How to get the best mix between water for energy and energy for water ?

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Senior adviser to the ParisTech Chair
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Why should we consider the question?

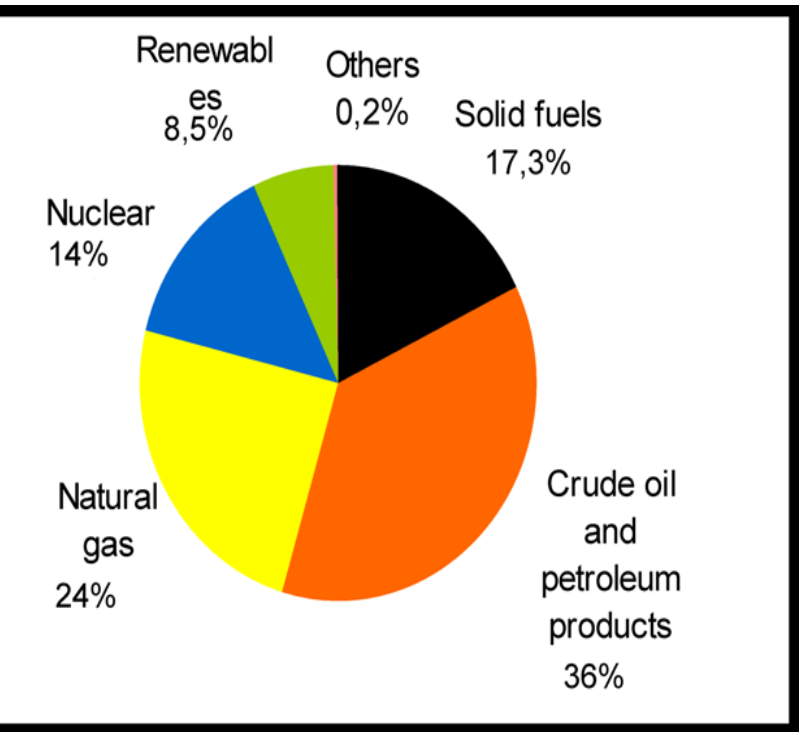
1. **Water and energy used to be considered separately by governments and by end users.**
2. Energy from fossil sources nourished human development for two centuries, especially in the western world and nowadays quite everywhere. **Market for energy became worldwide**. But now lifetime of fossil resources counts in decades and climate change challenges our gas emissions.
3. **Beyond Energy market, innovations and new regulations are at stake** and perhaps our civilization as well : Copenhagen Summit shows !
4. Water is life: it's vital. It's renewable. Globally it's abundant. But its distribution over the planet doesn't fit spontaneously human needs. **Good local management of water is its key problem**. But through agriculture needs it becomes also a world wide problem…
5. **Then articulation between energy and water asks for a review from global to local** : CO2 & fossil limits constraints are global, while energy mix is still a national matter and while water management should remain local (basins).

Through extracts from yesterday presentations

- EU case
- China-EU parallel
- Climate change - World challenge
- Basics of Energy

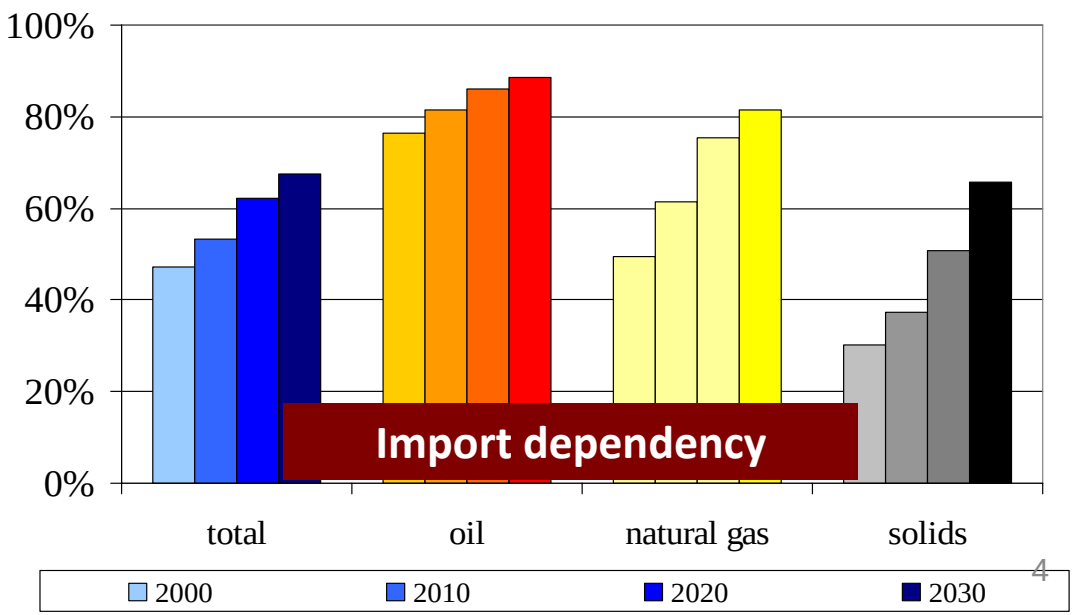
Let’s have a look at Energy, first

EU energy mix: business as usual is not sustainable



2005

~ 80% fossil fuel



SOURCE: Eurostat.

