



WATER & ENERGY

Viewpoint from an electric utility

COPENHAGEN – 28th May 2014

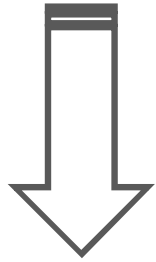
BELLET Laurent

EDF

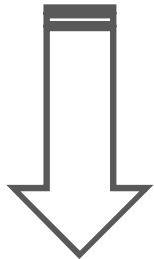
Water & Energy Advisor



EDF CR Commitment



**Preserving water
resources in all our
activities**



***Publication, starting
in 2015, of the water
footprint at Group
level***



EDF'S 3 COMMITMENTS TO THE 6TH WORLD WATER FORUM

1

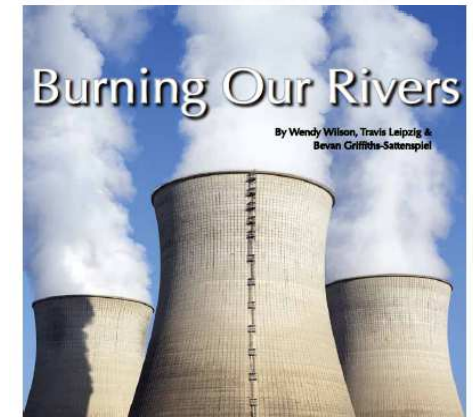
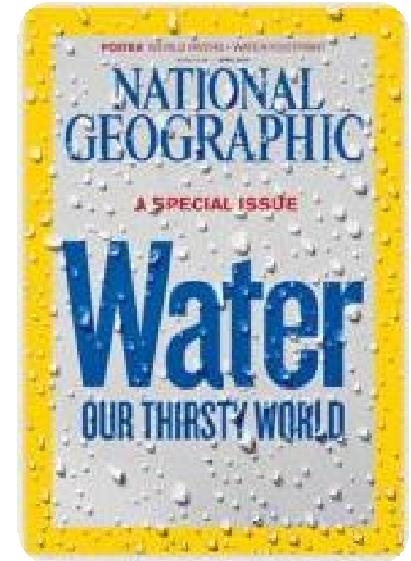
Invest the means necessary
to develop methods and tools
to evaluate the water footprint
of its electricity production
activities.

2

Manage the water footprint
of its electricity production
activities.

3

Create local value and
integrate reduction of our
water footprint from the
design phase of every new
electricity production project.

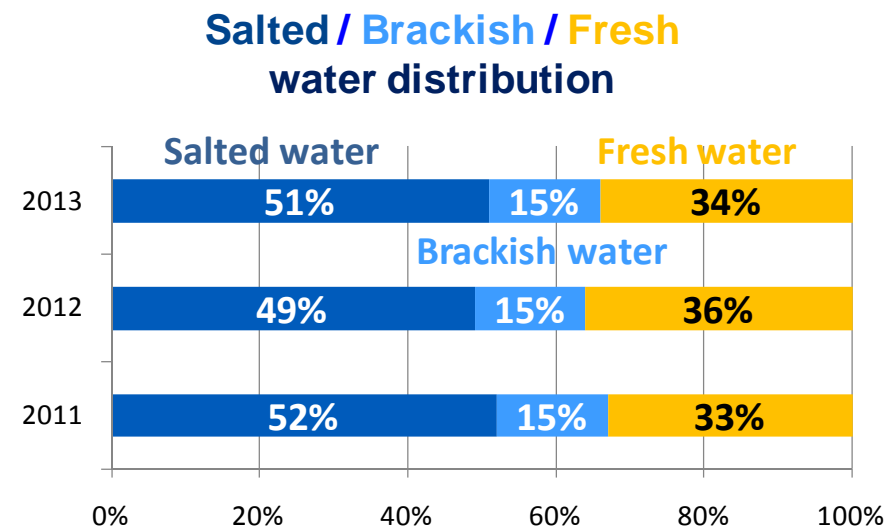
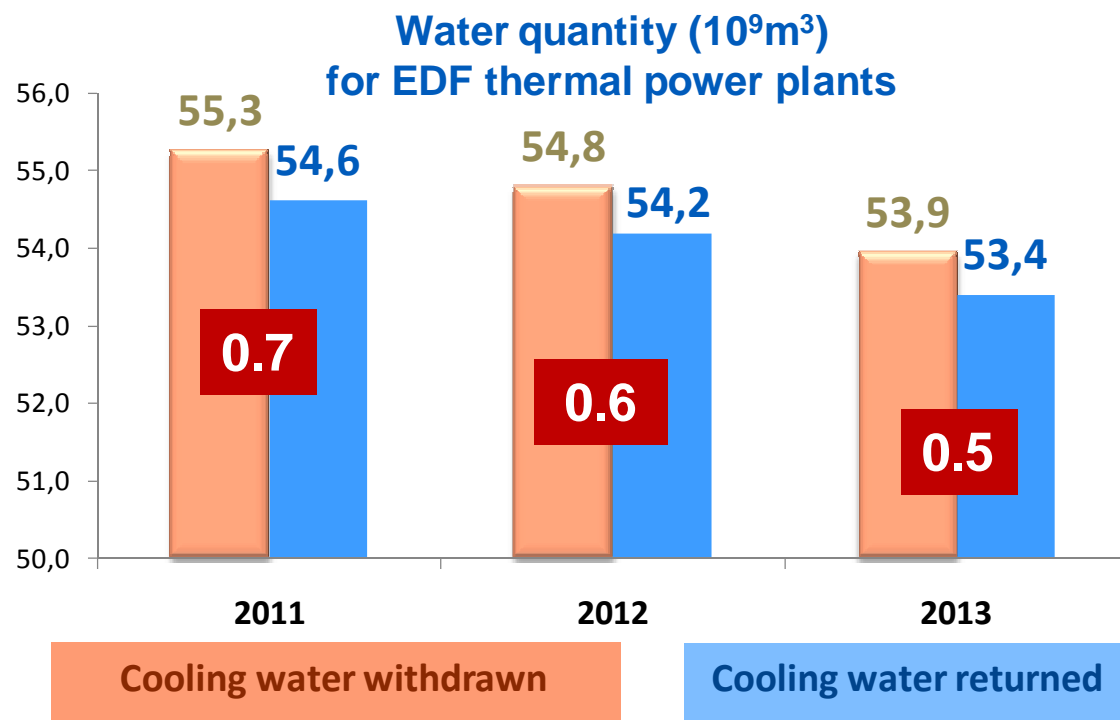


