

“ **Workshop on  
geothermal energy:  
Status and future in the  
peri-adriatic- area** ”

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# The workshop ....



- [ICTP \(Abdus Salam International Centre for Theoretical Physics\), Trieste](#)

consorzio per la fisica - trieste



- [Consortium for Physics of Trieste University](#)

XIV International Conference  
on Science Arts and Culture

WORKSHOP on  
GEOTHERMAL ENERGY  
Status and future  
in the Peri - Adriatic Area

25 - 27 August 2014  
Veli Lošinj, Croatia



- [ECSAC, European Centre for Science Arts and Culture](#)



- [HERA Group \(Environmental Services Multiutility\)](#)



- [International Foundation Trieste](#)



- [OGS - National Institute of Oceanography and Experimental Geophysics](#)



- [Unione Geotermica Italiana](#)



**“The Stone Age didn’t end because we  
ran out of stone ....**

**The Oil Age won’t end because we run  
out of oil! “**



**Don Huberts**



# The perfect storm - John Beddington



**theguardian**

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News > Science

## World faces 'perfect storm' of problems by 2030, chief scientist to warn

Food, water and energy shortages will unleash public unrest and international conflict, Professor John Beddington will tell a conference tomorrow

- Increase of food demand by 40%
- Increase of energy demand by 45%
- Increase of global water demand by 30%
- Reduction of green house gases not as expected
- Shortage of food, energy, water will lead to international tensions and migrations





