Public Perception of Nuclear Energy

Julio Vergara Aimone

LAS-ANS, Rio de Janeiro, June 22nd, 2016

Introduction

Scope of this brief presentation

- Opinion about NE in Chile → relevant?
- The context and the perception.
- Wishes and fears in technology.
- Spock: It is not logic, Captain Kirk!
- Can we do something sound about it?

The Context

The Context

The problem of energy

Do we know what energy (1st principles) is?

- It is about repulsion (EM, heat, movement)
- It is about matter breakout (fusion, bosons)
- It is about transformation ($m \rightarrow K_E$)
- It is about damage (muons, interactions)
- It is a consequence, a result (not planned)

So energy is restless, not steady nor calm…

The Context

The energy dilemma

Energy (different forms and fuels) has given us a service in recent centuries, it has been crucial for developing our society, allow our wellness and prosperity (true and apparent).

However, it is turning against us, with political problems (international friction), environmental polution (health), accidents, weather shifts (heat waves), anticipating midterm disturbance (water availa-bility, climate change) → social strain.

The Context

Once upon a time, not so far ago

Context:	Global War on Terrorism (comex 11-09-01).
Apparent Cause:	WMD (unsupported by UNMOVIC). Possible support to Osama Bin Laden (WTC).
Real Cause:	Stop Saddam Hussein´s dictatorship. Avoid effects over energy resources and restore peace in the Middle East (restored?).
Result:	Occupation of Iraq, execution of S. Hussein, exit of the Baaz party. Extension to Yemen, Afghanistan, Pakistan. Bin Laden´s death.
Outcome:	60.000 dead, 120.000 wounded. Humanitarian crisis & material losses. Not yet settled.

The Context

Health effects by fossil fuel combustion

The Context

Increasing accidents in the energy sector


Cosmo Oil Co. Refinery in Ichihara

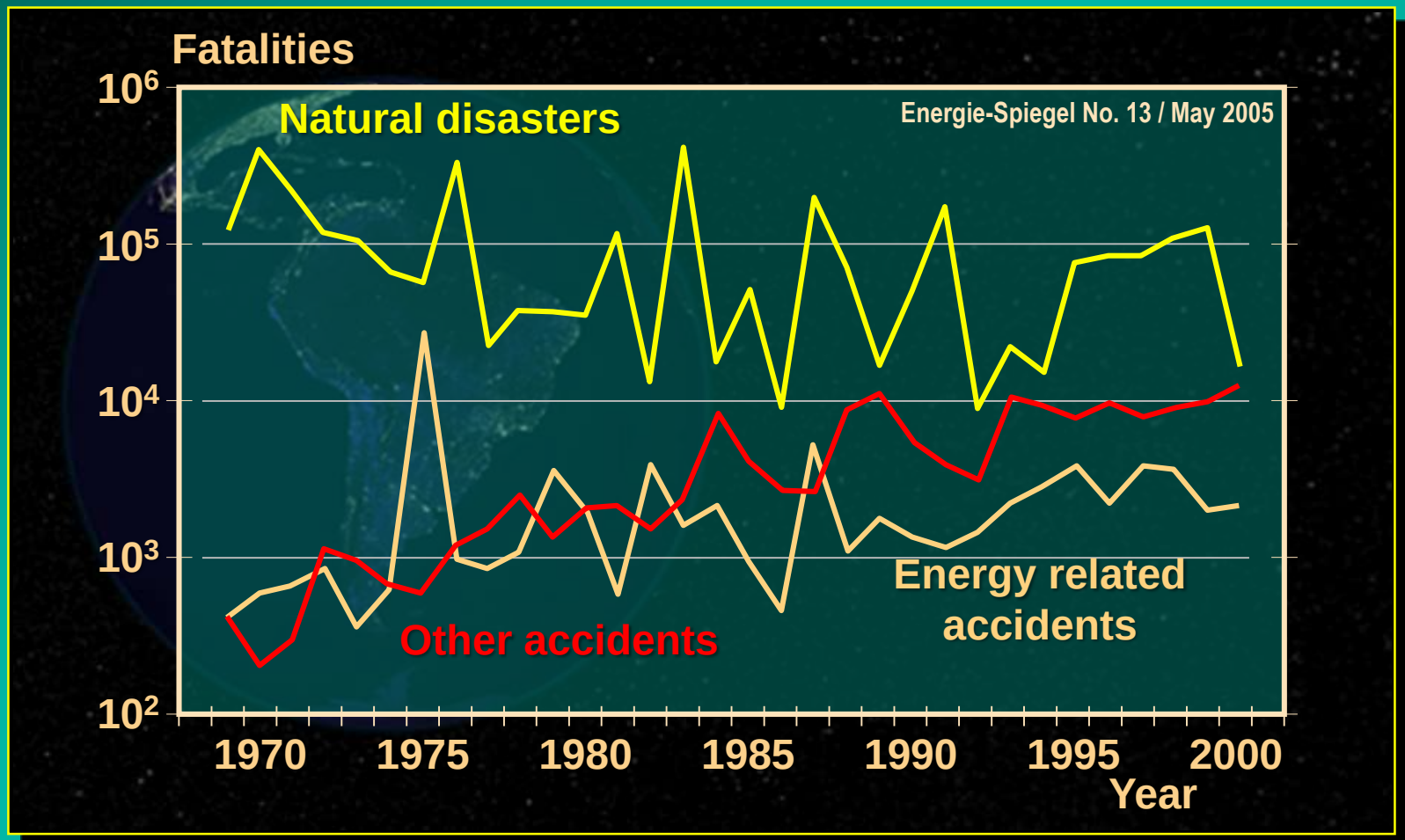

Deepwater Horizon Plataform (5)


Fukushima Dai-ichi Power Plant


Soma Coal Mine, Turkey (301)