1. Growing concern about security and continuity of oil and gas supplies; rising energy prices, despite the increased efficiency resulting from EU market liberalisation
2. Climate change
3. EU competitiveness policy: need for innovative industrial development and leadership

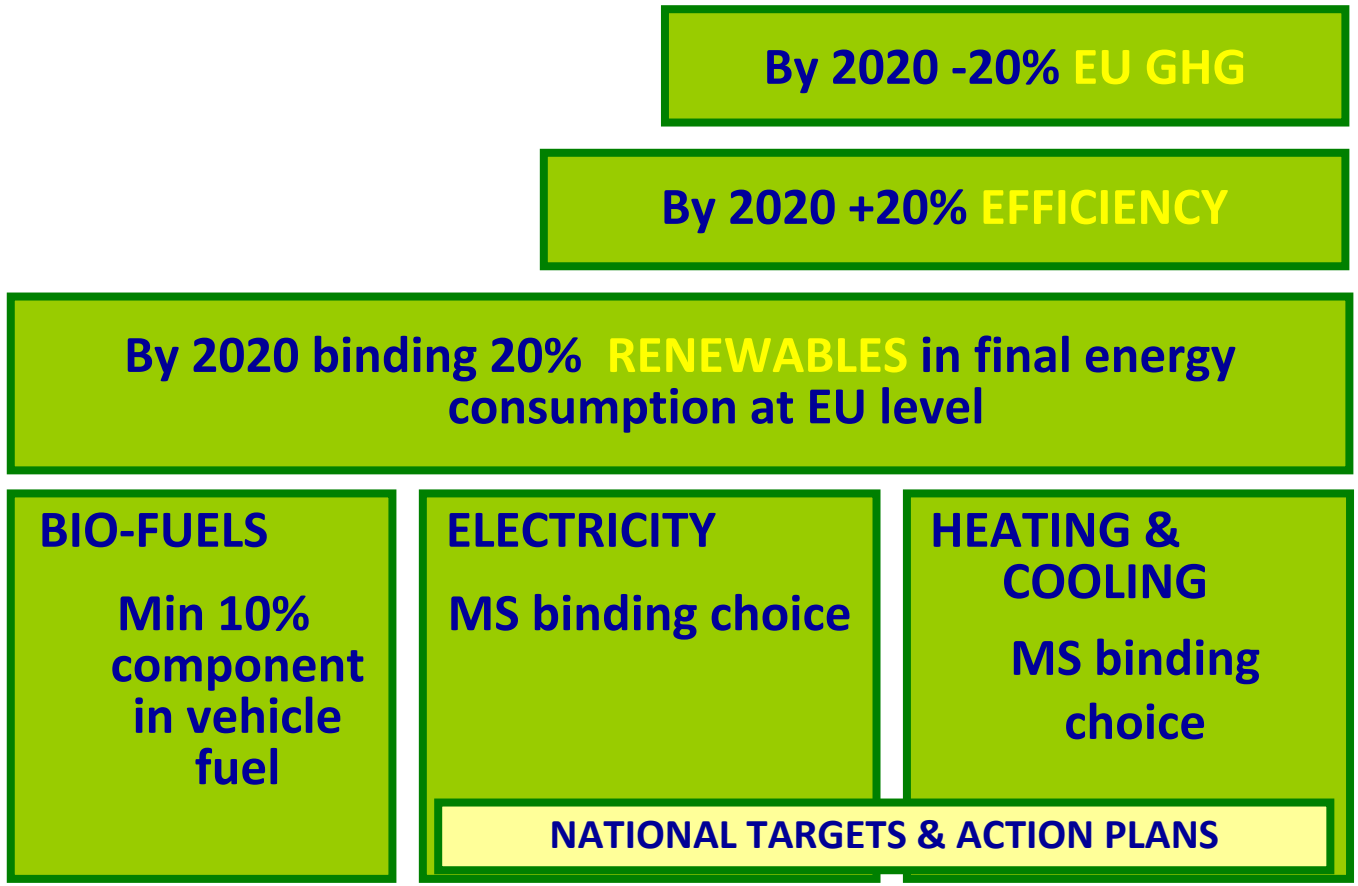
- **3 pillars of EU energy policy: sustainability, security of supply, competitiveness**

- January 2008 “energy package” proposed targets for 2020 of a
  - 20% GHG reduction (compared to 1990)
  - 20% renewable energy (from today 8.5%)

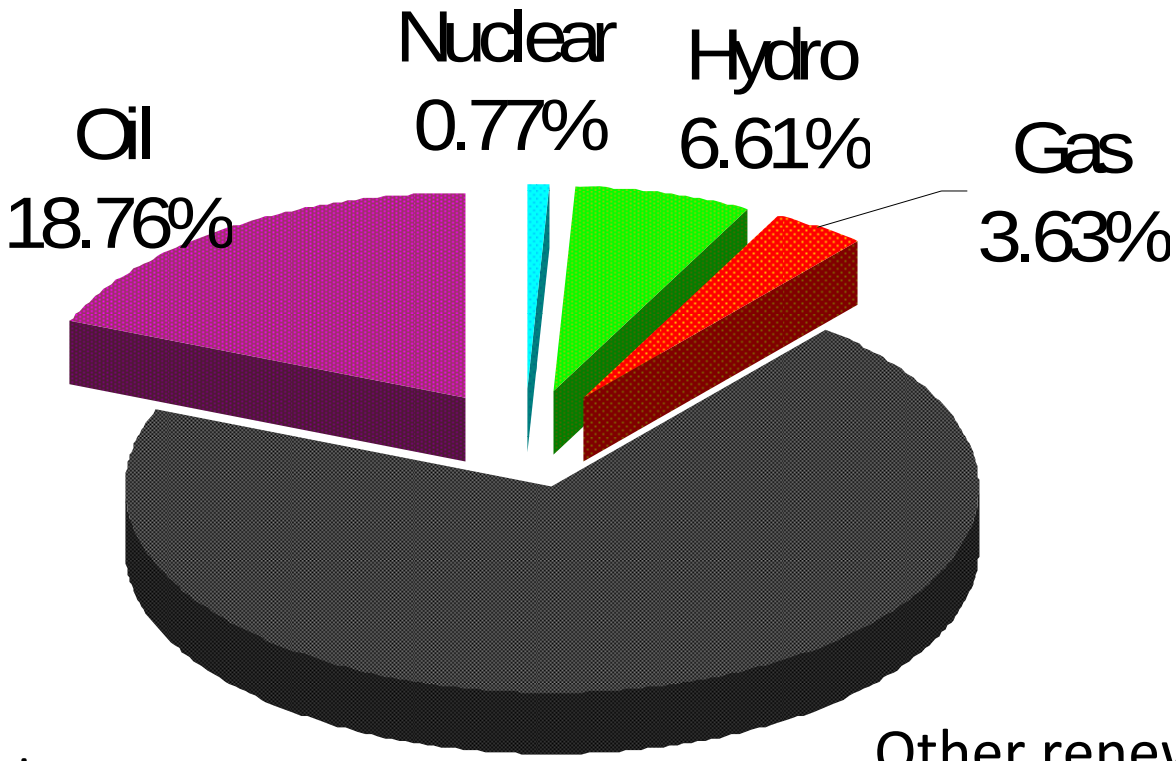
“20-20 by 2020”