**ENVIRONMENT**

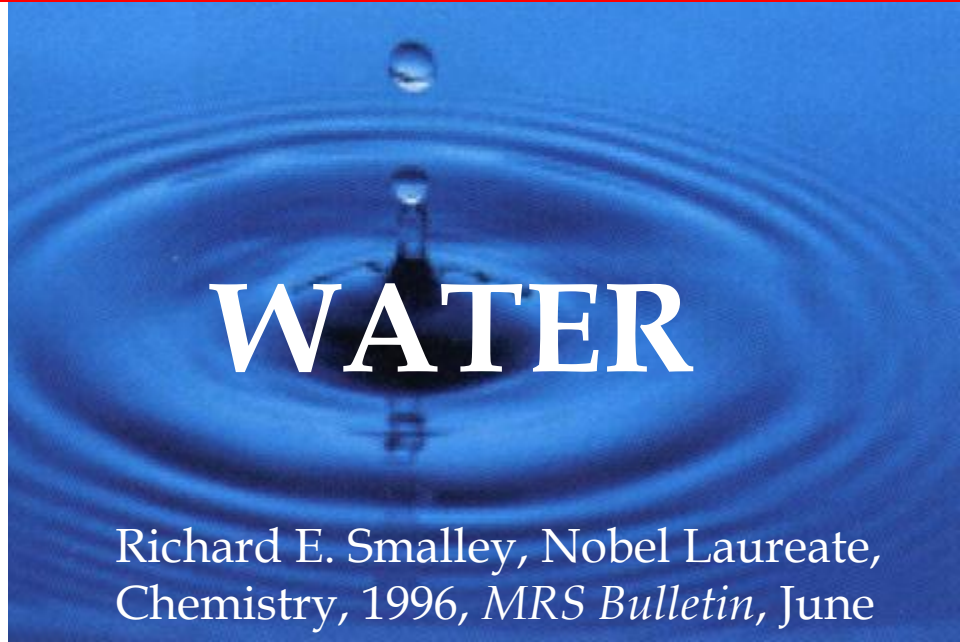


**FOOD**

**4 Emergencies at world level**



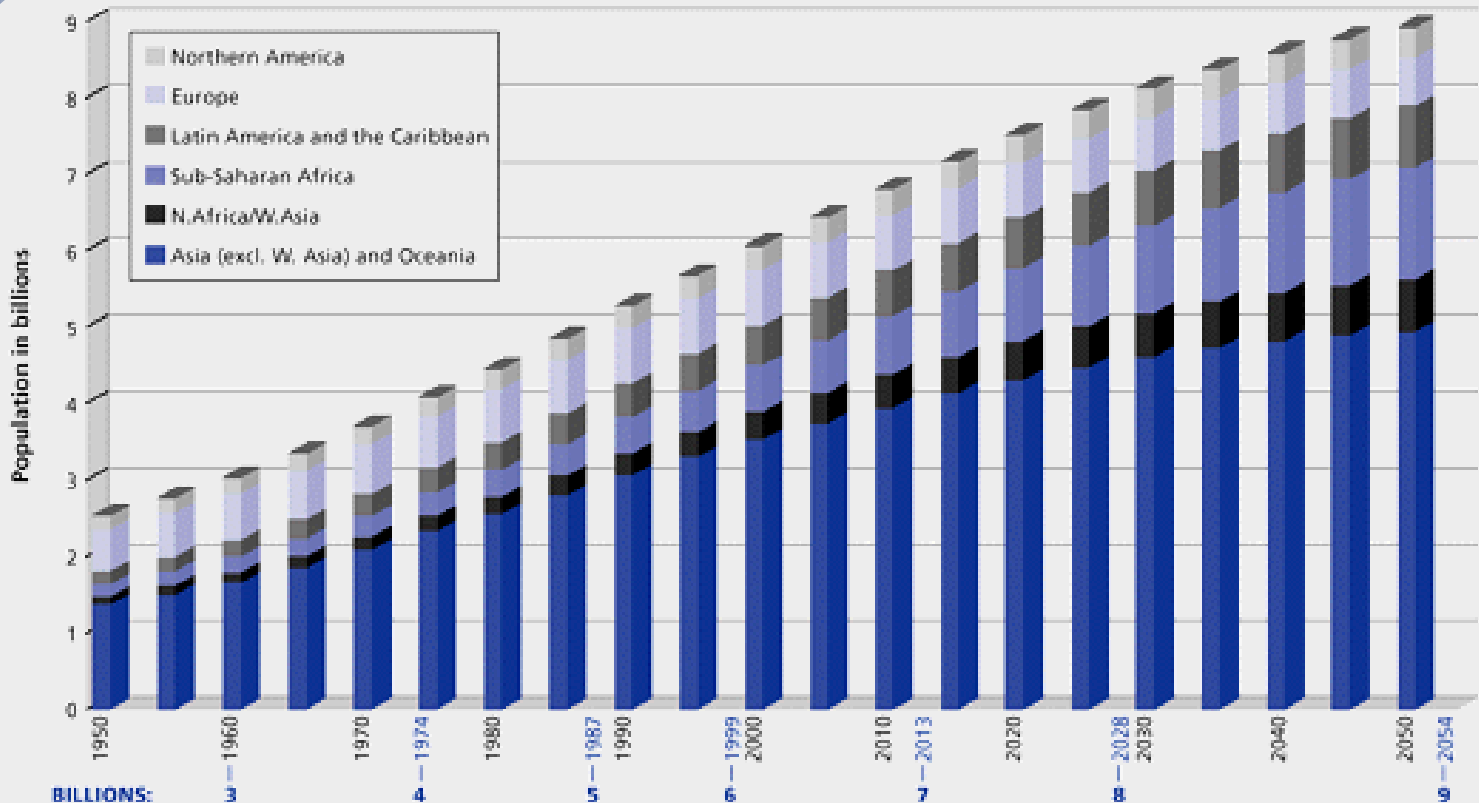
**ENERGY**



**WATER**

Richard E. Smalley, Nobel Laureate,  
Chemistry, 1996, *MRS Bulletin*, June

# World population grows ...





# A pioneer .... (an Hero !!!)

# SCIENCE



FRIDAY, SEPTEMBER 27, 1912

## CONTENTS

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### *THE PHOTOCHEMISTRY OF THE FUTURE*<sup>1</sup>

MODERN civilization is the daughter of coal, for this offers to mankind the solar energy in its most concentrated form; that is, in a form in which it has been accumulated in a long series of centuries. Modern man uses it with increasing eagerness and thoughtless prodigality for the conquest of the world and, like the mythical gold of the Rhine, coal is to-day the greatest source of energy and wealth.

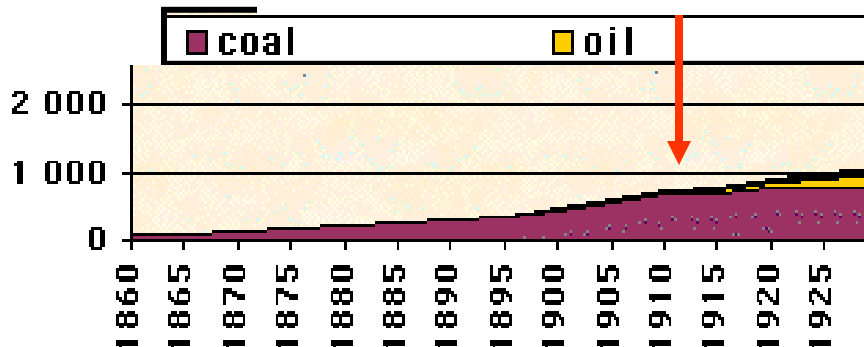
So far, human civilization has made use almost exclusively of fossil solar energy. Would it not be advantageous to make better use of radiant energy?

