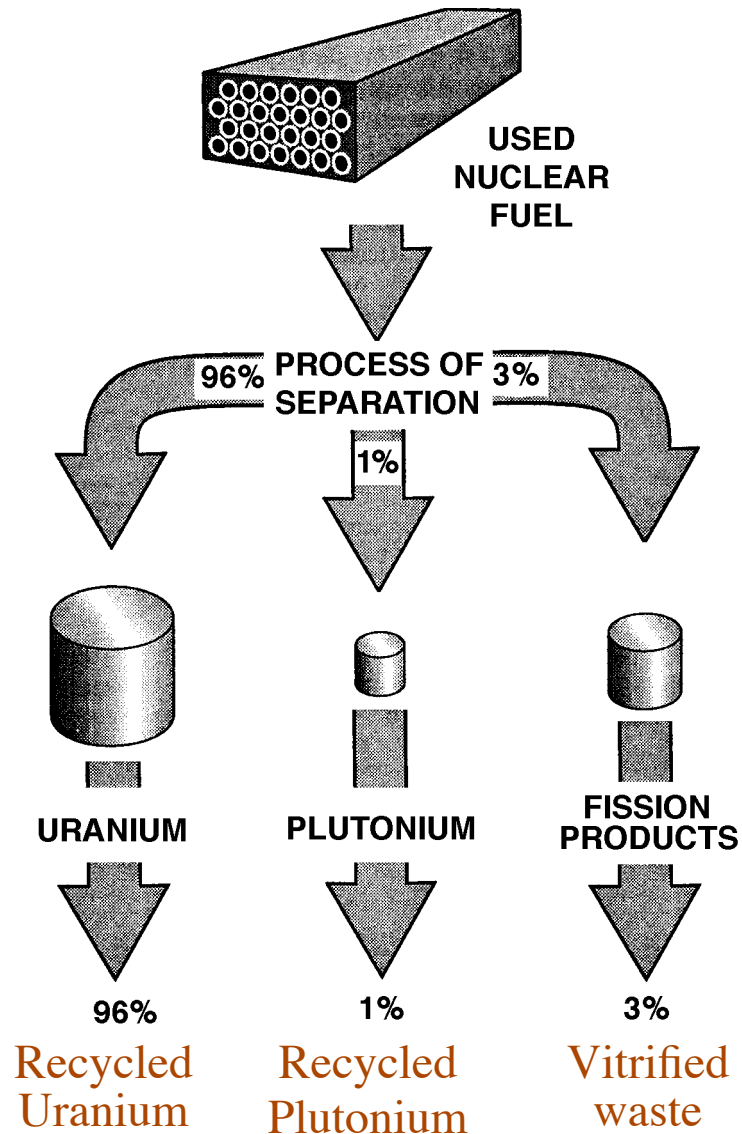


- The volume of the waste is small
- Nuclear waste is confined - not rejected
- Nuclear waste decays spontaneously



