The Abdus Salam
International Centre for Theoretical Physics

United Nations
Educational, Scientific and
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IAEA
International Atomic Energy Agency

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Joint ICTP-IAEA School of Nuclear Energy Management

8 - 26 August 2011

Nuclear Sociology

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IAEA, Vienna
Austria

Nuclear Energy and Nuclear Sociology

Yanko Yanev

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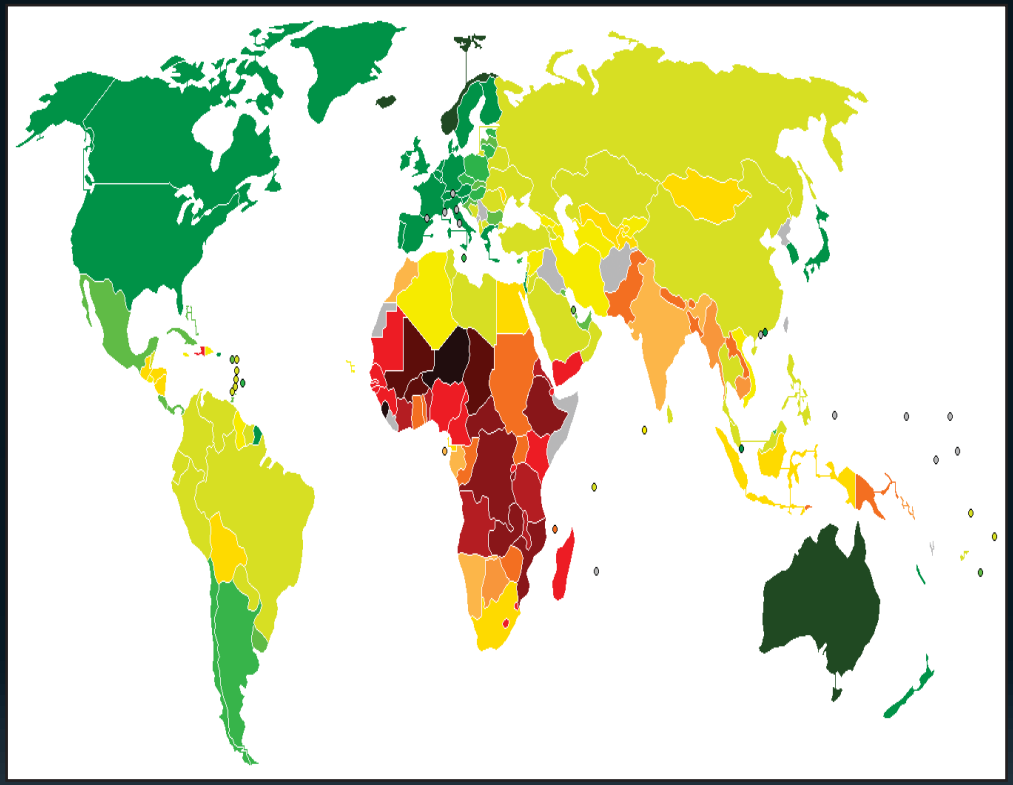
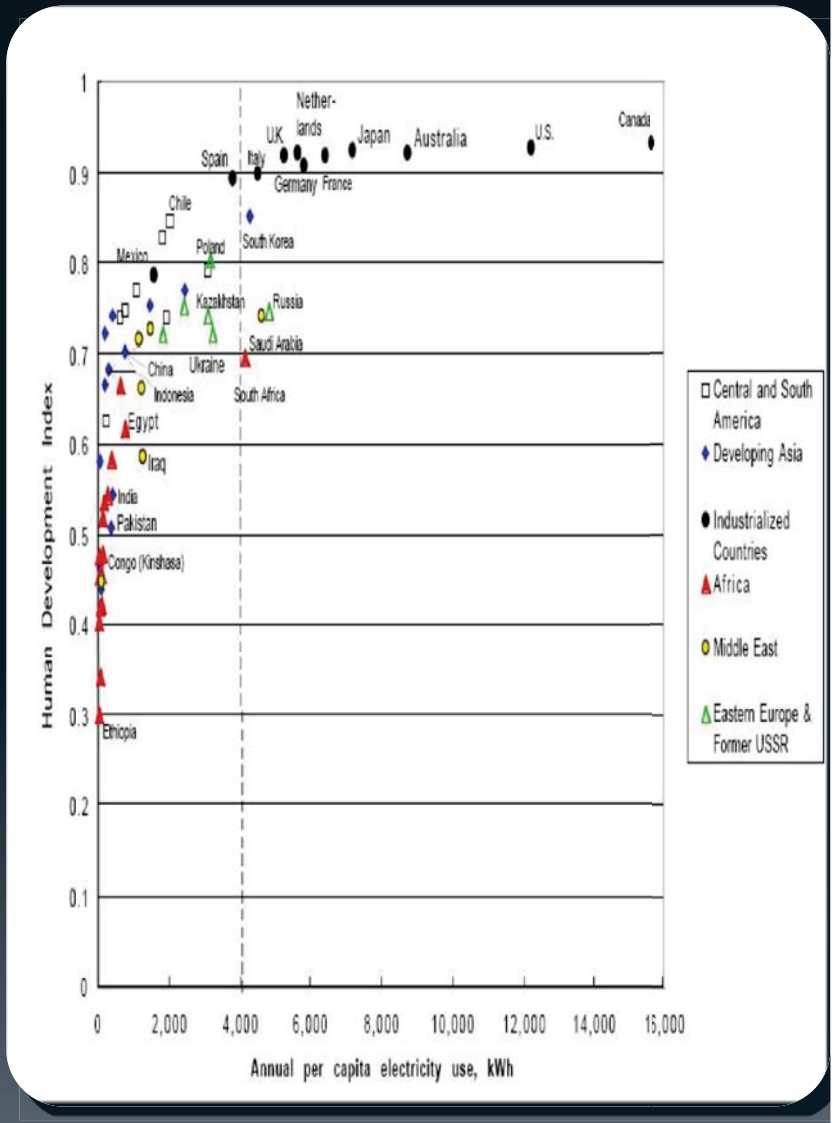
The Topics

- Energy and Human Development,
- The Global Environmental Crisis
- The Energy Debate
- The Red Herrings
- Nuclear Sociology

Energy and Human development



over 0.95
0.90-0.949
0.85-0.899
0.80-0.849
0.75-0.799
0.70-0.749
0.65-0.699
0.60-0.649
0.55-0.599
of 0.50-0.54
of 0.45-0.49
0.40-0.449
0.35-0.399
0.30-0.349
<0.30
N/A