GIACOMO CIAMICIAN

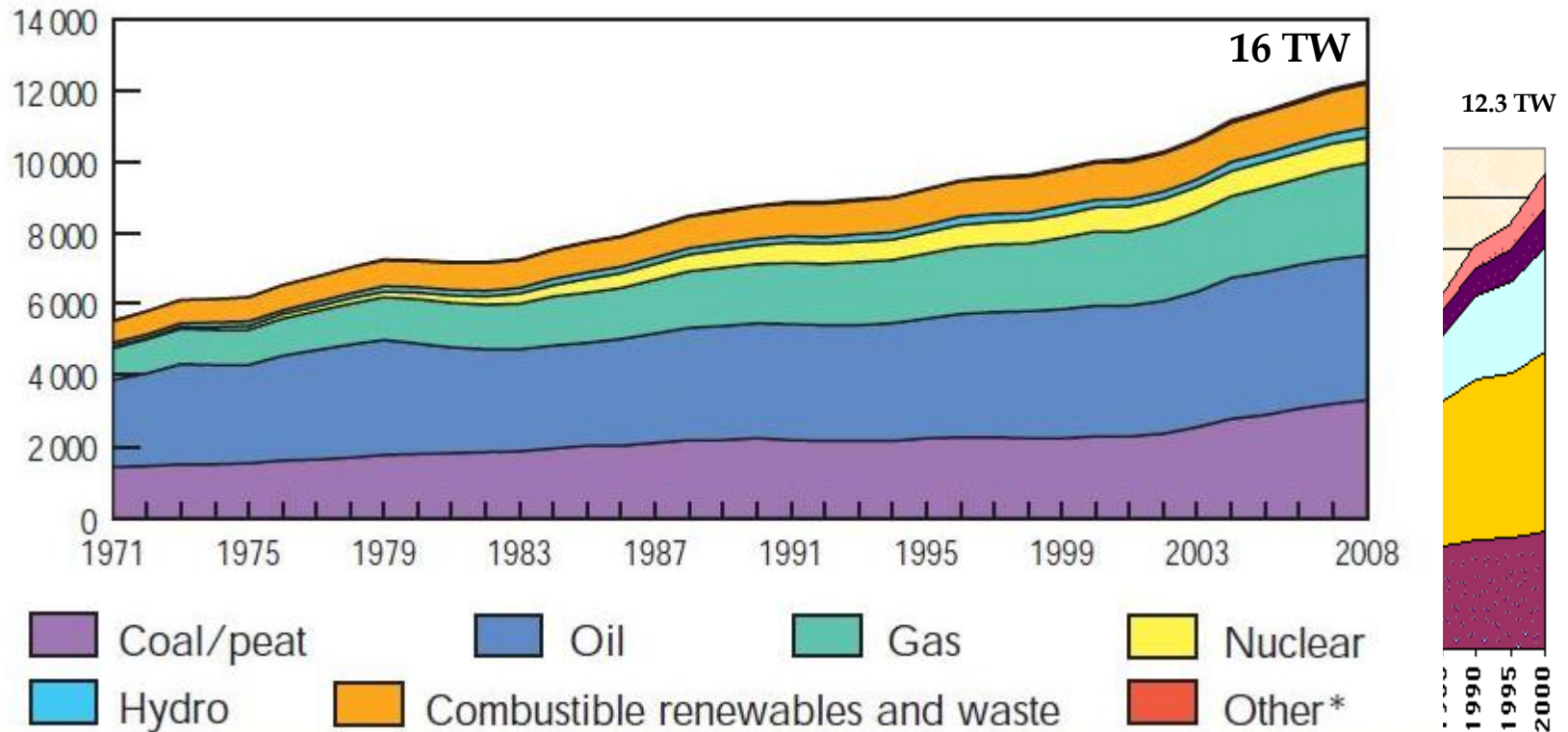
BOLOGNA

1912  
 ~ 1 TW

Mtoe/anno



# Evolution from 1971 to 2008 of