The Water Footprint of Electricity

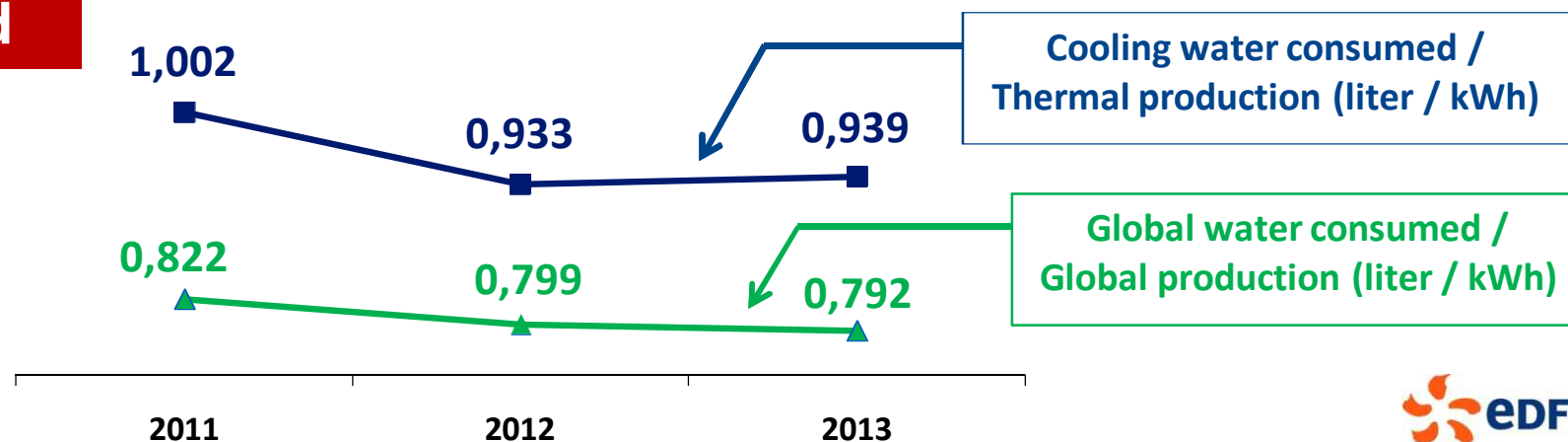
A River Network Report



EDF's WATER REPORTING for Thermal PP



Cooling water consumed



Water For Energy Framework – W4EF - Background

- **Starting point : WWF6 in Marseille (march 2012)**

- ➔ Consensus and willingness to develop the Framework with an objective of presenting the final results at the WWF7 in Daegu

- **Main ambition:** By 2015, Establish a conceptual and analytical Framework for evaluation and reporting of the energy impacts on water