2,000 years ago

10 million

1,000 years ago

300 million

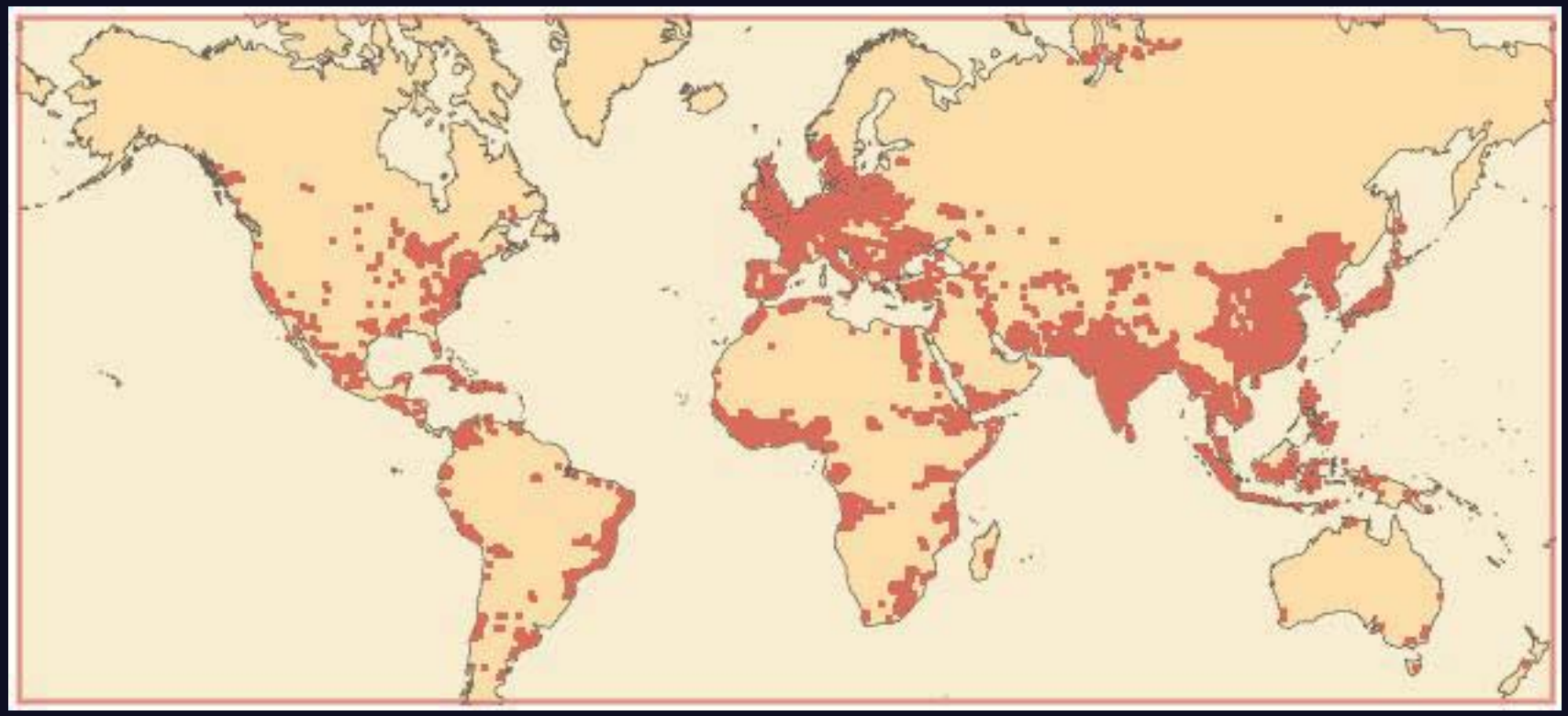
1800

1 billion

1927

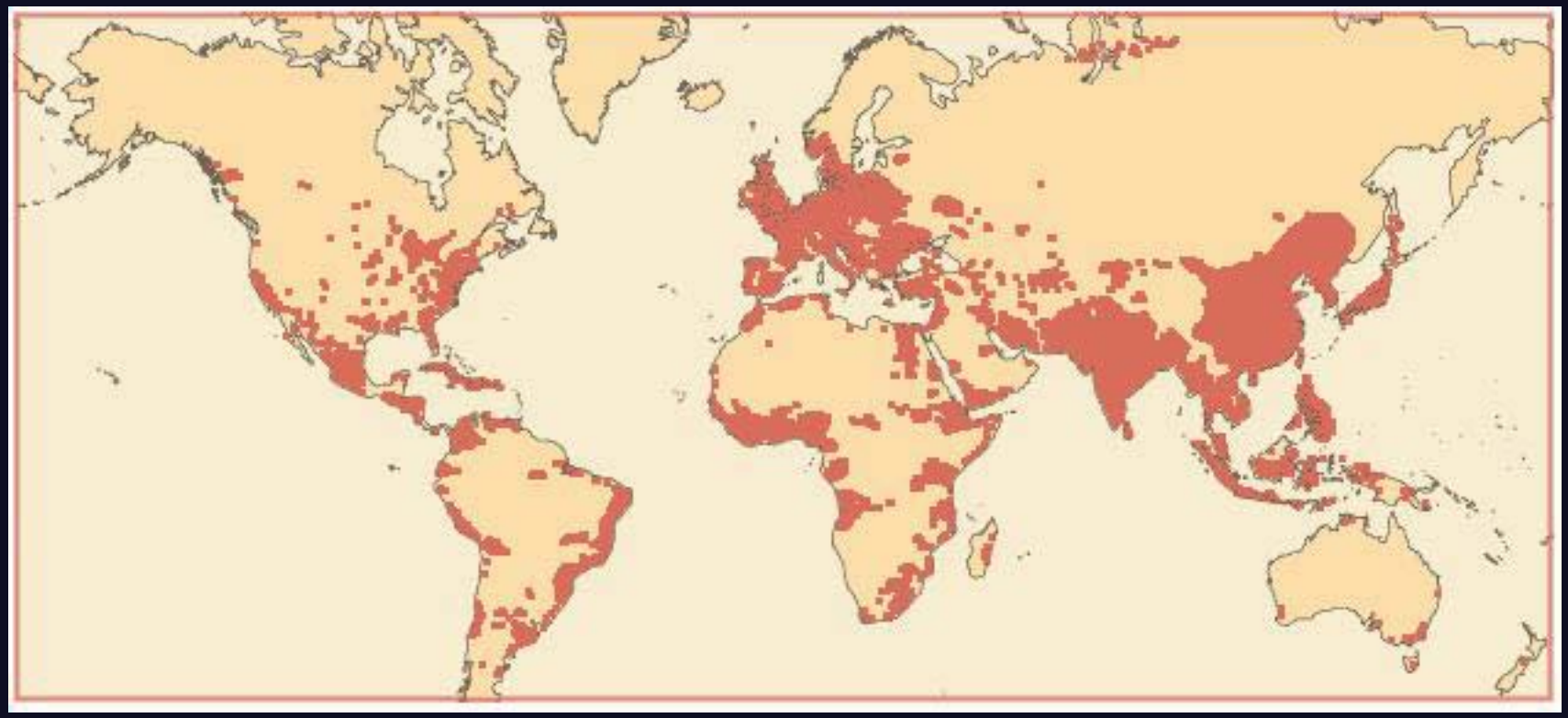
2 billion

1960



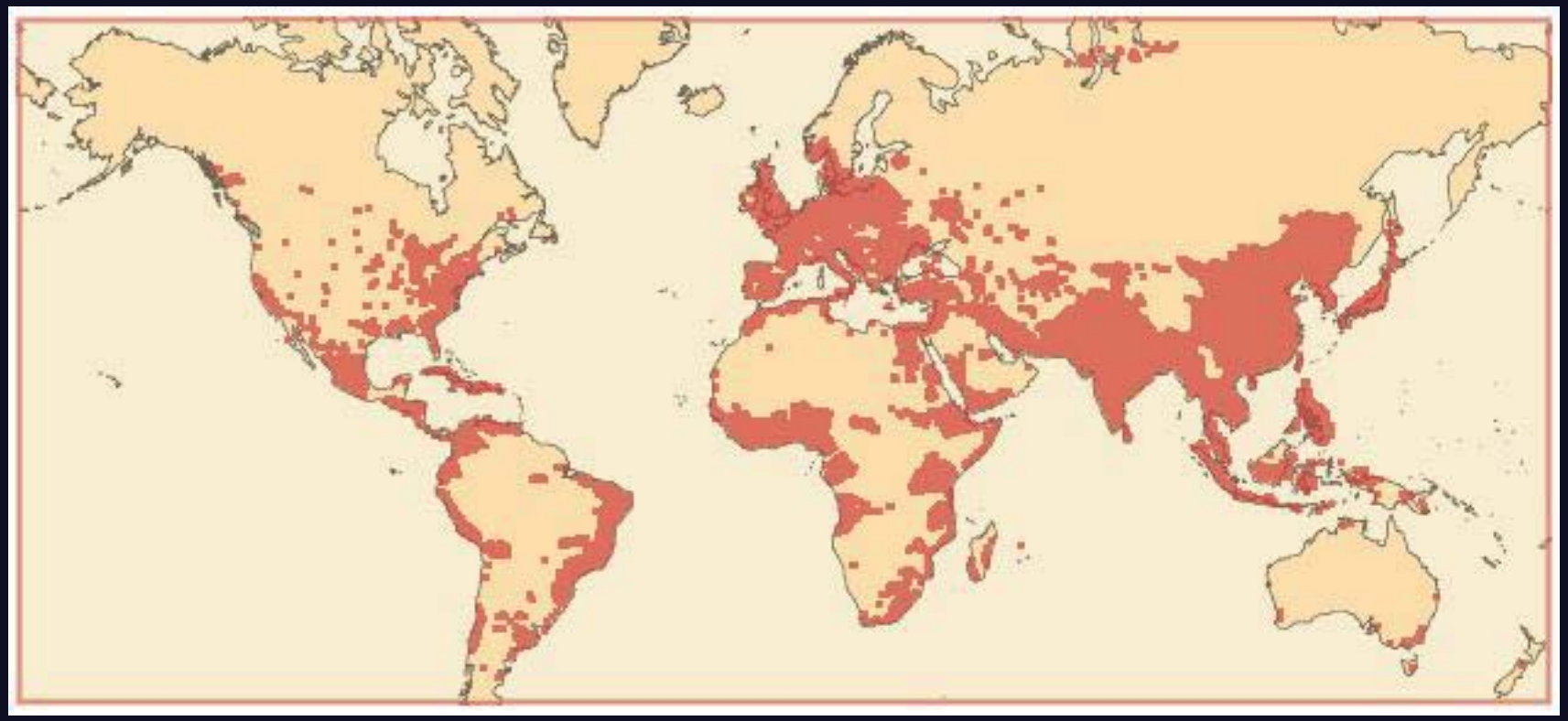
3 billion

1974



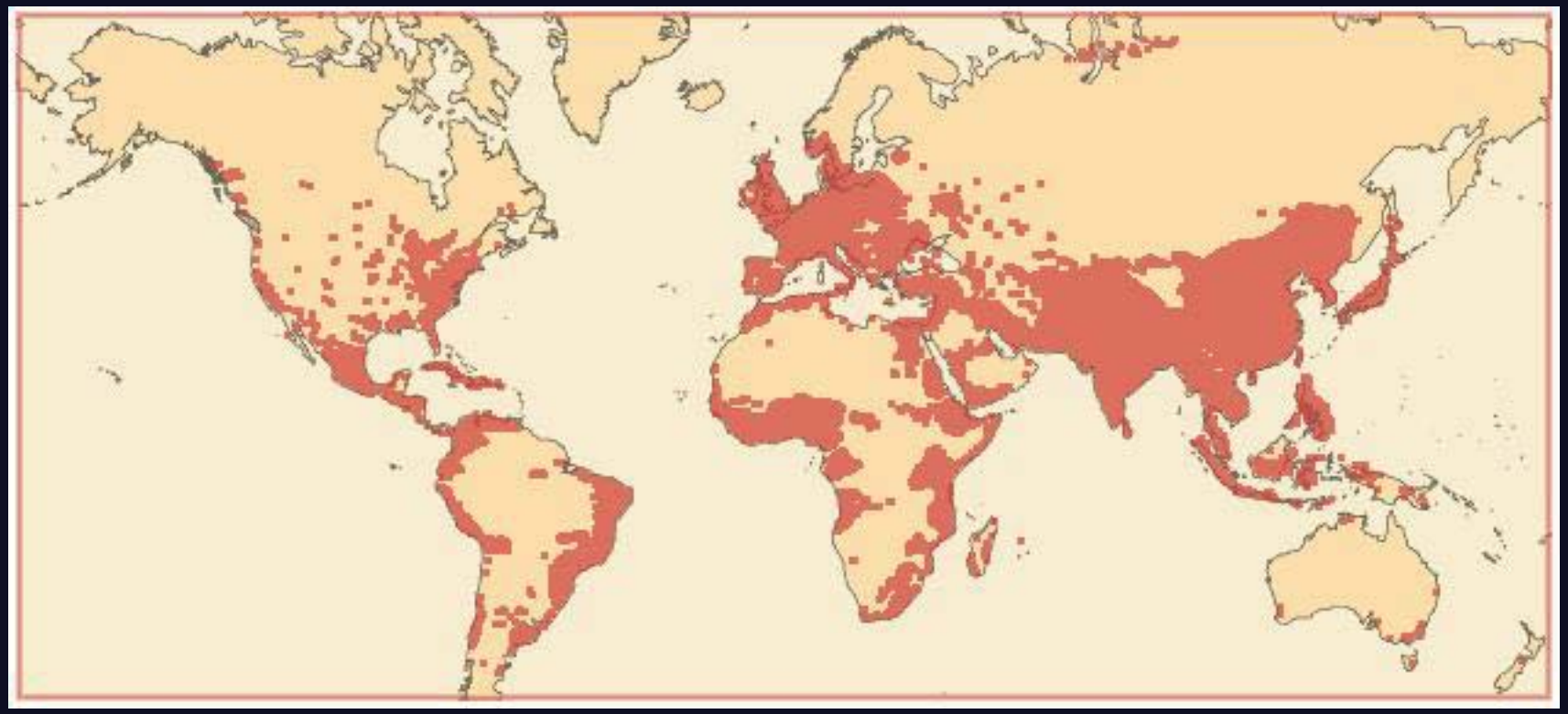
4 billion

1987



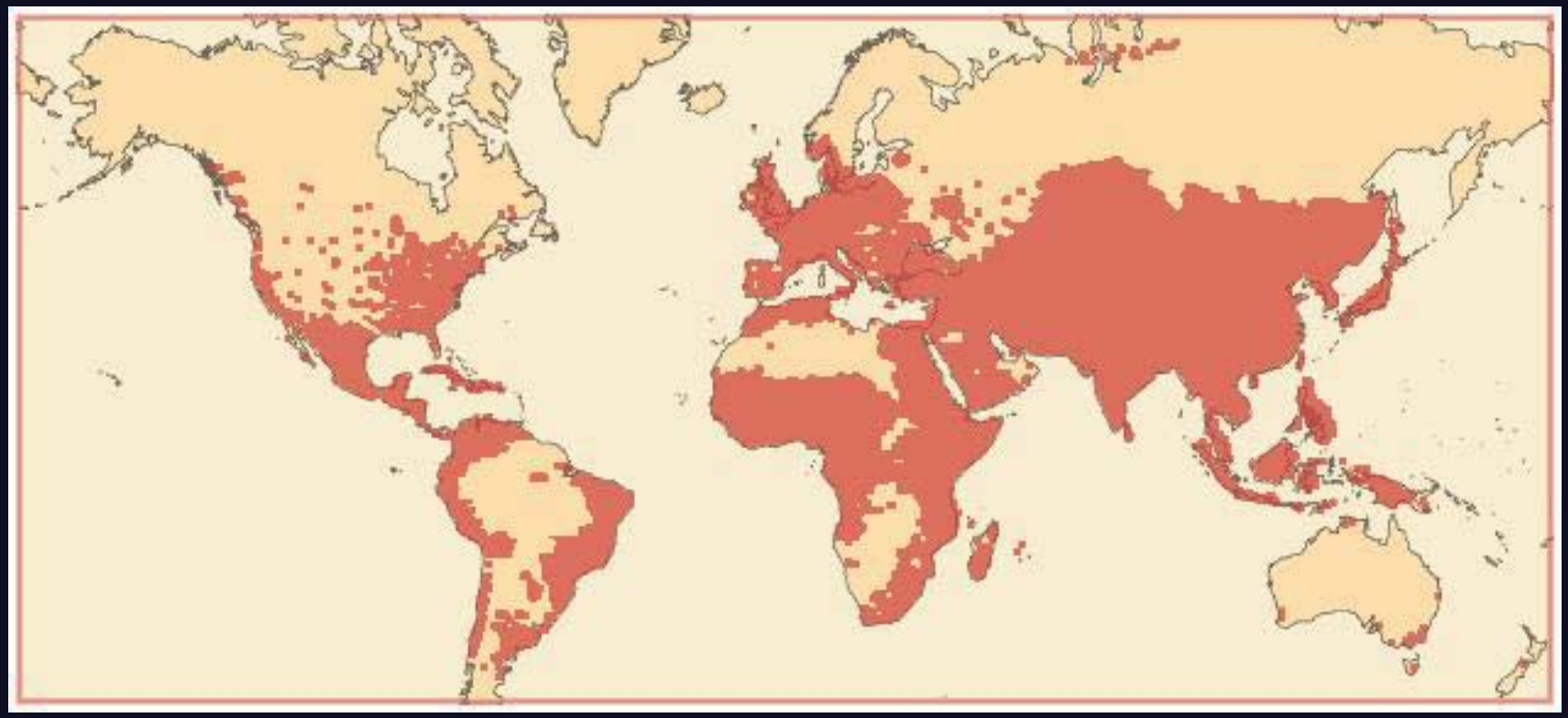
5 billion

1999

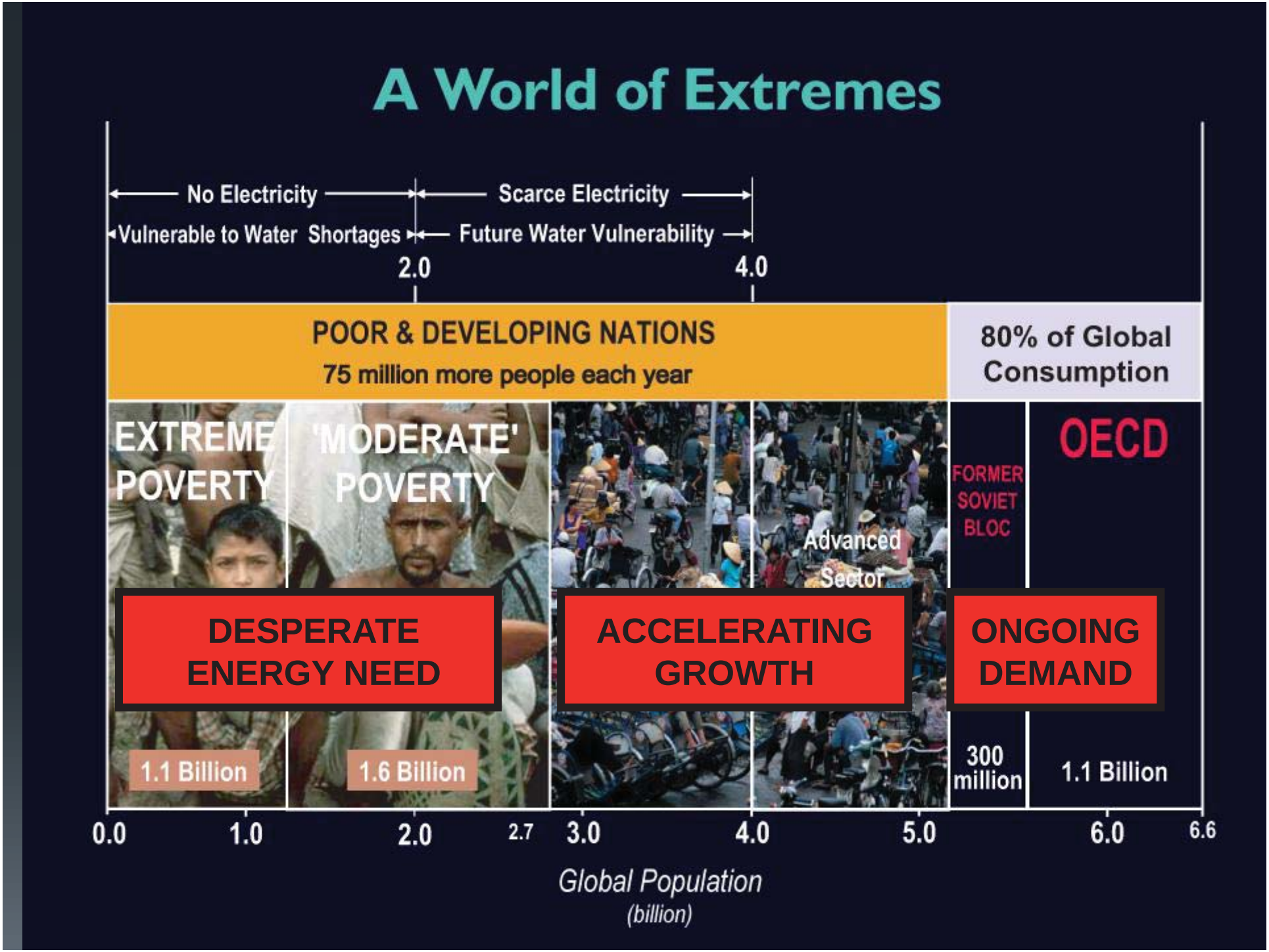


6 billion

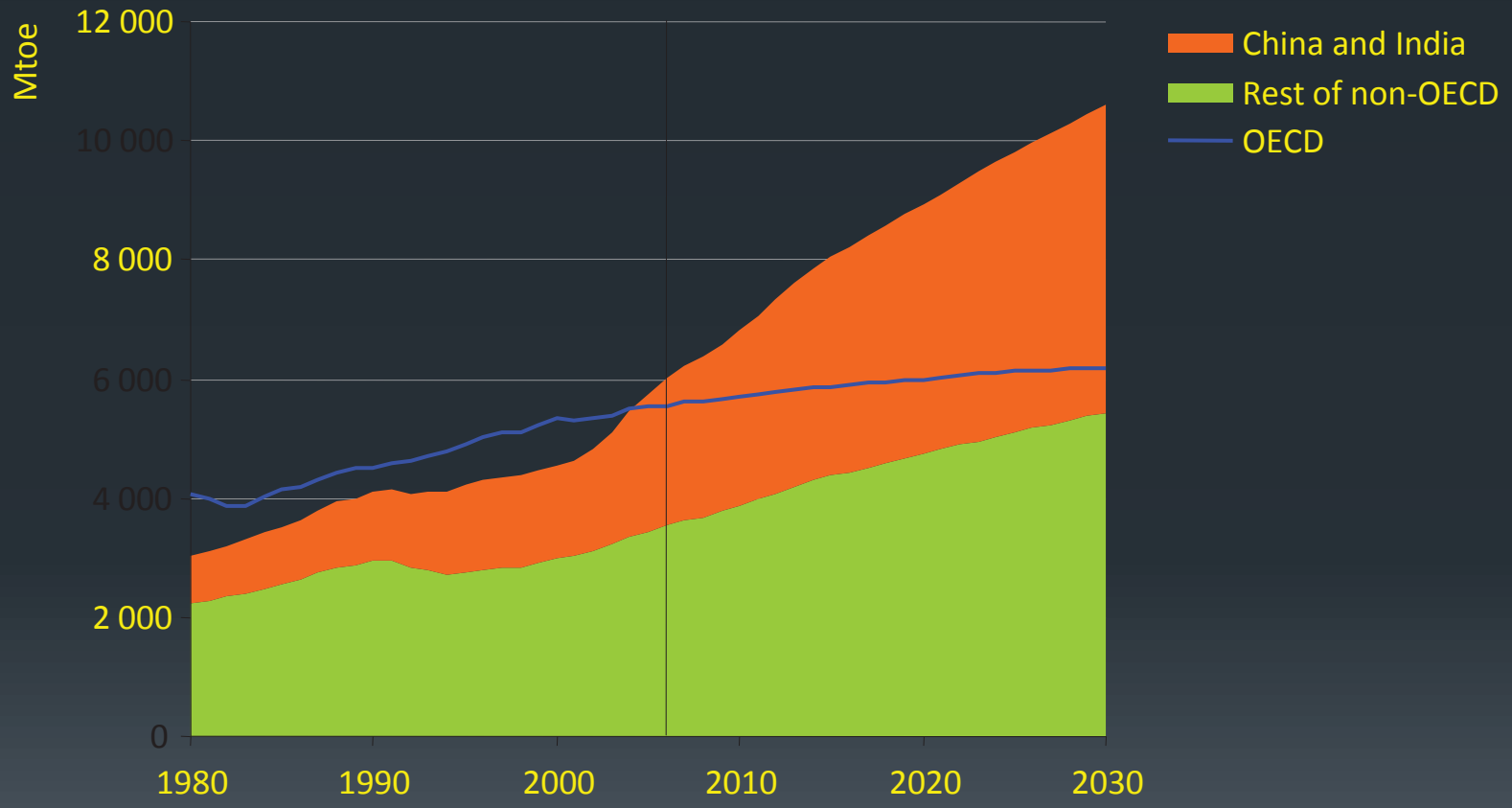
2050



9 billion

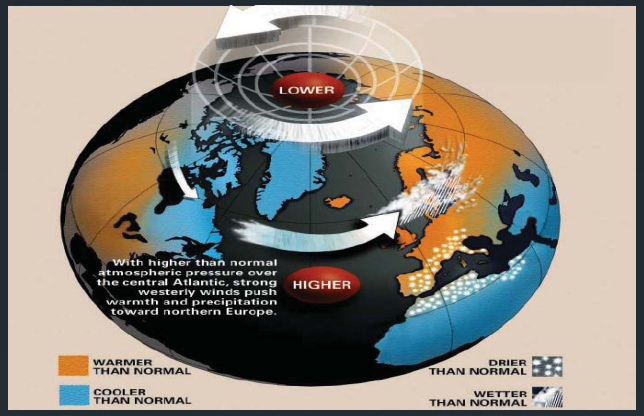

A World of Extremes
No Electricity
Scarce Electricity
Vulnerable to Water Shortages