- 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



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

In Guarapari (Brazil) :
up to 50 $\mu\text{Sv}/\text{hr}$ on beach

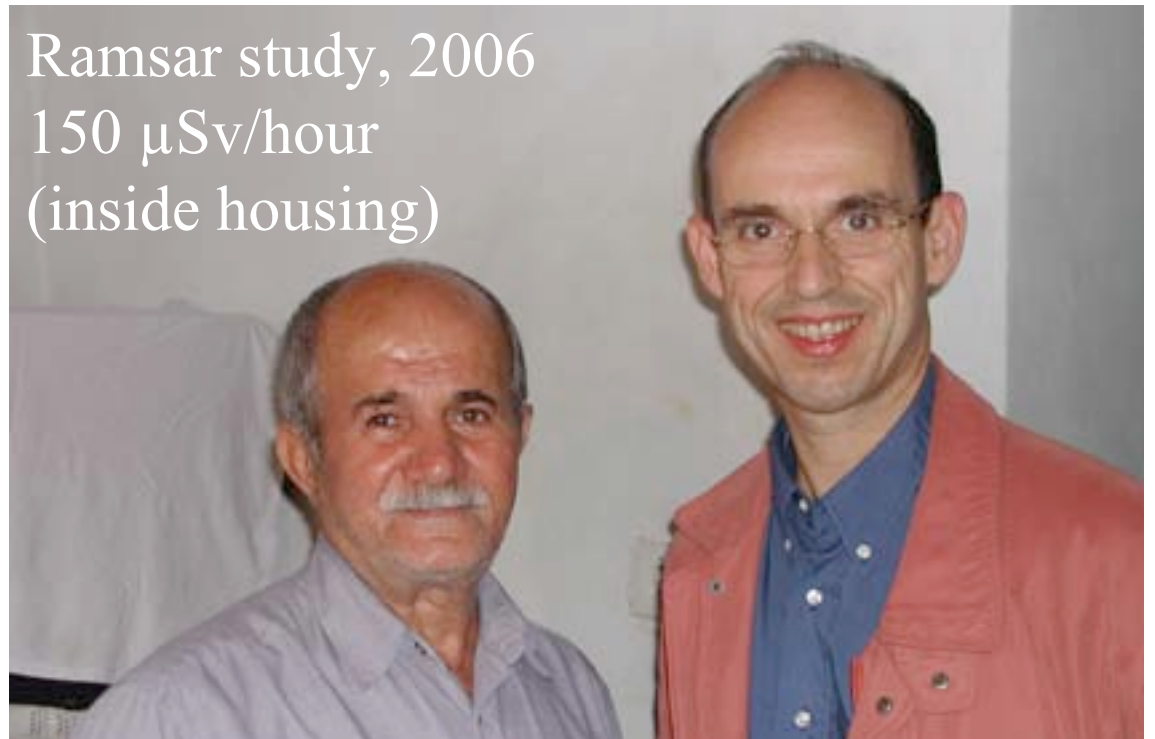
In Ramsar (Caspian Sea) :
up to 150 $\mu\text{Sv}/\text{hr}$ in houses