world total primary energy supply by fuel (Mtoe)



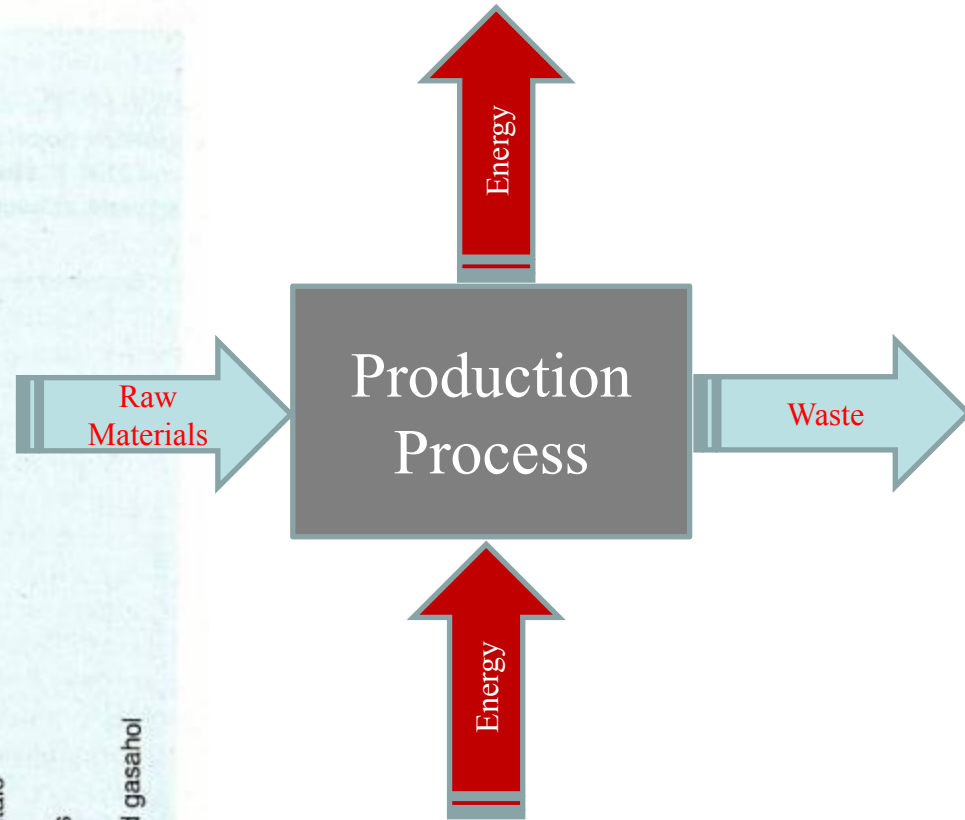
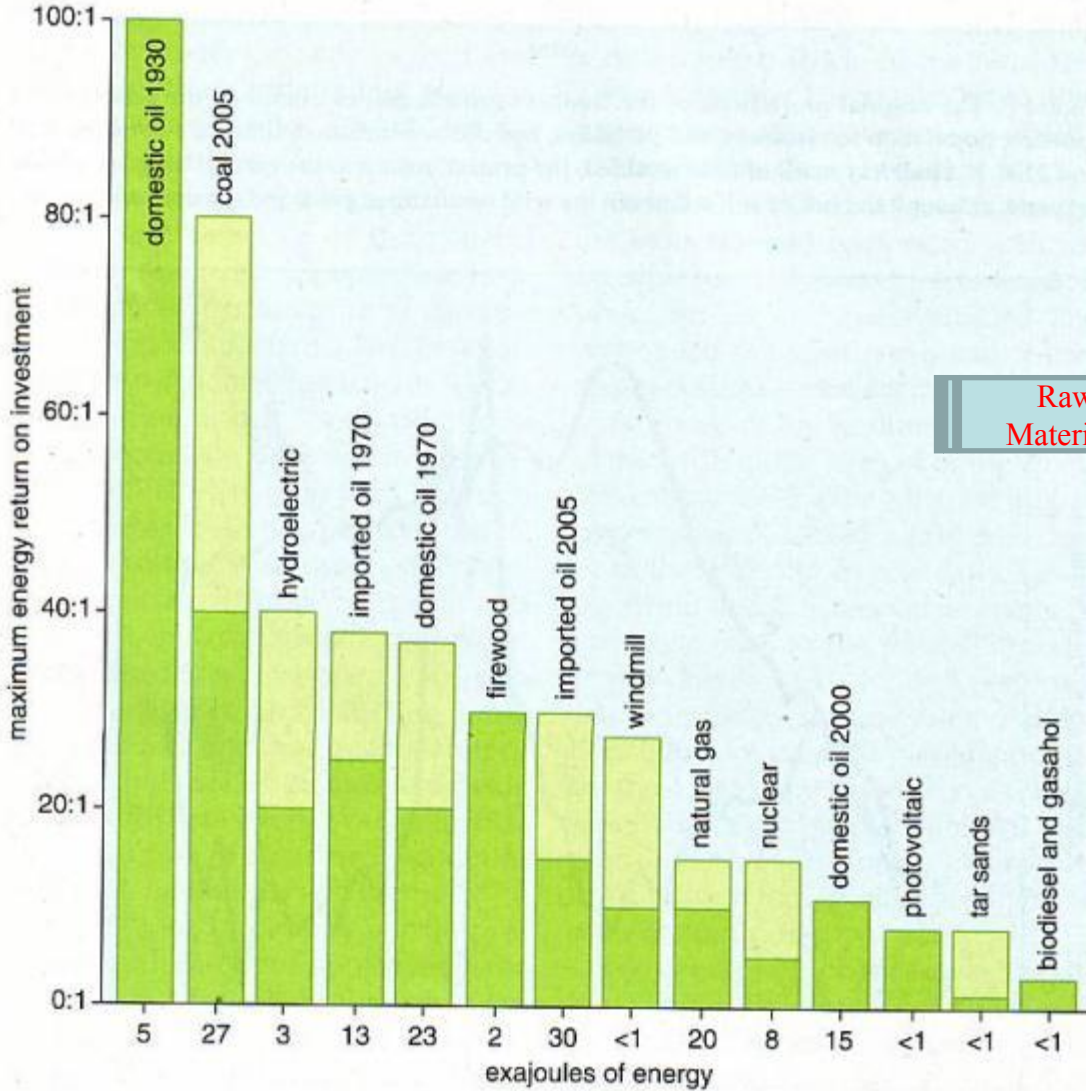


