Nuclear Energy Development in the World,

Facts and Fiction

Andrej Stritar

Past-President

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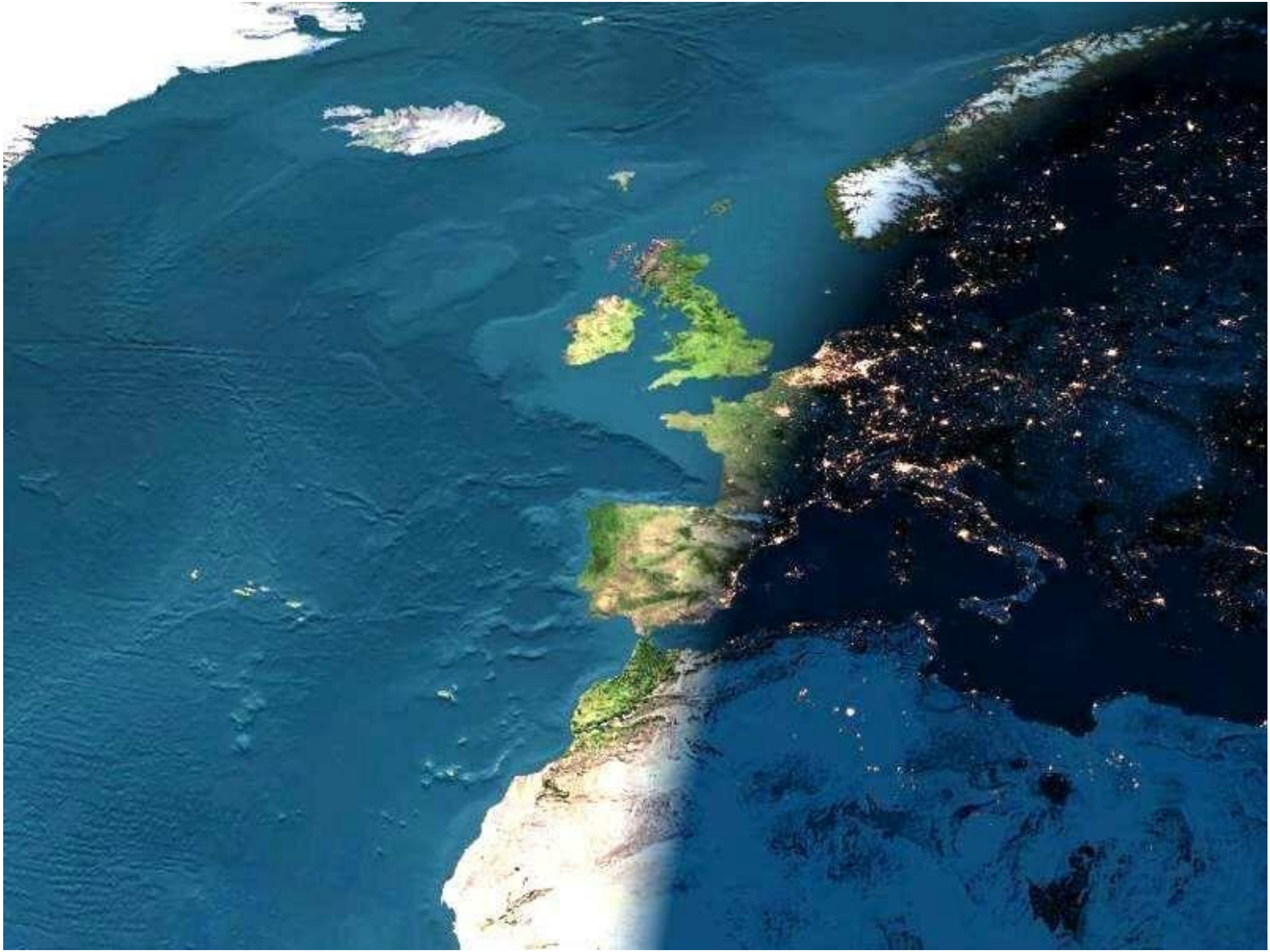



Where are these lights coming from?

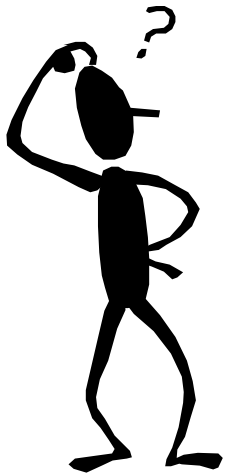

FINLAND
NORWAY
Oslo
Helsinki
Helsingfors
Stockholm
SWEDEN
ESTONIA
LATVIA
Moscow
RUSSIA
DENMARK
Vilnius
Minsk
BELARUS
IRELAND
ENGLAND
London
NETH.
Amsterdam
Berlin
Warsaw
POLAND
Kiev
GERMANY
GUERNSEY (UK)
Paris
Luxembourg
CZECH REP.
UKRAINE
Chişinău
Bern
Vienna
Budapest
AUSTRIA
HUNGARY
Ljubljana
Zagreb
ROMANIA
Belgrade
Bucharest
San Marino
YUG.
BULGARIA
Monaco
Sarajevo
Sofia
PORTUGAL
Andorra la Vella
Madrid
Lisbon
Tirana
Skopje
Ankara
Rome
ITALY
SPAIN
TURKEY
Athens
Algiers
Alger
Tunis
GREECE
Beirut
Damascus
Rabat
MALTA
MOROCCO
TUNISIA
Tripoli
Cairo

Primary energy consumption

Fuel	EU	World
Oil	45,2%	37,5%
Gas	24,7%	24,3%
Coal	15,3%	25,5%
Hydro	0,4%	6,3%
Nuclear	14,4%	6,5%

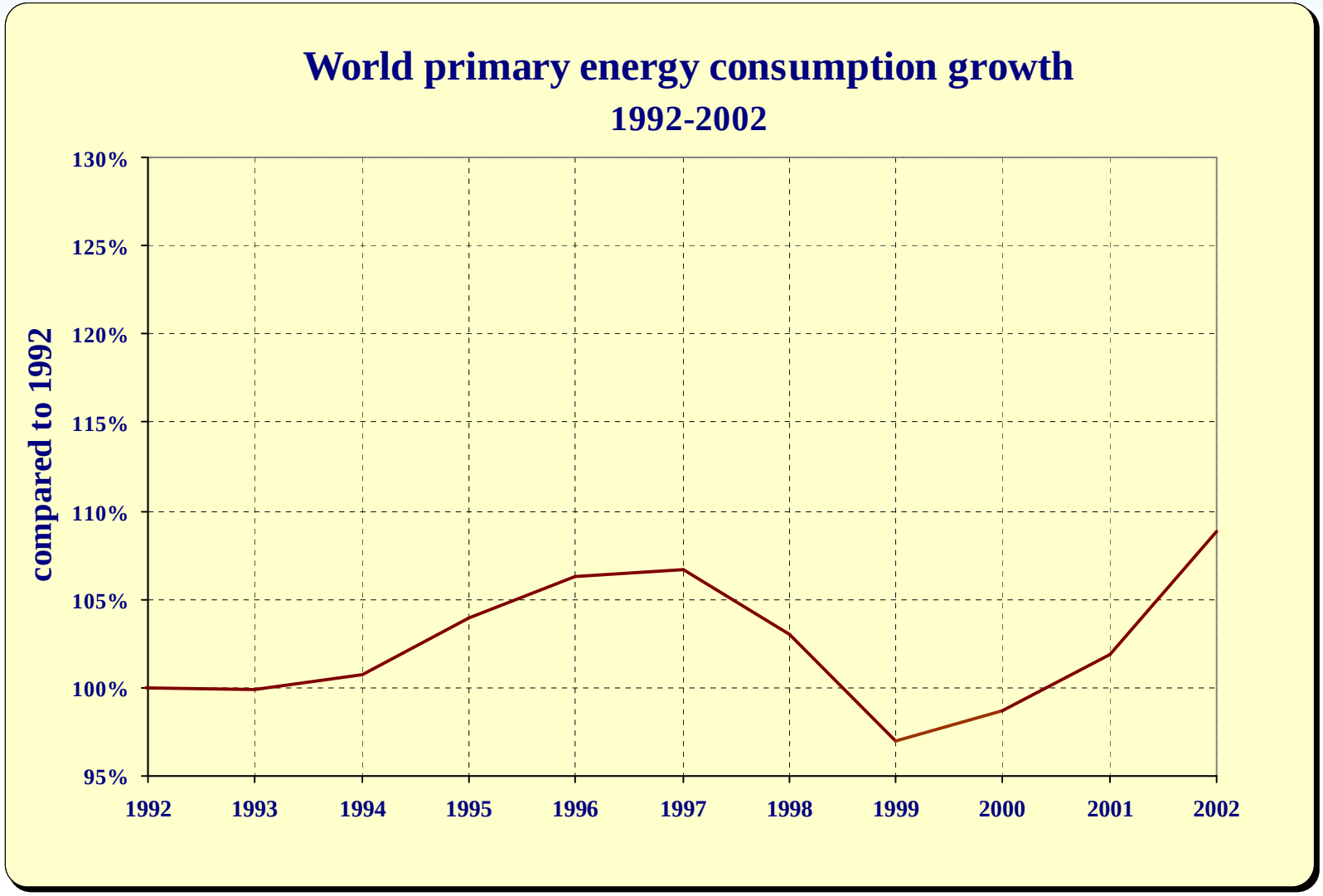
Fact and Fiction about Nuclear Energy

Let’s play a quiz!



What would you say about nuclear industry?

A. blooming	**B. growing**
C. stagnating	**D. decaying**



What would you say about this industry?

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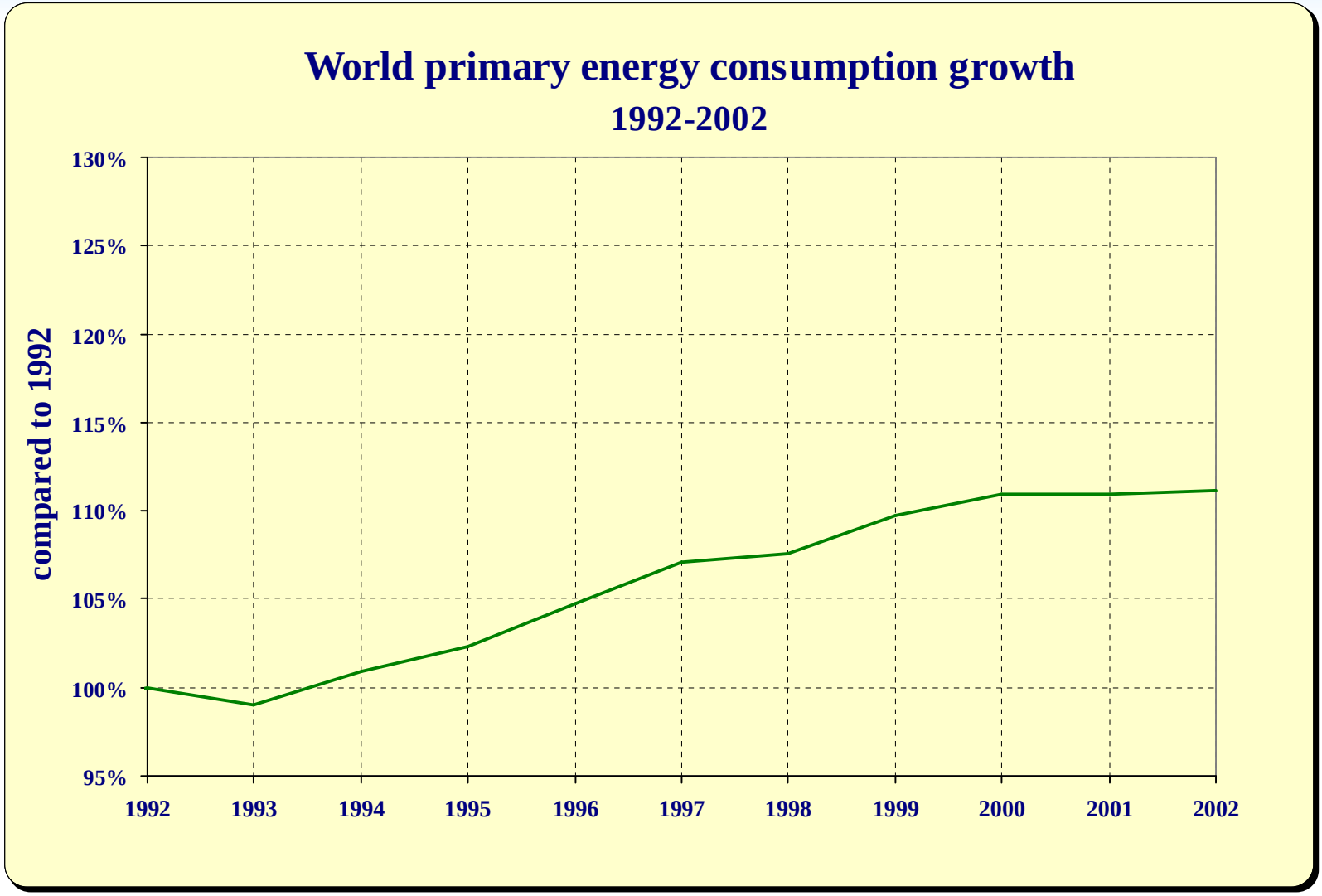

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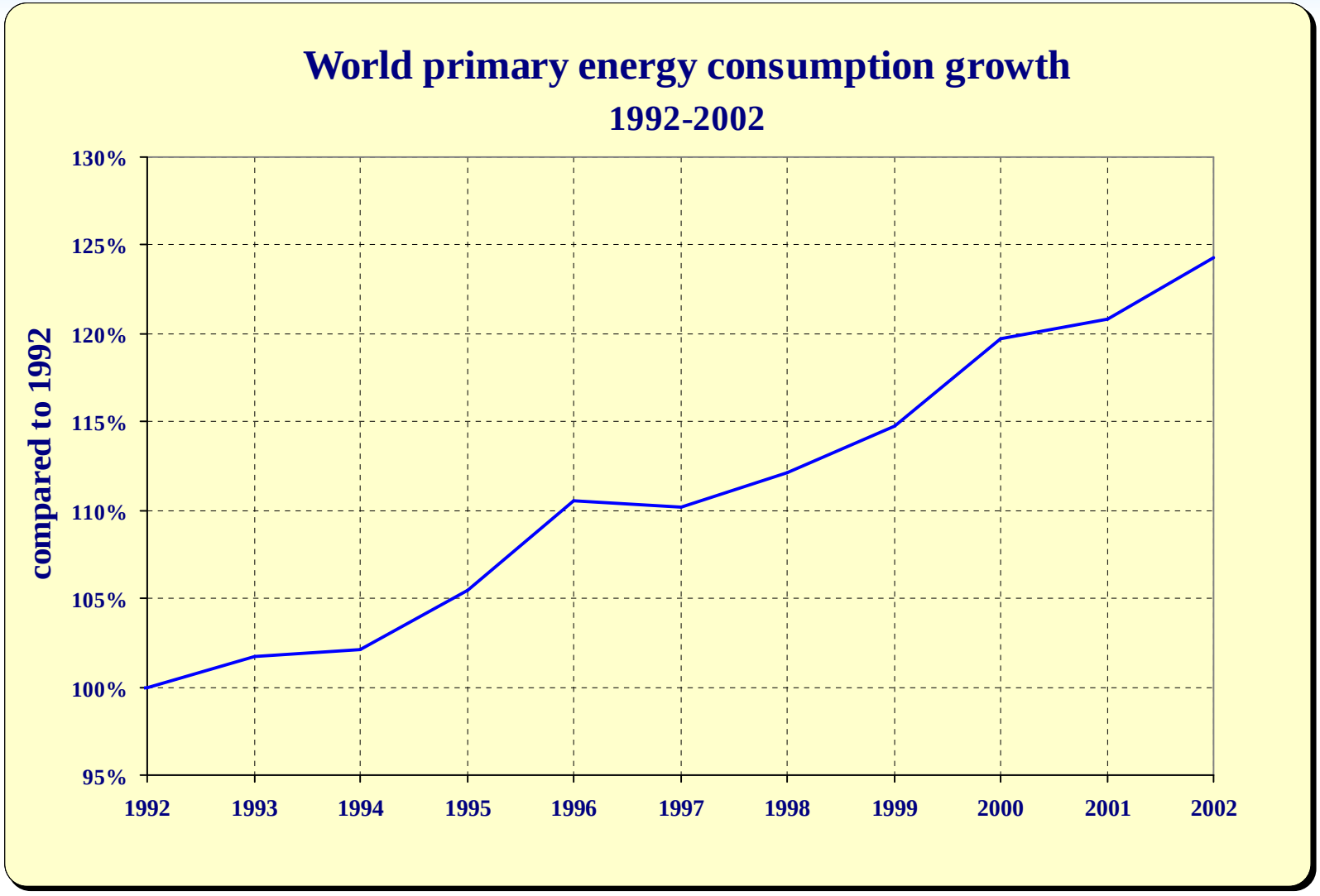