In addition:

- 20% increase in energy efficiency
- 10% biofuel component in vehicle fuel


By 2020 -20% EU GHG
By 2020 +20% EFFICIENCY
By 2020 binding 20% RENEWABLES in final energy consumption at EU level
BIO-FUELS
Min 10% component in vehicle fuel
ELECTRICITY
MS binding choice
HEATING & COOLING
MS binding choice
NATIONAL TARGETS & ACTION PLANS

China's Energy Consumption Structure by Fuel (2008)



Total consumption:

2.85 Bn. tons sce

Other renewables: negligible so far!

Source: ERI, September 2009

China and EU have Ambitious and Parallel Climate and Energy Plans

China – 2006-2010-2020

- 20 % reduction in energy intensity (energy consumption per unit of GDP) compared to 2005 in current FYP 2006-2010 + specific program targeted at 1000 largest enterprises
- **BREAKING NEWS 26/11/2009: 40% reduction in 2020 compared to 2005 !!**
- 15% of China energy from renewables in 2020 (today 7%)
- No obligation under present Kyoto protocol
- Increased forest coverage to 10% by 2010
- **BREAKING NEWS 03/12/2009: INDIA joins the fray as well !!! (20% reduction in energy intensity by 2020)**

EU - 2020

« Climate & Energy Package « (2008):

- 20% reduction in energy intensity

« 20-20 by 2020 »

- 20% of EU's energy from Renewables (today 8,5%)
- 20% reduction in GHG emissions (beyond Kyoto: 8% by 2012 over 1990 levels)
  30% if others commit as well
- 10% of transport fuels from biofuels
- Post 2020, if possible, all new fossil power stations with CCS

National Energy policies

In Asie and Pacific, as in the rest of the world, countries' challenge for energy is triple:

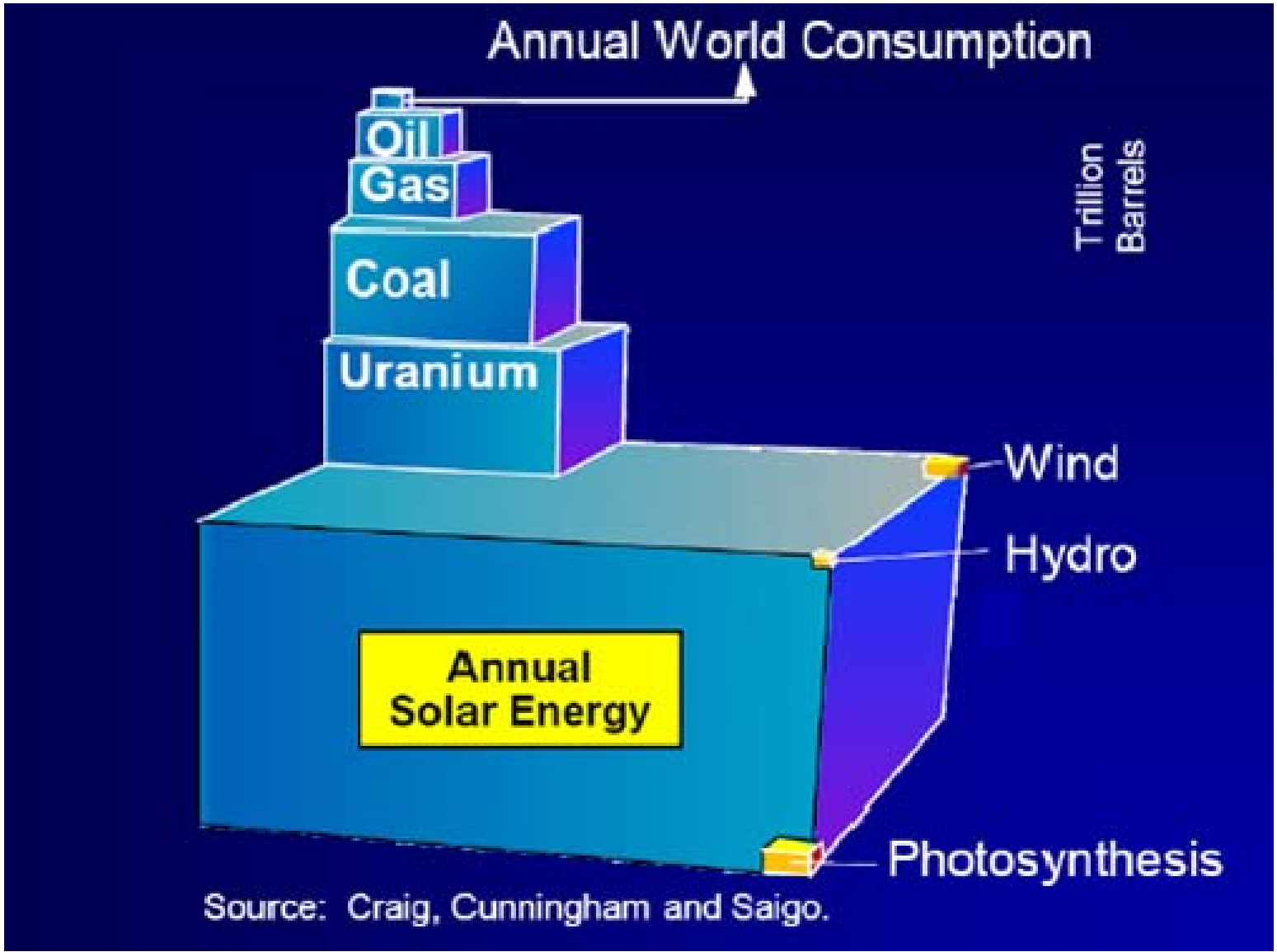
1. Guarantee their economic development and secure their energy resources
2. Fight climate change
3. Secure access to energy for every one, and for the poor in particular.