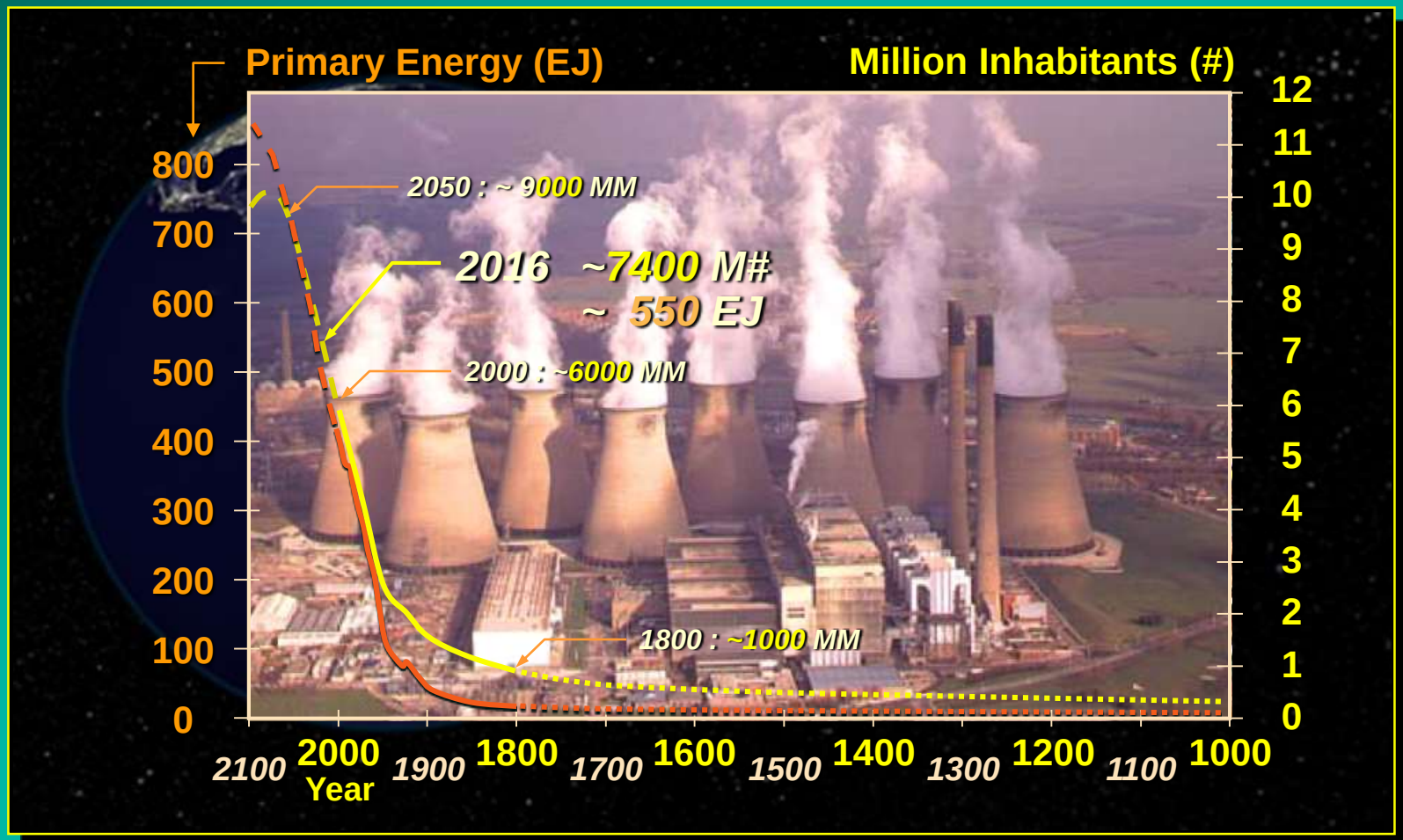
The Context

Increasing accidents in the energy sector



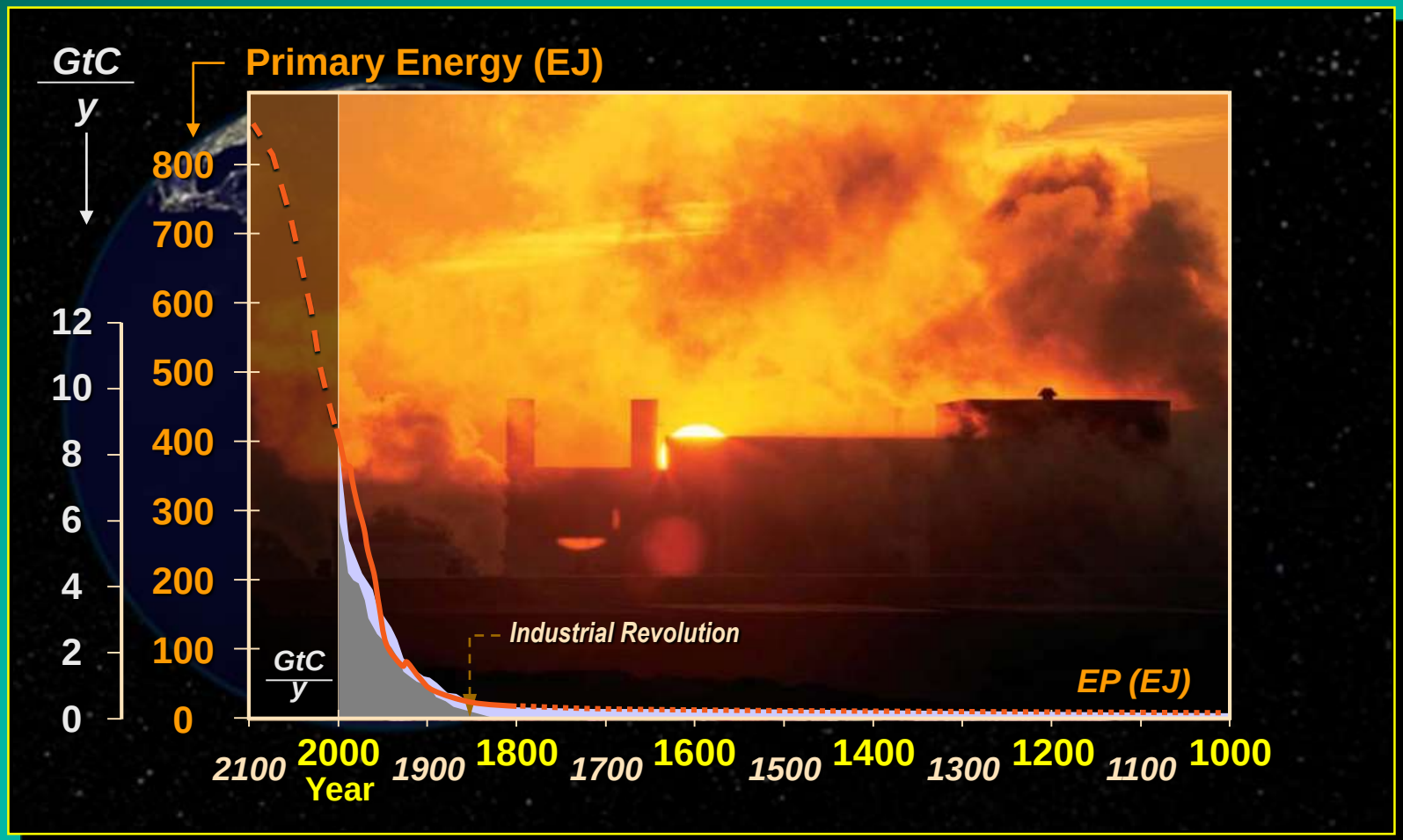
The Context

Sharp population and energy use growth



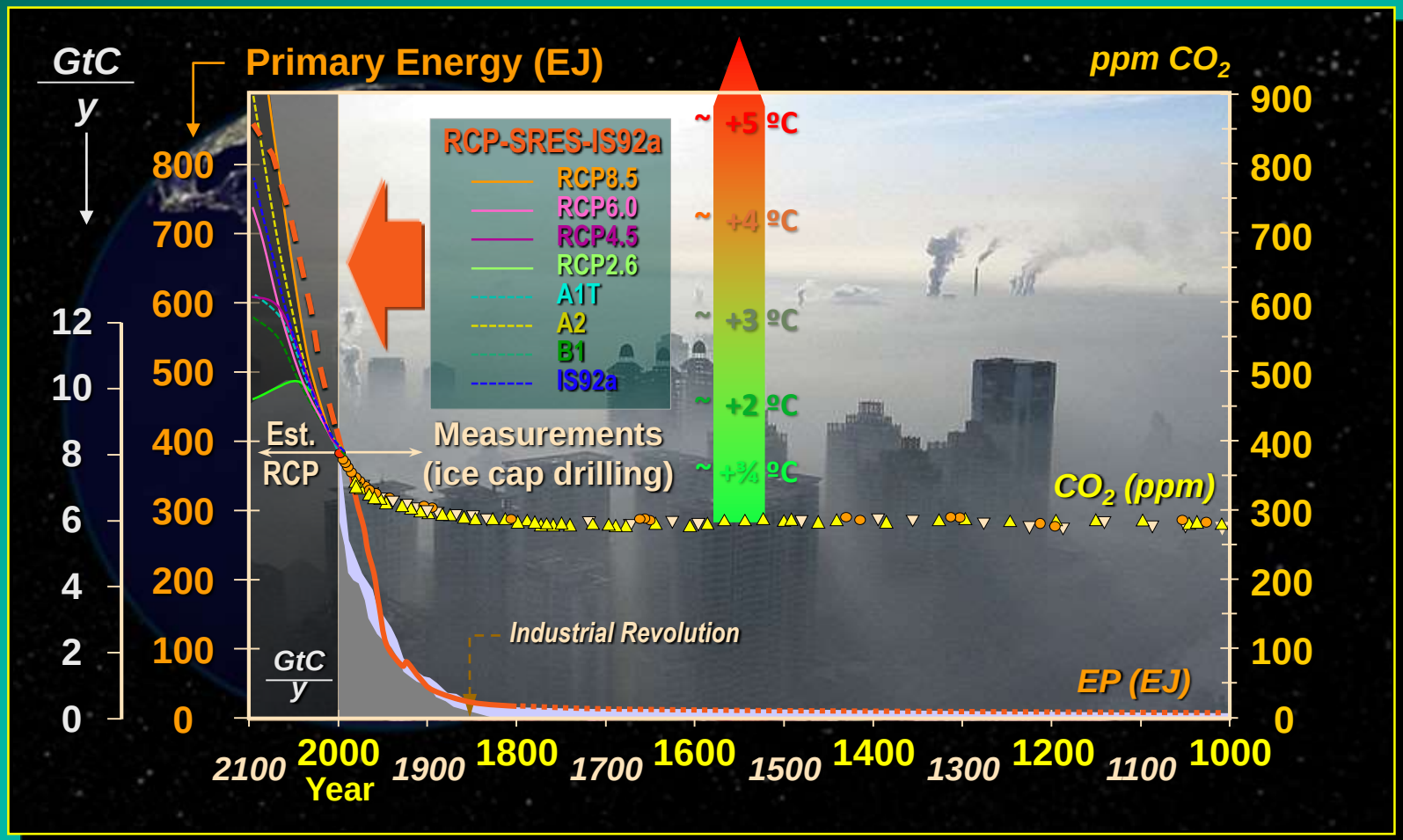
The Context

Sharp population and energy use growth



The Context

Energy emissions threatening sustainability



The Context

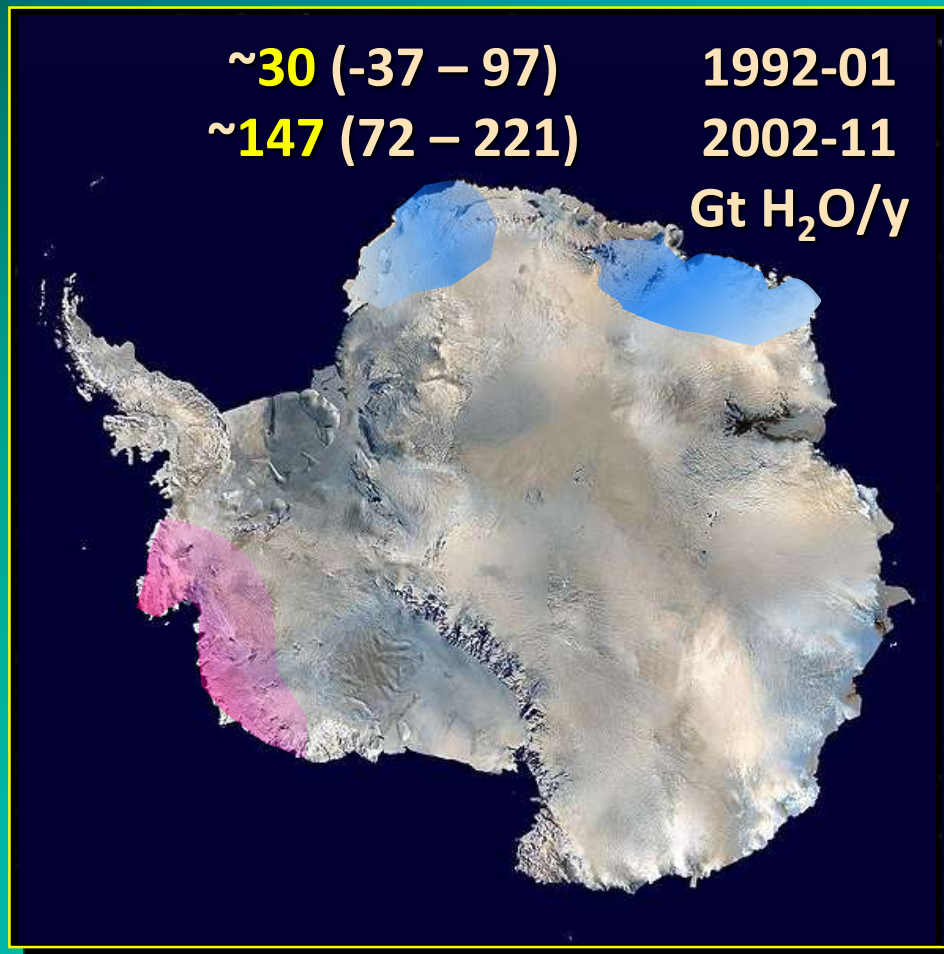
Fires by heat waves on increasingly dryer land

The Context

Water scarcity, i.e. 400 km north of Santiago

The Context

Antarctica and Greenland loosing water?