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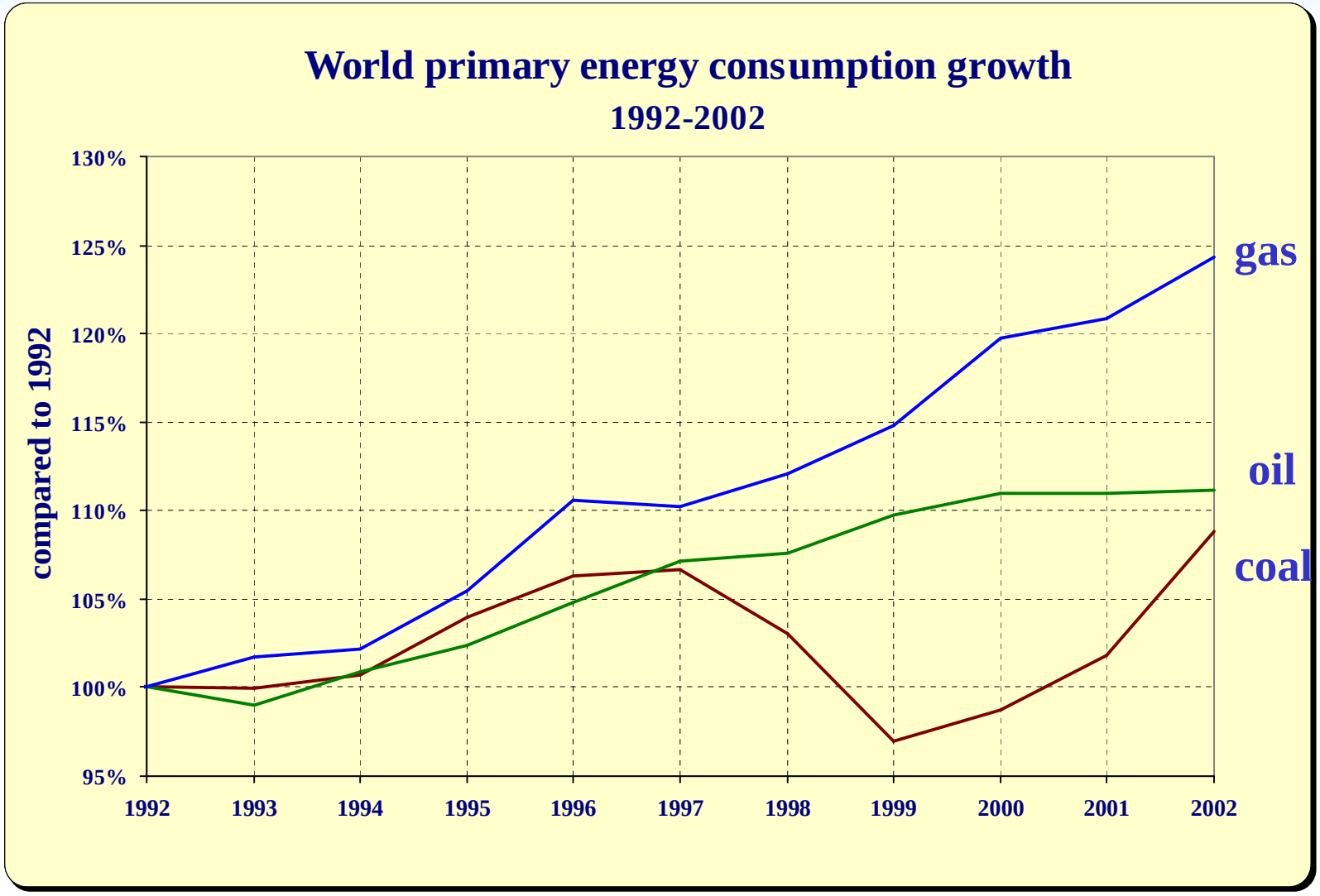

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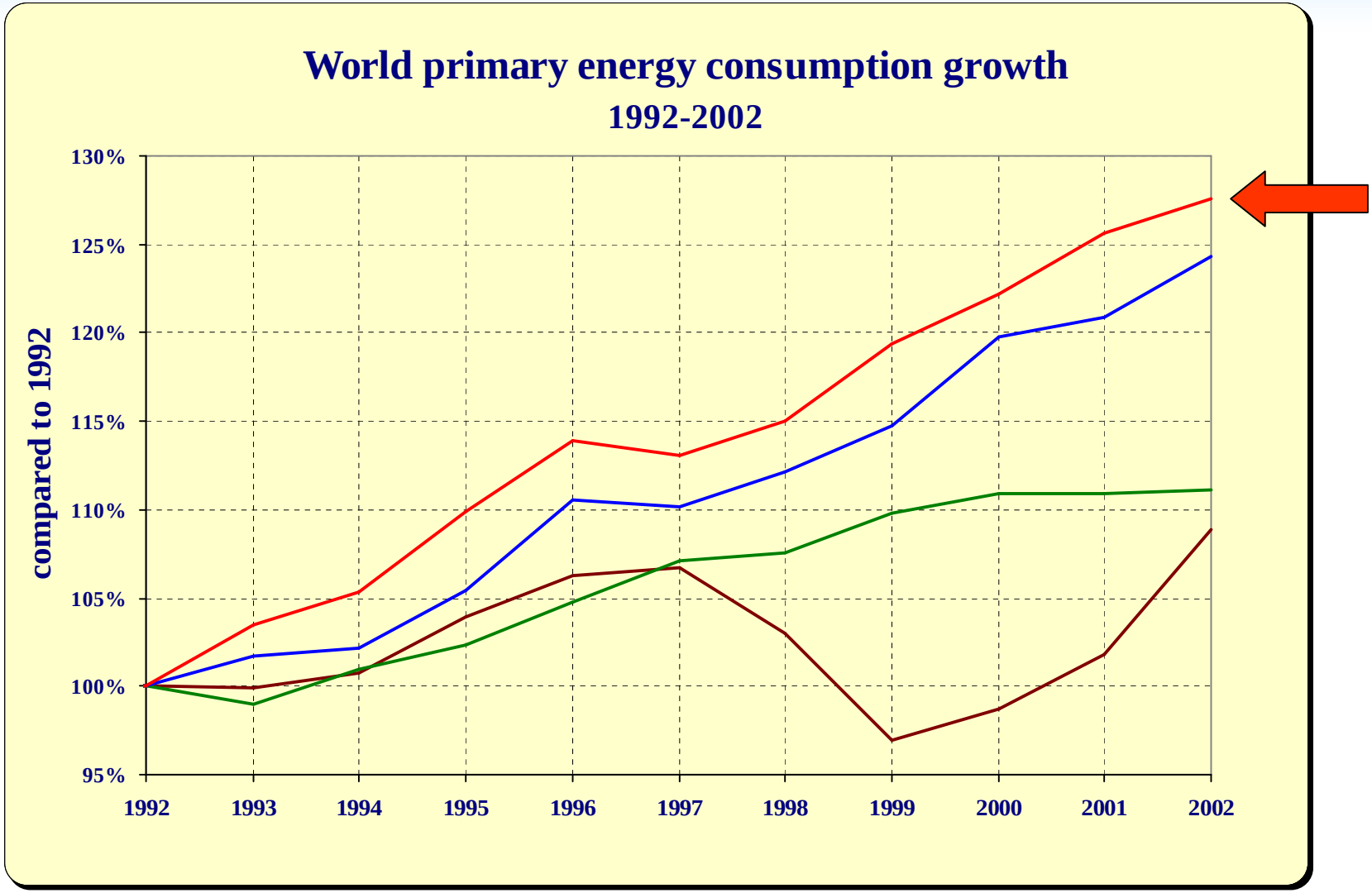

So, what do we say about nuclear?

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What would you say about nuclear industry?

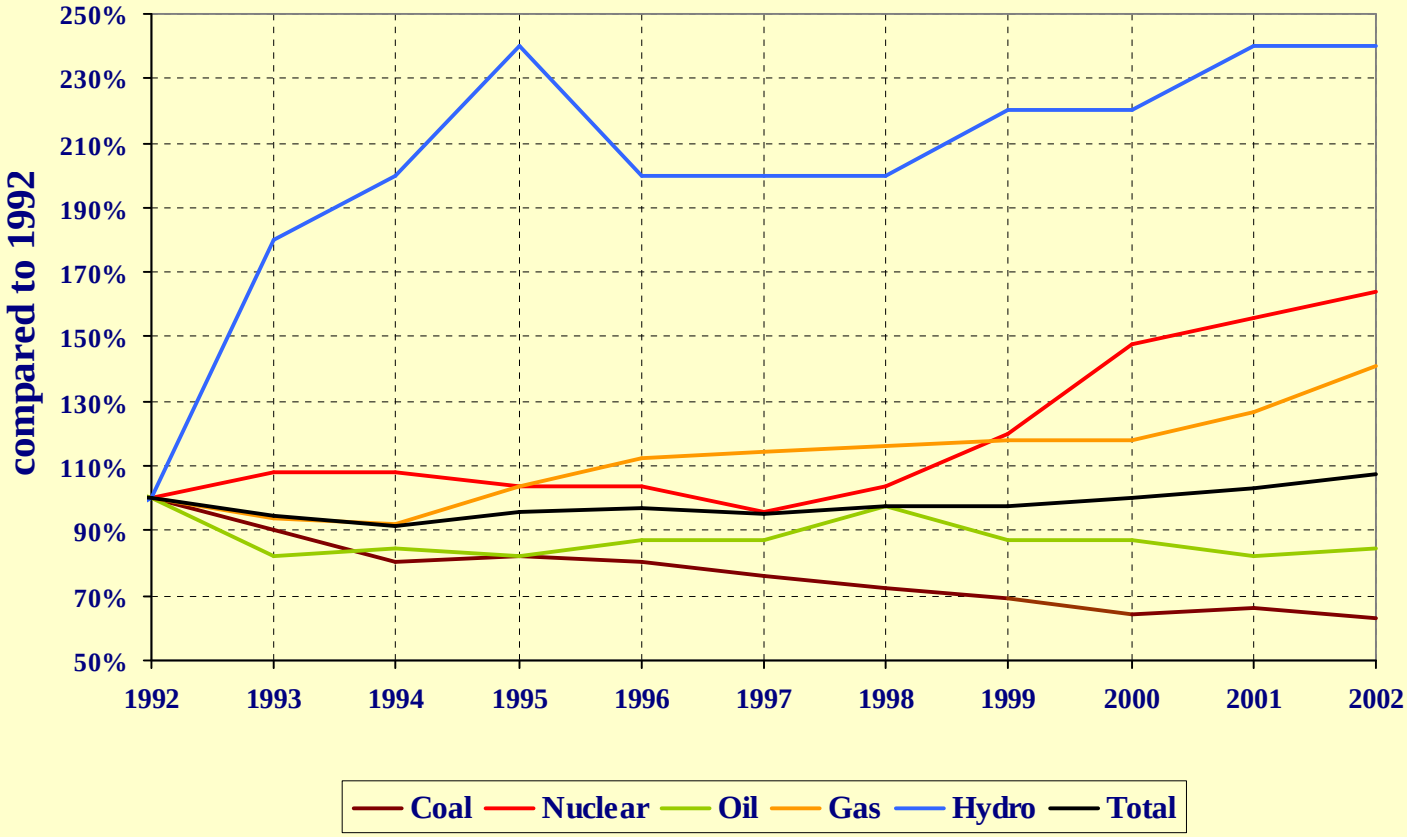
A. blooming	**B. growing**
C. stagnating	**D. decaying**

What would you say about nuclear industry?

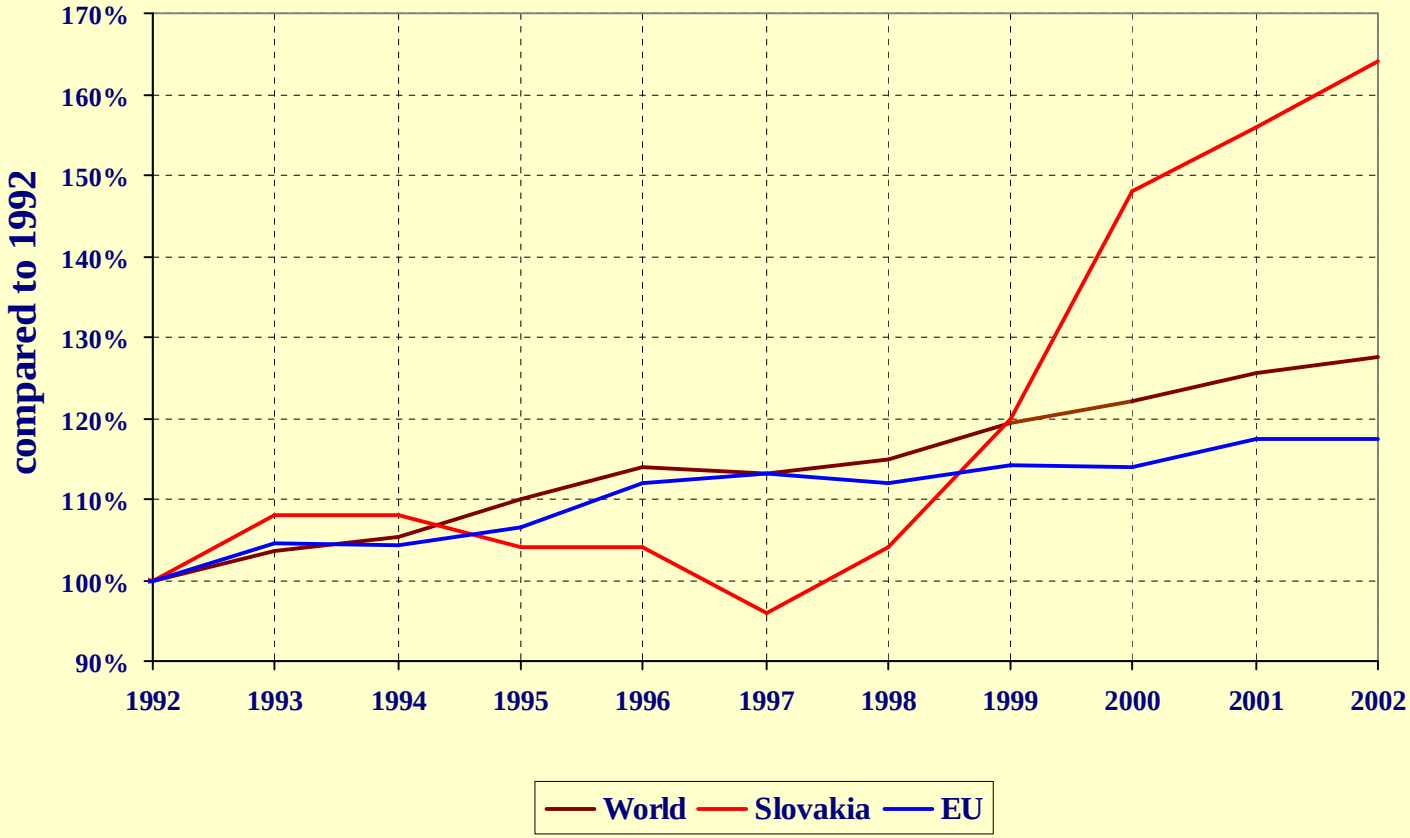
A. blooming	**B. growing**
C. stagnating	**D. decaying**