- **Main actors:**

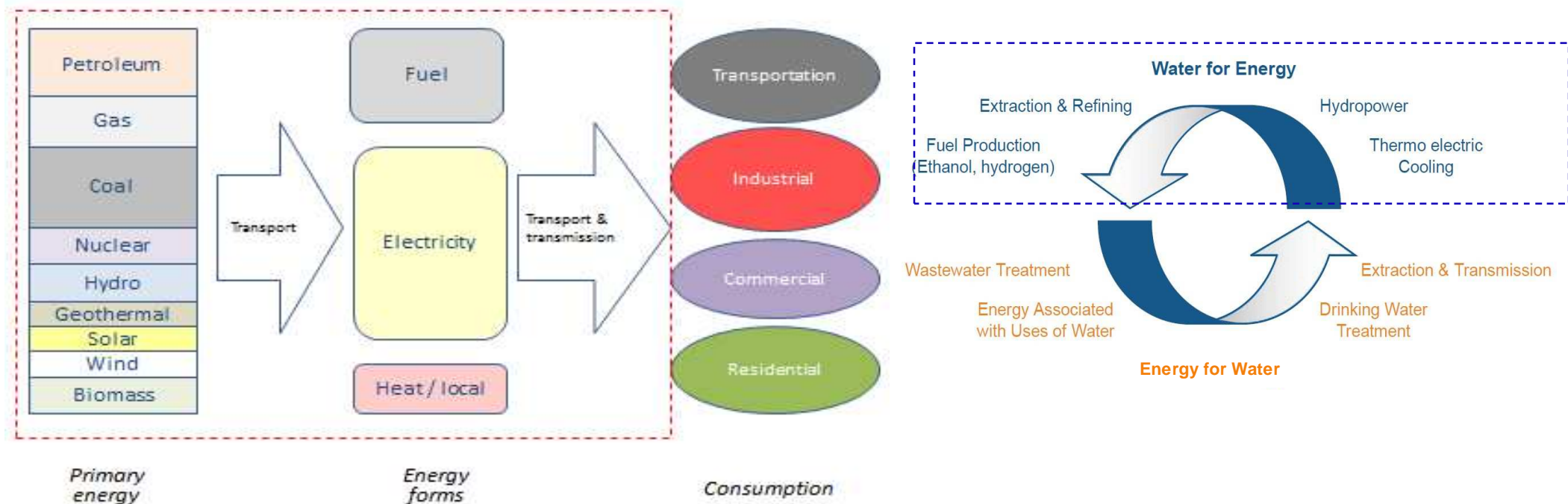


+ any interested stakeholders from all water and energy related backgrounds (more than 30 already involved)