Future Water Vulnerability
2.0
4.0
POOR & DEVELOPING NATIONS
75 million more people each year
80% of Global Consumption
EXTREME POVERTY
'MODERATE' POVERTY
Advanced Sector
FORMER SOVIET BLOC
OECD
DESPERATE ENERGY NEED
ACCELERATING GROWTH
ONGOING DEMAND
1.1 Billion
1.6 Billion
300 million
1.1 Billion
0.0
1.0
2.0
2.7
3.0
4.0
5.0
6.0
6.6
Global Population
(billion)

World of permanently growing energy demand

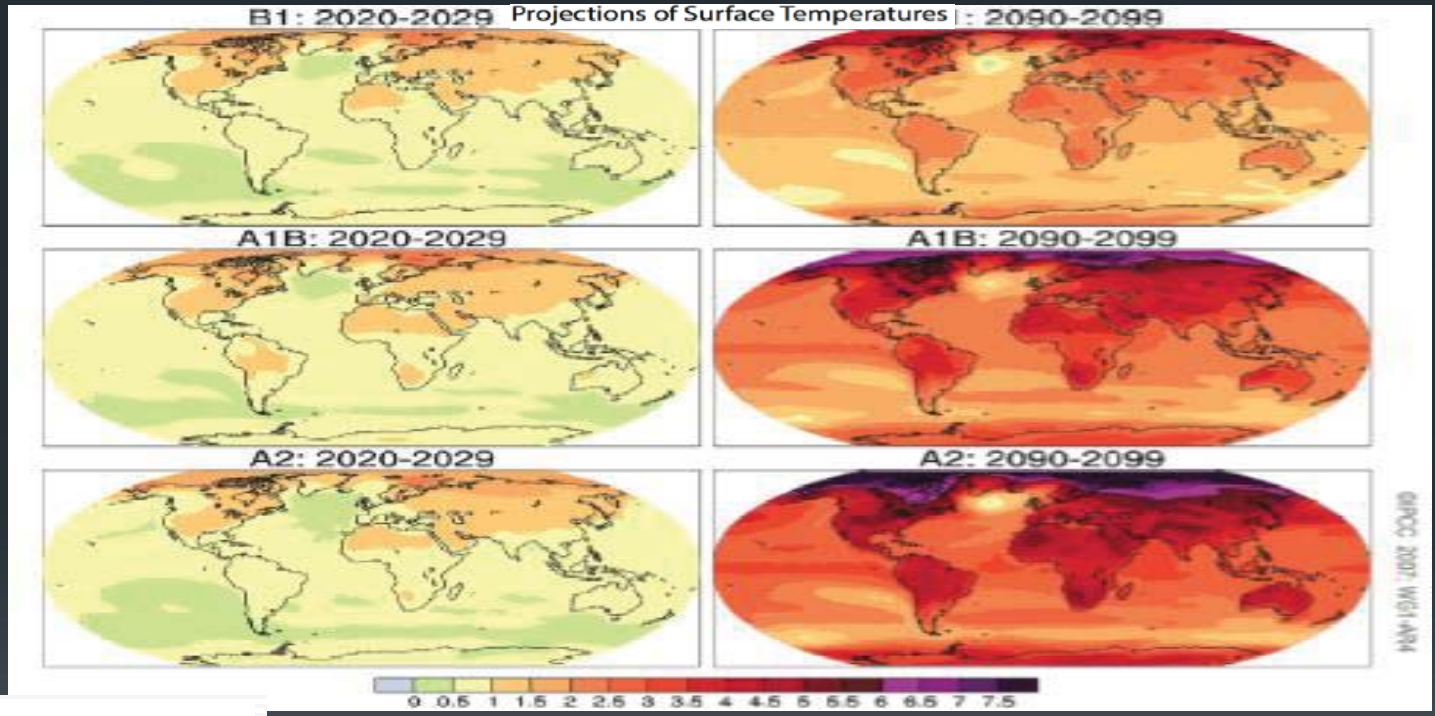


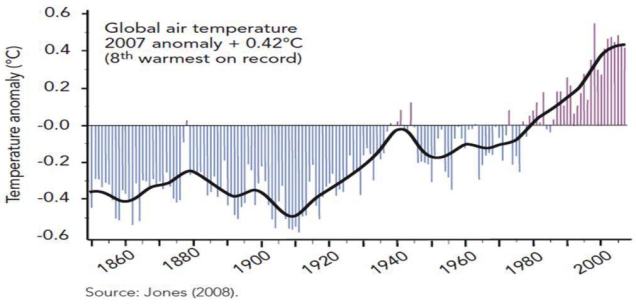
Non-OECD countries account for 87% of the increase in global demand between 2006 & 2030, driven largely by China & India

Climate crisis



24 August, 2011





http://www.ipcc.ch/SPM2feb07.pdf

Catastrophic Climate Change?

- Radical temperature changes & violent weather events
- Widespread drought, flooding, wildfires
- Famine
- Accelerating loss of biodiversity
- Rising sea levels & sudden changes in ocean currents
- Mass migration & epidemics of pestilence and disease

In consequence can be a fundamental disruption of human civilisation!

Should Nuclear Power participate in a Solution to the Energy and Environmental Crisis?

Science says “yes”

Society has no uniform decision.

Can we solve a global problem without global approach?