**2010 474 exaJ = 15,000,000,000,000 Wh => 17 TW**



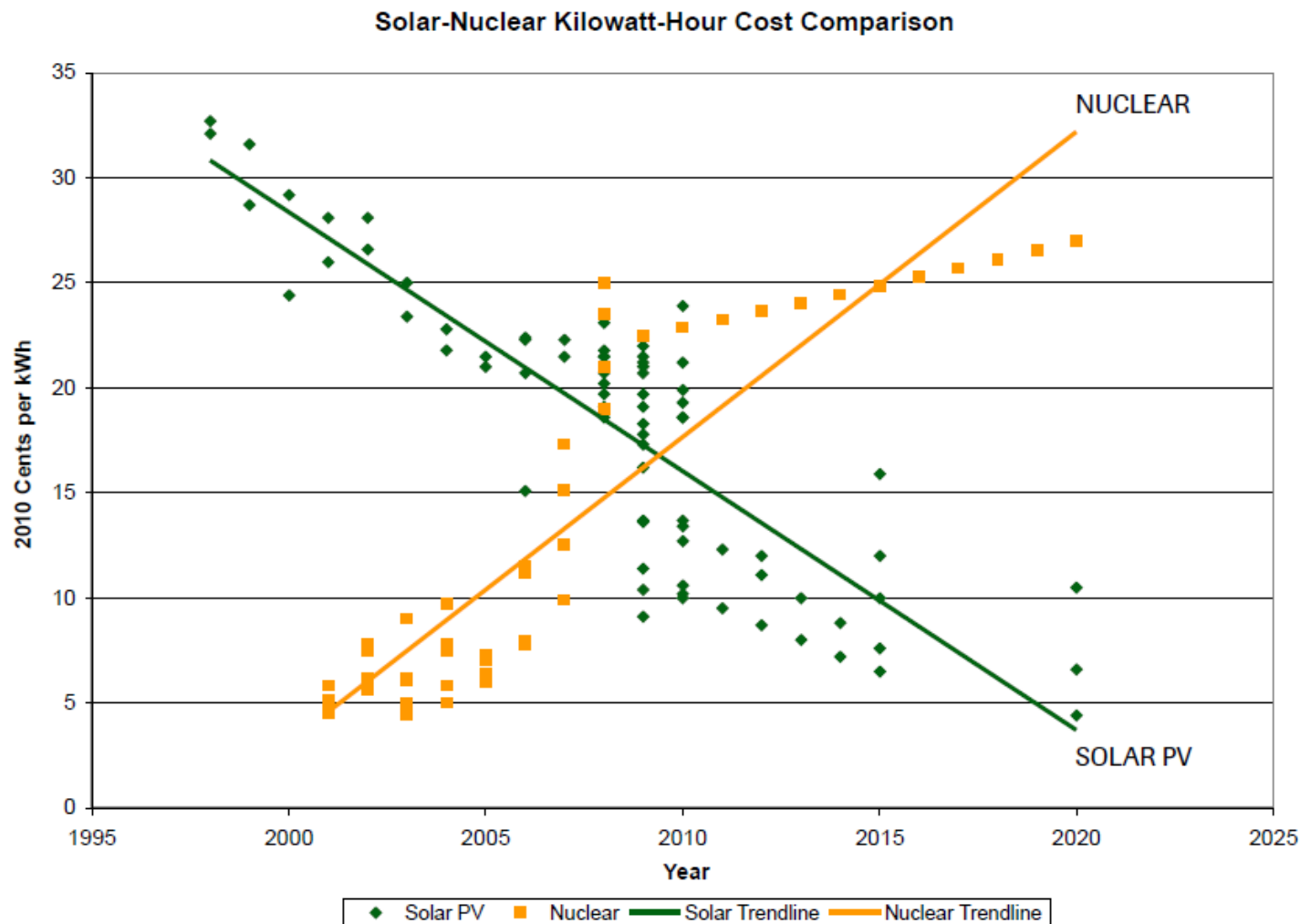
**2030 → 23 TW ; 2058 → 32 TW**

# EROEI



C.A.S.Hall, J.W.Day Jr.,  
"Revisiting the Limits to  
Growth After Peak Oil",  
Am. Sci. 97 (2009) 230

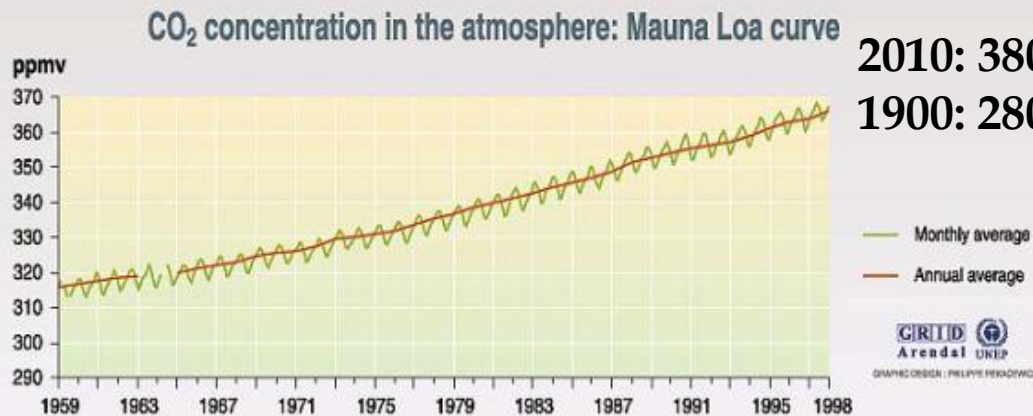
# Cost of solar energy vs. nuclear energy: historical crossover



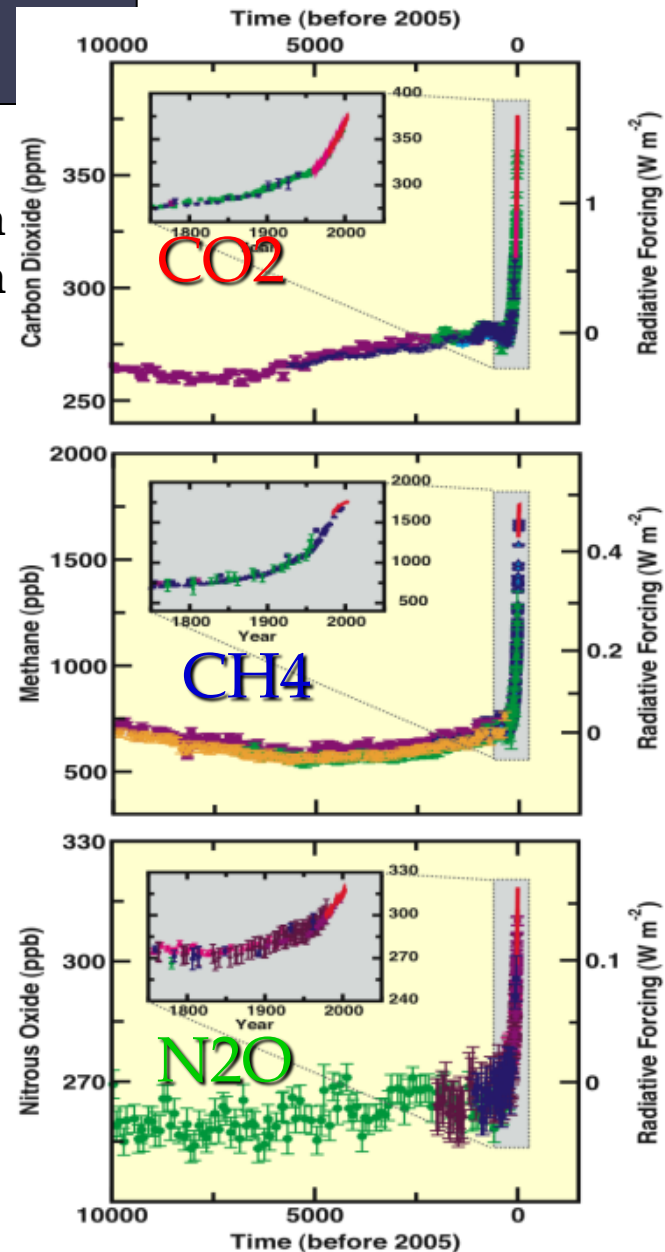
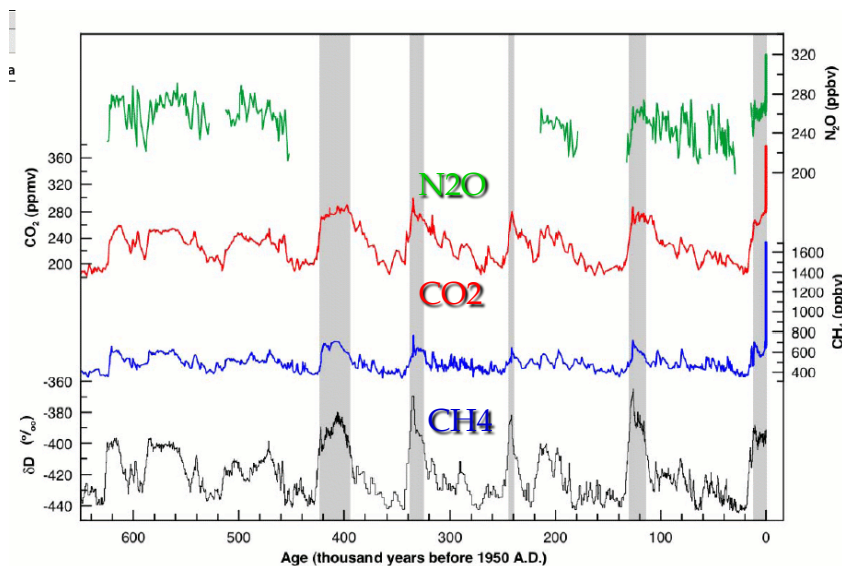
Source: John O. Blackburn, Sam Cunningham, July 2010