Primary energy consumption growth - Slovakia

1992-2002



Nuclear energy consumption growth - Slovakia, EU, World
1992-2002



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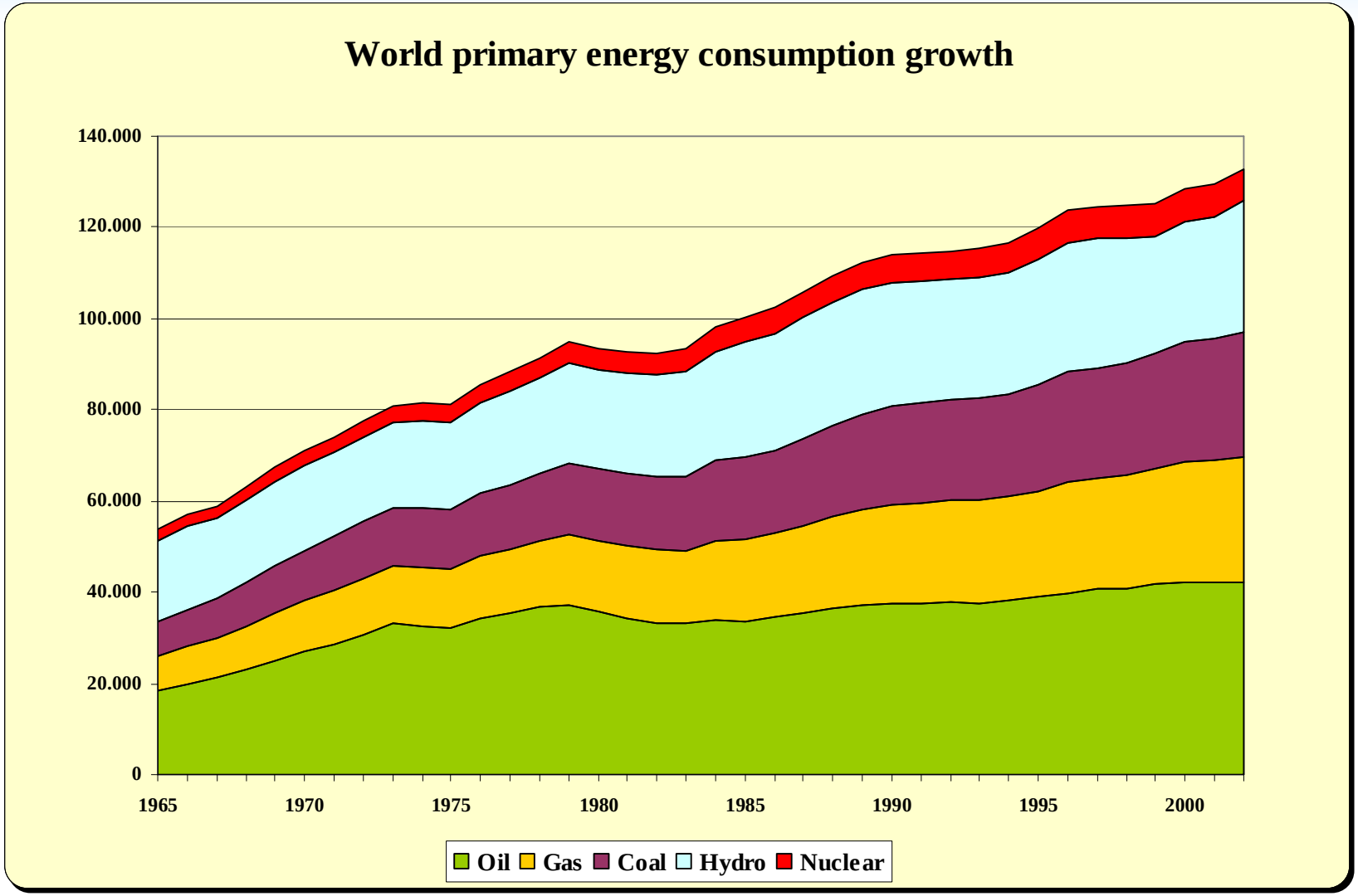
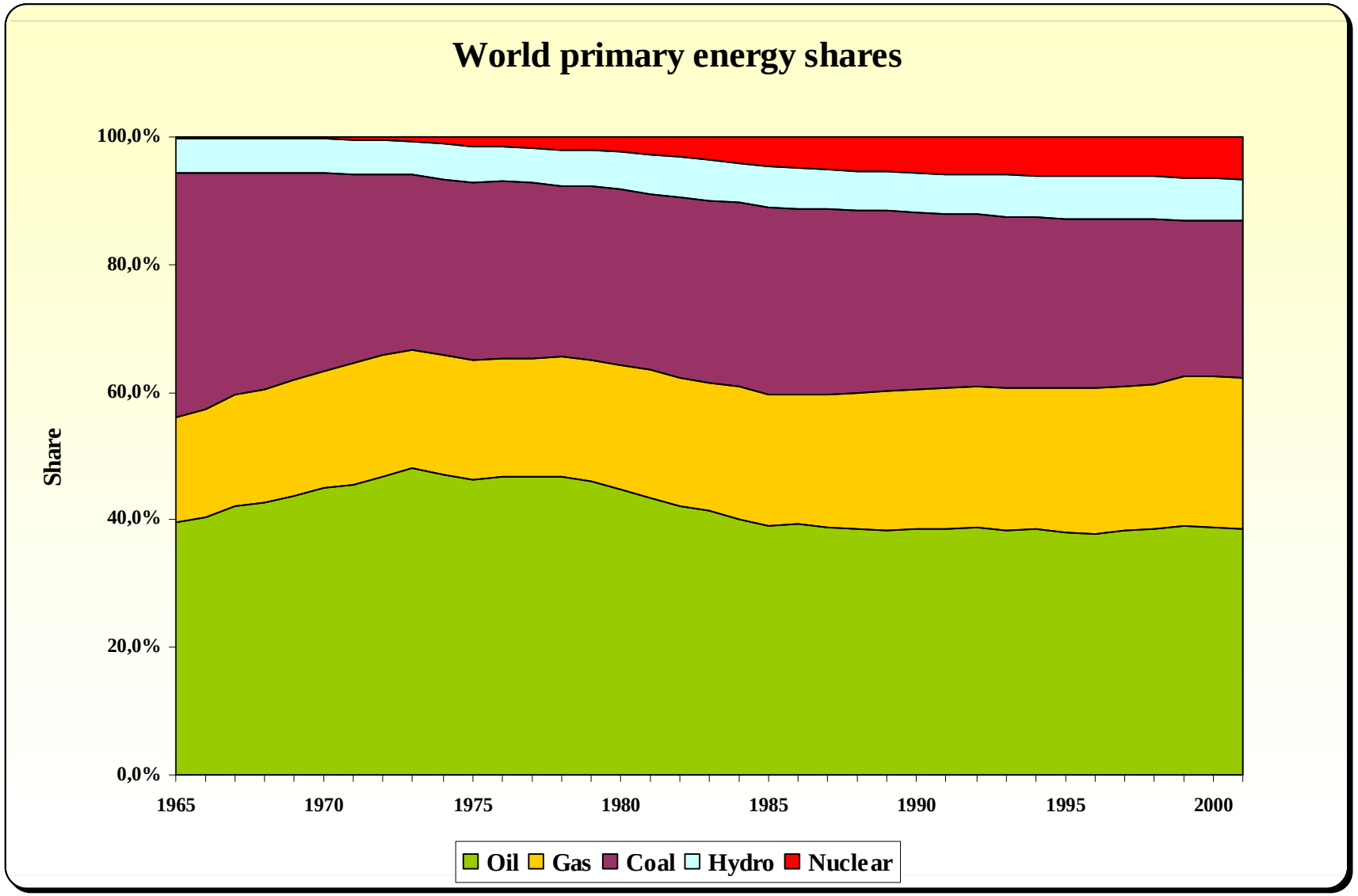


- Nuclear is representing 6.49% of World primary energy consumption.
- Ten years ago it was only 5.84%.



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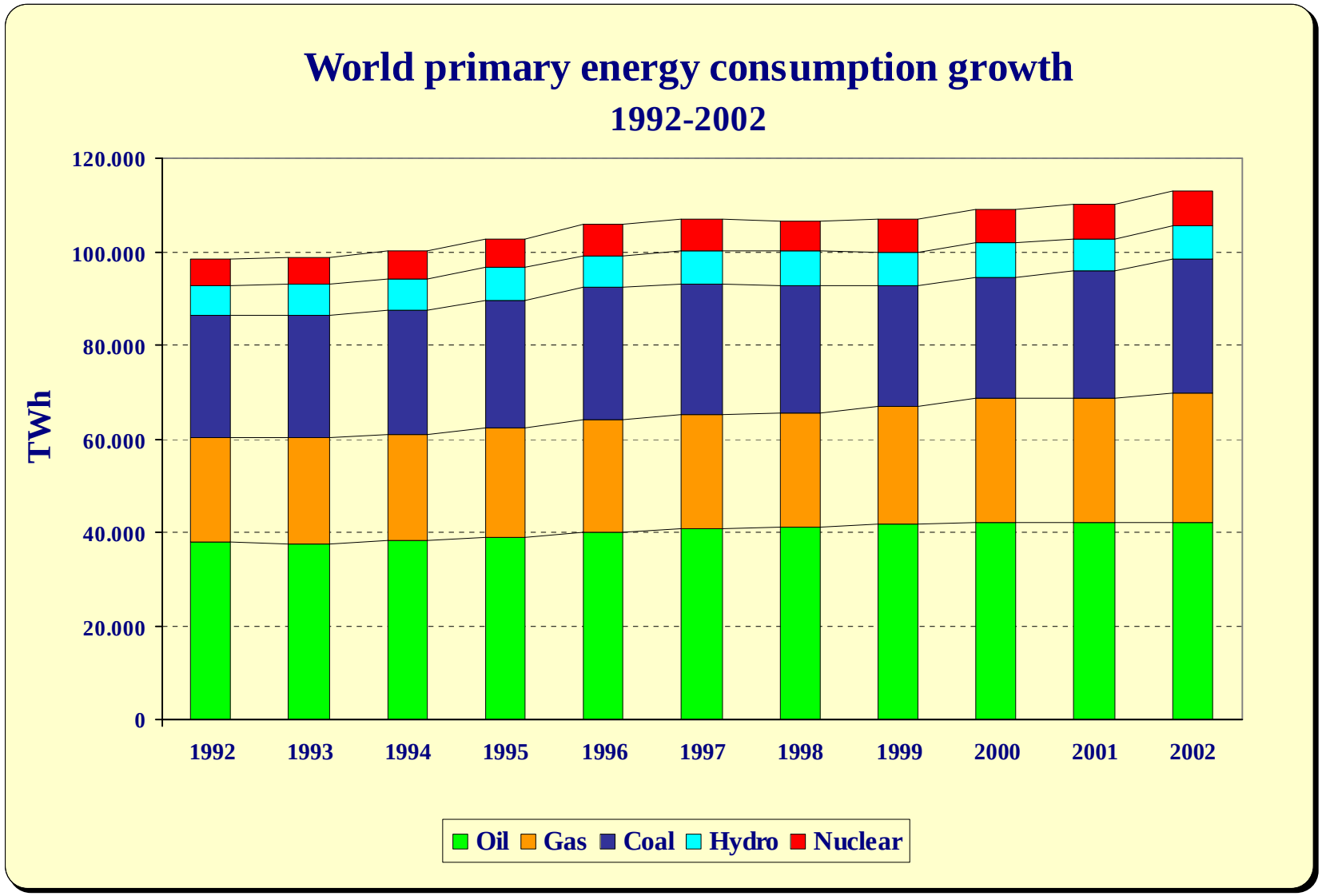

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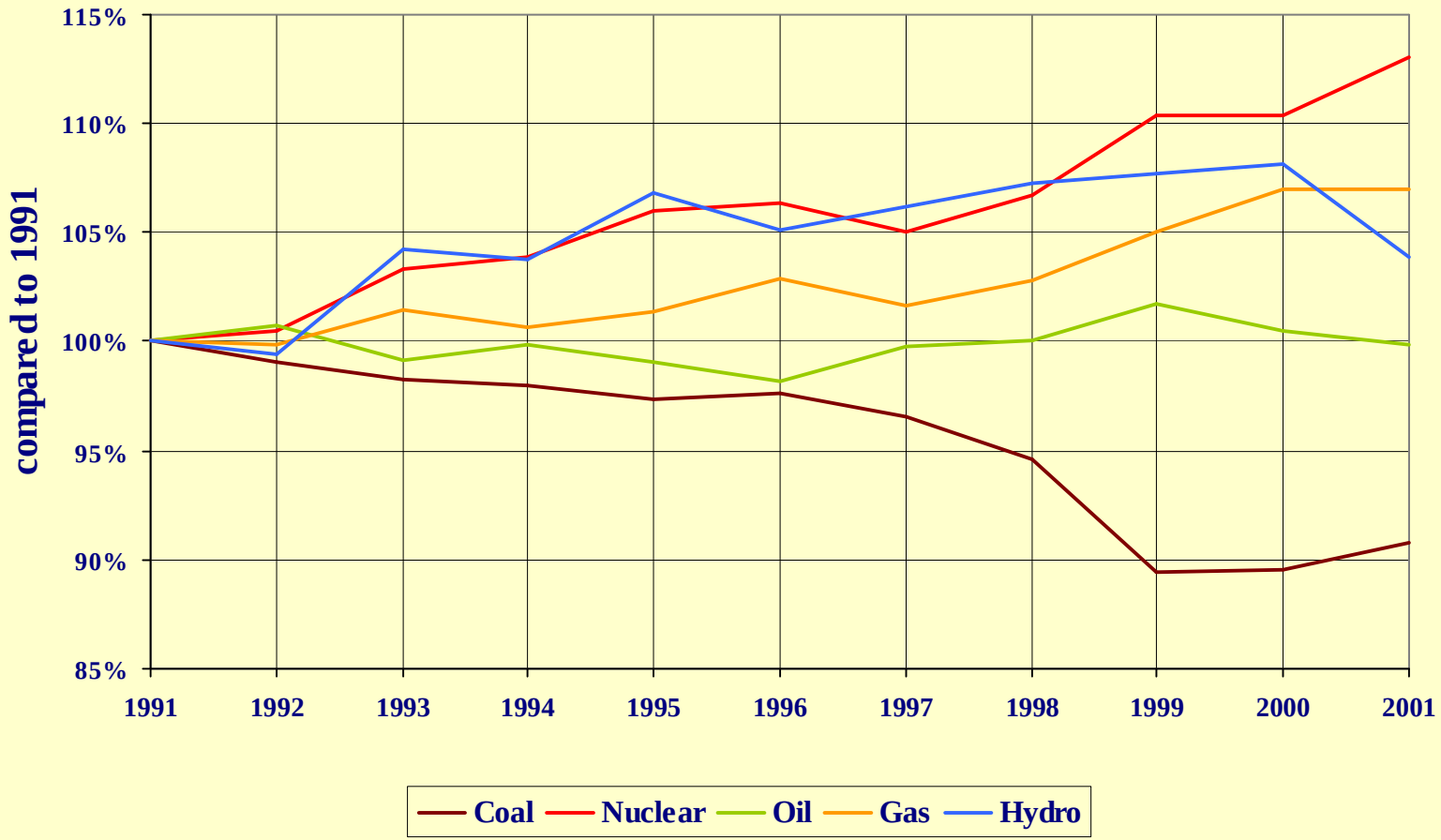
New nuclear developments

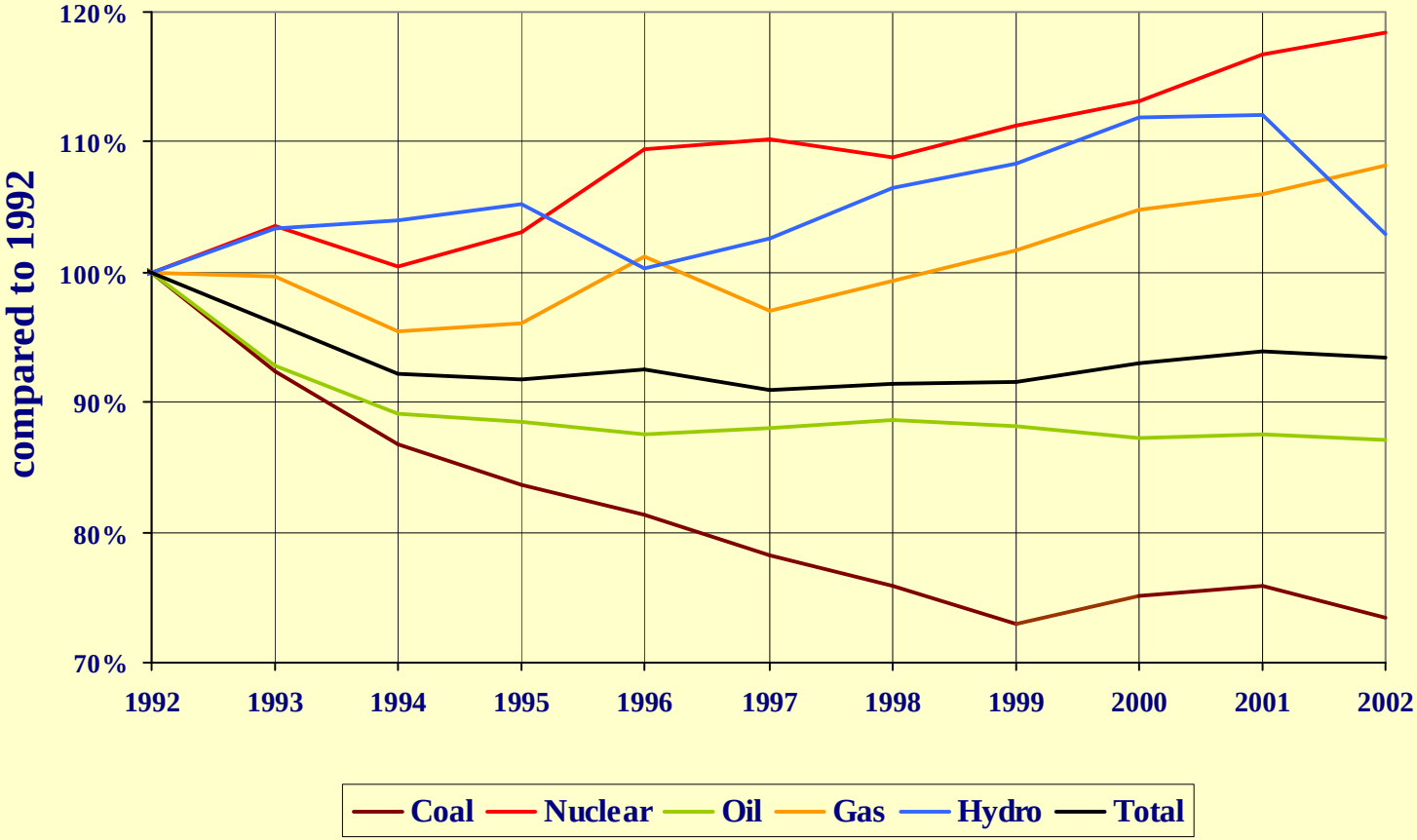
- Life extensions in USA
- Early site permits in USA
- New unit in Finland (by 2009)
- Plans in France (by 2012)

Share in primary energy consumption - World



- Nuclear Energy share in primary energy consumption is increasing the fastest.

Primary energy consumption growth - Europe & Former Soviet Union 1992-2002



- In the region nuclear is fastest growing.