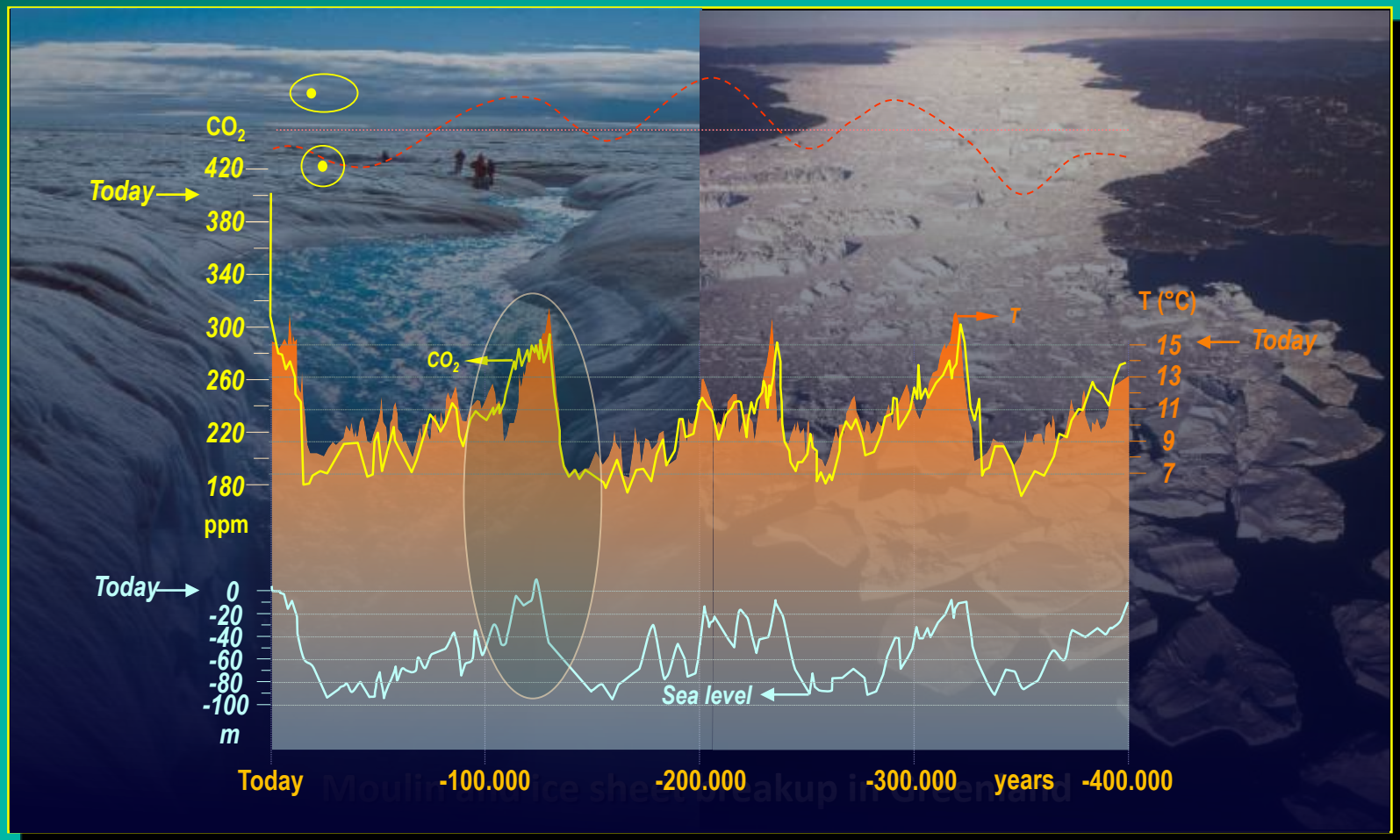
The Context

Antarctica and Greenland loosing water

Moulin and ice sheet breakup in Greenland → may affect the Atlantic THC

The Context

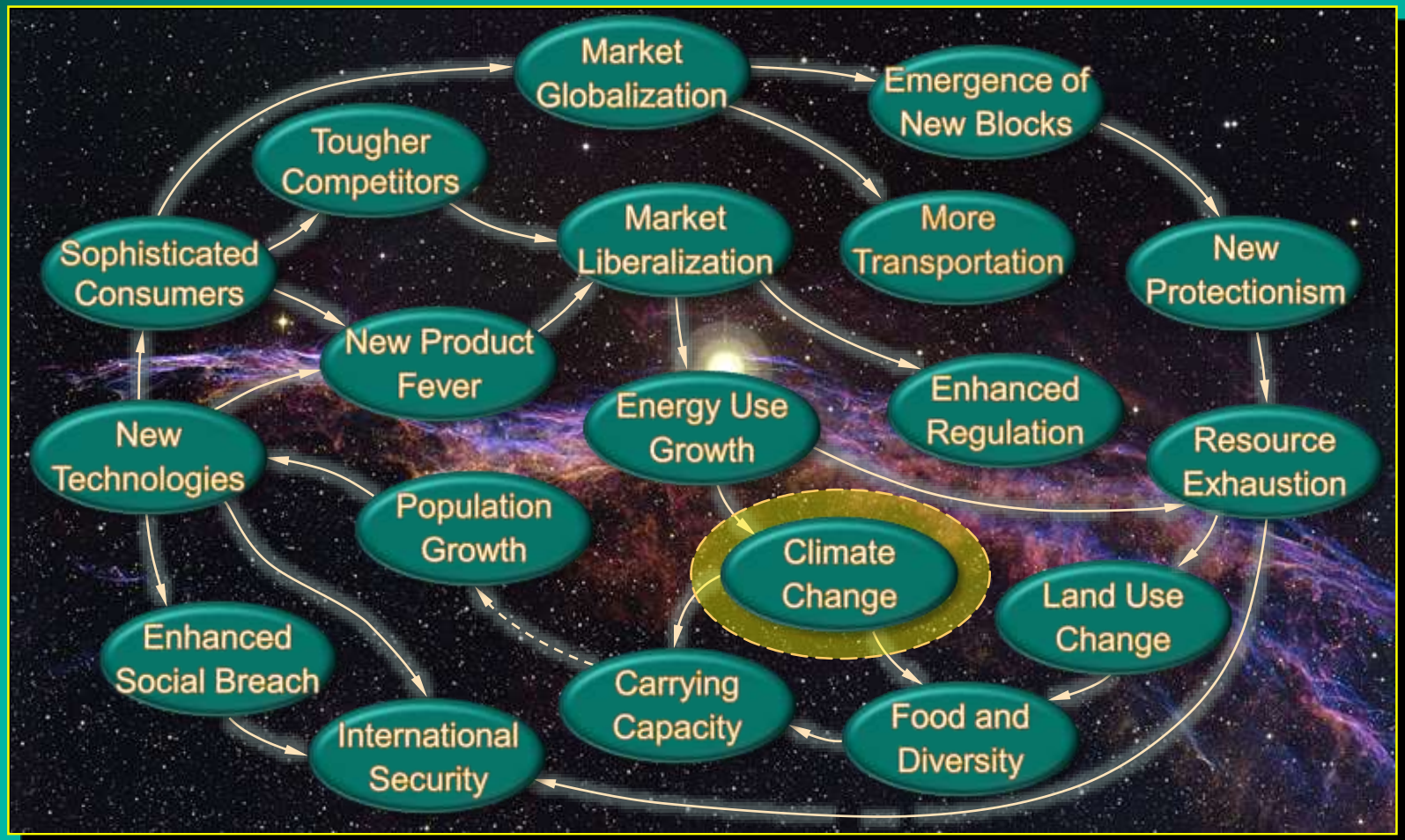
Current sea level is the highest in 120.000 years



Moulin in an ice sheet breakup in Greenland

The Context

A broader context: new megatrends



When Source Selection Comes

When source selection comes

This is what one may expect, as surveyed

NUCLEAR	HYDRO DAM	NC RENEWABLES
Large I would barely benefit. Big players only allowed.	**Large** Allow foreign capitalism deplete our resources.	**Small** I might benefit from being part of it.
Powerful Unsafe. It has exploded (as seen in CNN).	**Powerful** Distorts nature. Power lines will be a scar.	**Modest** Not a complex machine. Simple to setup & use.
Artificial It is synthetic, man-made, elaborated.	**Artificial** This was not developed by nature.	**Natural** Wind is natural. It is there. Use it.
Dirty It is synthetic, man-made, elaborated.	**Dirty** Replaces a wild forest by concrete and steel.	**Clean** Wind helps clean the environment.

When source selection comes

The missing tolls: need to be smarter

Most of us would use a logic approach in technology selection, for climate change mitigation.

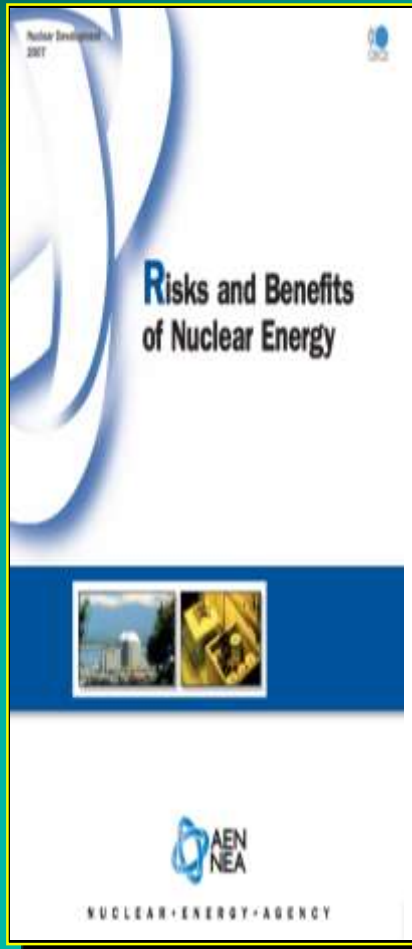
Nuclear technology would rank at the top level.

But, this is not what occurs. The society is tied to fossils and builds RE for its consciousness.

Nuclear engineers need to be psycho-PR-sociologists before practicing. We demand to better comprehend our society, policy and markets.

When source selection comes

We assume everybody understands risks



A REPORT TO THE U.S. DEPARTMENT OF ENERGY
WIND TECHNOLOGY DIVISION

EVALUATING THE RISK-REDUCTION BENEFITS OF WIND ENERGY

SUBMITTED BY

MICHAEL C. BROWER
BROWER & COMPANY

KEVIN BELL
CONVERGENCE RESEARCH

PETER SPINNEY
CHARLES RIVER ASSOCIATES

STEPHEN BERNOW AND MAX DUCKWORTH
TELLUS INSTITUTE

FINAL REPORT

JANUARY 1997

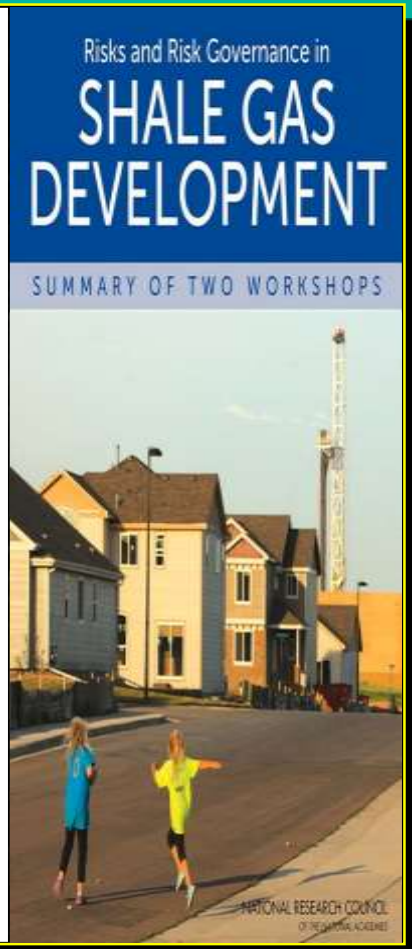
Risk Perception of an Emergent Technology: the case of Hydrogen Energy

Rob Flynn, Paul Bellaby and Miriam Ricci

University of Salford

Paper presented to the ESRC Social Contexts and Responses to Risk (SCARR) Network Conference, 'Learning about Risk'