# Concentration of greenhouse gases in the atmosphere

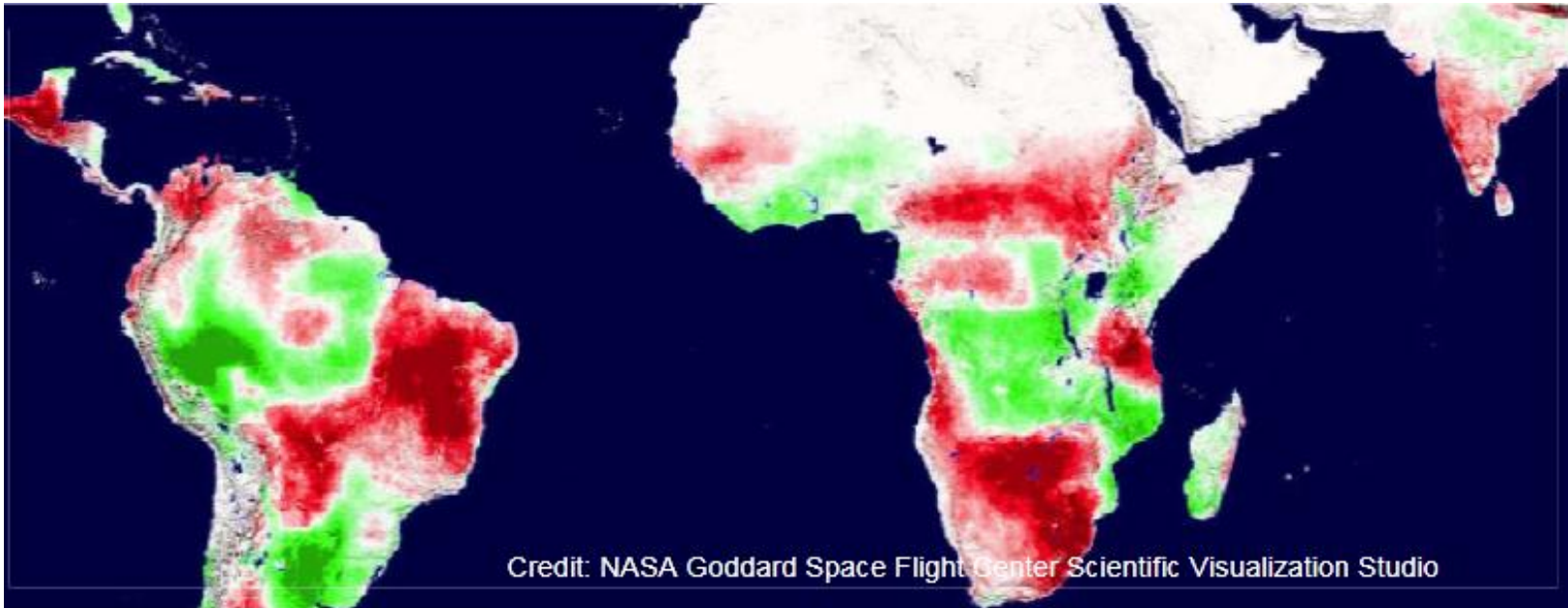


Source : Scripps institution of oceanography (SIO), University of California, 1998.