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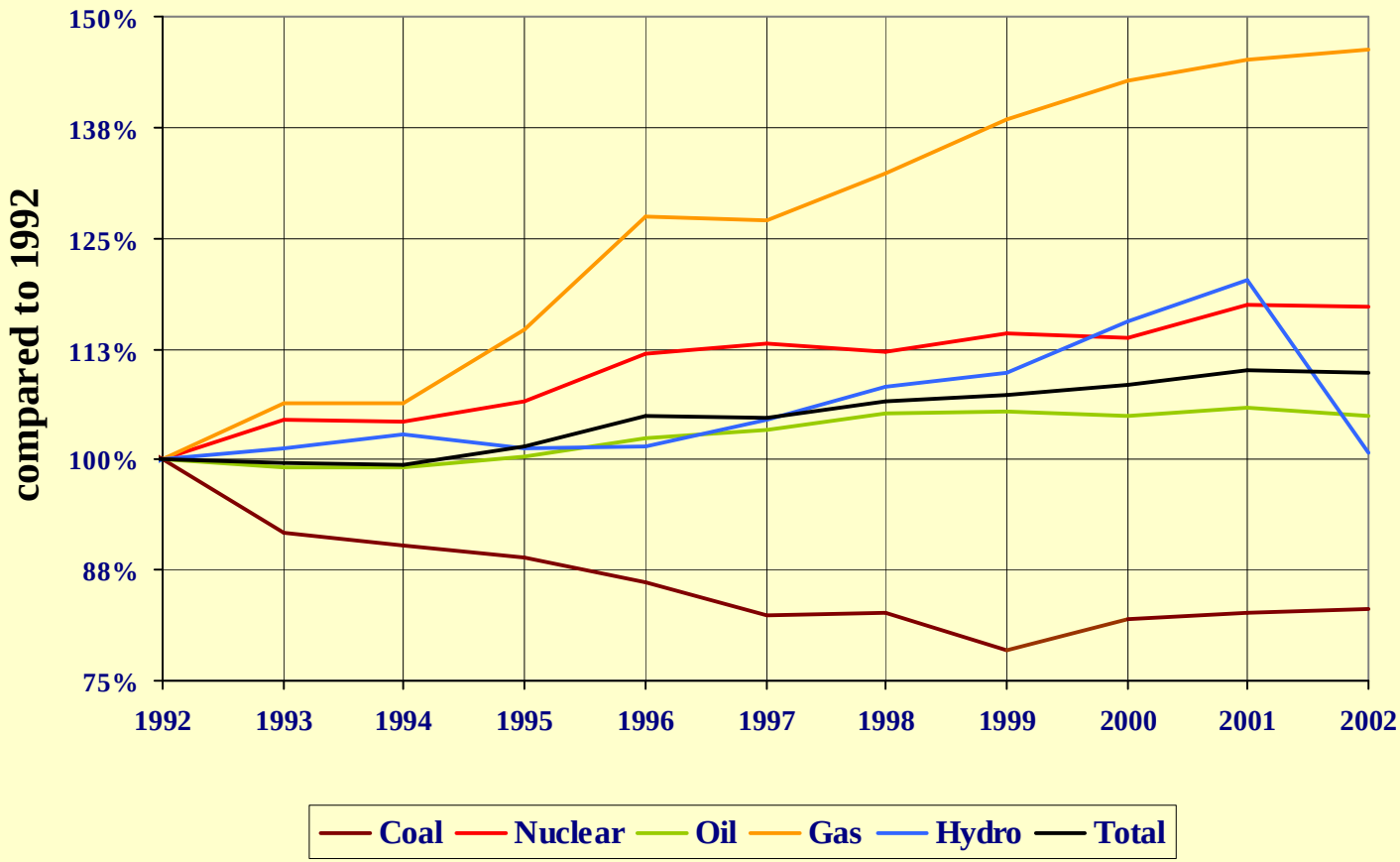
Primary energy consumption growth - EU
1992-2002



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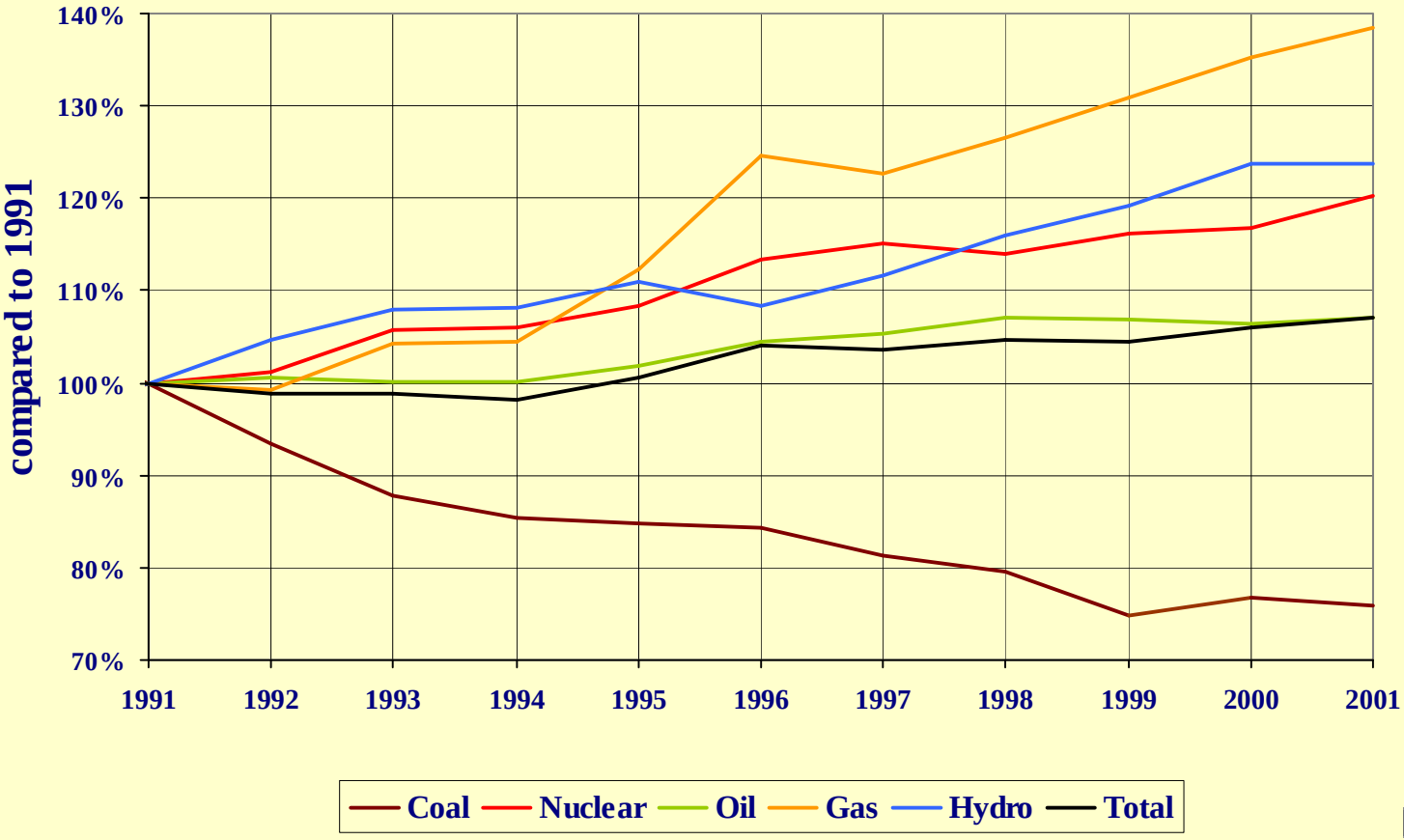
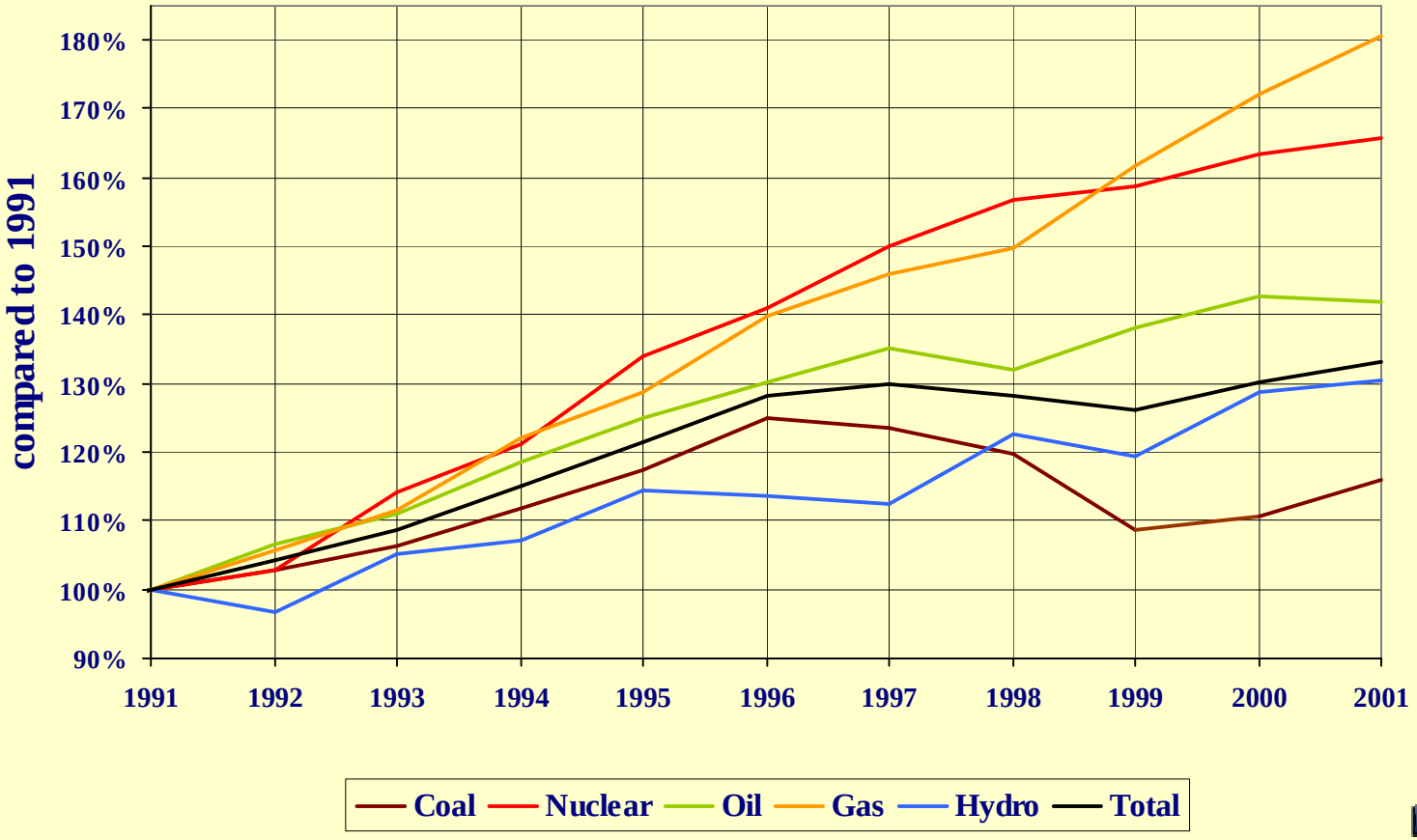
Primary energy consumption growth - North America
1991-2001



- In North America nuclear grew for 2.32% in 2001!

Primary energy consumption growth - Asia & Pacific
1991-2001



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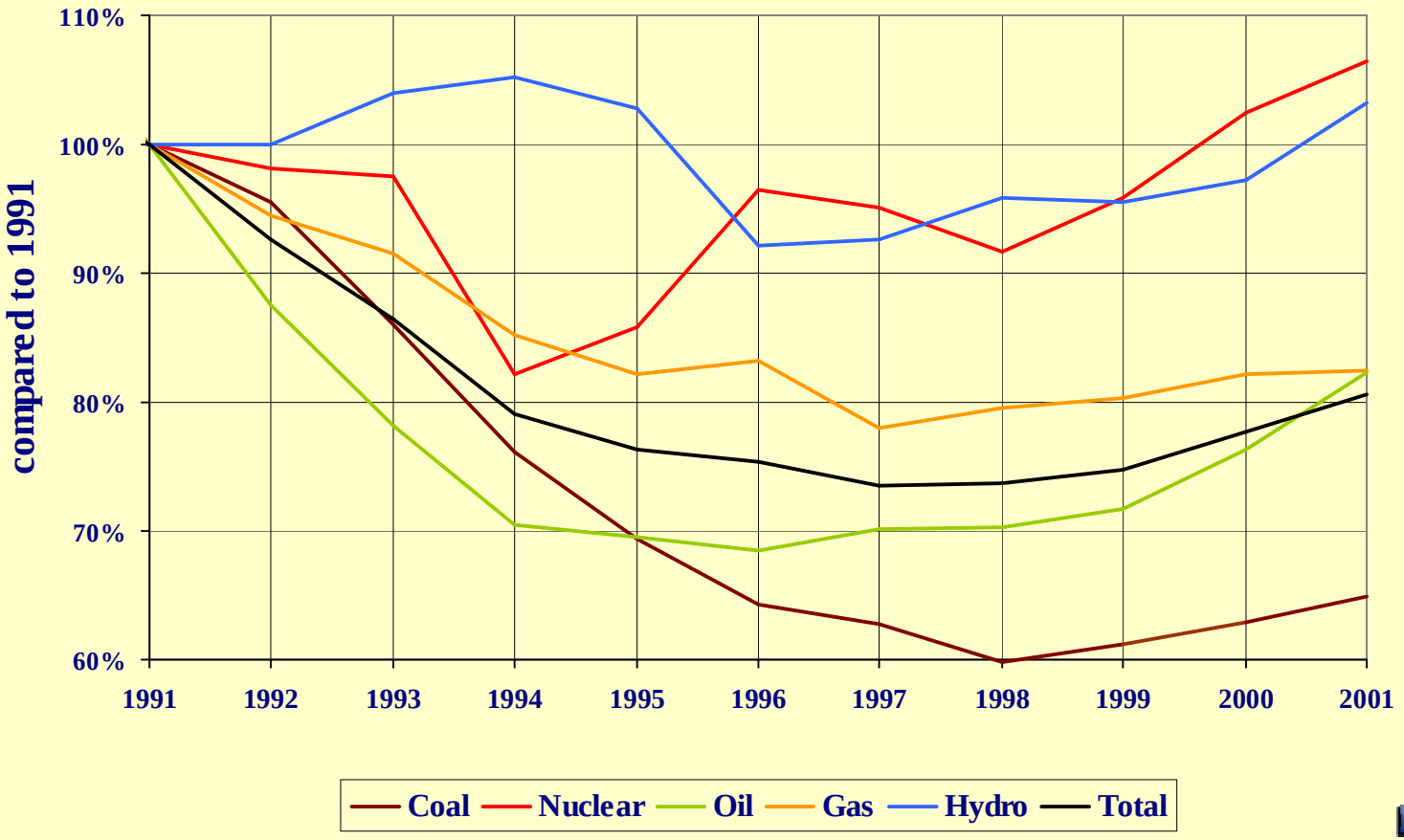
Primary energy consumption growth - Former SU
1991-2001



- Nuclear was first to reached the level before 1990!