University of Kent, Canterbury, 28-29 January 2005



When source selection comes

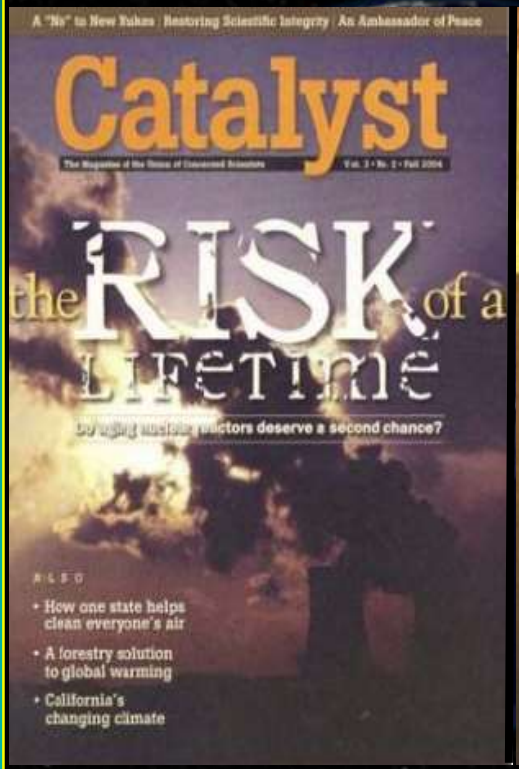
We do not communicate well. Images do it for us

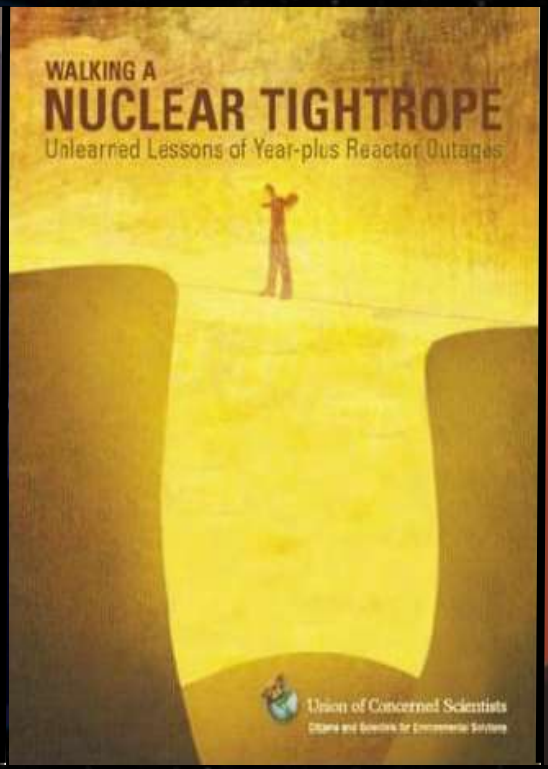
Issues needed to be understood for acceptance:

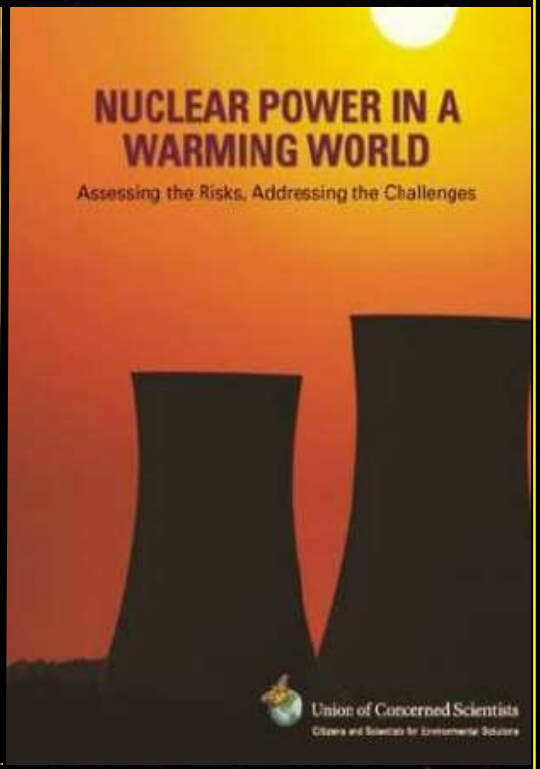
- Radiation safety
- Evacuation areas
- Nuclear waste (SNF)
- Fuel supply
- Capital cost
- Proliferation
- LNT deadlock

When source selection comes

We do not communicate well. Images do it for us

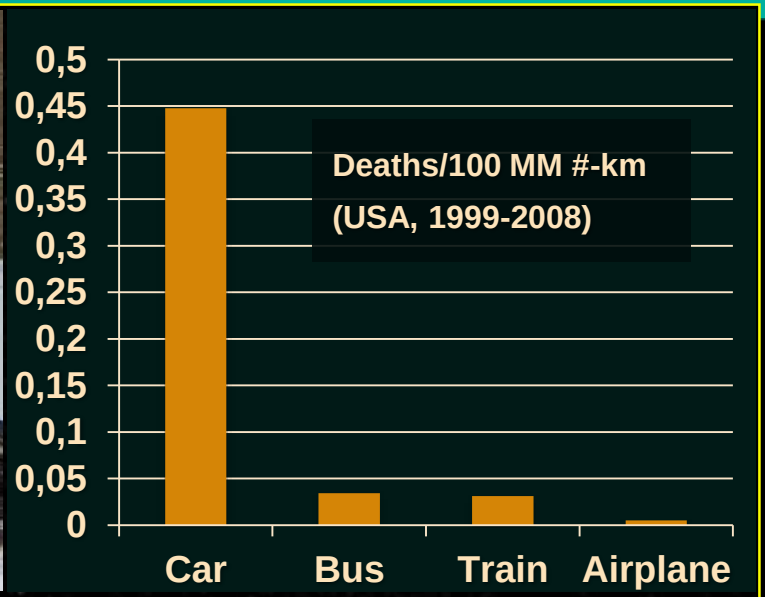






When source selection comes

(Not) understanding risks



***25% of us fear something or sweat when flying*.**

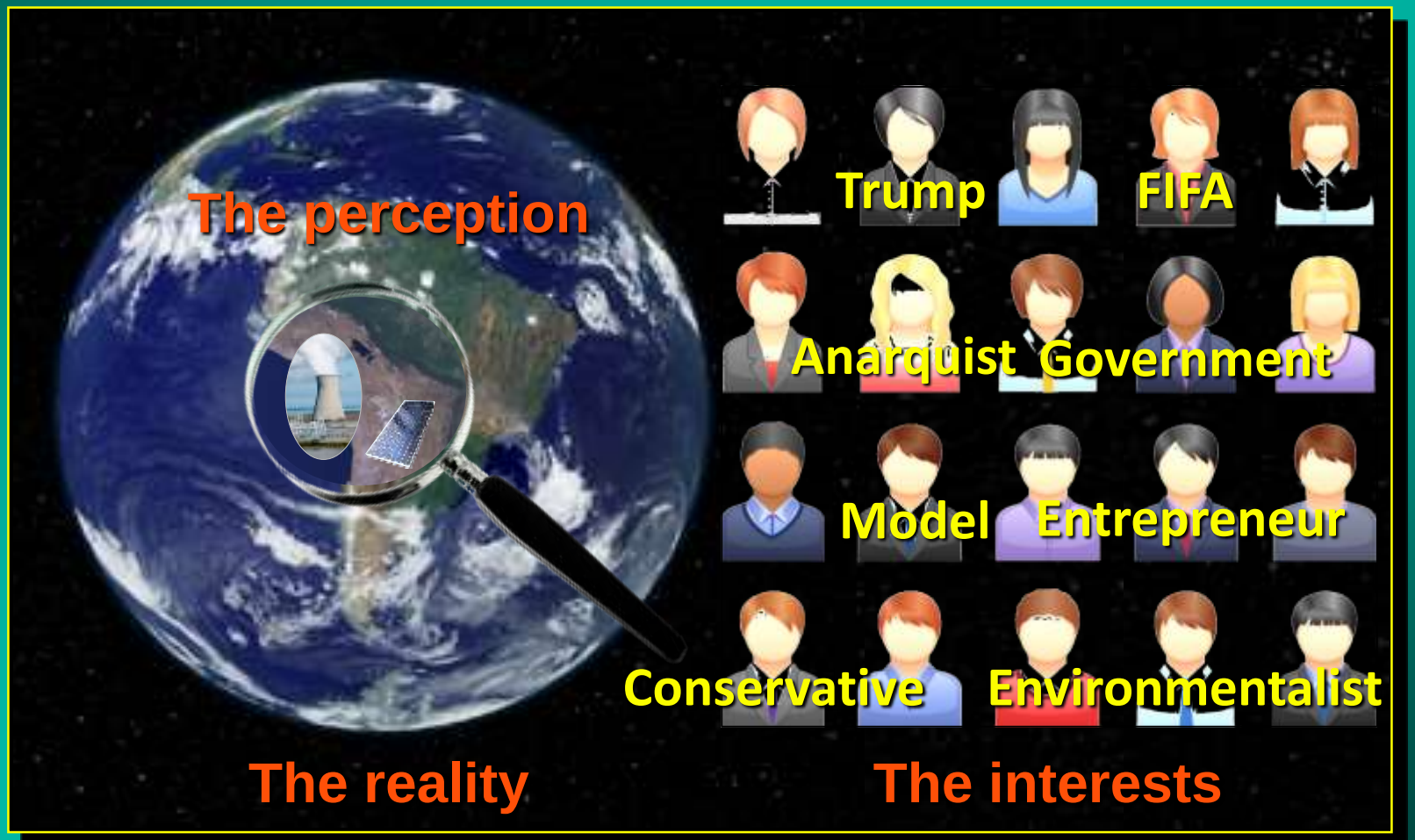
Based on the chart, what is the right conclusion?