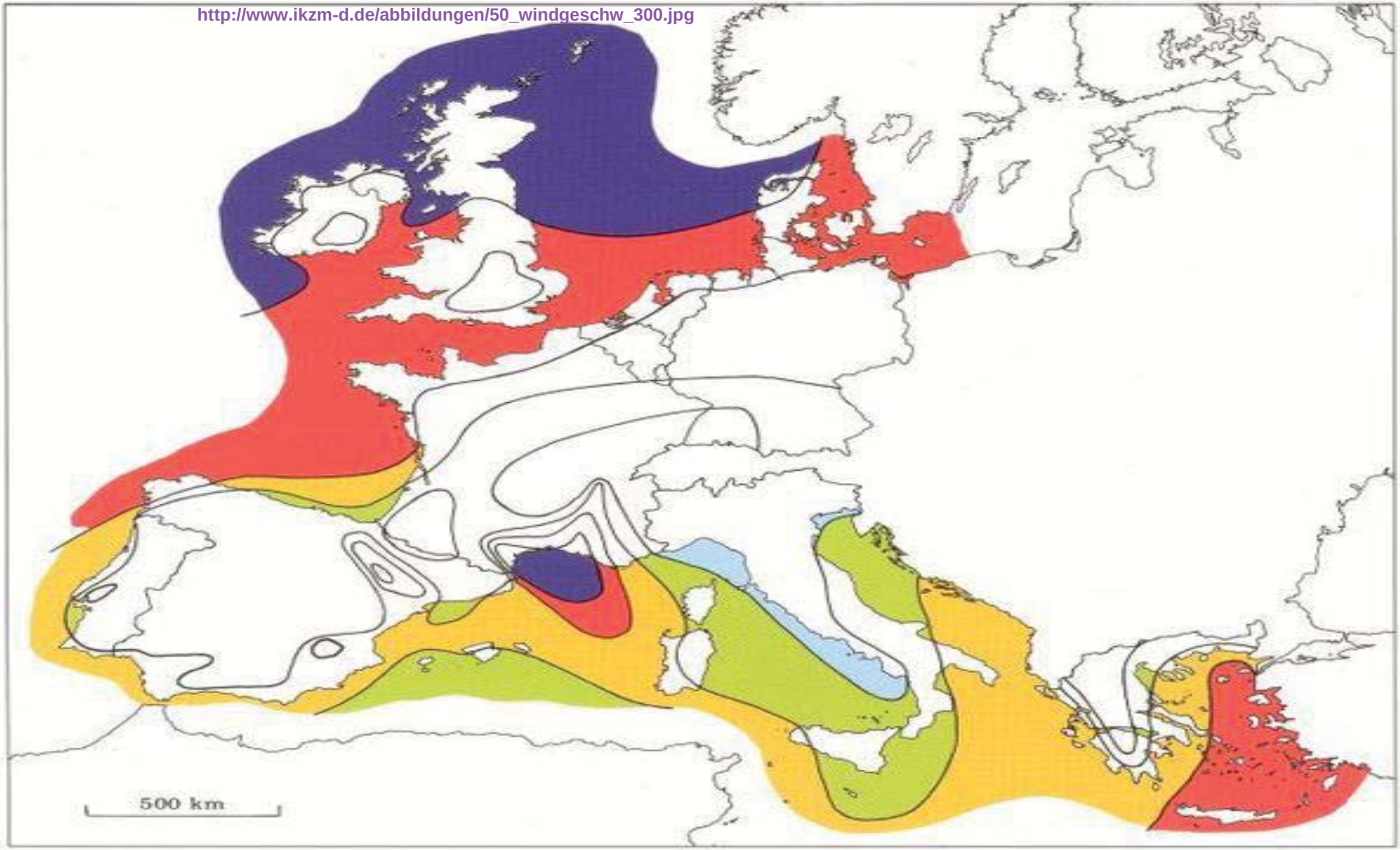
THE RED HERRINGS IN THE ENERGY POLICY

WIND

SOLAR

Red herring is an expression referring to a rhetorical tactic of diverting attention away from an item of significance.-

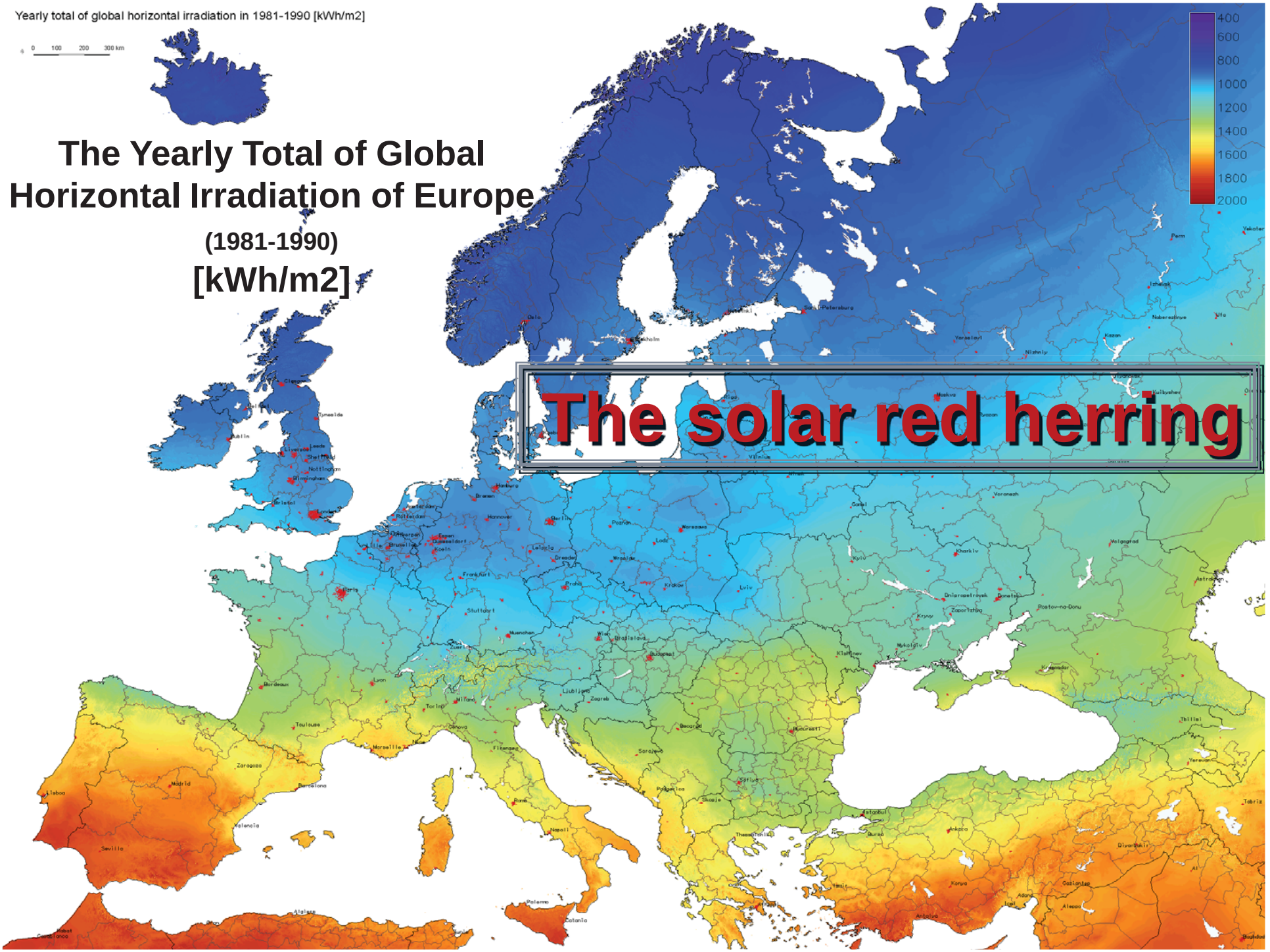
http://www.ikzm-d.de/abbildungen/50_windgeschw_300.jpg