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



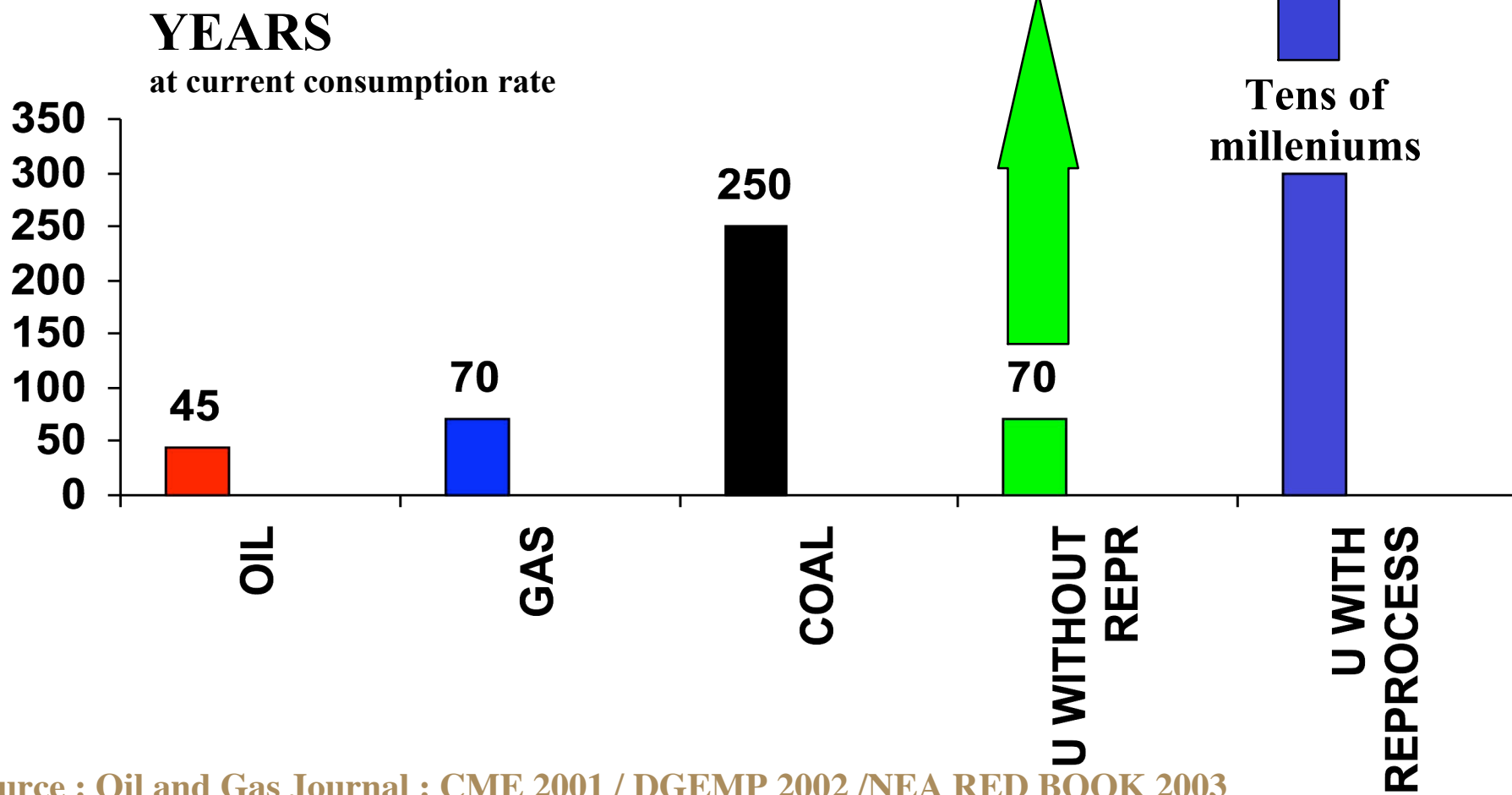
Hottest radiation on Earth

Ramsar study, 2006
150 $\mu\text{Sv}/\text{hour}$
(inside housing)





PROVEN RESERVES

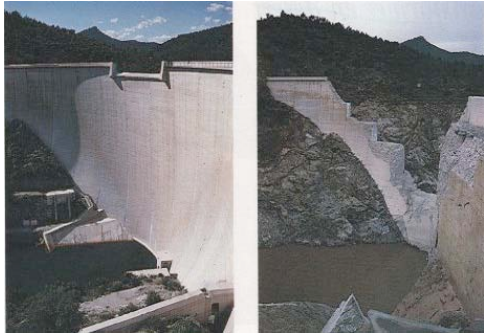


Source : Oil and Gas Journal : CME 2001 / DGEMP 2002 /NEA RED BOOK 2003

Risks and accidents



No energy is risk-free



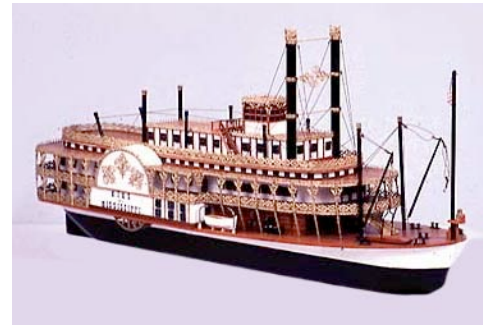
Hydro : Malpasset - 423 died
2 December 1959
Morvi : 30 000 died (1979)
World average=hundreds/year



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)



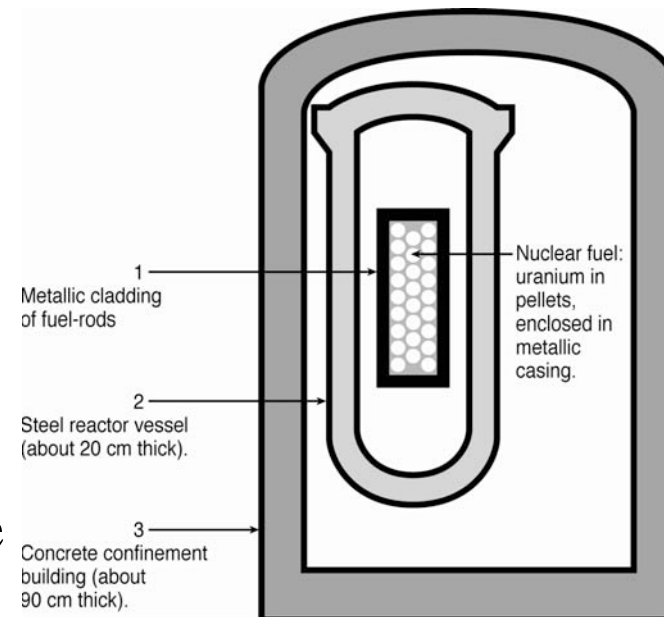
Steam explosion - 1865
Mississippi -> 1547 died