What is the actual conclusion? I will come back

Understanding the Problem

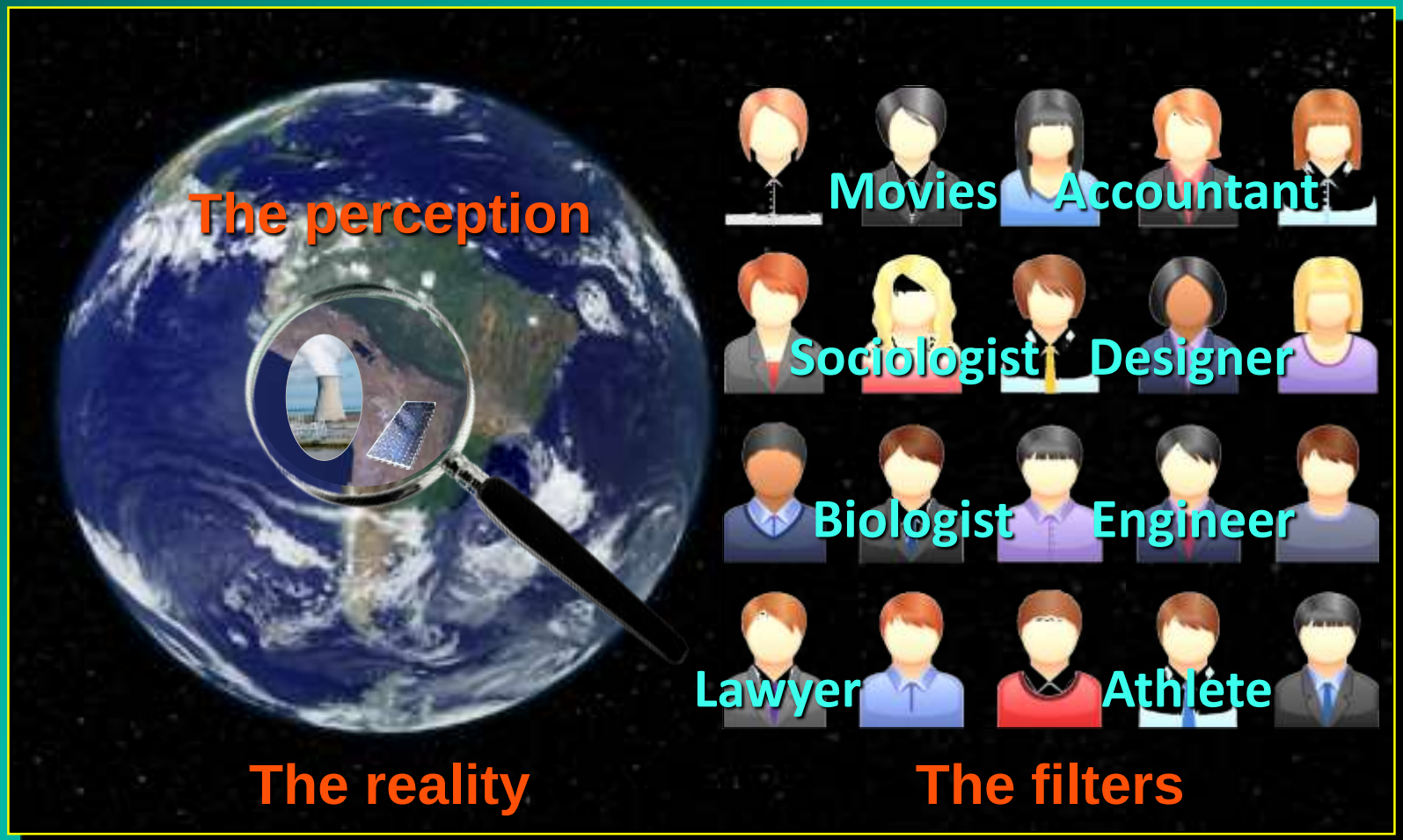
Understanding the Problem

We all have opinions and perceptions



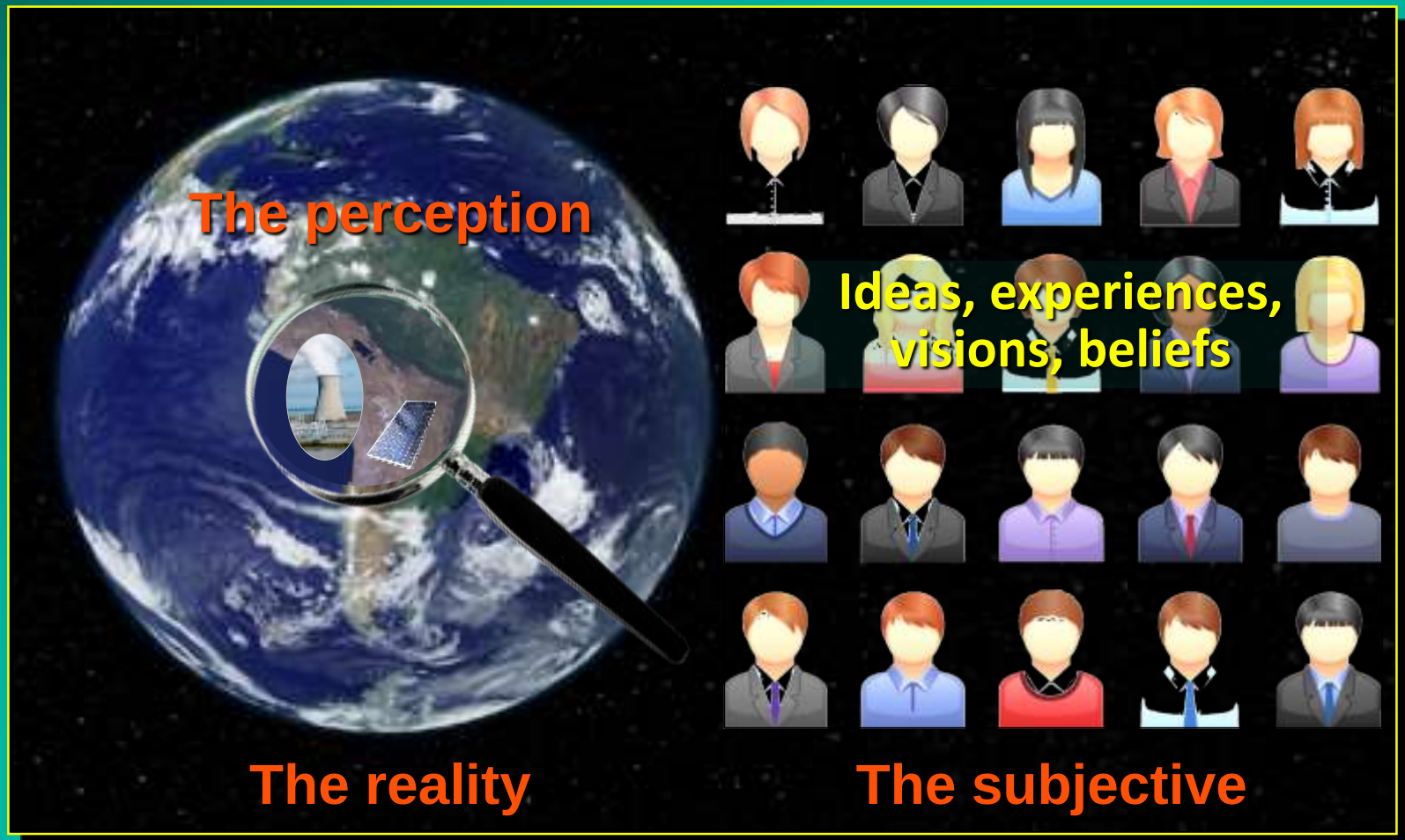
Understanding the Problem

We all have opinions and perceptions



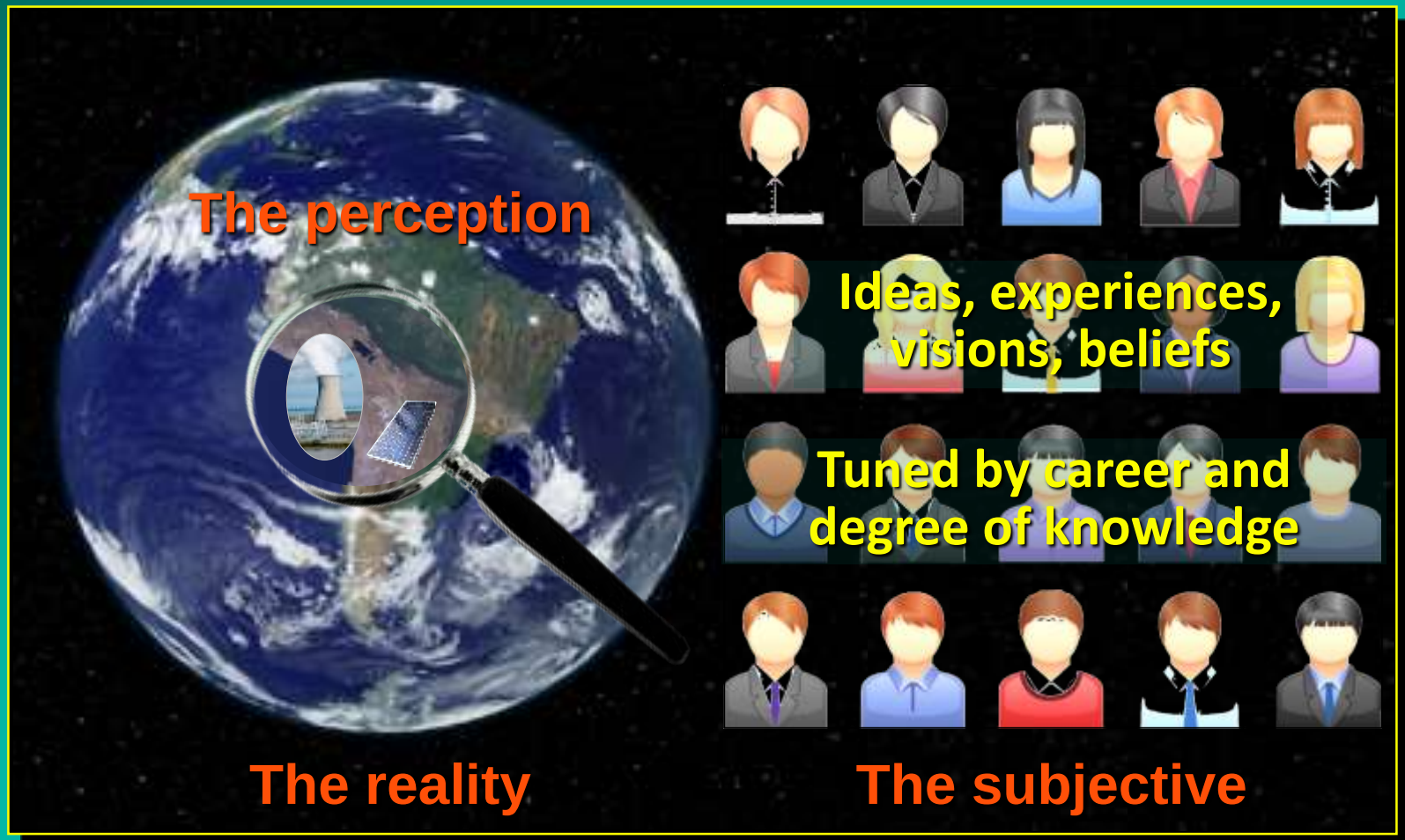
Understanding the Problem

We all have opinions and perceptions



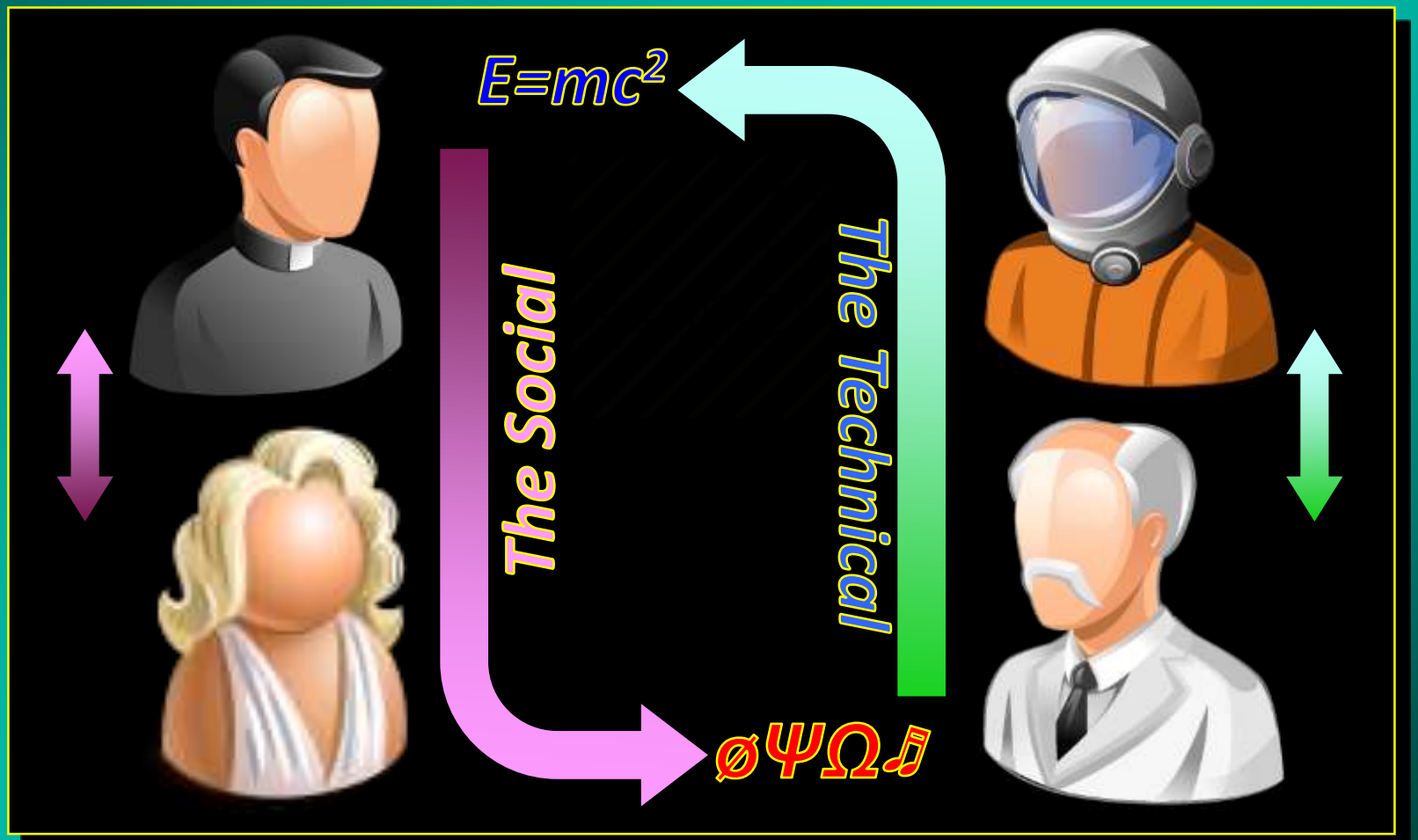
Understanding the Problem

The fact: reality and perception do not match



Understanding the Problem

How does these people communicate?



Understanding the Problem

Energy needs to be socially accepted today

Socio-political Acceptance

- The technology
- The applications
- The consequences

- General public
- Stakeholders
- Politicians

Community Acceptance

- Affected population
- Local groups
- Local authorities

Market Acceptance

- Contract viability
- Banks and investors

Adapted from Rolf Wüstenhagen et al (2007)

Understanding the Problem

Energy needs to be socially accepted today

Santiago 2014:
(Alto Maipo , 531 MW)

Copiapó 2010
(Castilla, 2256 MW)

Santiago 2011
(Signing of a US security protocol)

Curacautín 2015
(Minihydro, 3 MW)

Understanding the Problem

Energy needs to be socially accepted today

Understanding the Problem

Several new terms linked to energy

Biodiversity
COP
GHG
Renewable source
Entropy
Climate Change
Adaptation
Exergy
IPCC
Wind
Fossil
Geoengineering
Hybrid
Dependency
Accidents
Deterrence
CCS
LUC
RCP2.6
Ethics
Sustainability
Entrepreneurship
Negotiation
Conservation
Prosperity
Commerce
Risks
Wellness
Non renewable
Security
Duties
Nuclear energy
Geopolitics
Endurance
Storage
Electricity
Limits to Growth
Clean Coal
Liability

Reality versus Perception

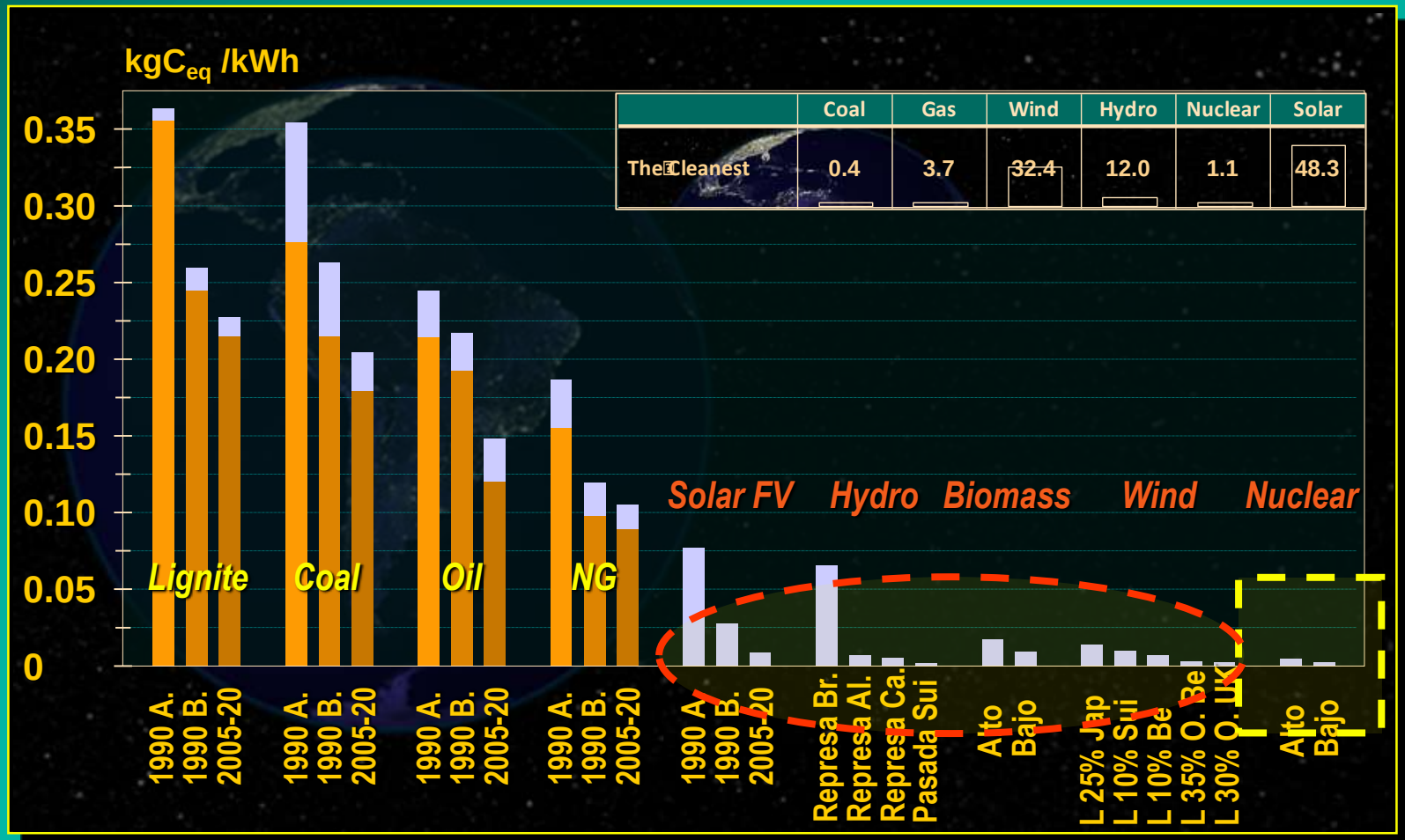
Reality versus Perception

A Government study requested to UC (before F1)

	Coal	Gas	Wind	Hydro	Nuclear	Solar
The Cleanest	0.4	3.7	32.4	12.0	1.1	48.3
The one deliver-ing the most	2.1	19.6	7.9	37.4	6.2	21.2
The most dangerous	17.8	14.3	0.9	3.9	59.0	1.5
The least expensive	29.3	6.7	13.3	8.4	2.1	33.7
The most powerful	1.7	8.3	1.6	31.1	36.9	12.7