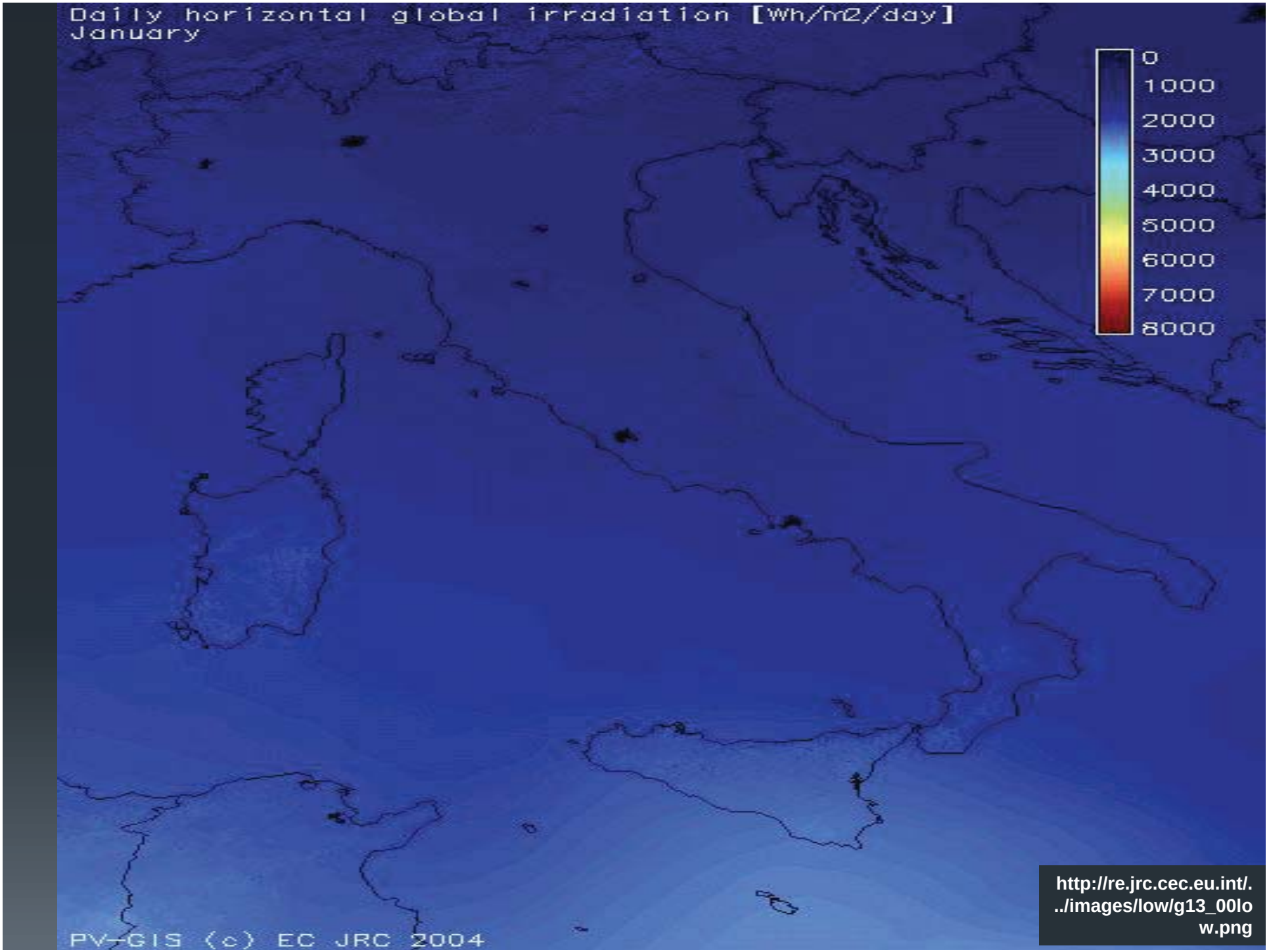


Wind resources over open sea (more than 10 km offshore) for five standard heights										
	10 m		25 m		50 m		100 m		200 m	
	$m\,s^{-1}$	Wm^{-2}	$m\,s^{-1}$	Wm^{-2}	$m\,s^{-1}$	Wm^{-2}	$m\,s^{-1}$	Wm^{-2}	$m\,s^{-1}$	Wm^{-2}
	> 8.0	> 600	> 8.5	> 700	> 9.0	> 800	> 10.0	> 1100	> 11.0	> 1500
	7.0-8.0	350-600	7.5-8.5	450-700	8.0-9.0	600-800	8.5-10.0	650-1100	9.5-11.0	900-1500
	6.0-7.0	250-300	6.5-7.5	300-450	7.0-8.0	400-600	7.5- 8.5	450- 650	8.0- 9.5	600- 900
	4.5-6.0	100-250	5.0-6.5	150-300	5.5-7.0	200-400	6.0- 7.5	250- 450	6.5- 8.0	300- 600
	< 4.5	< 100	< 5.0	< 150	< 5.5	< 200	< 6.0	< 250	< 6.5	< 300

The wind red herring

For replacing the power of one 1000 MW NPP you would need 500, 2MW wind mills and for replacing the energy it produced, almost 2500 wind turbines!


Yearly total of global horizontal irradiation in 1981-1990 [kWh/m2]
0 100 200 300 km
400
600
800
1000
1200
1400
1600
1800
2000
The Yearly Total of Global Horizontal Irradiation of Europe
(1981-1990)
[kWh/m2]
The solar red herring


Daily horizontal global irradiation [Wh/m2/day]
January
0
1000
2000
3000
4000
5000
6000
7000
8000
PV-GIS (c) EC JRC 2004
http://re.jrc.cec.eu.int/../images/low/g13_00low.png

Italy's average horizontal solar irradiation <1000 kWh/m^2 per year

Total surface of Italy ≈ 3 10^{11} m2

Utilizable for solar cells <10^{10} m2

Total potential for solar electricity production ≈ 10^{12} kWh per year

Current electricity consumption → 10^{12} kWh per year

Therefore, should Italy be covered by solar cells

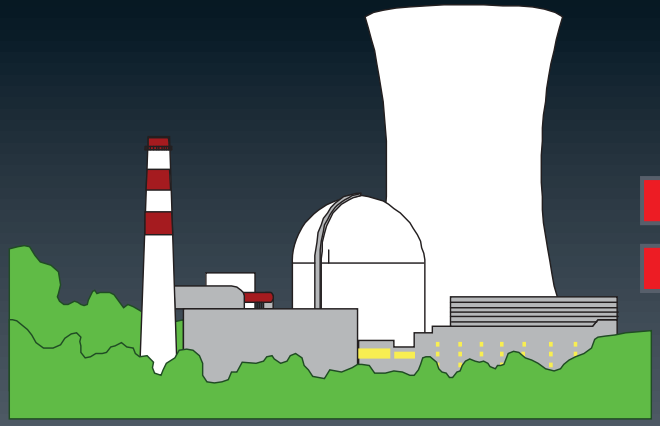
(i.e., with the Italians and their houses, factories and farms moving out),

the production of solar electricity would be just enough for satisfying the current Italian consumption!

ARE we praying for hope or we at least try to solve the problem and how much it will cost?

+

=



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The Role for Nuclear Power

- Nuclear power is an advanced and technological source of energy based on all the scientific achievements of human civilization.
- Nuclear power is the most scalable cost competitive source of non carbon electricity.
- Nuclear power alone will not solve all the problems but we will not make serious progress without nuclear power.

Peaceful Use of Nuclear Energy "Six elements for success"

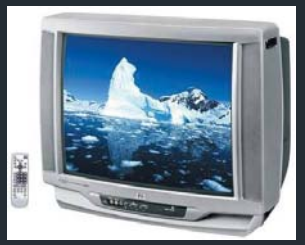
- Energy, Economics and Environmental analysis,
- Public outreach and confidence building
- Political commitment to peaceful use of nuclear technology,
- Resource mobilization,
- Competence building
- Program development and Implementation

NUCLEAR SOCIOLOGY

"Or why society does not think like scientists?"

Did you know?

- Radio needed 38 years to reach 50 million users



- TV – 13 years

- Internet – 4 years

- Facebook added 100 million users in less then 9 months

After 55 years Nuclear Power Electricity is currently being used by

more than 4 billion people world-wide!

G E N E R A T I O N S

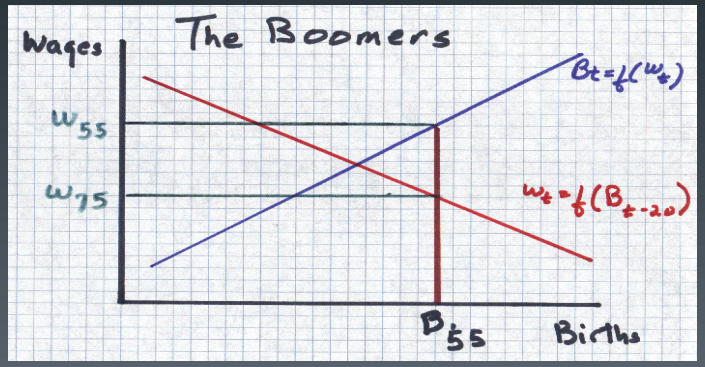
AND attitudes

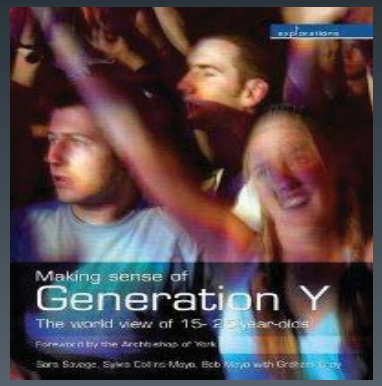
The postwar generation
“Baby boomers” and after?

The new generation (Millenials or GenY)

Yanko
Yanev

- In 2010 Gen Y outnumbered baby boomers – currently 2 billions
- Optimistic, tech-savvy, multicultural and collaborative
- What do they know about Nuclear issues and from where?
- How accurate, complete and reliable is the Information they get form portals, forums, blogs, social media?
- What to do?





HOW SOCIETY DEVELOPS AN ATTITUDE TOWARDS NUCLEAR ISSUES?

Sociology

- Sociology is the scientific study of human social behavior.
- As it studies humans in their collective aspect, sociology is concerned with all group activities: economic, social, political, and religious.

Sociology cont.

- Sociologists study such areas as bureaucracy, community, deviant behavior, family, public opinion, social change, social mobility, social stratification, and such specific problems as crime, divorce, child abuse, substance addiction etc.
- Sociology tries to determine the laws governing human behavior in social contexts.

Several sociologists in the late 1940s and early 1950s forecast that atomic energy would produce economic abundance. Vincent Whitney's cautions were an exception to these naive projections. But no sociologist foresaw how the technical and social processes of nuclear power development would compromise its public acceptance and give rise to an antinuclear movement, currently led by environmentalists. Their struggle with the atomic establishment for the mind of the public is registered in recent survey results, analysis of which responds in some measure to Blumer's challenge to polling. Despite a lapse of about two decades in their interest in problems of energy and society, sociologists now have an opportunity to supply the growing demand for social science inputs to the nuclear energy decision-making process.