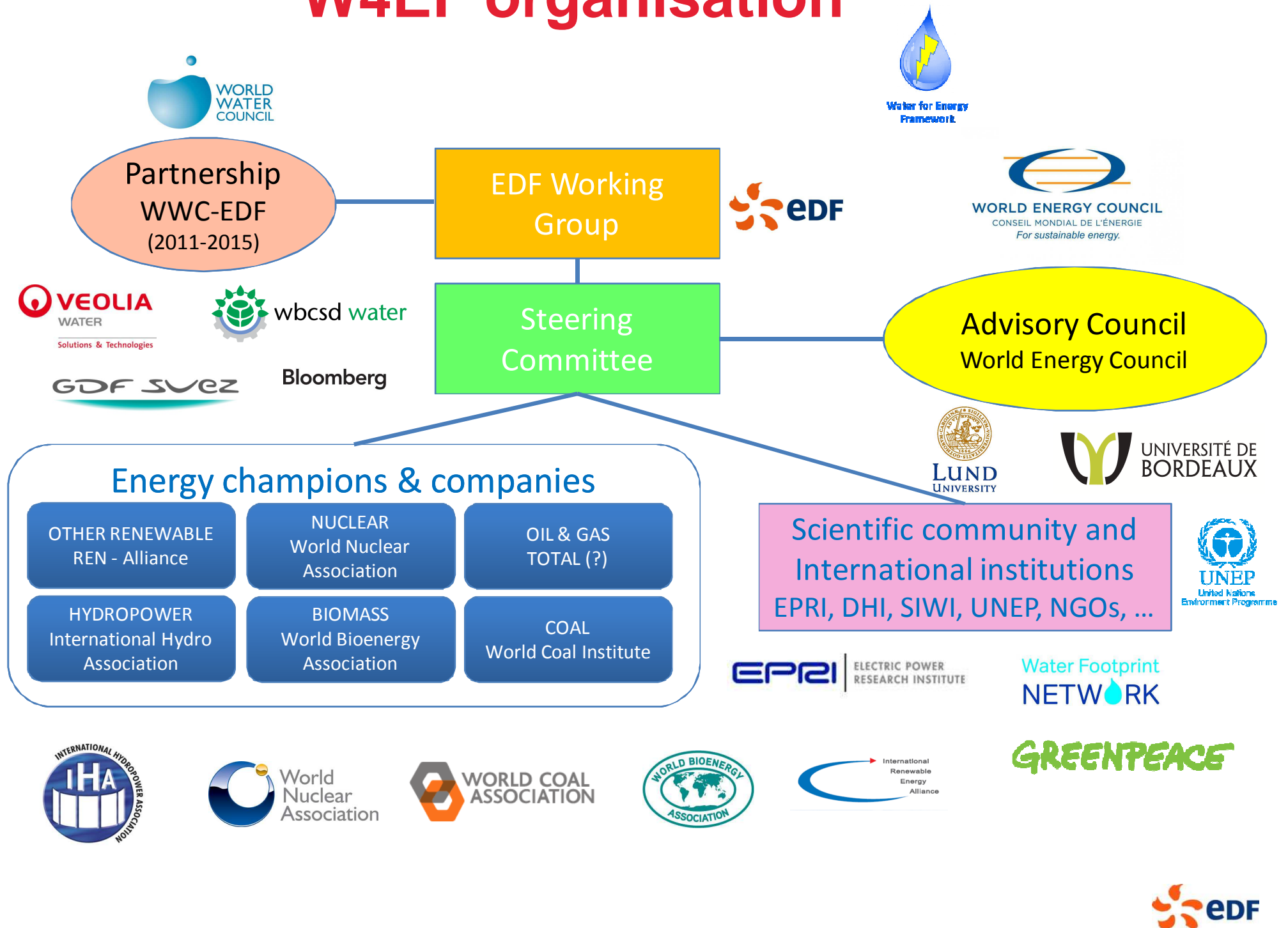
- **EIP :** The W4EF is an official Action Group of the European Innovation Partnership on Water. Connect and register to <http://www.eip-water.eu/> before joining the W4EF Action Group to have access to the latest news and documents.

Main principles

- ◆ Need for a common language and methodology : Use, Withdrawal, Evaporation, Consumption, Waterfootprint, ...
- ◆ To go beyond the ongoing simple volume methods of evaluating energy impacts on water
- ◆ To be comprehensive, practical, consistent, applicable across all energies sectors
- ◆ Including : Oil, Gas, Coal, Nuclear, Hydro, Solar, Wind, Biomass, Geothermal, ...
- ◆ Water for Energy : from source to service including production, conversion and transportation



W4EF organisation





WATER, ENERGY & FOOD LINKAGES

MULTIPURPOSE USE OF HYDRO RESERVOIRS

2 EXAMPLES :

- France : 1964**
- Lao PDR : 2010**

DURANCE VALLEY

2 seasonal reservoirs

Serre-Ponçon : 1200 hm³

Sainte Croix : 300 hm³

Watershed area : 11 700 km²

Average flow: 180 m³/s (min. 30 m³/s)

Flash flood: : 2700 to 6000 m³/s (1994/1882)

13 dams

21 power plants

2000 MW (peak)

6500 GWh/yr

250 km channel



Derivation towards Berre lake

SERRE-PONCON SCHEME

Typical Serre-Ponçon filling curve



DURANCE VALLEY

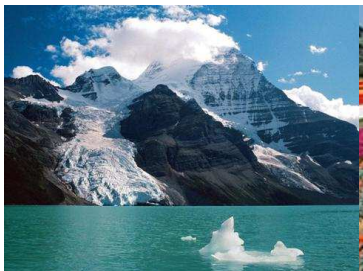
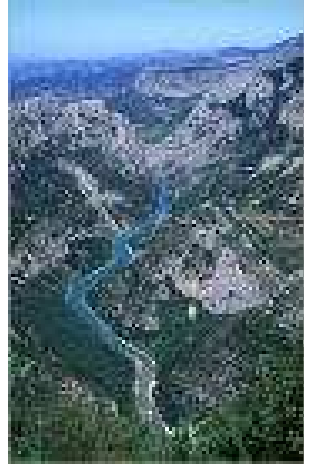
Multi-purpose project

- Hydropower
- Irrigation : total annual withdrawal of about 1800 Mm³ – 150 000 ha of irrigated lands
- Drinking Water
- Nowadays, 150 to 200 M€ annual turnover from Tourism