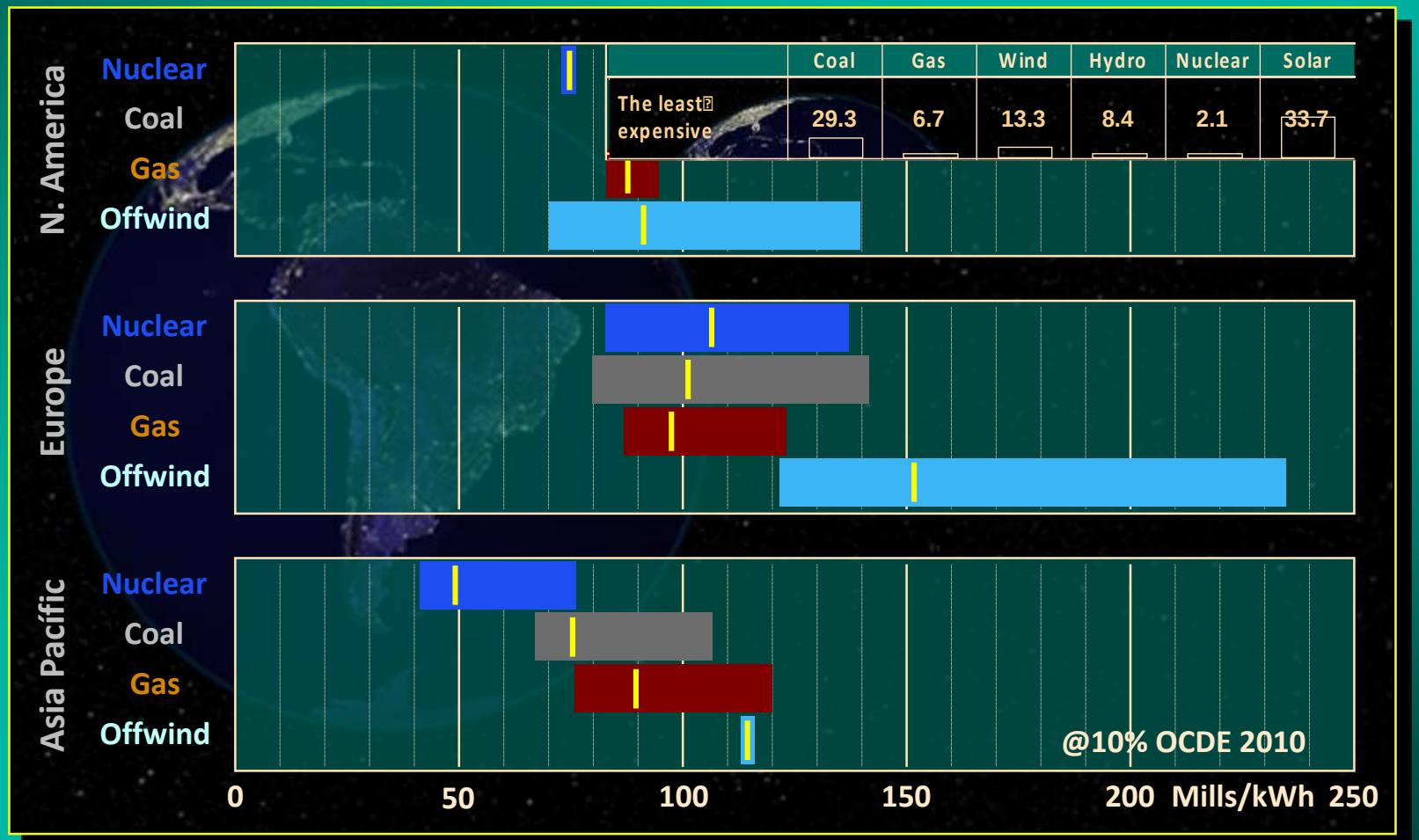
Reality versus Perception

Not exactly what people perceive



Reality versus Perception

Generation costs in different regions



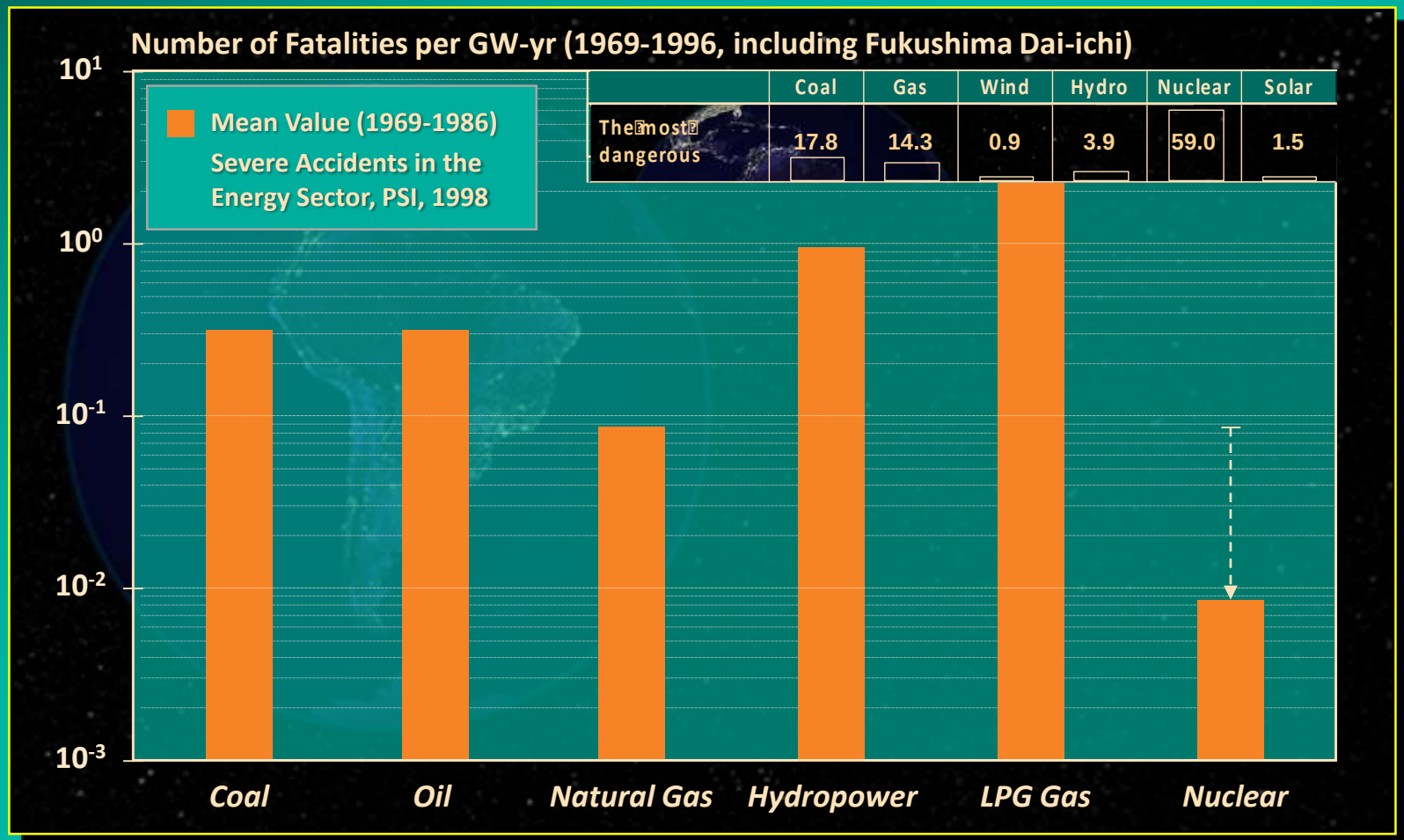
Reality versus Perception

Nuclear fission -by far- the densest

	Coal	Gas	Wind	Hydro	Nuclear	Solar
The most powerful	1.7	8.3	1.6	31.1	36.9	12.7

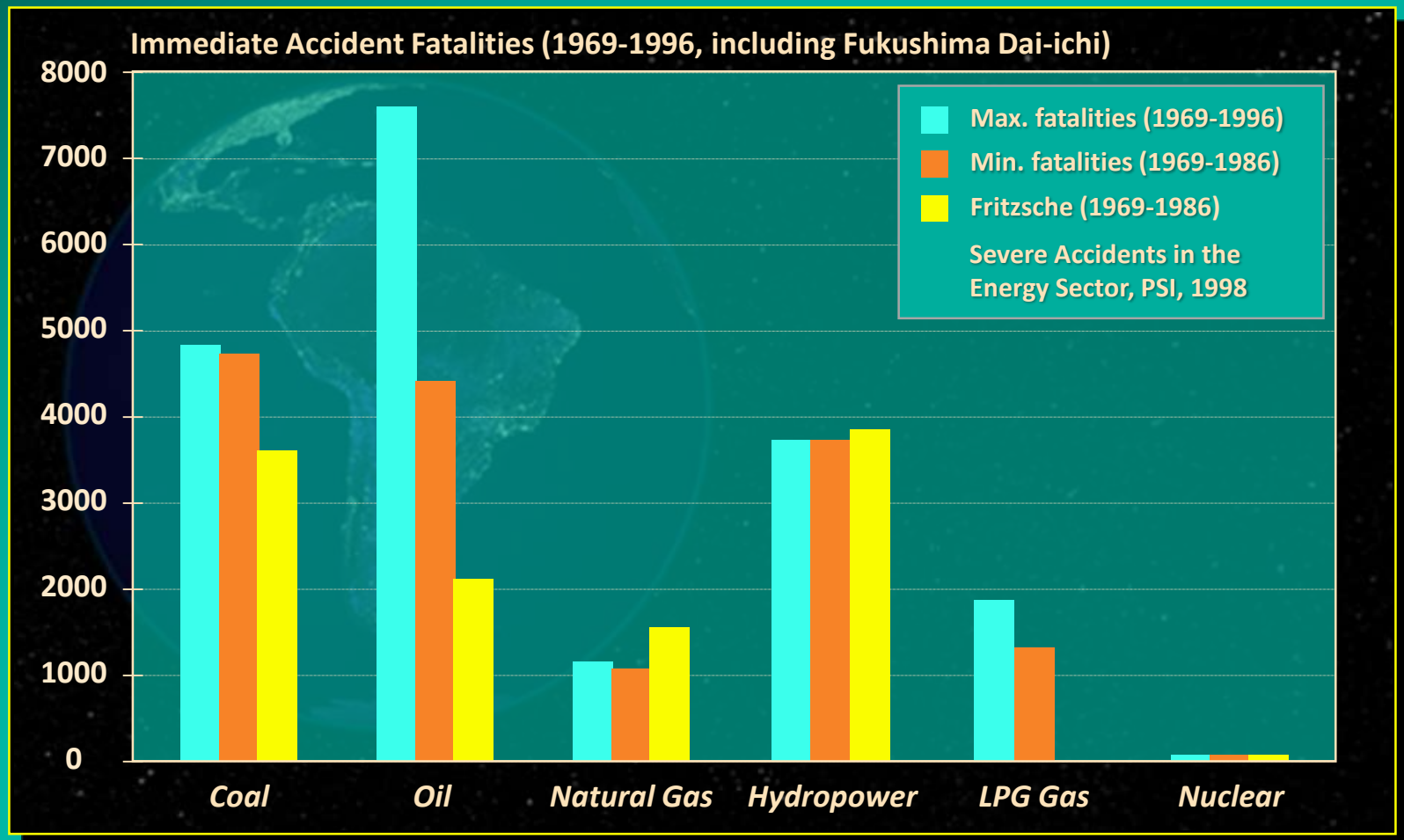
Reality versus Perception

Nuclear fission not the most dangerous



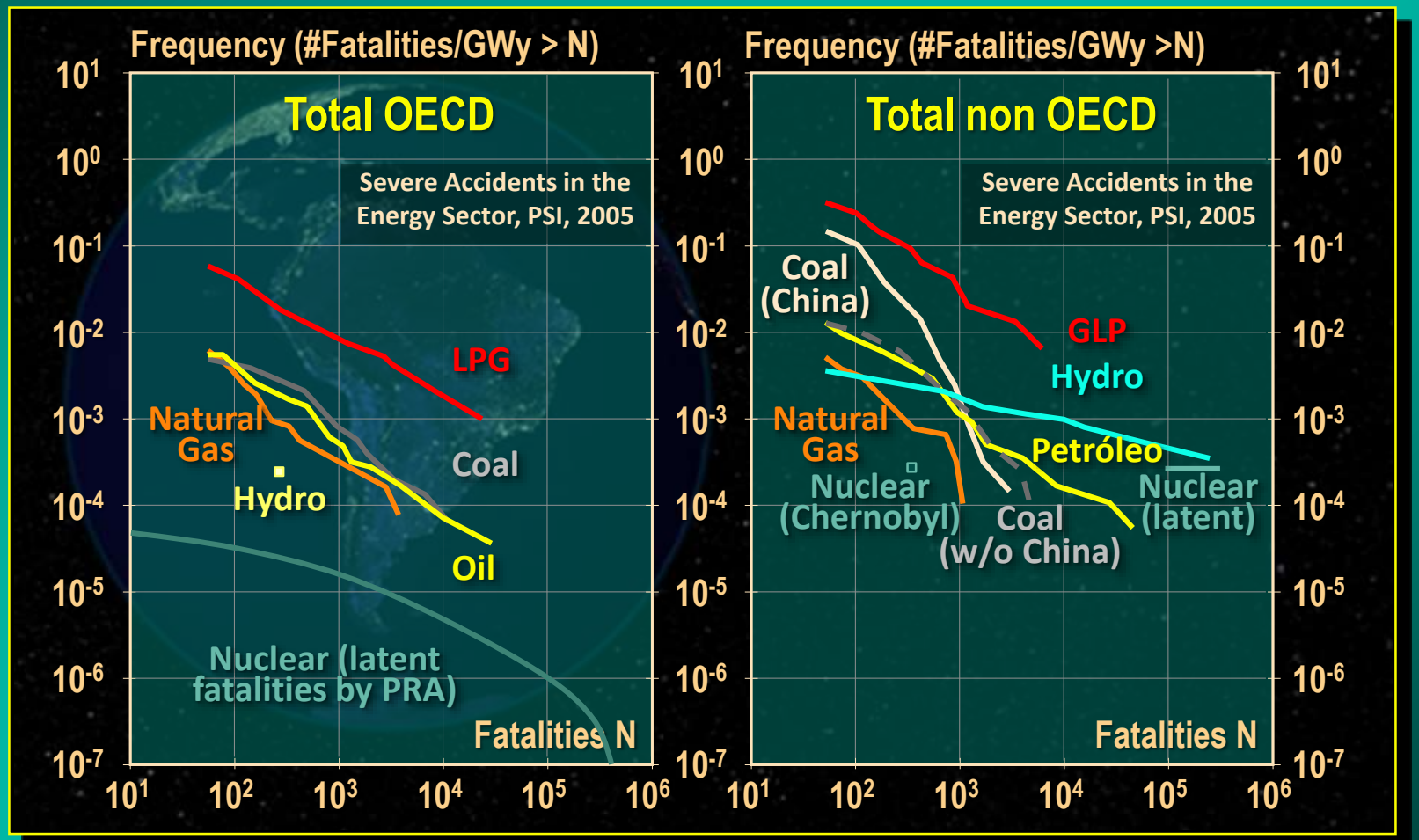
Reality versus Perception

Nuclear fission not the most dangerous



Reality versus Perception

Nuclear fission not the most dangerous



Reality versus Perception

A few recent examples of energy accidents

2010, Upper Big Branch Mine, W. Virginia	*(38)*
2010, Pike River Mine, New Zealand	*(29)*
2010, Anacortes Refinery, USA	*(10)*
2010, San Bruno Gaspipe, California	*(08)*
2010, Raspadskaya Mine, Kemerovo, Russia	*(66)*
2010, GNCC Plant, Connecticut, USA	*(05)*
2010, Deepwater Horizon Platform	*(11)*
2010, Dosquebradas Gaspipe, Colombia	*(39)*
2011, Coal Mine Well, México	*(14)*
2011, Gales Refinery, Great Britain	*(04)*

Reality versus Perception

A few recent examples of energy accidents

2011, Sorange Coal Mine, Pakistan	*(45)*
2012, Amuay Refinery, Venezuela	*(41)*
2012, Pemex Gas Plant, Mexico	*(26)*
2012, Fuel Truck Explosion, Nigeria	*(121)*
2012, Damp gas in Múzquiz, Mexico	*(07)*
2012, Panzhihua Coal Mine, Sichuan, China	*(41)*
2013, Vorkutinskaya Mine Explosion, Russia	*(18)*
2013, Crude Oil Train, Quebec, Canada	*(47)*
2014, Soma Mine Explosion, Turkey	*(301)*
2014, Gas Explosion in Kaohsiung, Taiwan	*(30)*

Reality versus Perception

More people died due to the evacuation

Reality versus Perception

Energy accidents with less media coverage

Reality versus Perception

Energy accidents with less media coverage

Reality versus Perception

Energy accidents with less media coverage

Reality versus Perception

Energy accidents with less media coverage

Conclusions

Conclusions

What can we do about it?

I do not have a clue: logic does not help much.

Not sure if the nuclear industry understands the social patterns. Our society is comfortable with an ipad scale and vendors sell 1-2 GW-units.