Energy and CO_2 Intensity of GDP

Country	BTU per 1995 US$	CO_2 per US$1000
Argentina	9,875	0.48
Australia	11,936	0.88
Canada	17,341	0.79
Chile	11,498	0.59
China	35,764	2.75
Denmark	3,920	0.26
France	5,998	0.22
Germany	5,269	0.31
Ireland	5,273	0.38
Italy	6,186	0.36
Japan	3,876	0.21
N.Z.	**11,871**	**0.51**
Norway	10,968	0.25
Poland	20,004	1.6
U.K.	7,039	0.41
U.S.	10,575	0.62

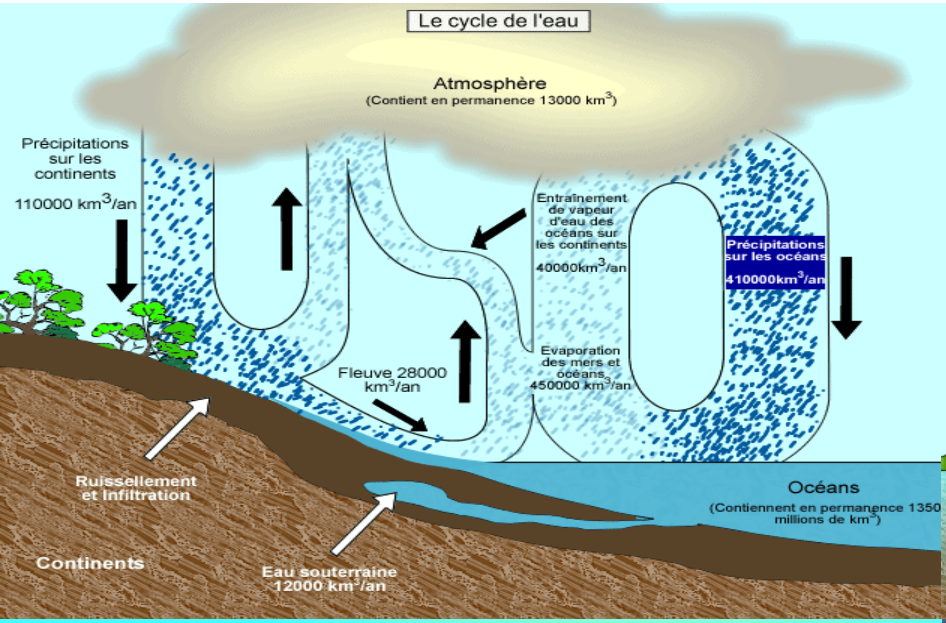
Source: Energy Information Administration 2004,