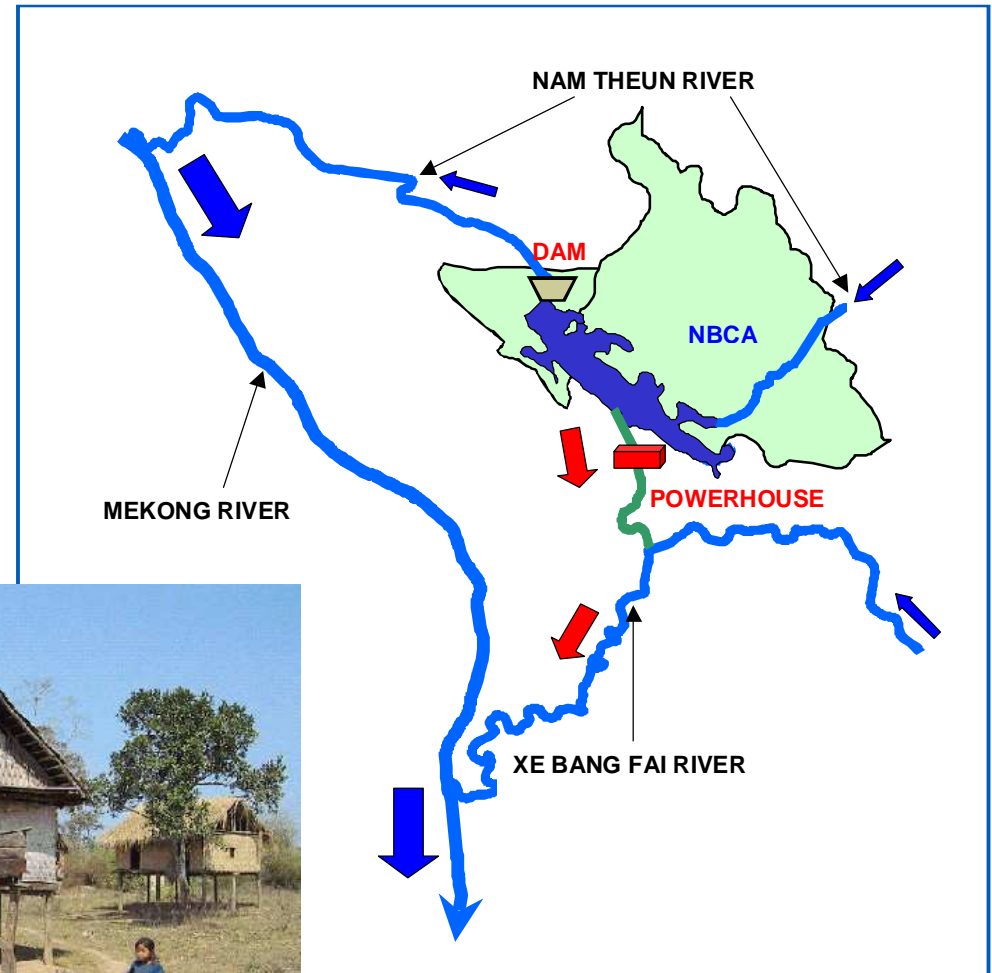
Water Saving Convention : between EDF and 2 main irrigators / 6-yrs period

- 2000: first Convention – Water saving target : **90 Mm³** -> remuneration by EDF for the saved water with incentives to outreach the targets
- Agricultural water consumption decreased from **310Mm³ in 1997 to 201Mm³ in 2006**
- Economic Study : **better use of water in time** from an agriculture purpose to an energy purpose (peak periods of electricity demand) is the key driver, **not the volume saved**

A third winner : Environment (e-flow s) -> 84% of the saved water is not turbiné



Nam Theun 2 – LAOS



NT2 - RATIONALE

► ORIGINE

- Protocol Laos / Thailand for electricity supply (3000 MW and 5000MW)

► DEVELOPMENT

- EDF (consortium leader) under BOOT (Build, Own, Operate, Transfer).