Teach engineers and others. Get into business and social sciences schools. Study psychology.

Need to educate about energy and to put risks & benefits, truth & myths, in proper balance.

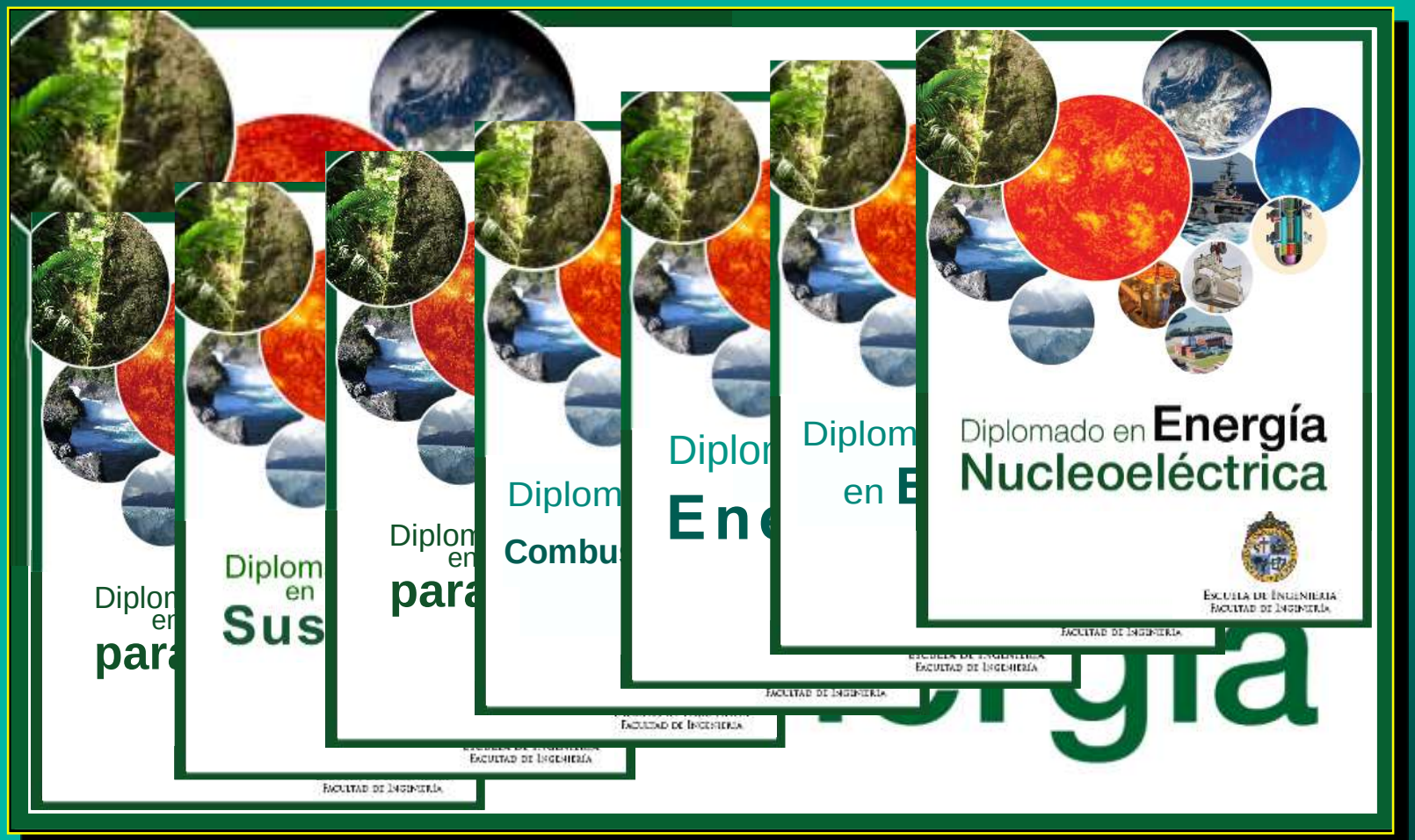
Conclusions

Master of Energy Engineering with nuclear content

QS rank #167

Conclusions

Energy Diplomas also offered, incl. Nuclear Power



Conclusions

Master of Energy Engineering with nuclear content

1st year				2nd year			
1	2	3	4	5	6	7	8
IEN 3110 Hydro Energy	IEN 3210 E. Economy	IEN 3310 Renewable E.	IEN 3410 Waste Mngt	IEN 3520 Sust. Constr.	IEN 3630 Renew Tech.	IEN 3730 Materials	IEN 3820 Renew. Design
IEN 3120 Energy & SD	IEN 3220 Policy, Planning	IEN 3320 Therm. Systems	IEN 3420 Tech, Pol, Soc.	IEN 3550 Energy Safety	IEN 3620 Hydrogen	IEN 3720 Bioenergy	IEN 3850 Energy Eff.
IEN 3140 Power Technol.	IEN 3240 Energy Markets	IEN 3330 Nuclear Energy	IEN 3430 Transport	IEN 3510 Project Eval.	IEN 3610 Innovation	IEN 3710 Industrial Econ.	IEN 3810 Energy Law
				IEN 3540 Fuel Cycle	IEN 3640 Reactor Physics	IEN 3740 Nucl. Industry	IEN 3840 Nuclear Design
				IEN 3530 Nuclear Safety	IEN 3620 Hydrogen	IEN 3750 Nucl. materials	IEN 3830 Adv. Systems

Common Block

Renewable Energy

Nuclear Energy

Conclusions

What else can we do about it?

Meeting renewable and nuclear energy is one initiative. But that may better help the industry, not the environment nor the future of society.

Need to integrate the fossil and the biomass industries to help mitigate their externalities with nuclear energy products and techniques.

Perhaps these industries are better partners for sustainable energy. RE (not hydro) has replaced less than 2%. Get into politics, get a vaccine!

Speaker: Julio Vergara Aimone

PhD, Nuclear Materials, MIT; MBA, UAI; MSc, Nuclear Engineering, MIT; MSc, Naval Architecture & Marine Engineering, MIT; MSc Materials Engineering, MIT; Naval Engineer and BSc in naval Engineering, APN.

Professor of Sustainable Energy, Nuclear Engineering, and Design, PUC; former Professor of Management of technology and Innovation, UDD & UAI.

Listed in Marquis´ "Who´s Who in the World" and "Who´s Who in Science and Engineering". Former Consultant to the IAEA. Board Member, CCHEN. President of 2015 Latin American Section of ANS.