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

- A perfect example of what should not be done:
- 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 : molten reactor, but 0 deaths

PWR/BWR: have containments, no graphite to burn

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



FUKUSHIMA



- A NATURAL disaster
- 28 000 died from TSUNAMI (only 4 in NPP)
- All reactors stopped (as they should)
- 4 reactors destroyed, 3 melted cores, H2 explosions
- Evacuation before 15/3/2011: no public health impact
- 4 deaths in NPP workers (none from radiation)
- <10 workers exposed above authorized limit: 250 mSv

Lessons learned : nuclear will be even safer

- Tsunami predictions inadequate (wave 5.7m -> 14 m)
- Emergency cooling systems were not sufficient
- Safety is improved around the world

Risk of terror attack

WTC
tower

Relative size



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



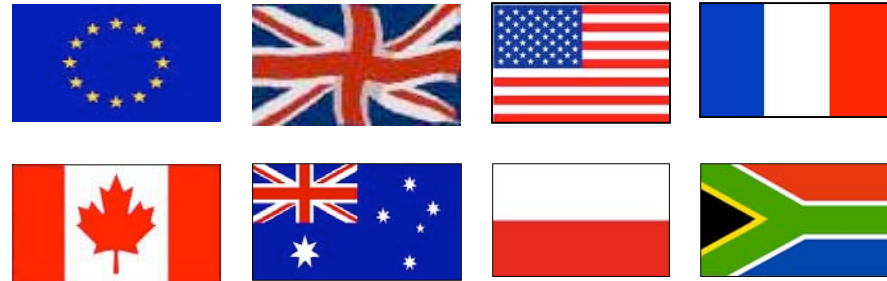
Reactors of the future



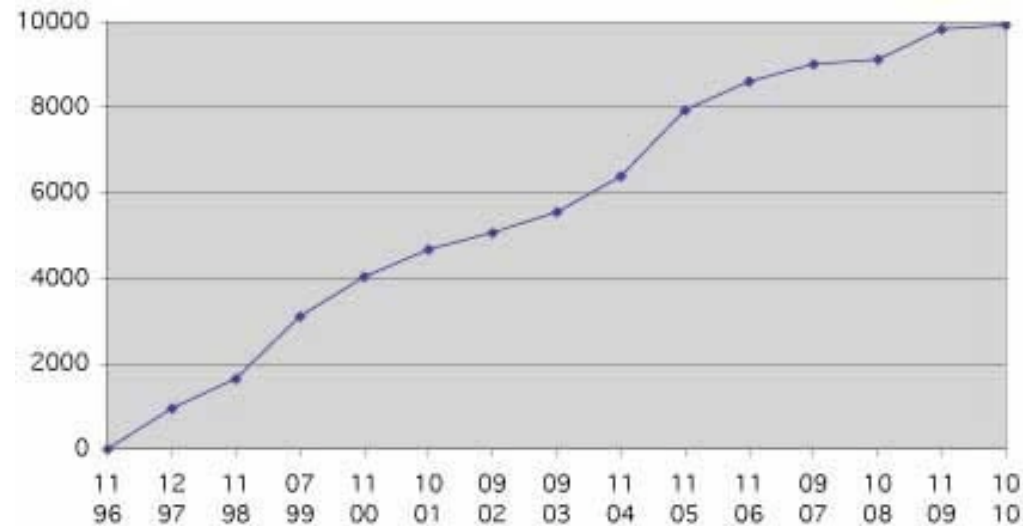
- **Advanced reactors :**
 - EPR, AP-1000, ACR, ABWR
 - **New small reactors :**
 - Small, very safe reactors
 - For developing countries
 - Worst case not dangerous
 - Terapower, Flexblue, ships, barge...
-
- **Generation IV :**
 - Resources x100, less waste
 - 6 concepts (SFR, LFR, GFR, VHTR, MSR,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