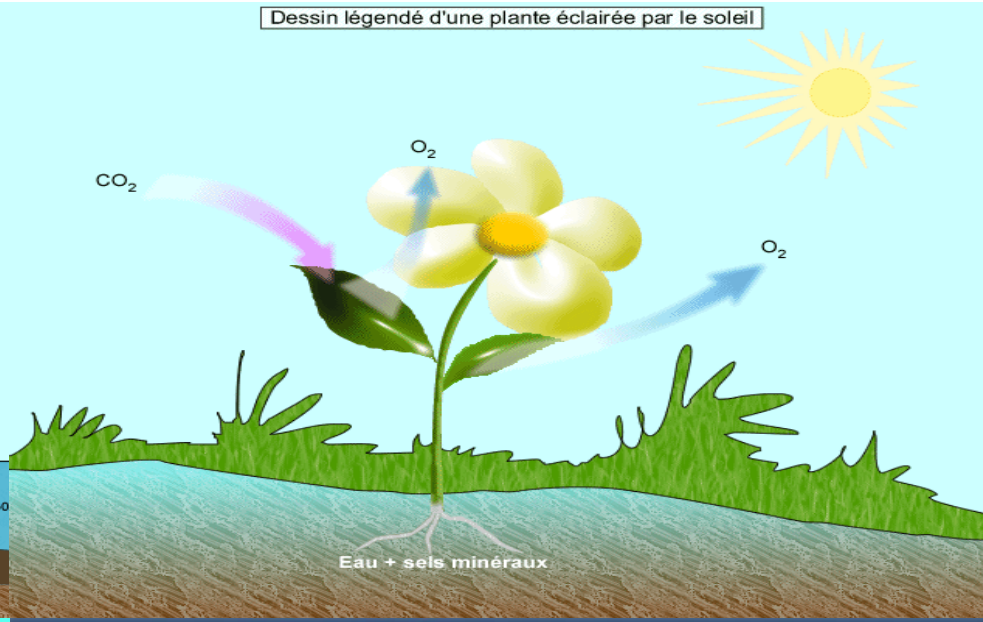
Annual Solar energy

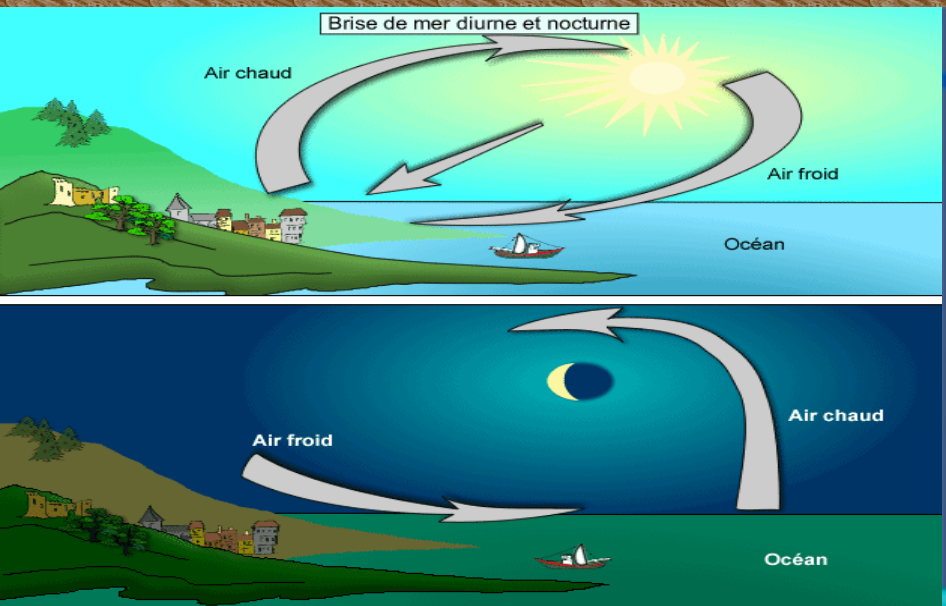


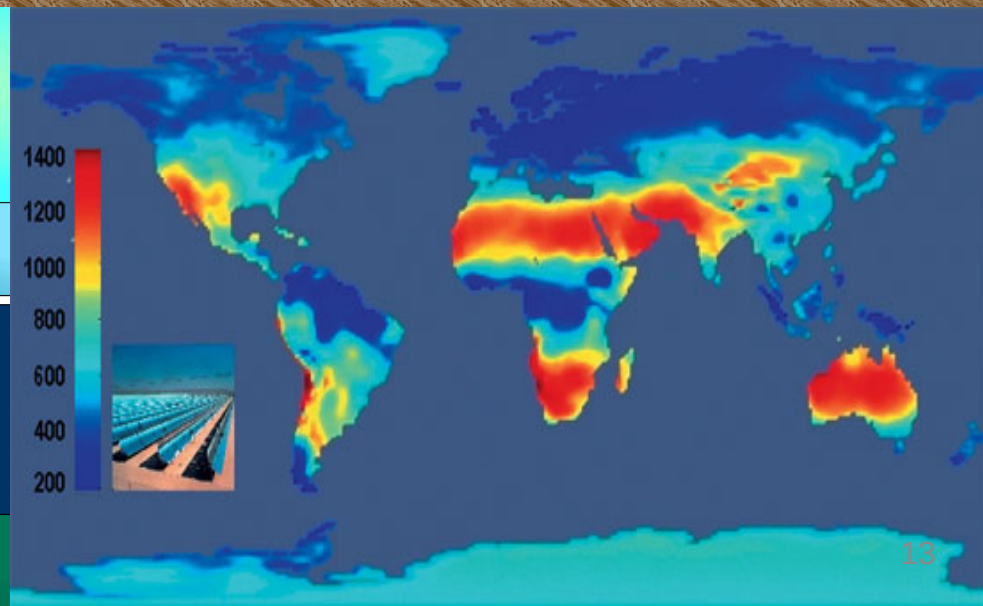