► 1070 MW Trans-basin project (350 m head)

- Multi-purpose: energy, irrigation, drinking water
- Dam: 39 m high / 350 m long
- Reservoir: 3.5 billion m³ / 450km² / 100 km long
- Construction : 15/06/2005 to 15/12/2009
- Operation: 16/12/2009 to 16/12/2034

► 2 Purchasers

- EGAT with 995 MW (5350 GWh/year)
- EDL with 75 MW (200 to 300 GWh/year)

► Sustainable Development

- World Bank showcase for future hydro development worldwide
- 180 MUSD for Environmental & Social costs (13% of the USD 1.4 billion total costs)



NT2 BENEFITS SHARING

► SUSTAINABLE & RENEWABLE ENERGY GENERATION

- 1075 MW of competitively stable priced power (4.2 US cents/kWh - no fuel adjustment mechanism)
- Revenues to GOL : USD 2 billion (over 25 years), USD 240 million yearly after 25 years. GDP increase by 3.2 % over the concession period.
- Avoided CO2 emissions: between 300 and 500 million tons (over 100 years)

► LAND & WATER USE

- Clean drinking water, Flood control, Irrigation facilities
- Resettlement : 3 plots of land per family (1200): 0.6ha:rice + 3ha :agriculture + 5ha : livestock
- Fishing and boating activities in the new reservoir
- Village Forestry Association

► BIODIVERSITY

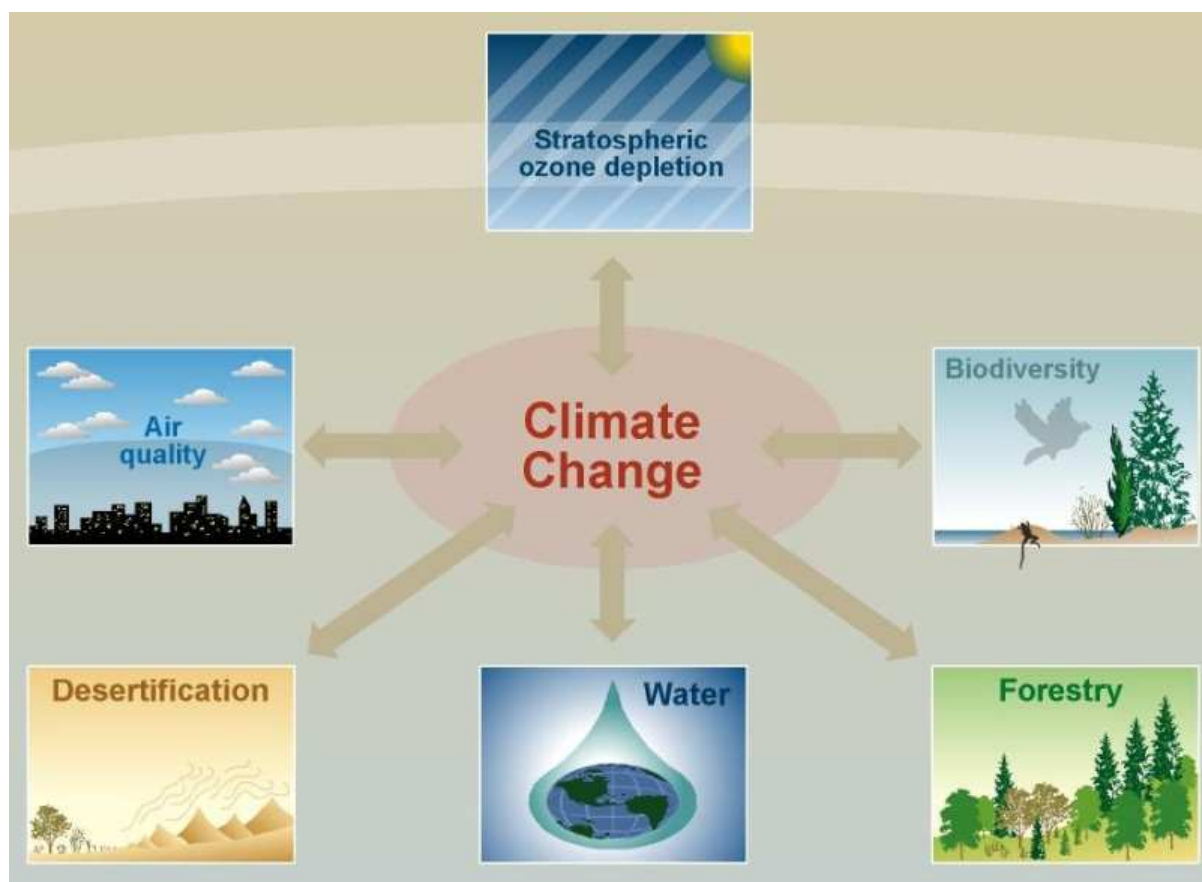
- Project funded a 4,000 km² National Biodiversity Conservation Area: USD 1 million/year (30 yrs).
- Programs: Elephant, Wetland, Wildlife, Turtle, Education, ...

► INFRASTRUCTURE DEVELOPMENT

- Road, Houses, Schools, Hospital, Buildings, ...