Nuclear Sociology

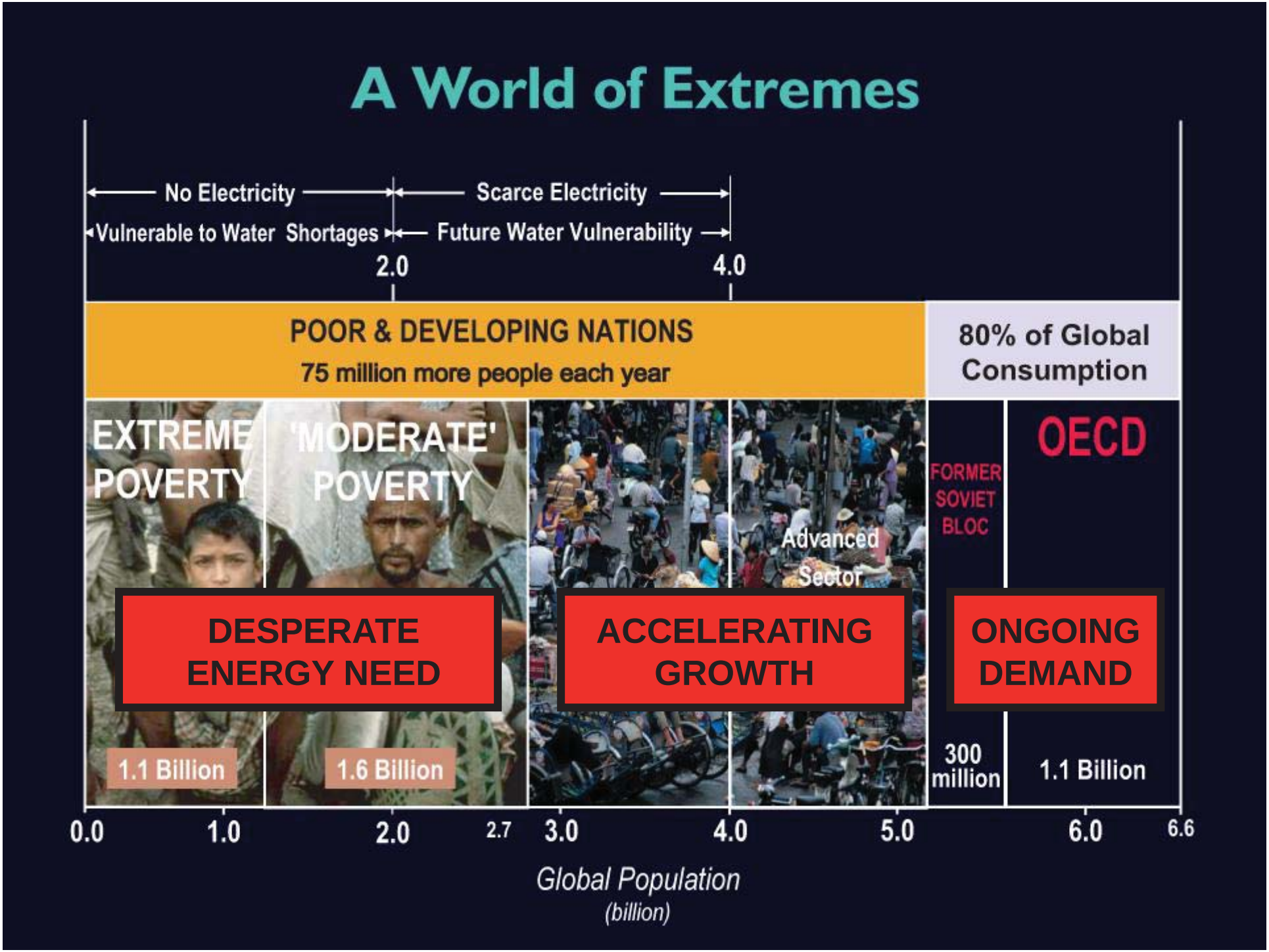
- Address the most important social problem in the nuclear energy utilization in the world.
- Identify the technological and systemic problems concerning nuclear energy utilization and work towards solutions.

Nuclear sociology elements

- The legal environment for using nuclear technology
- The ethics of energy use.
- The harmony of technology with society
- Coexistence of nuclear nonproliferation and the peaceful use of nuclear energy

“We often think of 'progress' and 'economic growth' as natural developments that benefit all members of society”

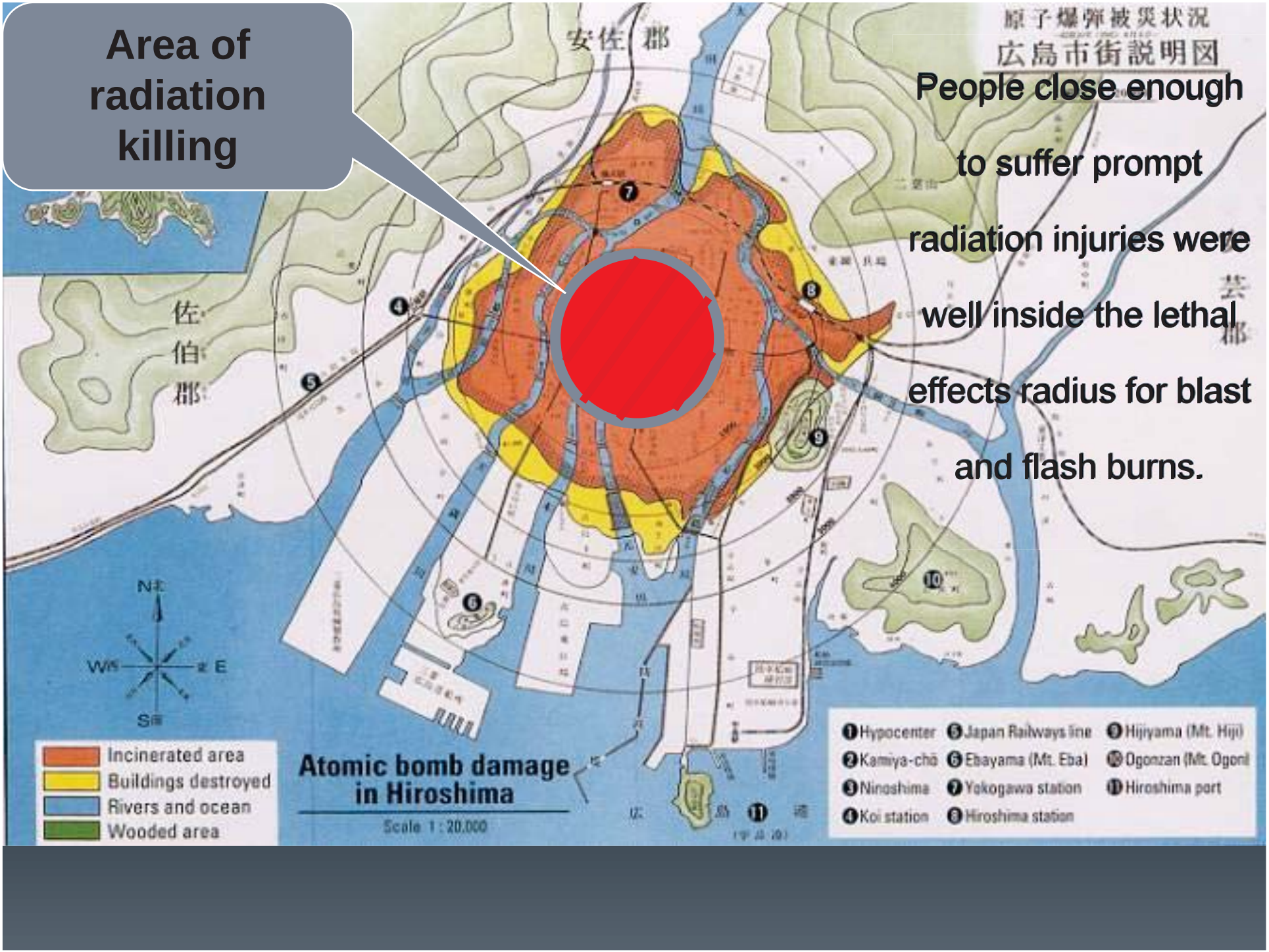
A World of Extremes



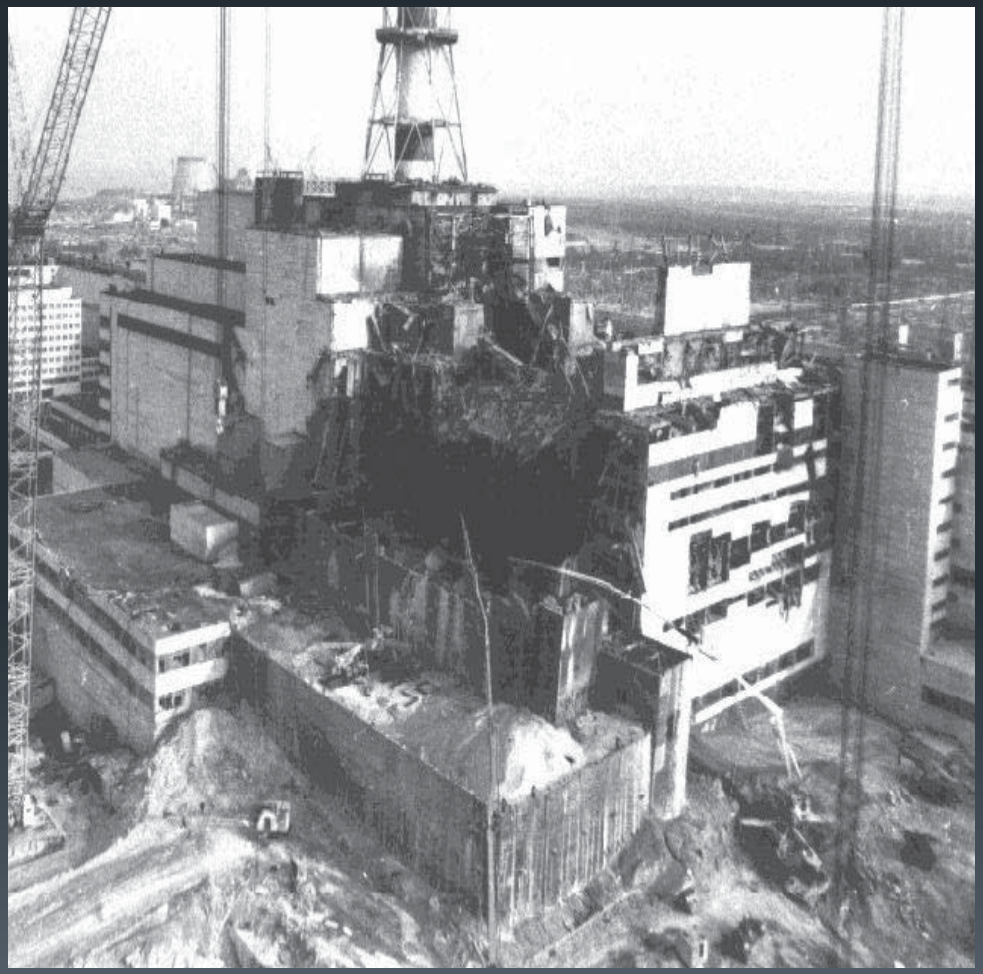
The ongoing energy debate.