Sun Energy >>>

Hydropower & Biomass growth
Wind Energy & Solar thermodynamic

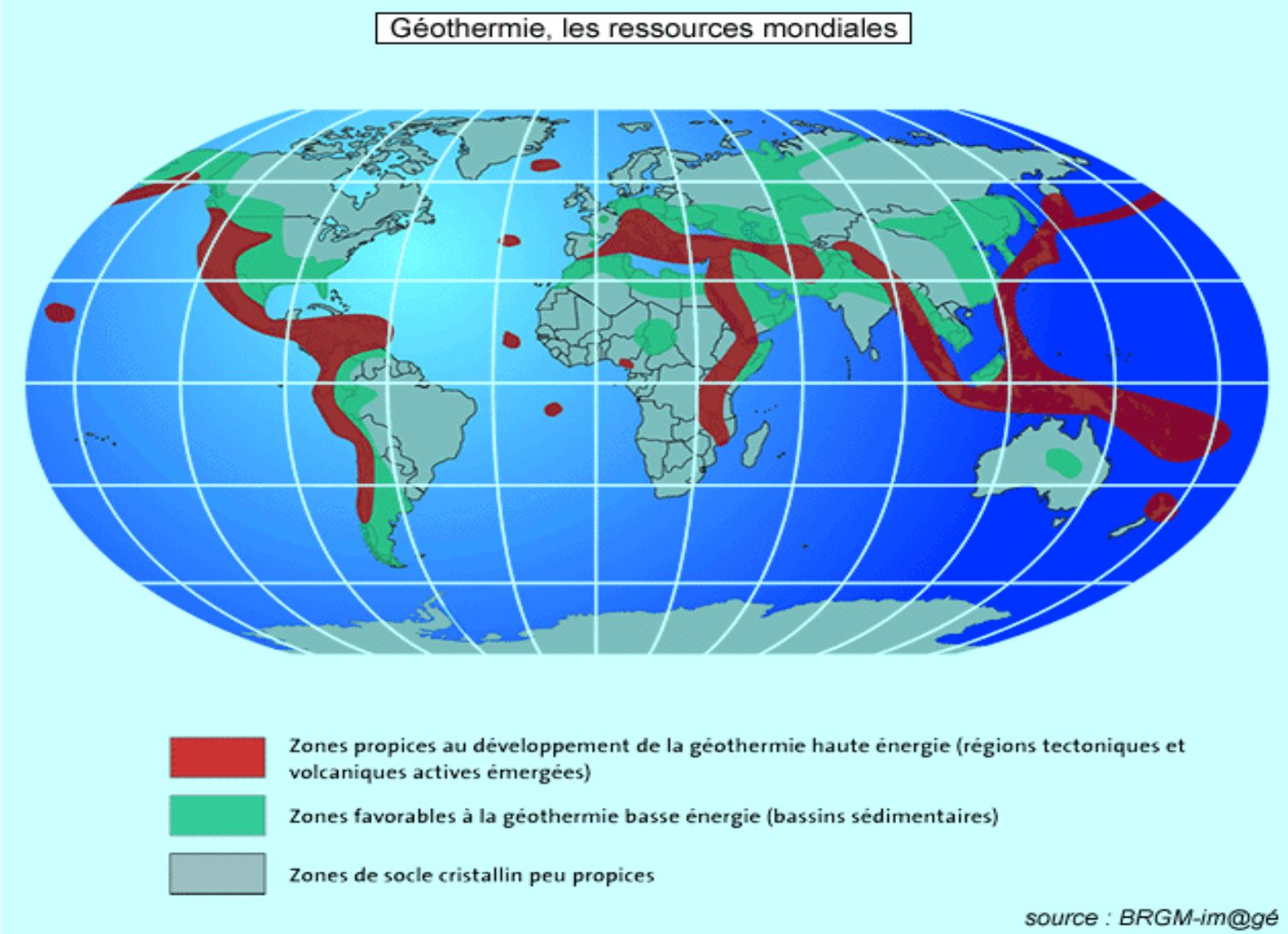