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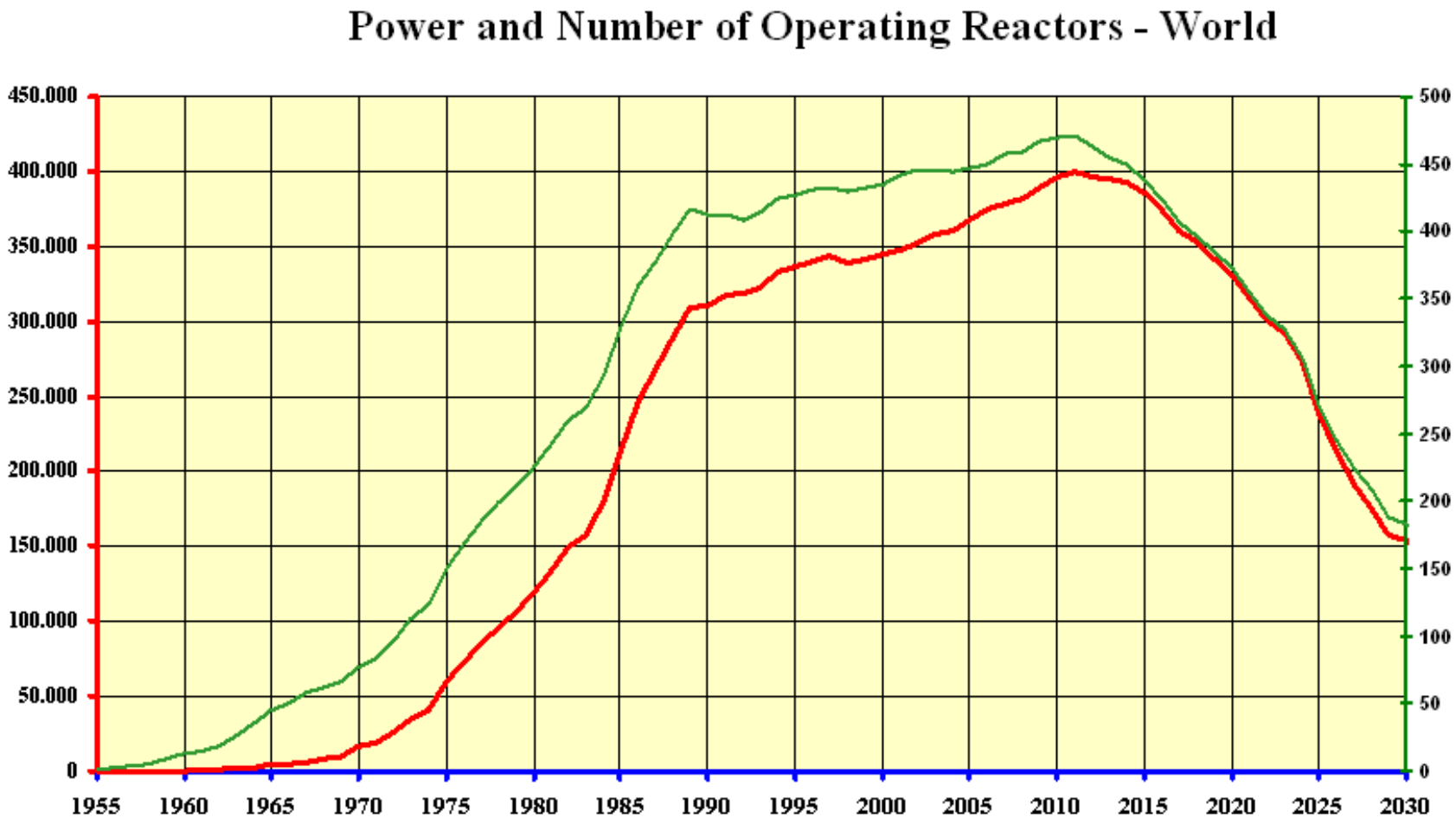
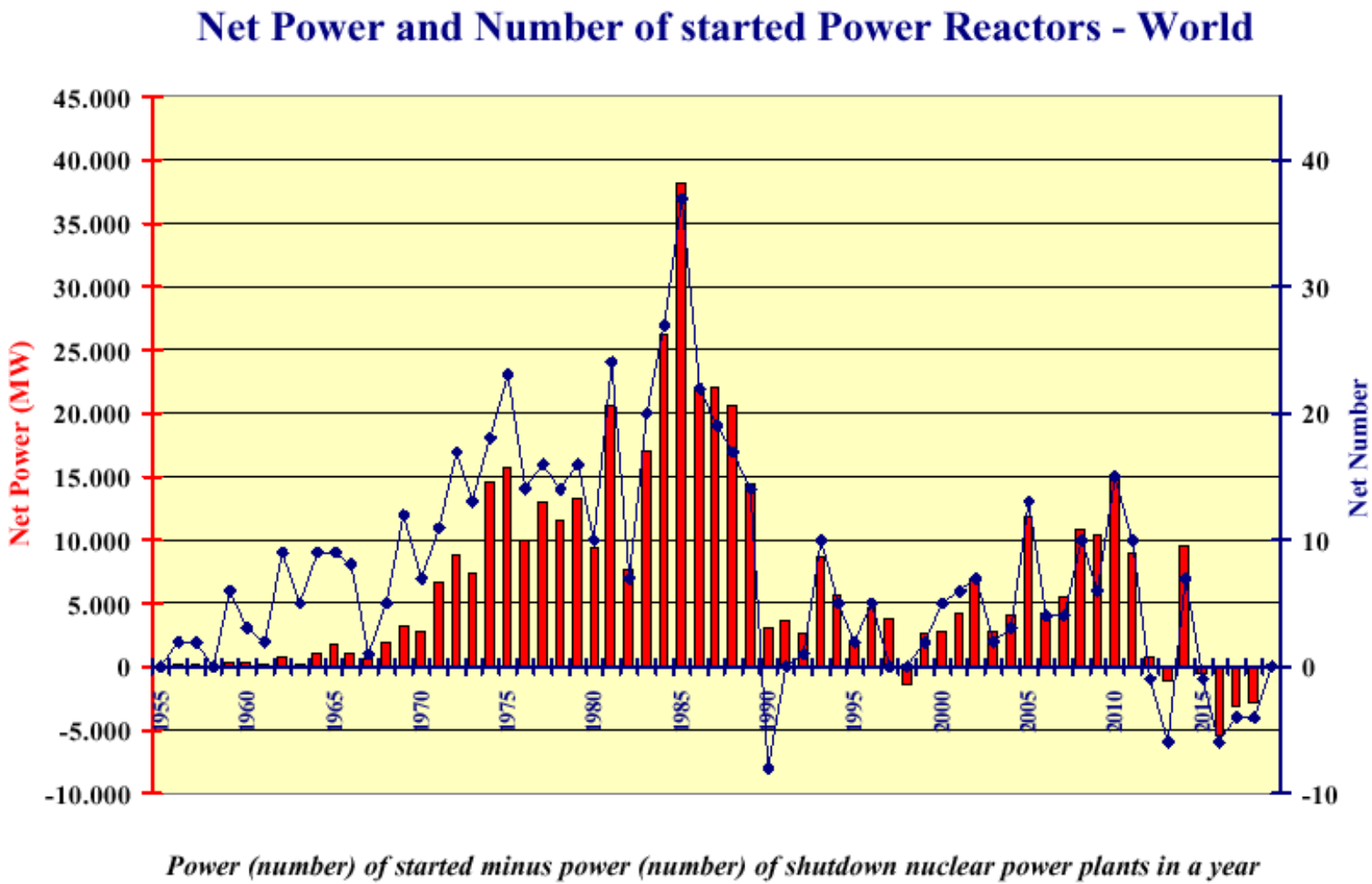
Past and Future



Effective change in installed power



Power (number) of started minus power (number) of shutdown nuclear power plants in a year

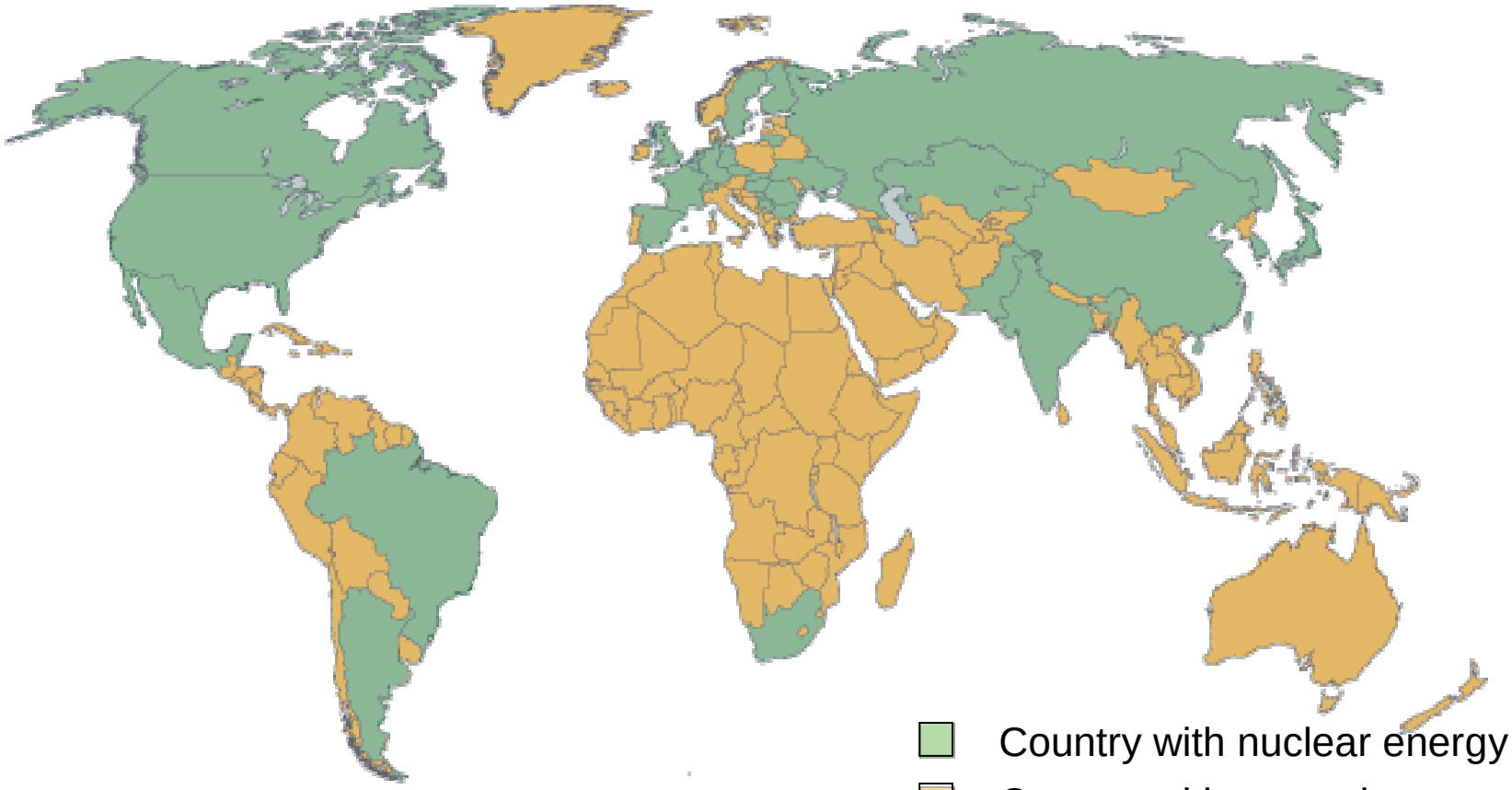
Summary of countries with nuclear power programmes

Nuclear Training Centre
Ljubljana, Slovenia

		Operating		Production 2001 TWh	Share of total production	Shut Down		Under Construction		Firmly Planned		Vaguelly Planned	
		no.	MW			no.	MW	no.	MW	no.	MW	no.	MW
1	ARGENTINA	2	935	7,10	8,30%	-		-		-		-	
2	ARMENIA	1	376	1,90	34,80%	1	376	-		-		1	1.000
3	BELGIUM	7	5.712	44,10	58,20%	1	11	-		-		1	1.000
4	BRAZIL	2	1.855	14,30	4,10%	-		-		-		-	
5	BULGARIA	4	2.722	19,60	44,60%	2	816	-		-		2	1.906
6	CANADA	20	13.601	77,49	13,00%	5	2.016	-		-		-	
7	CHINA	8	6.017	16,68	1,13%	-		4	2.620	26	22.165	-	
8	CZECH R	5	2.560	14,80	20,00%	-		1	912	-		-	
9	FINLAND	4	2.310	22,50	30,00%	-		1	1.600	-		-	
10	FRANCE	59	63.293	401,30	76,19%	12	3.719	-		-		6	8.780
11	GERMANY	18	20.432	171,30		18	5.605	-		-		-	
12	HUNGARY	4	1.731	14,13	39,10%	-		-		-		2	1.400
13	INDIA	14	2.446	19,19	3,76%	-		9	4.712	6	2.160	3	2.000
14	IRAN	0		0,00		-		2	1.900	-		2	870
15	ITALY	0		0,00		3	1.163	-		-		-	
16	JAPAN	54	44.394			2	172	4	5.062	11	14.654	16	18.958
17	KAZAHSTAN	0				1	70	-		-		8	5.190
18	KOREA, SOUTH	18	14.890	112,00	39,30%	-		2	2.000	4	4.360	6	6.260
19	LITHUANIA	2	2.370	11,40	77,60%	-		-		-		2	880
20	MEXICO	2	1.308	8,70	4,60%	-		-		-		-	
21	NETHERLANDS	1	452			1	55	-		-		-	
22	PAKISTAN	2	425	1,98	29,00%	-		-		-		2	900
23	ROMANIA	1	650			-		1	650	-		-	

		Operating		Production 2001 TWh	Share of total production	Shut Down		Under Construction		Firmly Planned		Vaguelly Planned	
		no.	MW			no.	MW	no.	MW	no.	MW	no.	MW
24	RUSSIA	**30**	**20.739**	134,90	15,40%	5	786	6	5.125	15	9.580	3	1.260
25	S.AFRICA	**2**	**1.842**			-		-		1	110	-	
26	SLOVAK R	**6**	**2.408**	17,10	53,40%	1	110	-		-		-	
27	SLOVENIA	**1**	**676**	5,00	39,00%	-		-		-		-	
28	SPAIN	**9**	**7.460**	63,60	27,00%	1	480	-		-		-	
29	SWEDEN	**11**	**9.401**	69,20	44,00%	2	610	-		-		-	
30	SWITZERLAND	**5**	**2.985**	25,30		1	9	-		-		-	
31	TAIWAN, CHINA	**6**	**4.885**	35,00	21,60%	-		1	1.350	-		2	2.200
32	UKRAINE	**13**	**11.358**	76,20	50,40%	4	3.317	2	1.950	-		2	1.200
33	UNITED KINGDOM	**27**	**11.992**			18	2.254	-		-		-	
34	USA	**104**	**95.622**	767,30		24	9.107	-		1	0	-	
Grand Total		**442**	**357.847**	**2.152**		**102**	**30.676**	**33**	**27.881**	**64**	**53.029**	**58**	**53.804**

Nuclear power is utilised in countries where 2/3 of world population live.
New build of nuclear in countries with half the world population.



NUCLEAR ENERGY - NEW GROWTH

Concerns over:

- Energy resource availability
- Climate change
- Air quality
- Energy security
- Competitive price

Point to important role for nuclear power

Challenges facing nuclear

Public, political and commercial acceptance

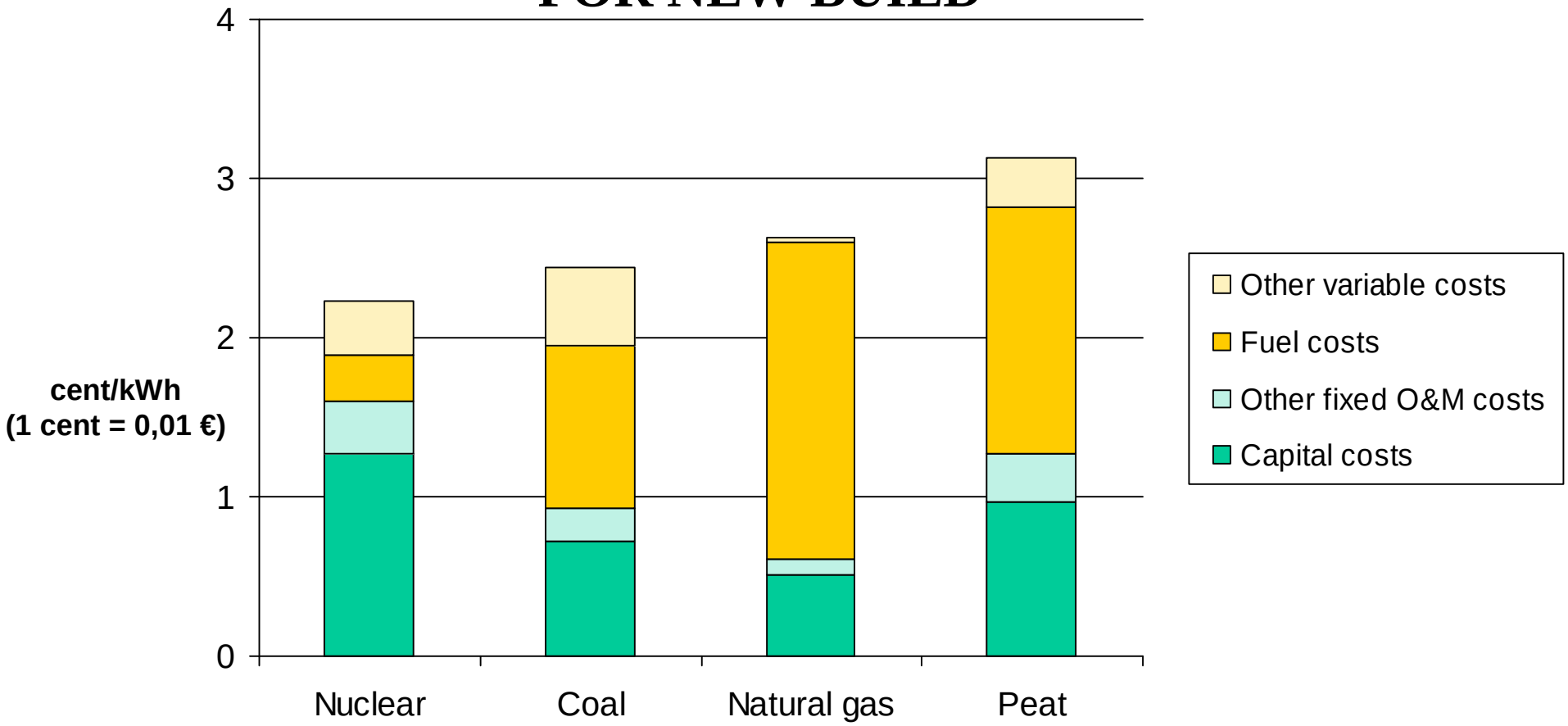
Radioactive waste management

Maintenance of safety record

SUSTAINABILITY

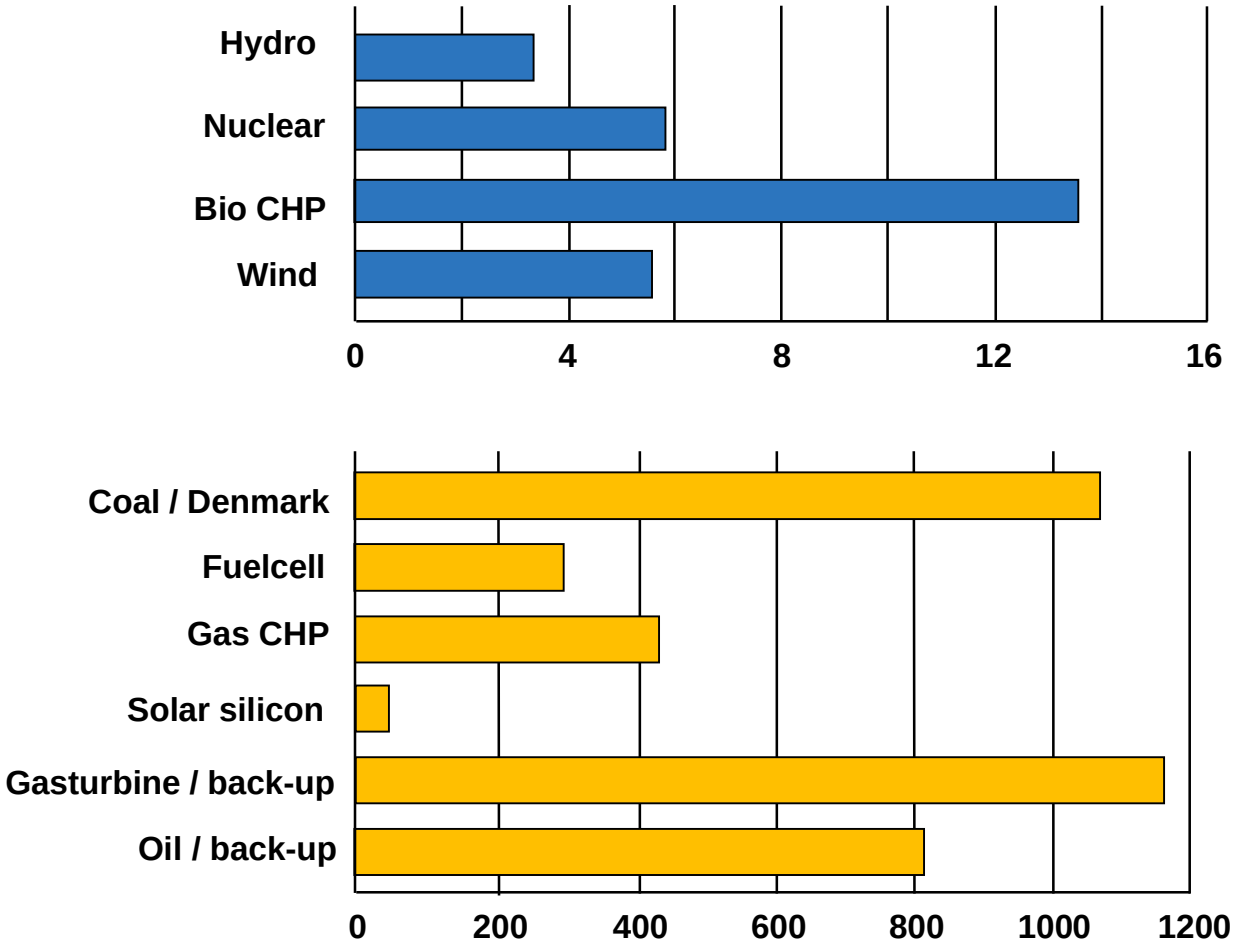
- Economically
- Environmentally
- Socially