WATER, ENERGY and CLIMATE CHANGE



EDF and Climate Change

➤ **MITIGATION : LOW CARBON EMITTER**

- Cut by 2 carbon emissions in France from 1990 to 2012
- 96% carbon-free generation in France (85% worldwide)

➤ **ADAPTATION : STRATEGY for EDF Group – 2010**

- Adapting existing facilities bound to stay in the landscape for a long time
- Boosting our resilience to extreme climate events
- Mainstreaming the expected consequences of climate change into our design of future assets and facilities
- Activating the right R&D to address the right topics and gaining access to relevant and sufficient information

➤ **RESISTANCE and RESILIENCE**

- capacity of our installations to resist to climate hazards (aerial lines replaced by underground lines, increasing dike elevation for flood protection, ...)
- capacity of our operational teams to face extraordinary events (creation of the Intervention Force on electricity networks, wind farms which can be lied on the ground in case of cyclonic events, ...)



2003 Heat wave in France



■ Stress on water resources

↪ An increasing pressure to “share” our resources

■ Very high temperature of the air

↪ An increasing demand for cooling (not only AC)

■ Very high temperature of water ($>28^{\circ}\text{C}$)

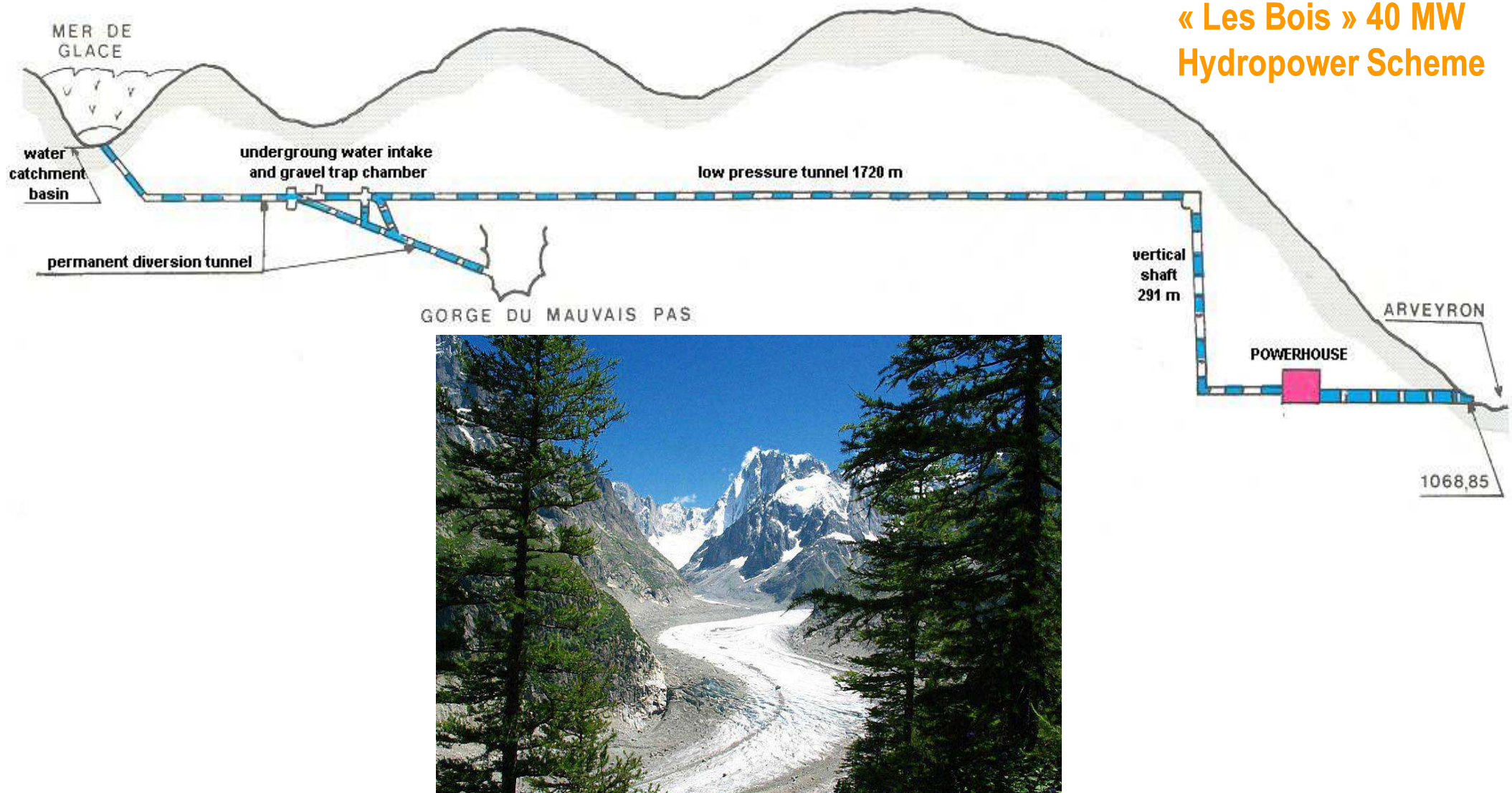
↪ limiting thermal production due to regulatory constraints