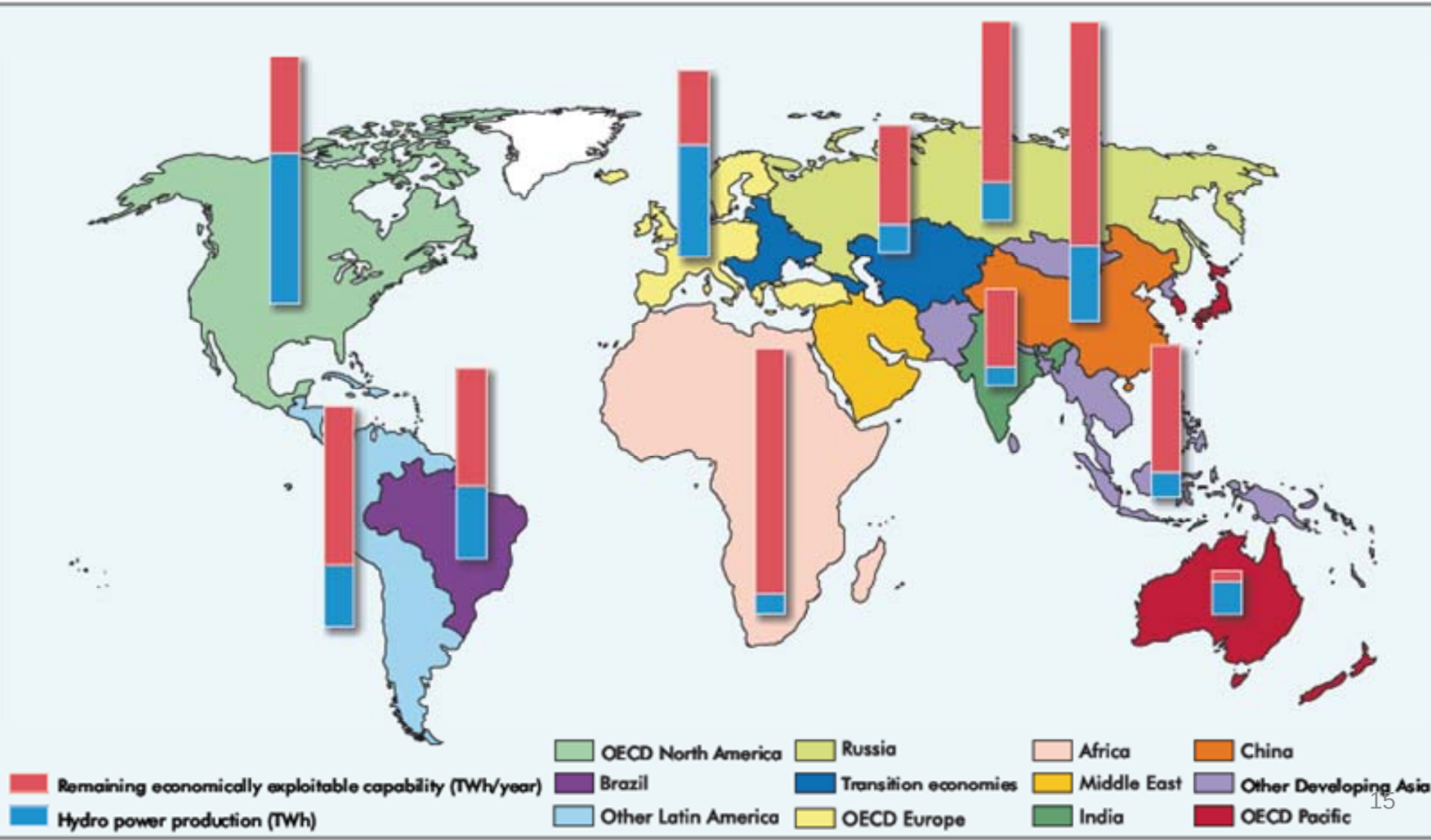




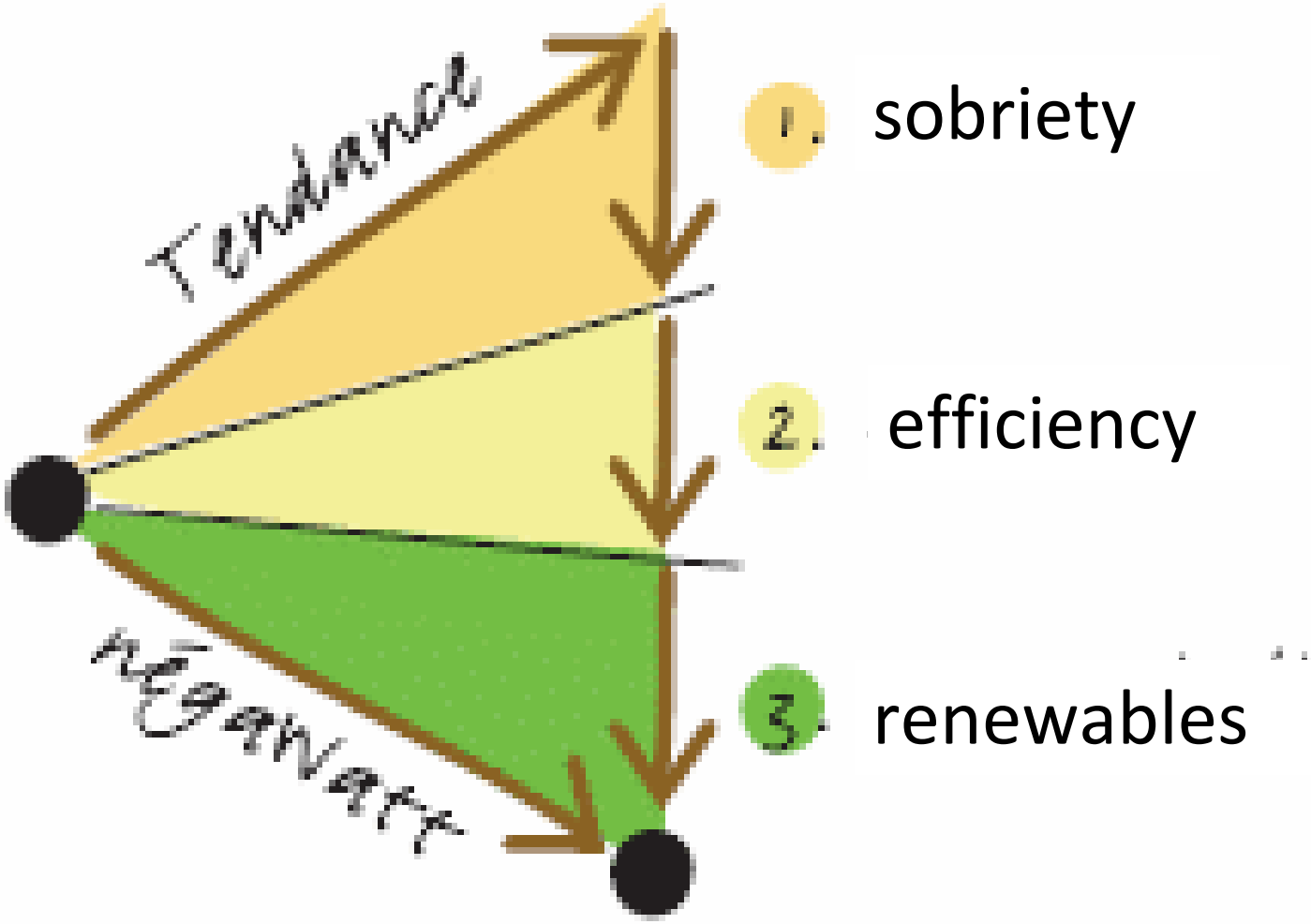
From Earth Core nuclear fission to Geothermal World Resources