ALTERNATIVE BASELOAD GENERATION COSTS FOR NEW BUILD



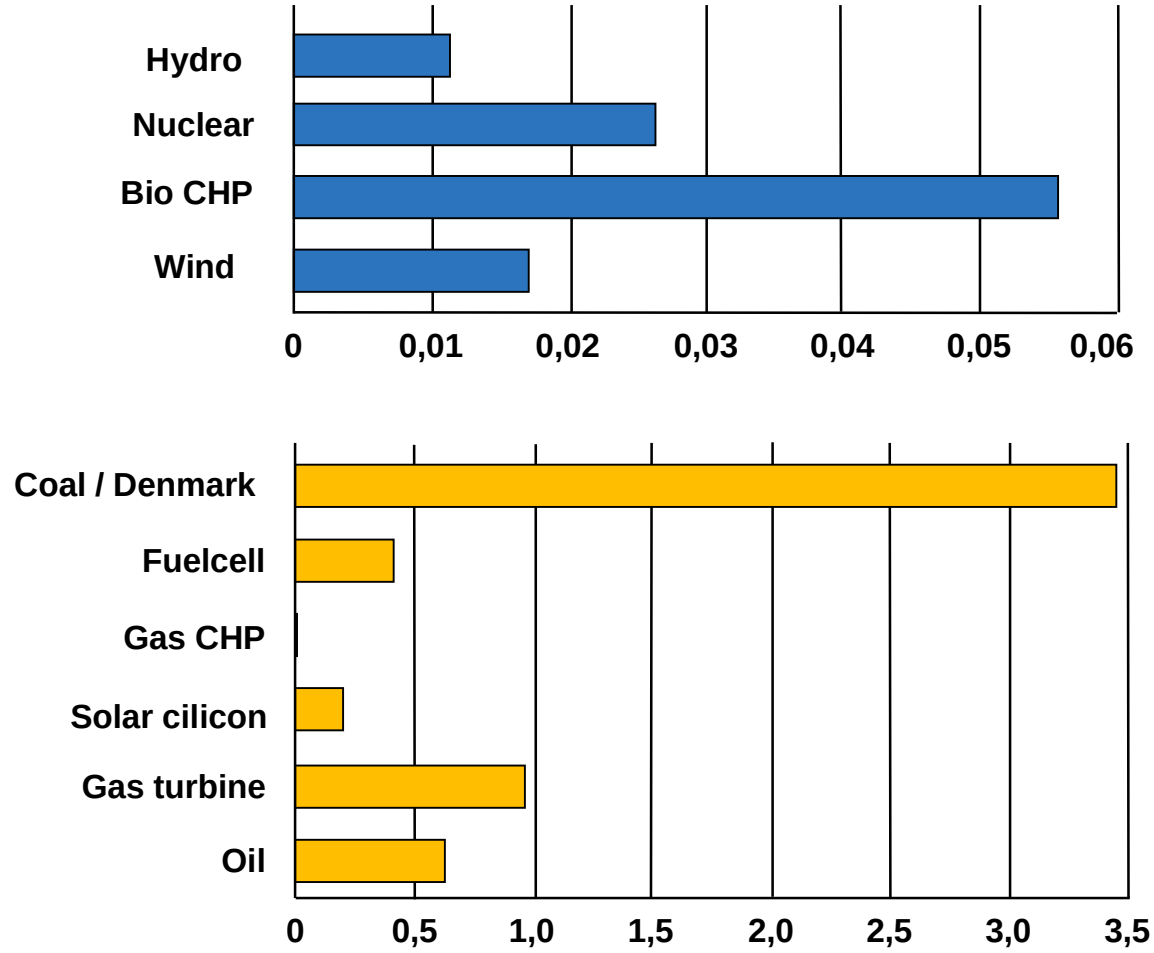
Source: Lappeenranta Univ. of Technology
(Paper in Uranium Institute 30.8.-1.9.2000)

Emissions of carbon dioxide



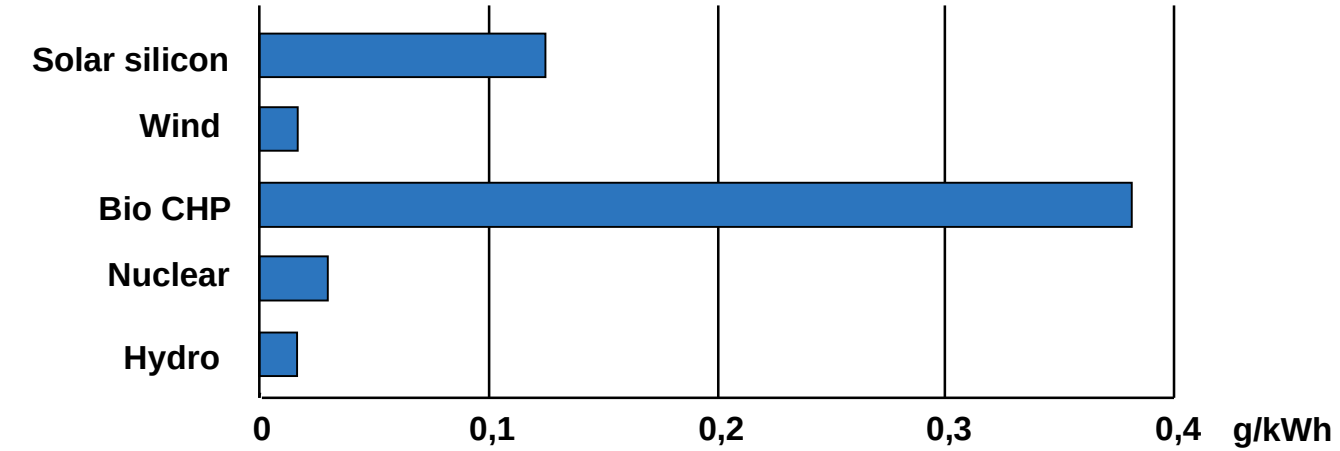
Source: Vattenfall Life Cycle Analysis of electricity delivered to households.

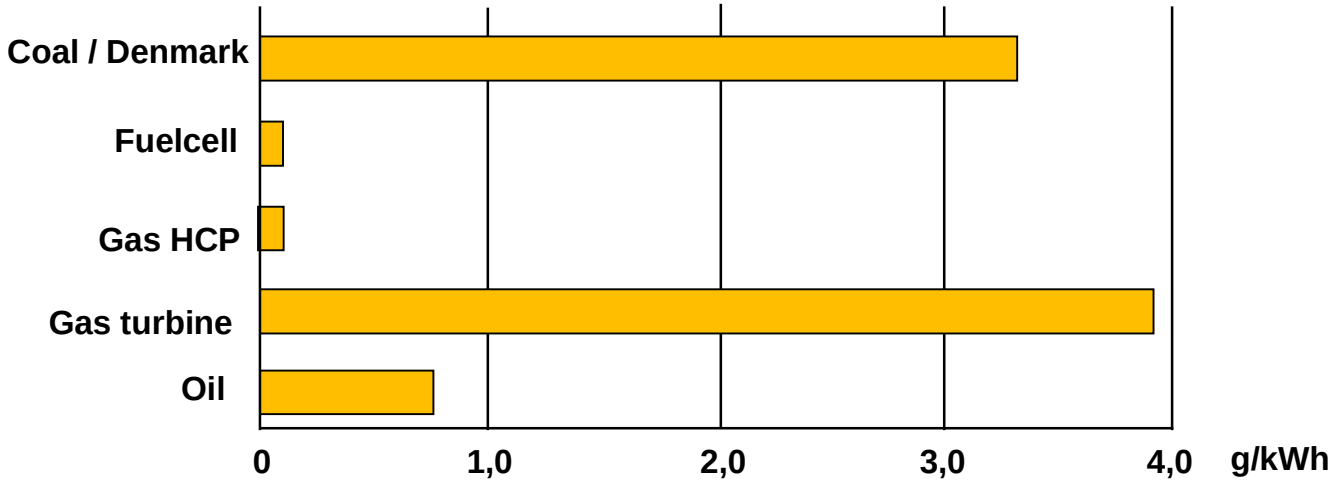
Emissions of sulphur dioxide



Source: Vattenfall Life Cycle Analysis of electricity delivered to hoseholds

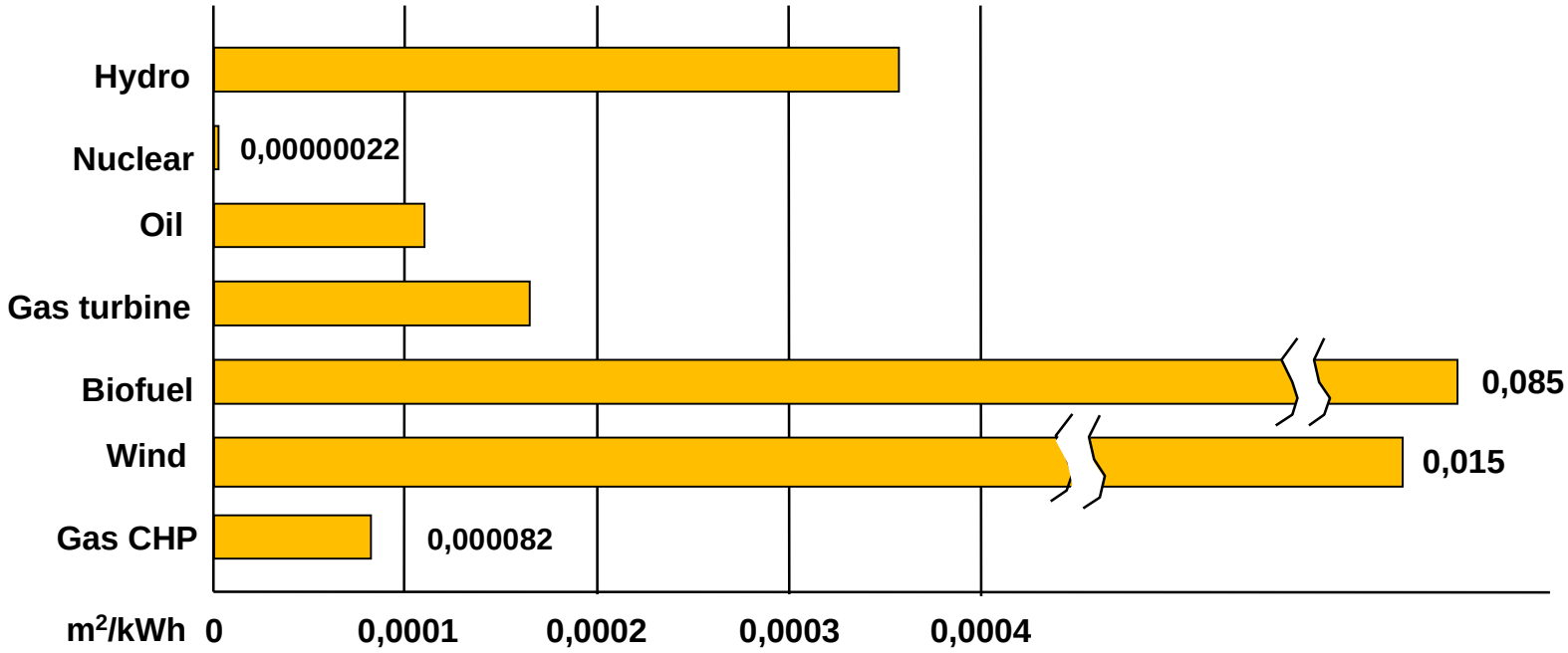
Emissions of nitrogen oxides





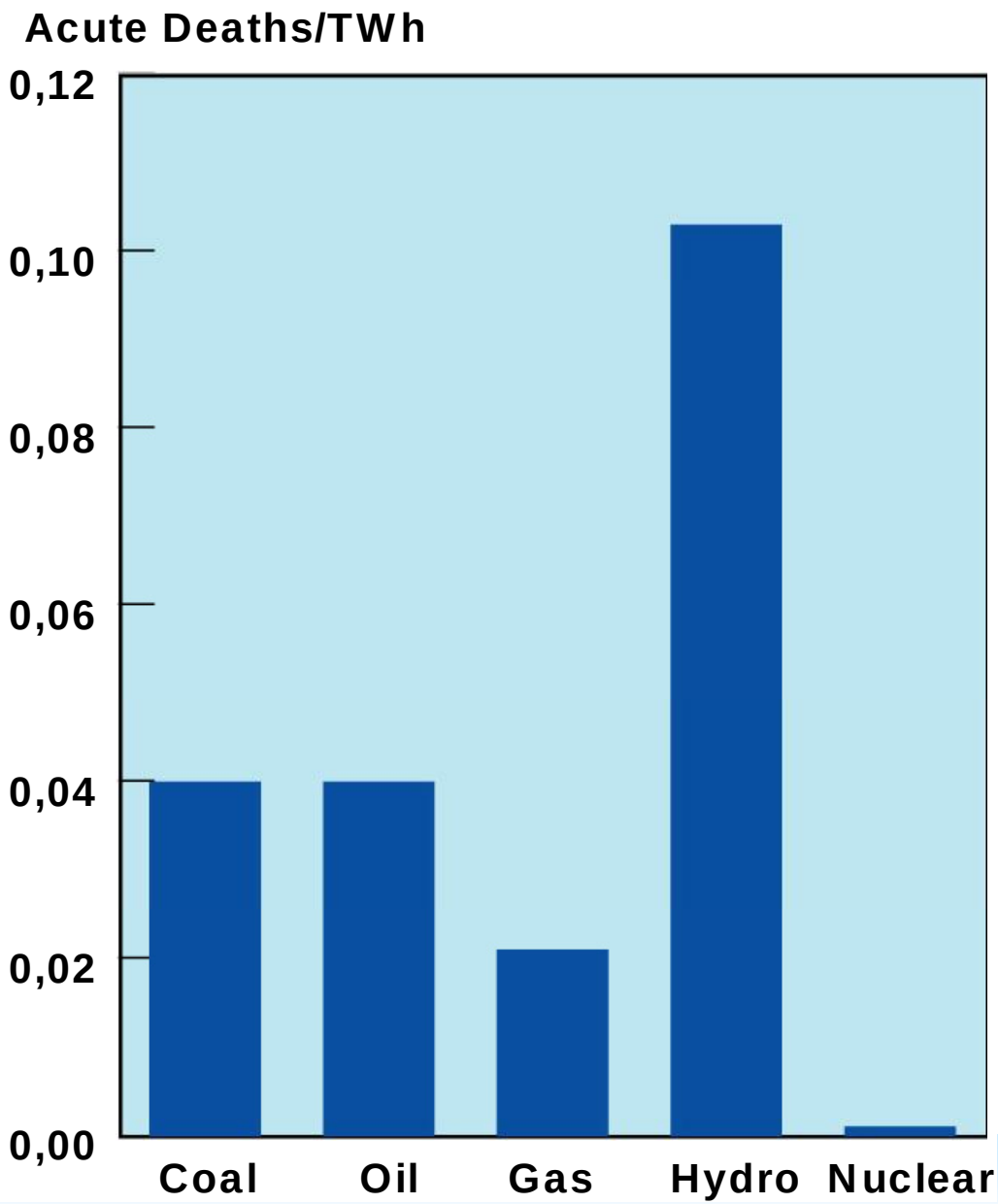
Source: Vattenfall Life Cycle Analysis of electricity delivered to households