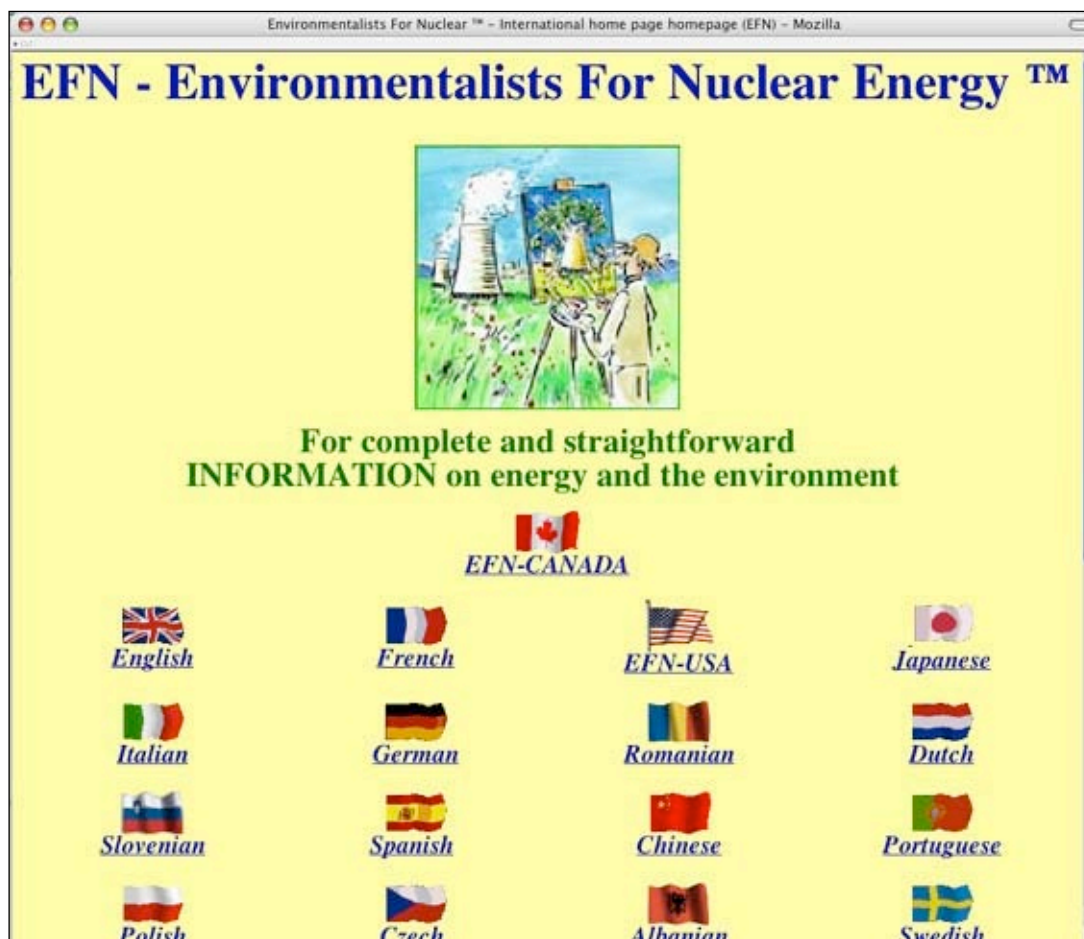


EFN's mission :
information about energy and the environment



EFN web site

in 15 languages : www.ecolo.org



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



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@ecolo.org)