World Hydro Potential



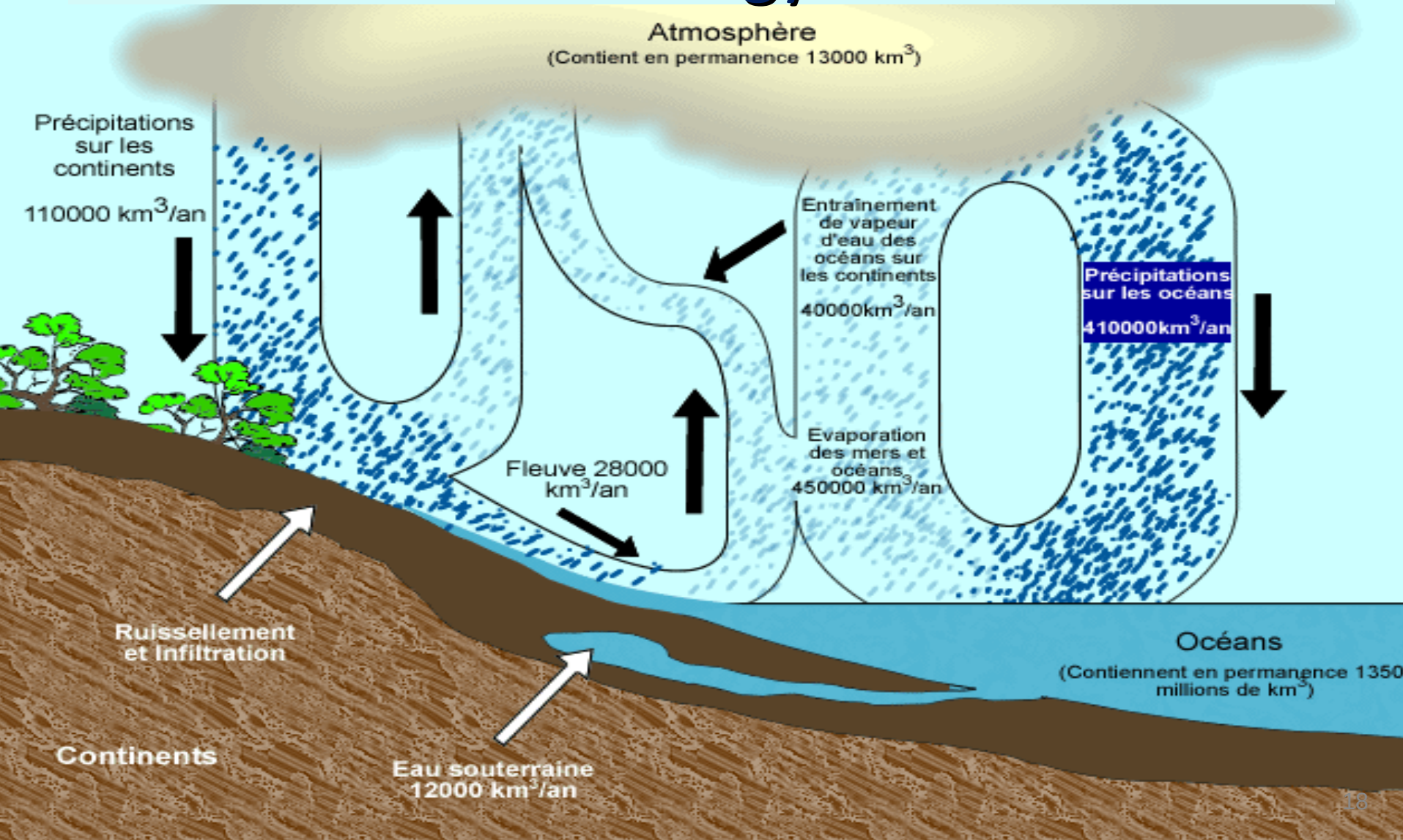
The negawatt scheme



Through other extracts from yesterday presentations

Let’s now have a look at Water
and
to the Water Energy Nexus

Water cycle is at the core of Water Energy Nexus



Hydro is key to Generate and Stock Energy

- Resource is the product of rainfall, catchments area, and vertical head
- A power resource that has evolved with technology for centuries
- Simple, well understood conversion of potential energy into mechanical and then electrical power

P = d * h* r*g*k

where **P** is power in watts, **d** is density 1000 kg/m3, **h** is height in meters, **r** is flow rate in m3/s, **g** is gravity of 9,8 m/s2 and **k** is a coefficient of efficiency

4 enjeux pour l'accès à l'eau dans le monde (Gérard Payen*)

1. **La gestion des ressources en eau**. On ne manque pas d'eau globalement, mais certains pays subissent de plus en plus souvent des pénuries, principalement à cause de l'augmentation des consommations.
2. **L'accès à l'eau potable**, pour les 4 milliards de personnes qui ne bénéficient pas de l'eau courante. Parmi eux, 3 milliards n'ont même pas accès à un robinet d'eau ! L'eau coûte dix fois plus cher pour les populations qui n'ont pas accès aux réseaux d'eau potable.
3. **la pollution transportée par les eaux usées**. En France et en Europe, nous avons fait beaucoup, mais dans certains pays en développement, la situation est critique.
4. **Les catastrophes liées à l'eau** : inondations, tsunamis... il faut gérer ces événements en anticipant.

* Gérard Payen est conseiller du secrétaire général de l'ONU pour l'accès à l'eau

EU and China Rivers & Water

Similar History – Similar challenges

- Rapid industrialisation
- Water pollution
- Trans-border issues
- Limited water resources and competitive use
- Impact of climate change: glaciers melting, floods and droughts

An Integrated River Basin Management is a must
& it's more than water resource utilization

As EU experience and its Water Framework Directive show

IWRM and its Challenges

- Integrated Water Resources Management (IWRM) has become a leading paradigm
- Defined by the Global Water Partnership (GWP)
  - "a process which promotes the coordinated development and management of water, land and related resources, in order to maximise the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems"

How is Water Traded Internationally?

- **Direct Trade**
  - **E.g. bottled, bulk water**
  - **Limited**

- **Indirect Trade**
  - **Trade in "virtual" or "embedded" water**
    - **Water required for production of each good/service (water content)**
    - **"Water footprints"**
    - **Much more significant than direct trade**

Dimensions of Virtual Water Trade
The Link to Agriculture

- Agriculture is the largest user of global water resources
- Approximately 1250m3 of water (blue water basis) used in agriculture is traded each year
  - One third of all water used in agriculture in a year
  - 15% of all water used on earth (including soil water)
- Wide variation in water content of agricultural products

Managing Conflicts and Promoting Synergies

- Increased competition between demands for water and need for society to respond to these pressures
  - Countries showing water stress or scarcity is expected to climb from 24 in 2001 to 50 in 2025 and 54 in 2050, with a total population of 4 bn living in these conditions
  - The combination of water pollution and scarcity - environmental degradation – an additional factor of concern in areas of continuing population growth
- Increased complexity in water management
  - A proliferation of new aims, constraints, and performance criteria
- Balancing trade-offs between
  - equity and efficiency, claims of the environment and future generations, cost recovery and basic needs
- Water is vitally affected by events and decisions outside the water sector
- Strong links between water and general socio-economic development

Utilize water energy guided by New Recycle Economics

Wu Jisong Dr. Prof.

Foreign member of Royal Swedish Academy of Engineering Sciences

Director-General of China Center of Recycle Economy Research,

Beijing University of Aeronautics and Astronautics

President of Beijing Association of Recycle Economy Development

Thank you

Let’s now proceed with your morning and afternoon presentations

The energy footprint in the water sector

- Energy use for production and distribution of water, and wastewater treatment
- Production of drinking water from freshwater resources - the energy footprint in the Pacific Islands
- Energy use in the Pacific Islands
- Water conflicts over urban use, agriculture, and ecosystem protection - California case
- Economies of energy and cost optimization: how to reduce energy consumption?

Round table discussion on the Energy Footprint

key points to be addressed

best practices to be retained.

Afternoon session

The water footprint in the energy sector:

water consumption for energy production and distribution

- Geothermal energy: Mighty River Power (NZ)
- Thermoelectric fuels: coal, oil, natural gas (NZ)
- Nuclear energy: the use of water for cooling
- The impact of energy production on water resources and potential conflicts over water uses (CN)
- Upstream control over water sources for securing water and electricity supply - Impact of hydroelectric dams and plants on downstream access to water (CN)
- Competing use of water for energy and/or irrigation – Chili

Round table discussion on the Water Footprint

key points to be addressed with a special focus on hydroelectricity.