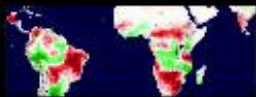
# Plants productivity

- Increase in green – Decrease in red



Credit: NASA Goddard Space Flight Center Scientific Visualization Studio

Negli ultimi dieci anni, il riscaldamento globale ha causato un rallentamento della capacità delle piante nel mondo di rimpiazzare anidride carbonica con ossigeno: l'allarme arriva da due ricercatori che hanno studiato i dati satellitari immagazzinati dalla Nasa negli ultimi 30 anni. Nell'immagine qui sopra, in verde sono evidenziate le aree in cui la produttività delle piante è aumentata, mentre in rosso le aree in cui la produttività è calata. Il dato preoccupante, sottolineano gli scienziati, è che mentre, fino al 2000, il riscaldamento globale aveva comportato un'accelerazione della produttività delle piante (e quindi le aree verdi erano complessivamente maggiori delle aree rosse), dal 2000 al 2009 l'inacidimento delle terre ha comportato una diminuzione netta della capacità delle piante di rimpiazzare CO<sub>2</sub> con ossigeno (ovvero le aree rosse sono maggiori di quelle verdi)





# A final (and definitive) proof of the global warming???







# Horizon2020 Structure

## Societal Challenges

- Health, demographic change and wellbeing
- Food security, sustainable agriculture and bio-economy
- Secure, clean and efficient energy
- Smart, green and integrated transport
- Climate action, efficiency and raw materials
- Inclusive, innovative and secure societies

## Industrial Leadership

leadership in enabling and industrial technologies

KET

facilitate access to risk finance

support for innovation in SMEs

ICT

Advanced materials

Biotechnologies

Advanced Manufacturing

Space

Nanotechnologies

support for cross-cutting actions combining several Key Enabling Technologies

## Horizon 2020

## Excellence Science

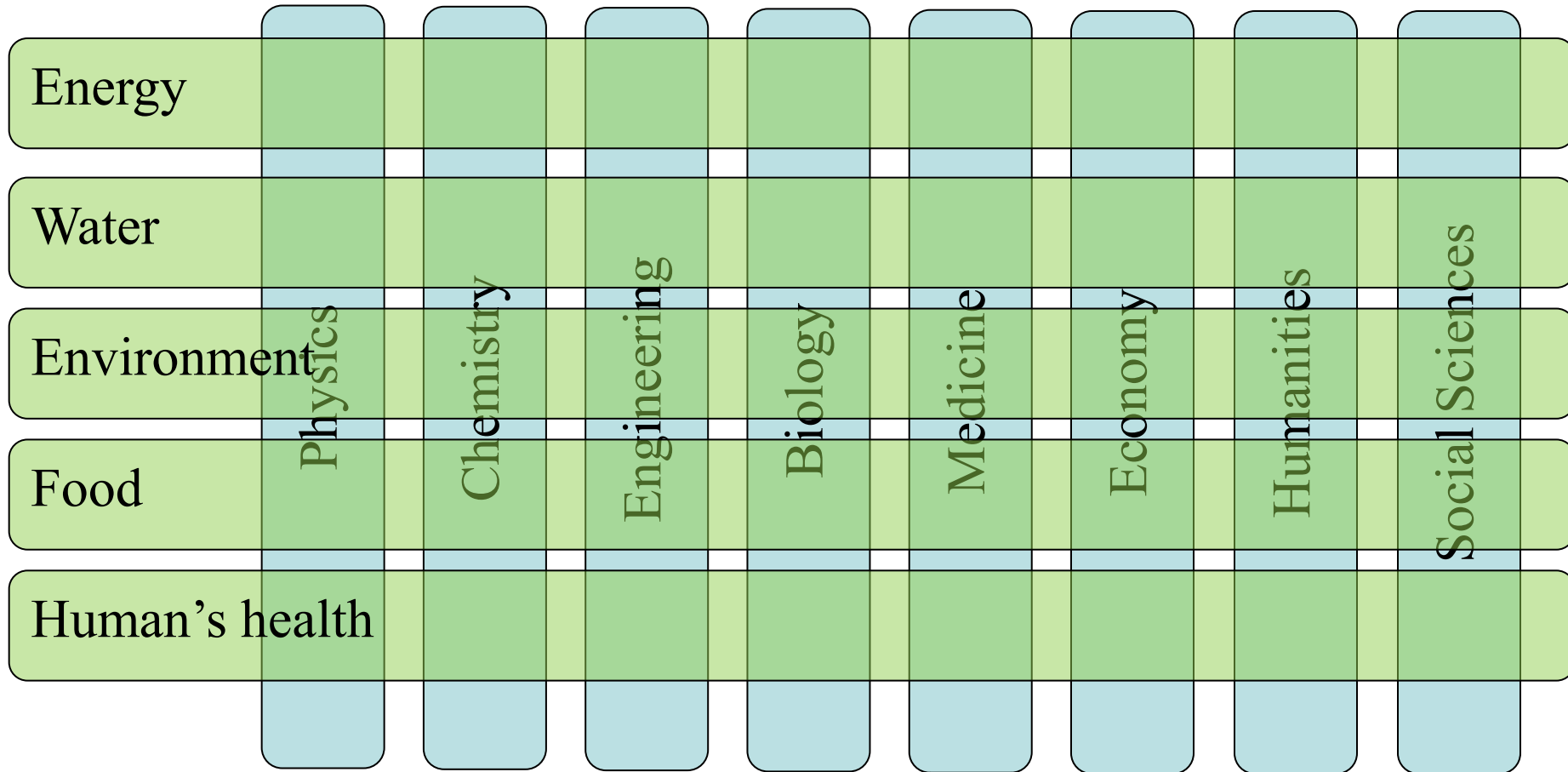
Marie Curie actions

Support for Future and Emerging Technologies

Research infrastructures (including e- infrastructures) accessible to all researchers in Europe

Support the individuals and their teams to carry out frontier research by building on the success of the European Research Council

# Disciplines .... and relevant themes for the world



# Geothermal energy and EU 27/2012



- Geothermal has adequate characteristics to be used for space heating and cooling

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European Commission > Energy > Energy Efficiency > Energy Efficiency Directive

## Energy Efficiency



[Home](#)

### Energy Efficiency

- Energy Efficiency Directive
  - National Energy Efficiency Action Plans
  - Reporting targets
  - Guidance notes
  - Article 4 Building Renovation Strategies
  - Notifications according to Article 5

### Energy Efficiency Directive

The new Directive entered into force on 4 December 2012. Most of its provisions will have to be implemented by the Member States **by 5 June 2014**.