- Every source of energy is accompanied by certain risks and the nuclear risks are not the greatest.
- Climate disruption, and environmental pollution present tremendous risk to society which we refuse to accept just because they are not quantified.
- For nuclear everything is well known and assessed.
- Nuclear causes pessimistic discussion while all the rest and especially renewables are discussed optimistically - W H Y ???

IS IT THE BOMB?


Area of radiation killing
People close enough to suffer prompt radiation injuries were well inside the lethal effects radius for blast and flash burns.
原子爆弾被災状況
広島市街説明図
安佐郡
佐伯郡
Incinerated area
Buildings destroyed
Rivers and ocean
Wooded area
Atomic bomb damage in Hiroshima
Scale 1 : 20,000
1 Hypocenter
2 Kamiya-chō
3 Ninoshima
4 Koi station
5 Japan Railways line
6 Ebayama (Mt. Eba)
7 Yokogawa station
8 Hiroshima station
9 Hijiyama (Mt. Hiji)
10 Ogonzan (Mt. Ogon)
11 Hiroshima port

Millions of people dead from Chernobyl accident?

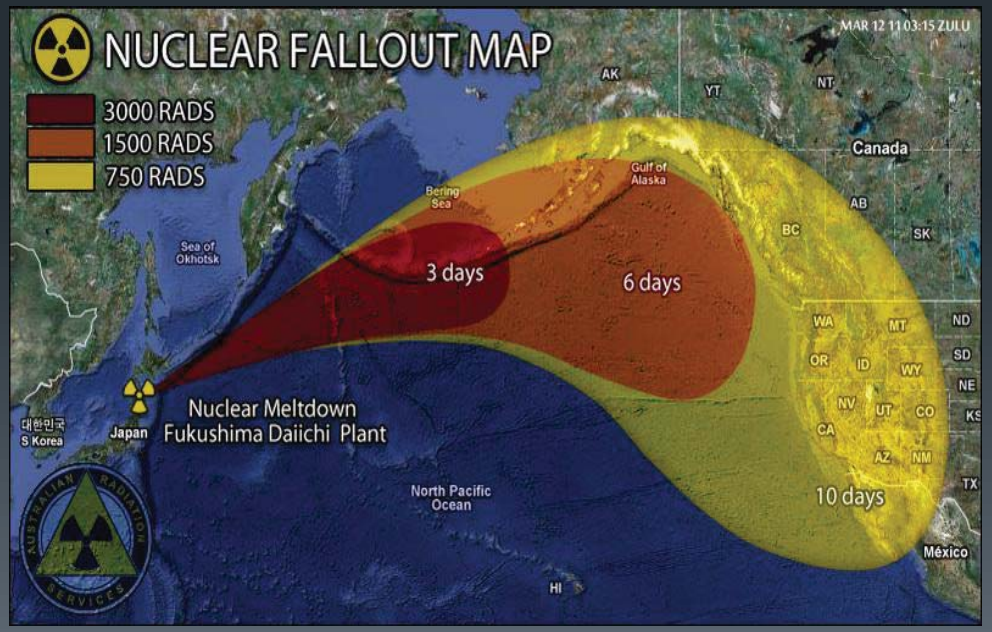


- Official human life losses :
- 31 Liquidators,
- 16 deaths from tyroid cancer
- 4500 according the “collective dose” hypothesis???

FUKUSHIMA

More than 26 000 dead or missing from TSUNAMI.

NOBODY dead from radiation!



Nuclear Energy Basic Principles (How society may understand it?)

Beneficial use

- Benefits
- Transparency

Responsible use

- Protection of the people and environment
- Security
- Non-proliferation
- Long term commitment

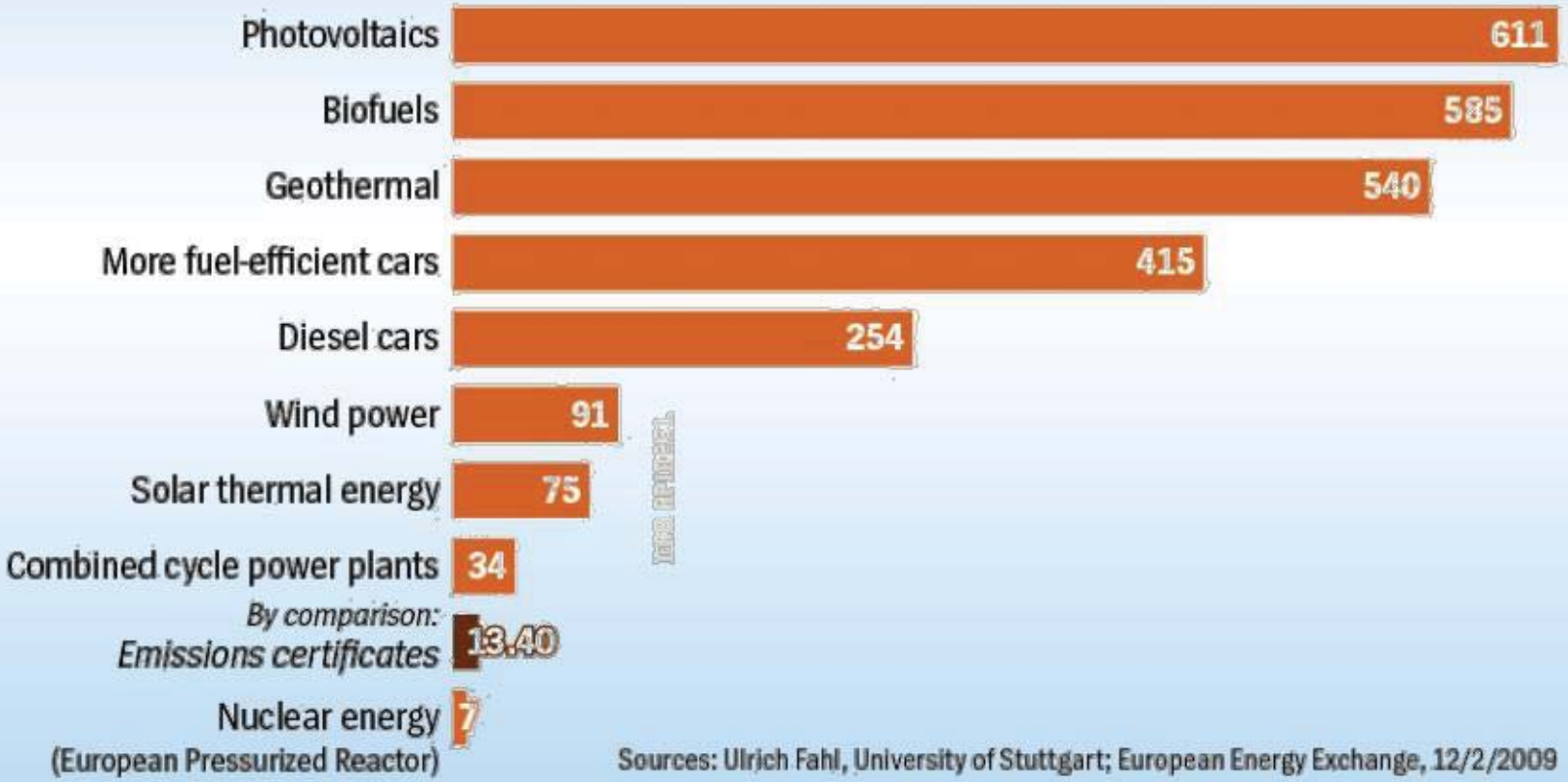
Sustainable use

- Resource efficiency
- Continuous improvement

SPIEGEL ONLINE

The Cost of Cleaner Energy

The maximum costs of diverse measures to prevent one ton of CO_2 emissions, in euros



Sources: Ulrich Fahl, University of Stuttgart; European Energy Exchange, 12/2/2009

Lessons learned from the past

- The energy intensity follows a trend of rationalization long before the “greens” and other modern energy consultants came into existence.
- It is simply that the countries with later industrialization have learned from the countries with earlier industrialization that energy is an important constituent of everyday life and that it has to be used efficiently.
- We should also keep in mind that coal was the fundamental energy source for the world industrial development and will continue to be important in the future as well.

Energy and Ethics

- Saving of resources seems to general public beneficial but Pu is not recognized as resource but rather as evil and obviously this is connected with the nuclear weapons.
- Nuclear weapons are prepared from water as well (respectively tritium - the heavy isotope of hydrogen) but nobody considers water as evil.

Questions of ethics and tolerability.

- Society is ready to tolerate high risks which it understands (OR BELIEVES TO UNDERSTAND) and is not prepared to tolerate low risks because it does not understand them.

Thinking about the Future

- If we are thinking about the future as **traders** (i.e. our horizon is 5- 10 years) it will be difficult to consider nuclear energy as viable energy source. It requires serious POLITICAL COMMITMENT, INVESTMENT and the FINANCIAL RISK may be substantial.

Thinking about the Future

- If we are looking about the future as **investors** than we have to take a serious decision about nuclear energy, because it is a real source, one that does not destroys the climate of the planet and carries less risk than most of the other energy technologies.

Thinking about the Future

- Finally if are looking ahead as **philosophers** we should ask the question, how long is the human race going to exist?
- How much of us are going to survive through the millennia and which will be the energy source that they are going to use.

Thinking about the Future

- Obviously, in the distant future , if the human race is still existing, they will not use the resources that we consider now. In this context Nuclear energy appears to be without any competition as long as this is the energy that powers the stars and the universe.

Something else to think about…

- The picture was taken in 1956...
- The big load is a 5MB Hard Disk Drive for the IBM 305 RAMAC, the first IBM 'SUPER' computer released in September 1956.
- This HDD weighed over a ton and stored an 'astonishing' (@ the time) 5 MB of data.
  Do you appreciate being able to reach into your pocket & pull out your 8 GB memory stick now - or perhaps even your 4GS iPhone with 32 GB of memory?!?

THE END

Thank you very much for paying attention…