Use of land for different types of energy



Source: Vattenfall Life Cycle Analysis of electricity delivered to households

30 Years Historic Global Data



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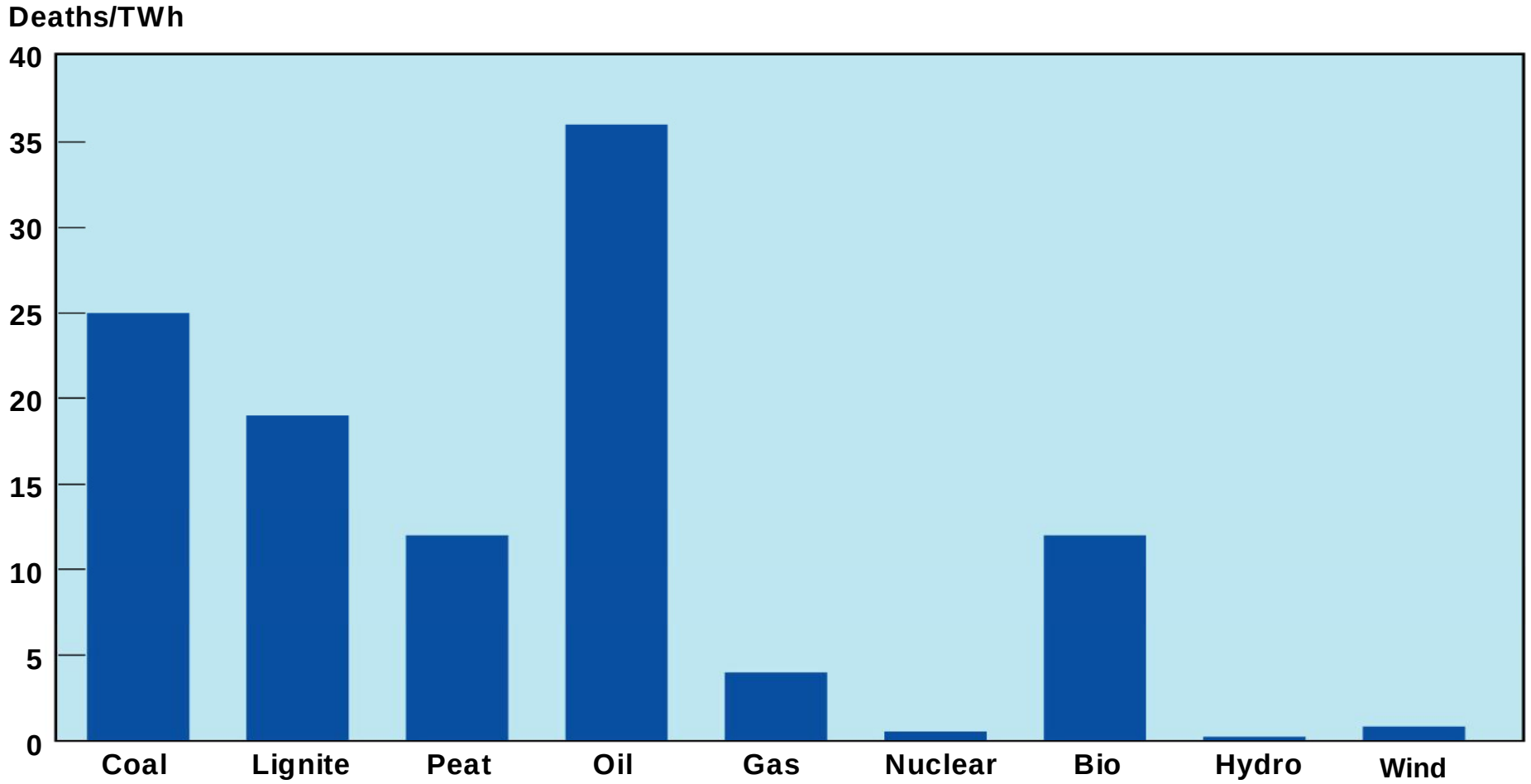
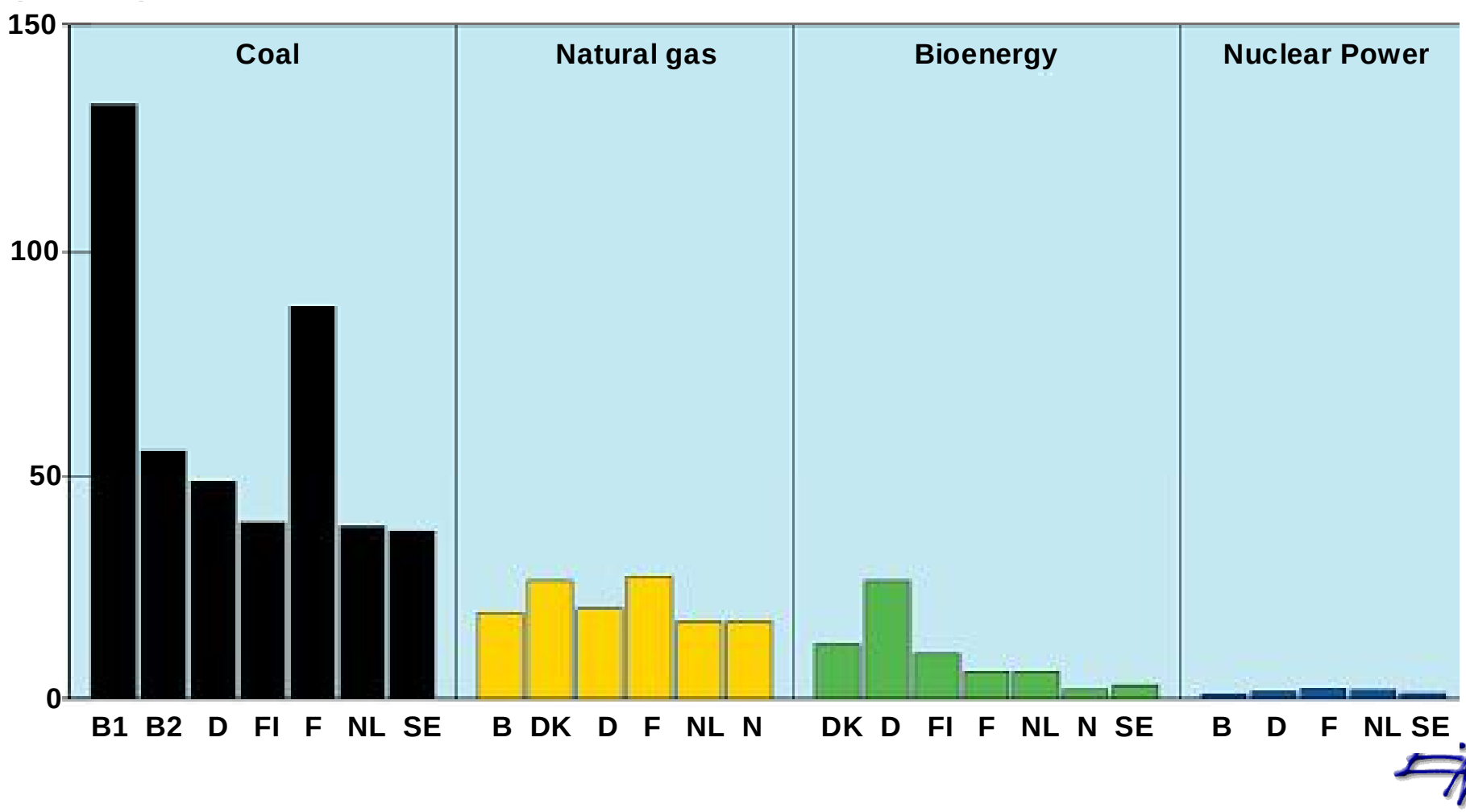
European Union: estimated (acute + late) deaths with existing systems



External Cost

cent/kWh **1 cent = 0,01 €**



What nuclear offers…

- Greater stability and predictability
- Costs higher initially, but more predictable in the long term
- Fuel prices stable, with only marginal influence on total costs.

…nuclear offers bulk power at stable and reasonable prices.

A nuclear new-build scenario

- Predicted increases in demand
- Need to replace older capacity
- Pressure to meet environmental targets
- High gas prices
- Need to lower import dependency

European Institutions should

- recognise nuclear's current benefits and its great potential
- avoid discrimination against specific energy options
- keep all available options open

Nuclear industry actions

- Continued high safety performance
- Lower new-build investment costs
- Shorter construction times
- Deployment of new-generation reactors, backed by streamlined licensing procedures.

Greenhouse, Geography and Nuclear Future

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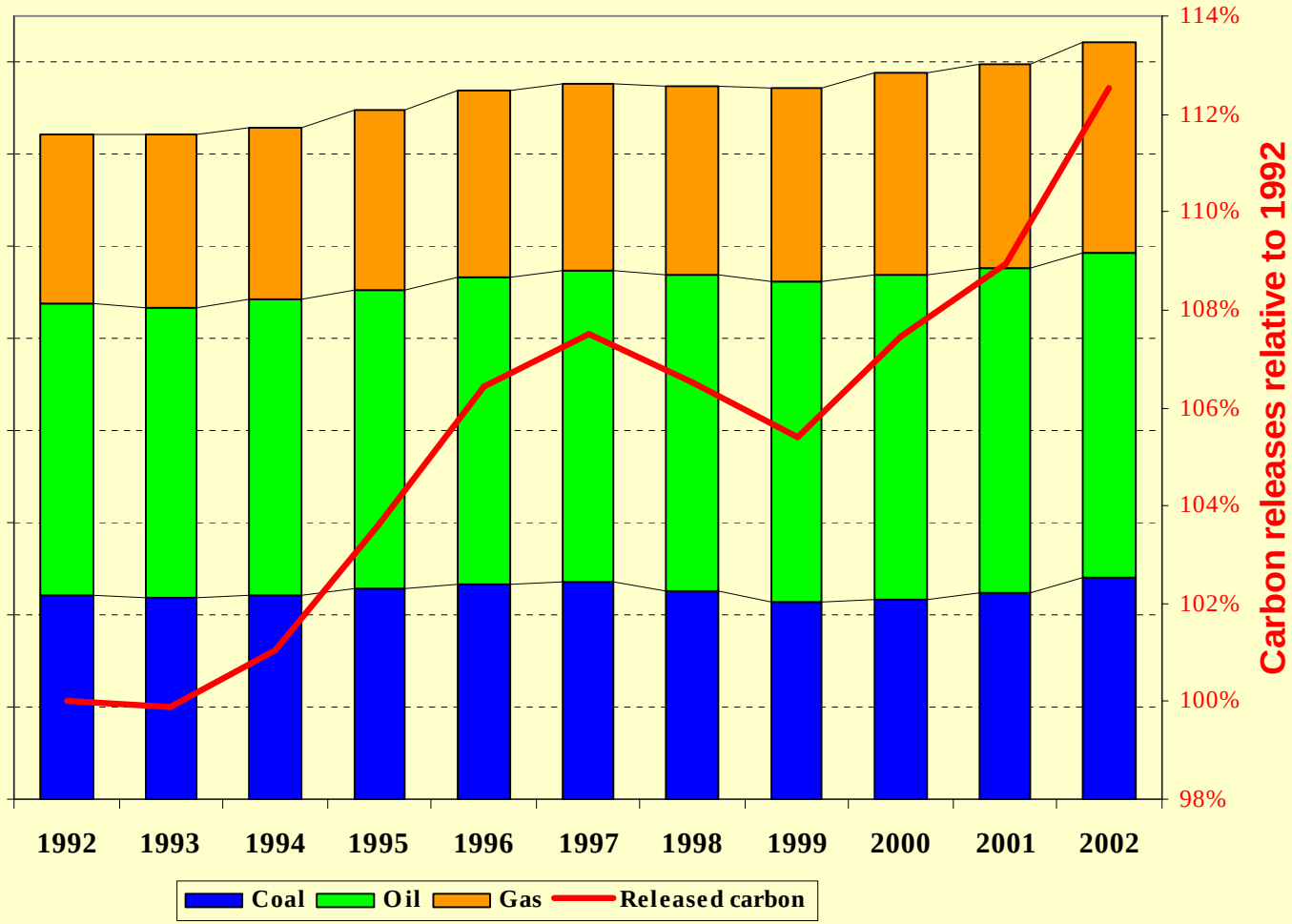
World: Change in fossile fuels use and carbon releases



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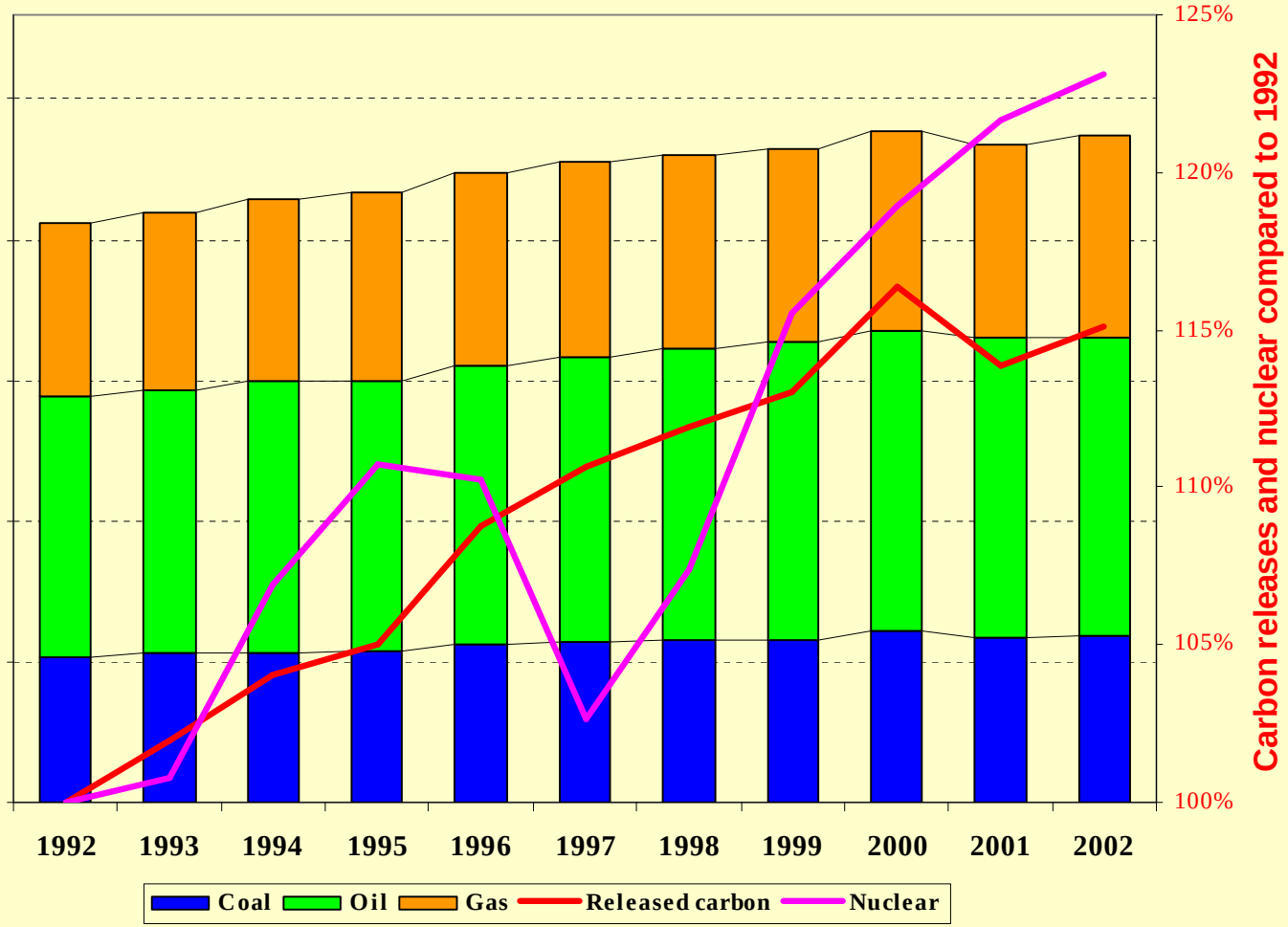
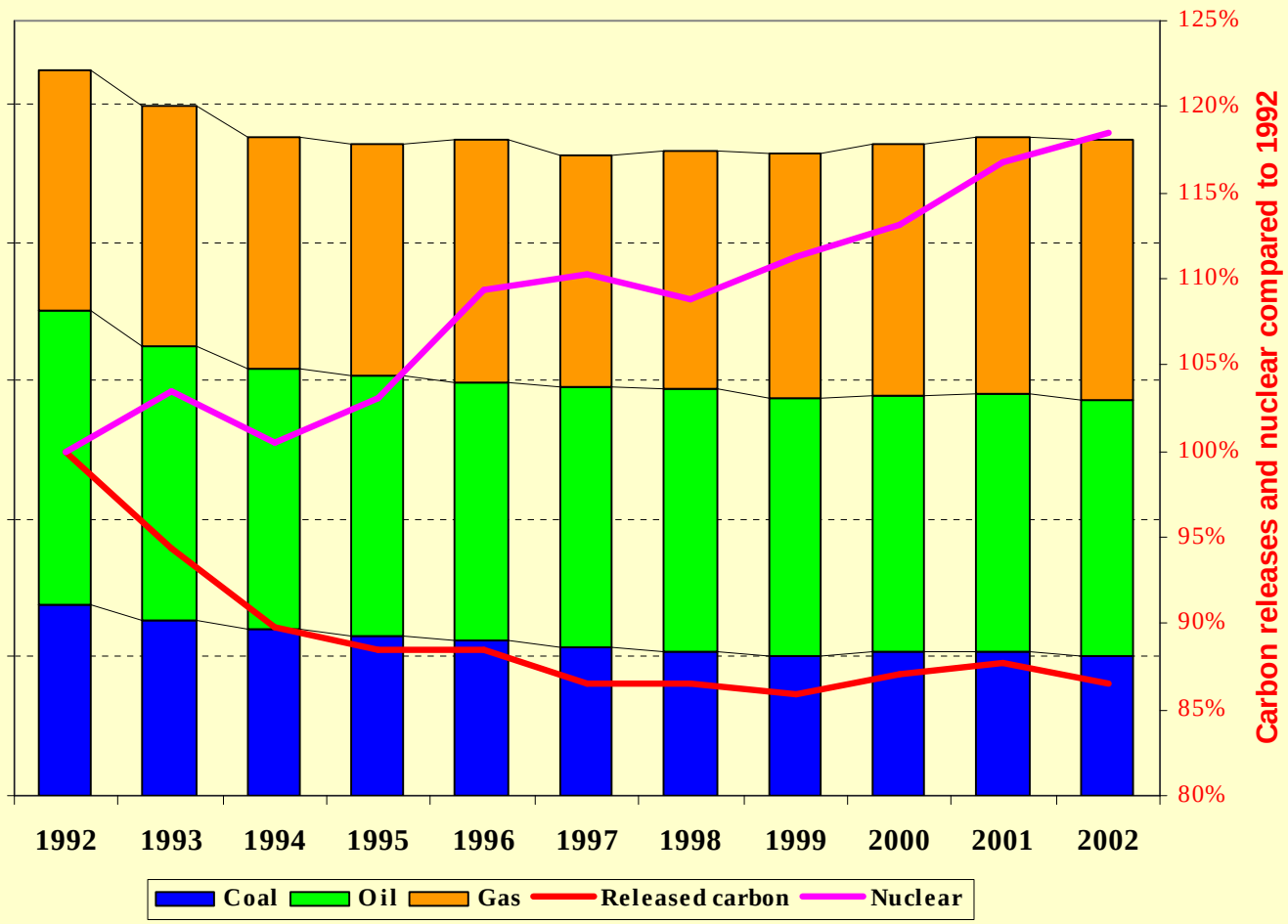
North America: Change in fossile fuels use, carbon releases and nuclear energy use



Europe & Euroasia: Change in fossile fuels use, carbon releases and nuclear energy use



Is this World a fair place?