#### An effective common framework

This Directive establishes a common framework of measures for the promotion of energy efficiency within the Union in order to ensure the achievement of the Union's 2020 20 % headline target on energy efficiency and to pave the way for further energy efficiency improvements beyond that date.

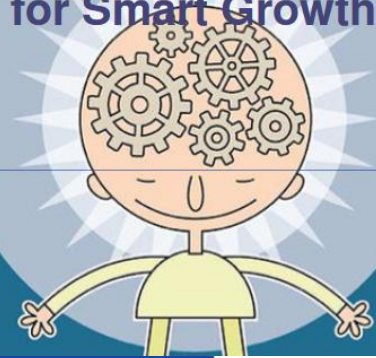
All EU-28 countries are thus required to **use energy more efficiently at all stages of the energy chain** – from the transformation of energy and its distribution to its final consumption. The new Directive will help remove barriers and overcome market failures that impede efficiency in the supply and use of energy and provides for the establishment of indicative national energy efficiency targets for 2020.





# Smart Specialization Strategy S3

Smart Specialisation  
for Smart Growth

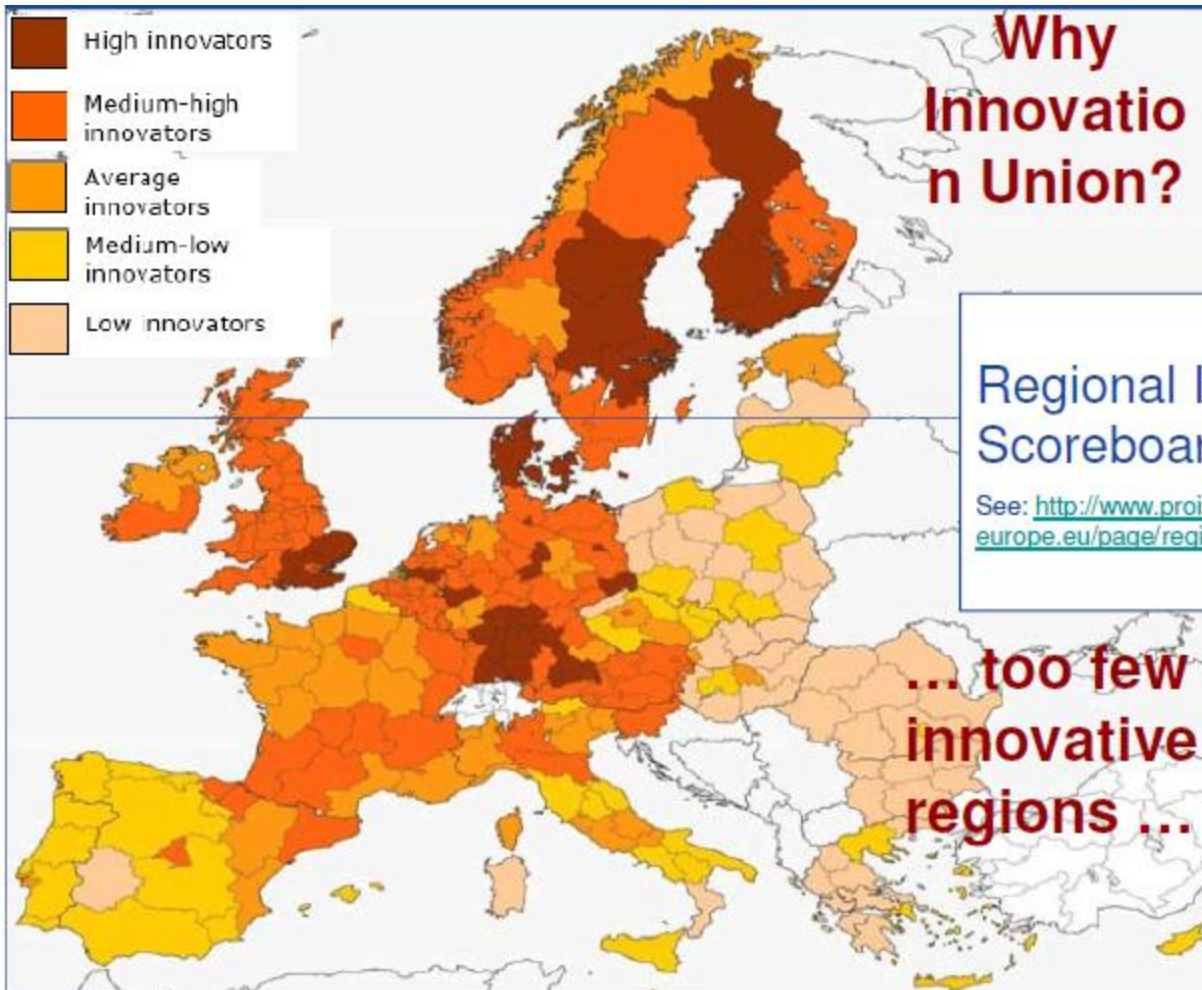


Why  
Innovation  
in Union?

Regional Innovation  
Scoreboard - 2009

See: <http://www.proinno-europe.eu/page/regional-innovation-scoreboard>

... too few  
innovative  
regions ...





... and anyway!!

“If you think education is expensive,  
try ignorance”

Derek Bok - President of Harvard 1971-1990