■ A global cost estimated at 300 millions Euros for 3 weeks



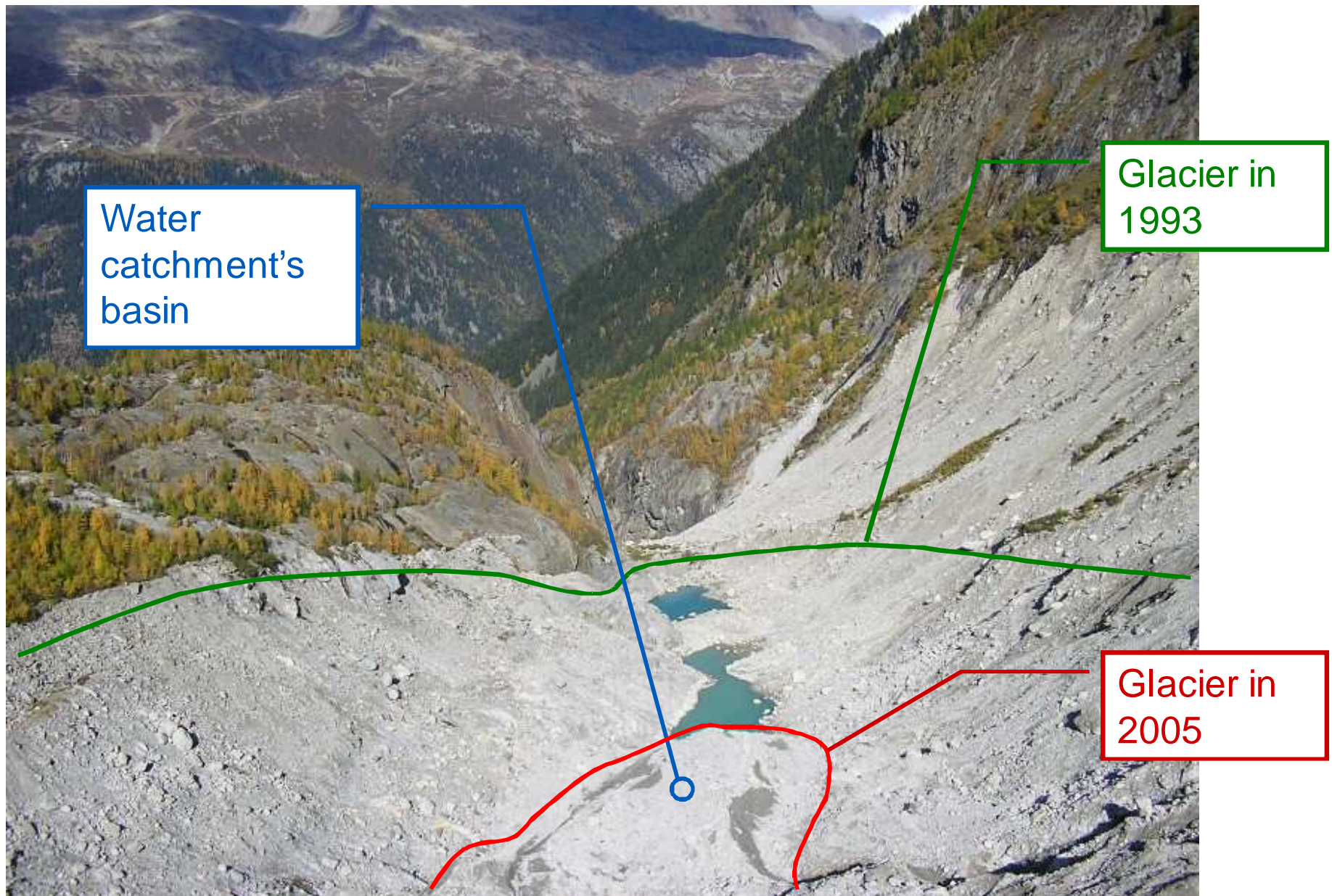
ADAPTATION TO CLIMATE CHANGE

« Les Bois » 40 MW Hydropower Scheme



Redesign of the sub-glacial water intake (*Mer de Glace*) related to the accelerated glacier retreat

Evolution of the glacier



Evolution of the glacier