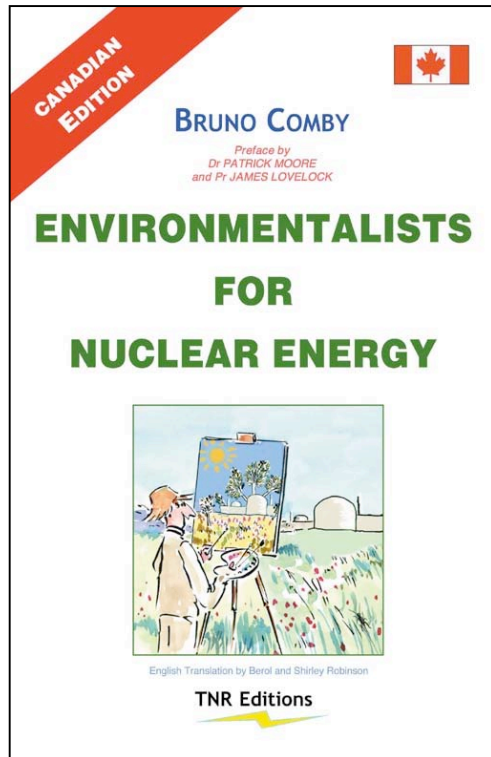


Over 1,500 TV/radio/press interviews and >1,000 lectures given around the world



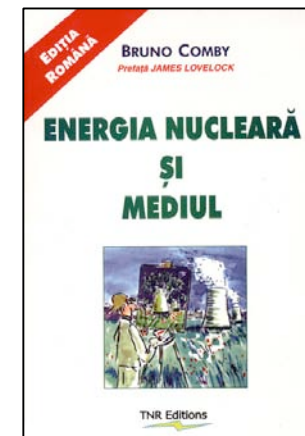
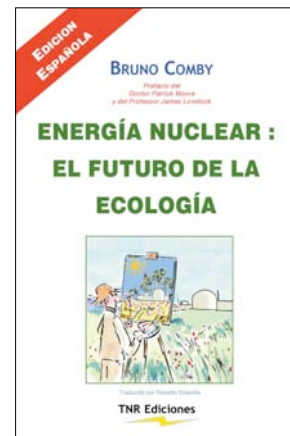
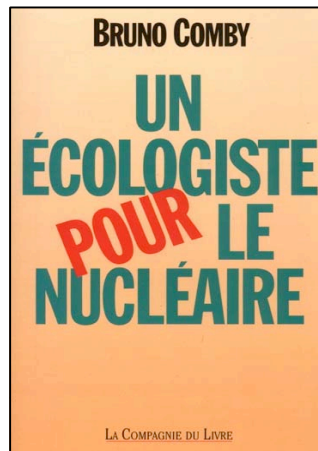
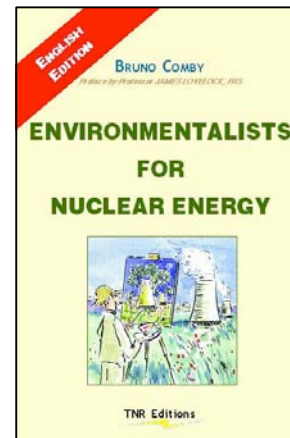
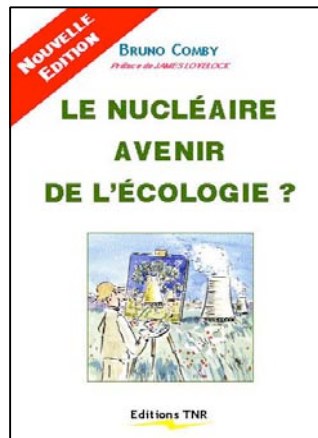
The book:

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 -> click on « books »



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 »

© Institut Bruno Comby

“ 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

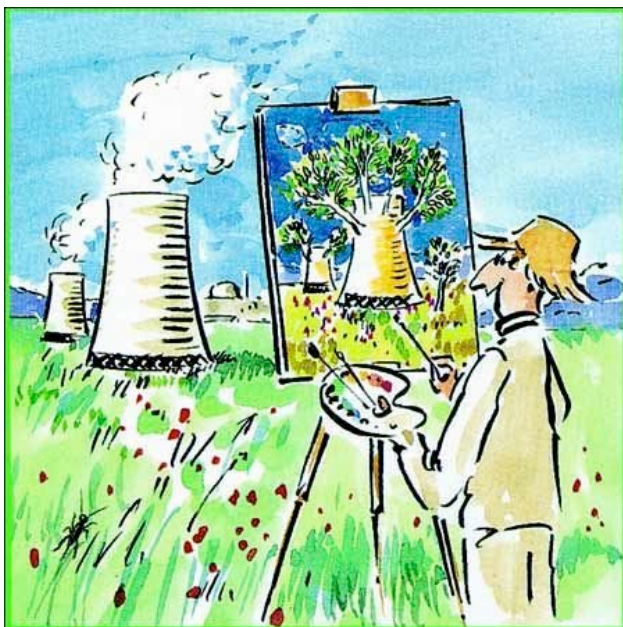
and future generations...

CONCLUSION

A MAJOR ENERGY CRISIS IS
DOWN THE ROAD

THE WORLD NEEDS A LOT
MORE CLEAN ENERGY

CONSERVATION, RENEWABLE
ENERGIES AND CLEAN
NUCLEAR ENERGY
ARE A PERFECT MATCH



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

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

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

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