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Northeast Asia: Population Density
Map Trek
Astana
Barnaul
Abakan
RUSSIA
Kyzyl
Irkutsk
Chita
Ulan-Ude
Khabarovsk
KAZAKHSTAN
Ulaanbaatar
Ulan Bator
Qiqihar
Harbin
Sapporo
Jilin
Vladivostok
Changchun
UZBEKISTAN
MONGOLIA
Toshkent
Bishkek
Ürümqi
Namangan
KYRGYZSTAN
Mashhad
Meshed
Dushanbe
Kanggye
N. KOREA
JAPAN
Baotou
Beijing
P'yŏngyang
Seoul
Mazār-e Sharīf
Tianjin
Tientsin
Taejŏn
Kyoto
Yinchuan
Taiyuan
Kabul
SOUTH KOREA
AFGHANISTAN
Xining
Jinan
Zibo
Peshawar
Lanzhou
Islāmabad
Luoyang
Cheju
Sargodha
Zhengzhou
Siālkot
Xi'an
Multan
Lahore
CHINA
Shanghai
PAKISTAN
Yushu
Nanjing
Chandigarh
Hangzhou
Hisār
Wuhan
Sukkur
Delhi
Chengdu
Lhasa
Hyderabad
Jaipur
Chongqing
Nanchang
NEPAL
Karachi
Kathmandu
Changsha
Fuzhou
Kanpur
Lucknow
BHUTAN
Guiyang
Ahmadabad
Guwahāti
T'aichung
T'aipei
Patna
Bhopal
Dhaka
Dacca
Kunming
Vadodara
Guangzhou
Canton
TAIWAN
INDIA
Kolkata
Calcutta
Mumbai
Bombay
Macau
Victoria
Chittagong
Map Trek
Country and City
Hanoi
Pune
MYANMAR
Haiphong
Hyderabad
Sittwe
LAOS
Chiang Mai
Vinh
Baguio
Yangon
Rangoon
Vientiane
Đà Nẵng
Manila
Naga
Bangalore
Chennai
Madras
Moulmein
Khon Kaen
THAILAND
Qui Nhon
PHILIPPINES
Cochin
Pondicherry
Bangkok
Spratly Islands
(disputed)
Iloilo
Cebu
PALAU
Phnom Penh
Ho Chi Minh City
Cagayan de Oro
Davao
Sri Jayawardenepura
Map Trek
General Santos
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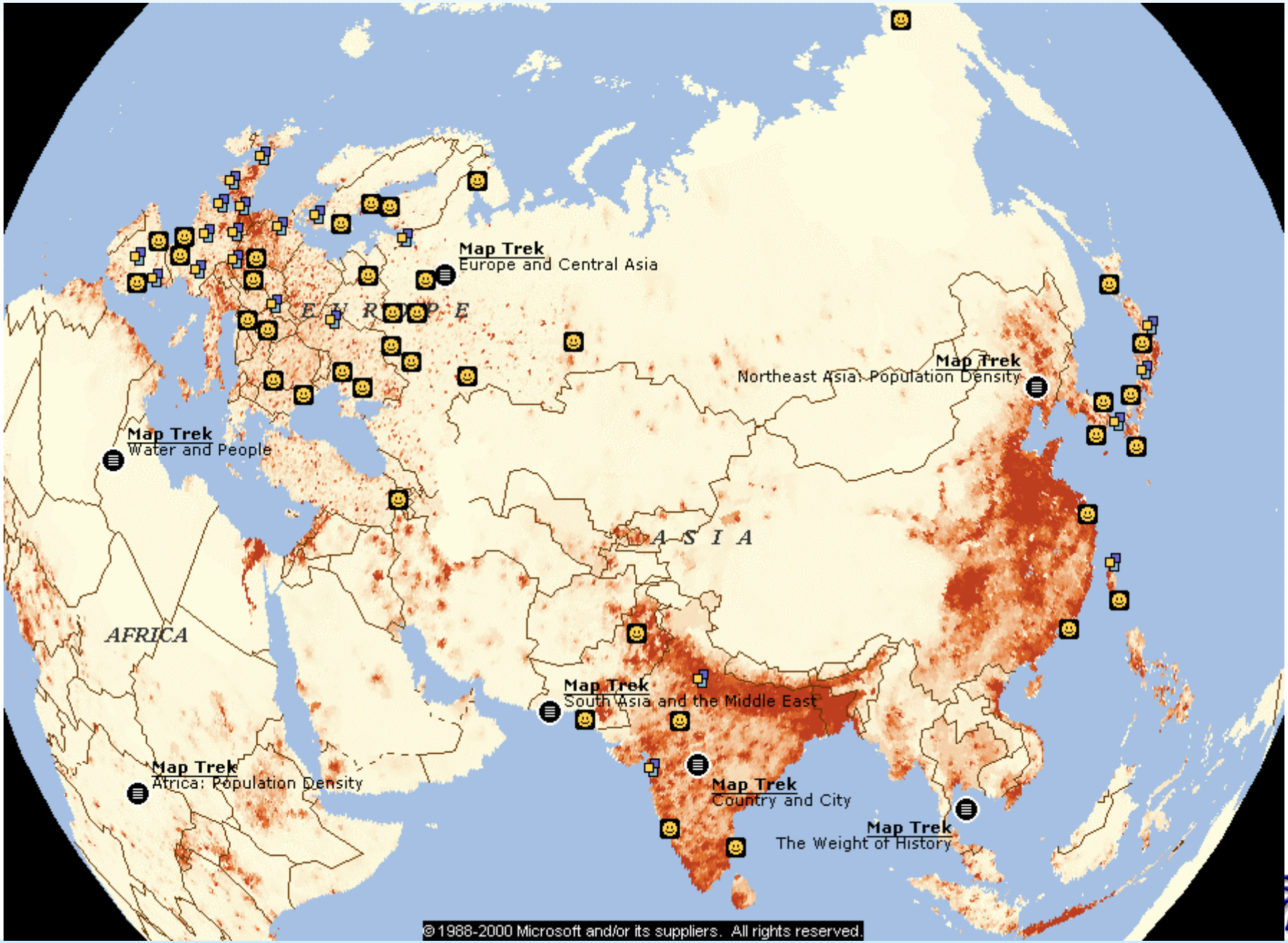
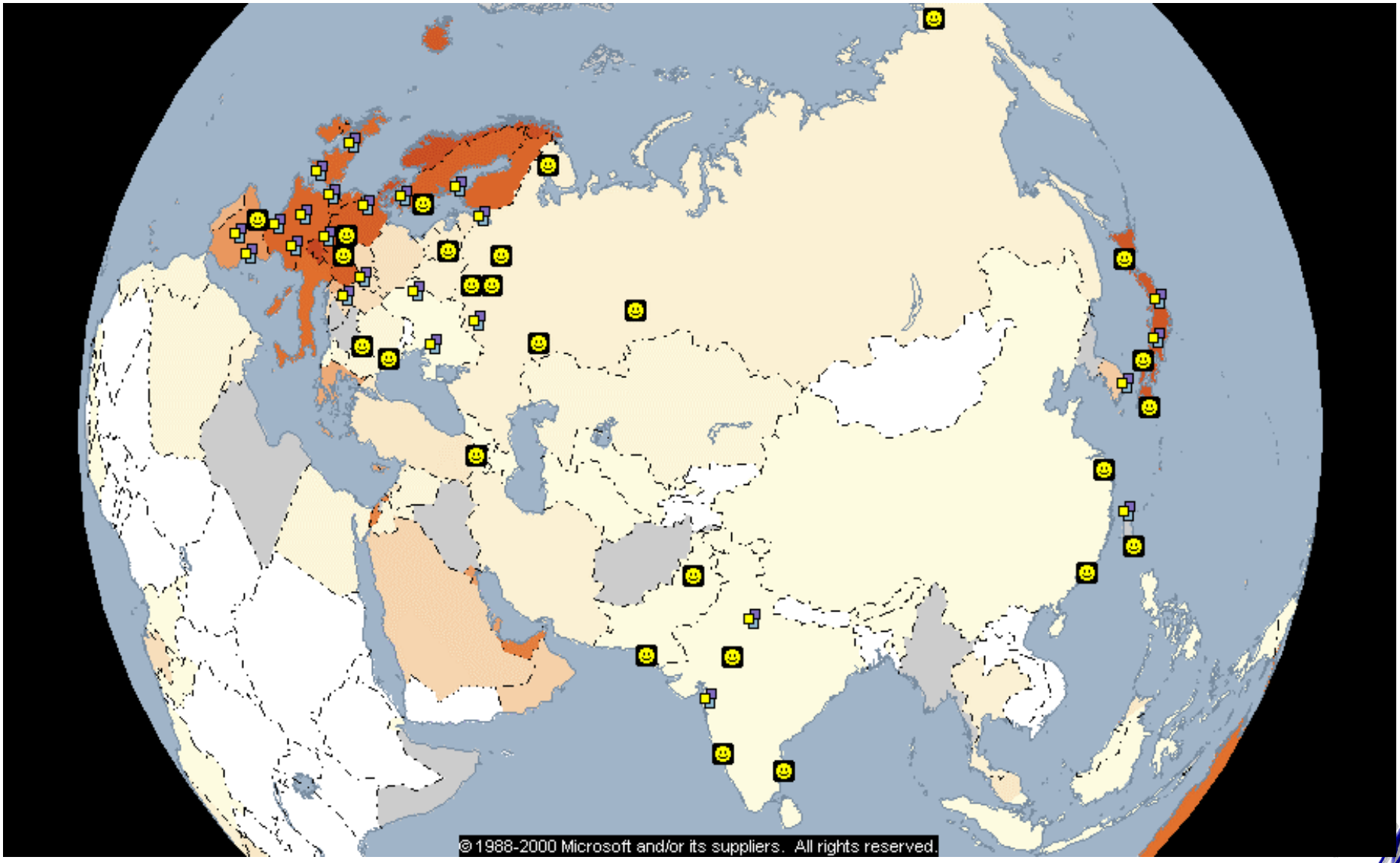
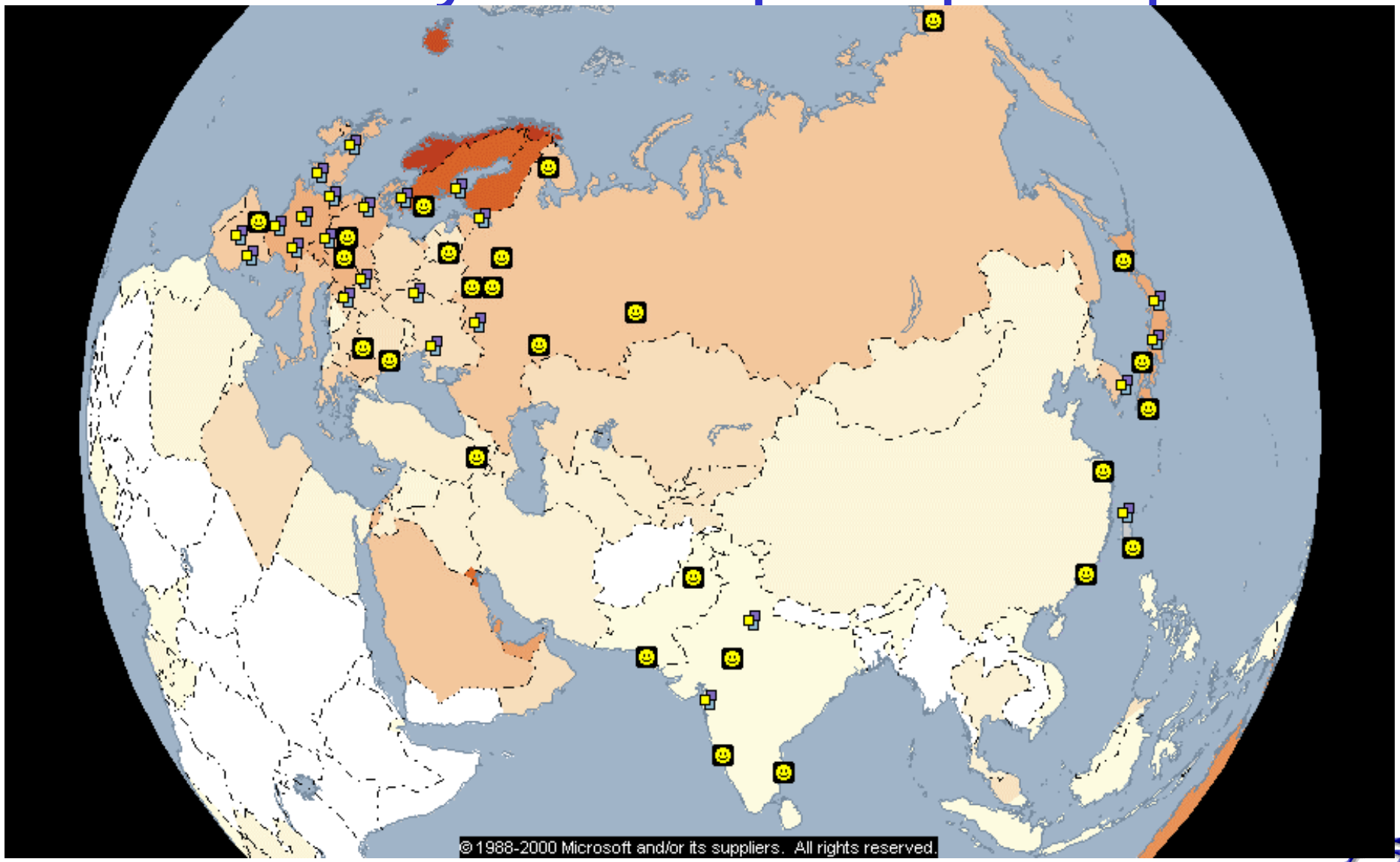


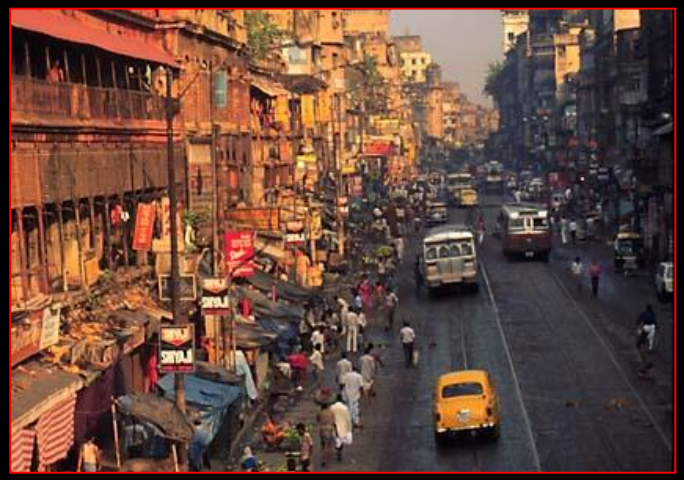
Andrej Stritar
European Nuclear Society

GDP per capita



Electricity consumption per capita





Calcuta

423 kWh per capita

25,000 kWh per capita

60 times more!

This World will be fair...

...once everybody is given the same opportunity,

which includes

electrical power.

10, **20**, **fifty** times more electricity than today!


...and we want to do it sustainable,
without damaging the environment!