A new golden era for dams?

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In 10 minutes, we will try to show that…

The demand for new reservoirs will be strong in the near future

But not always for classical dams' reservoirs

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New reservoirs?

*there are external trends that are **drivers***

*reservoirs offer **services** that may be triggered by these trends*

From external trends to new reservoirs: we developed a methodology

1/ How strong is the trend?

2/ To which extent does the trend call for a specific service?

3/ How vital is this service?

4/ Are there alternatives to reservoir to provide this service?

TRENDS (case of Southern Europe)

Increase in population	Increase in Electricity demand (per capita)	Urbanization	Need for Climate Change mitigation	Need for Climate Change adaptation
0	1	1	2	2

« In Southern Europe, there is a ~~no~~ / ~~a~~ / a strong trend towards more CC mitigation measures »

SERVICES IMPORTANCE, UNIQUENESS

« In Southern Europe, mitigating floods is ~~useful~~ / important / ~~vital~~ to maintain lifestyle »

	Producing REN	Storing Electricity (and services to the grid)	Regulating Water resources	Relieving droughts	Mitigating floods	Supporting freshwater biodiversity	Lakes as recreational areas
How vital is the service (to maintain lifestyle)	+++	+++	+++	+++	++	++	++
Are reservoirs the unique solution?	+	+++	+++	+++	++	++	+++

do TRENDS call for the SERVICES?

	Increase in population	Increase in Electricity demand	Urbanization	Need for Climate Change mitigation	Need for Climate Change adaptation
Producing REN	2	2	0	2	0
Storing electricity	2	2	0	2	0
Regulating water resources	2	0	0	0	2
Relieving droughts	2	0	0	0	2
Mitigating floods	2	0	2	0	1
Supporting freshwater biodiversity	2	1	0	0	2
Lakes as recreational areas	1	0	1	0	0

« Meeting the Increase in Electricity demand might require Supporting freshwater biodiversity »

« Meeting the need for CC Change modification requires Storing electricity »

And the matrix is …

	NW Europe	S Europe	N Africa	Sahelian Africa	W Africa
(typically	N France, Switzerland, Germany, UK)	S France, Italy, Spain, Balkans, greece)	Algeria, Tunisia, Egypt)	Mali, Niger, Burkina)	Cameroon, Gaboon, DRC)
Producing REN	0	18	10	24	48
Storing electricity	48	54	90	72	72
Regulating water resources	4	36	72	72	24
Relieving droughts	24	36	72	72	18
Mitigating floods	8	20	48	48	22
Supporting freshwater biodiversity	18	20	10	10	8
Lakes as recreational areas	3	6	0	0	0

The higher the score, the higher the need to built new reservoirs

There are needs in every region (score above 15)

The services to be provided differ across the regions. There is a always multipurpose component

This exercise is somewhat arbitrary, both in the definition of geographical areas and in the attribution of scores. However, the results allow to draw different conclusions.

Reservoirs : unique solution for GWh electricity storage, water resources regulation & drought relief. This is the priority!

Trends & Services differ a lot across the regions => future reservoirs will also differ a lot.

Multiple services are required. Multipurpose or combined reservoirs are a solution.

Biodiversity will be a stronger trend tomorrow.

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New reservoirs: economical approaches *to calibrate the design and the water allocation*

Benefits = **B$** + ***B$*** + ~~**B$**~~

Monetised benefits + Electricity production, Water for irrigation, Flood direct costs

Monetisable benefits + Power storage, Drought relief, Floods indirect costs

Non monetisable benefits « Life insurance » for extreme conditions, long term beneficial impacts incl. biodiversity

Costs = **C$** + ***C$*** + ~~**C$**~~

Monetised costs + CAPEX, Land acquisition, O&M, Env & Soc action plans, Resettlement

Monetisable costs+ Indirect costs of : loss of land & livelihood of affected communities

Non monetisable costs Long term detrimental impacts incl. biodiversity

New reservoirs: economical approaches to calibrate the design and the water allocation

$$\frac{C}{B} = \frac{C\$ + C\$ + \cancel{C\$}}{B\$ + B\$ + \cancel{B\$}} = \frac{C\$ + C\$}{B\$ + B\$ + \cancel{B\$}} + \frac{\cancel{C\$}}{B\$ + B\$ + \cancel{B\$}}$$

1- Checking the Sustainability.

Sociological and Environmental non quantifiable (~~B$~~ & ~~C$~~) issues might dominate and shall be considered with care and fairness

2- Optimizing the services

By enhancing total benefits (**B$ +** *B$*) to get the best ratio.
A quantified approach is possible (if ~~B$~~ is neglected)

Sustainability: do Soc. & Env. Costs overcome the total Benefits?

$$\frac{C\$}{B\$ + B\$ + B\$}$$

Never simple. Never objective. Every region is unique, every project is unique.
C$ *cannot be "measured"*

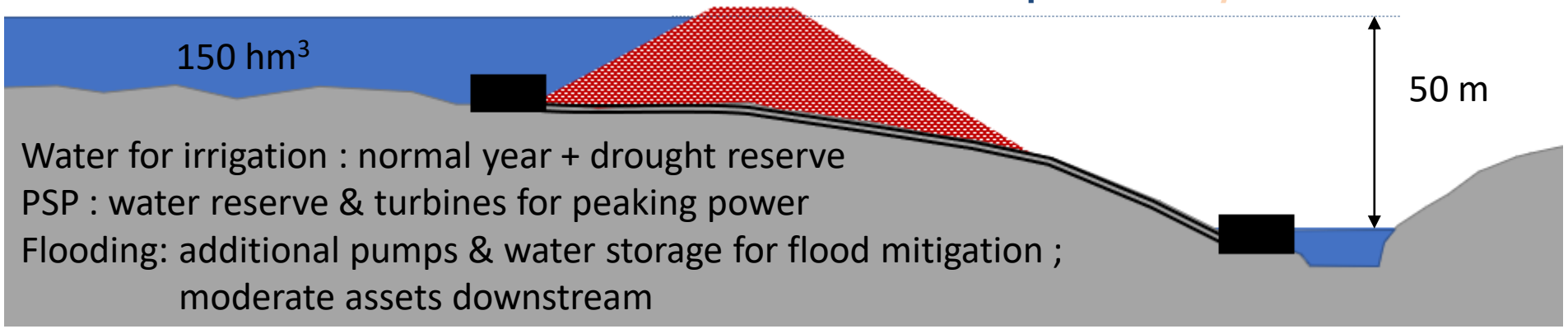
Yet ***C$*** *is directly linked to (1) reservoir surface + (2) river obstruction + (3) water abstraction. It might be strongly reduced, for instance :*

- *Combining solar & hydro*
- *Placing the reservoir off the river*
- *Optimizing every drop of water through new technologies*

Optimization: B$ and C$ can strongly tilt the balance

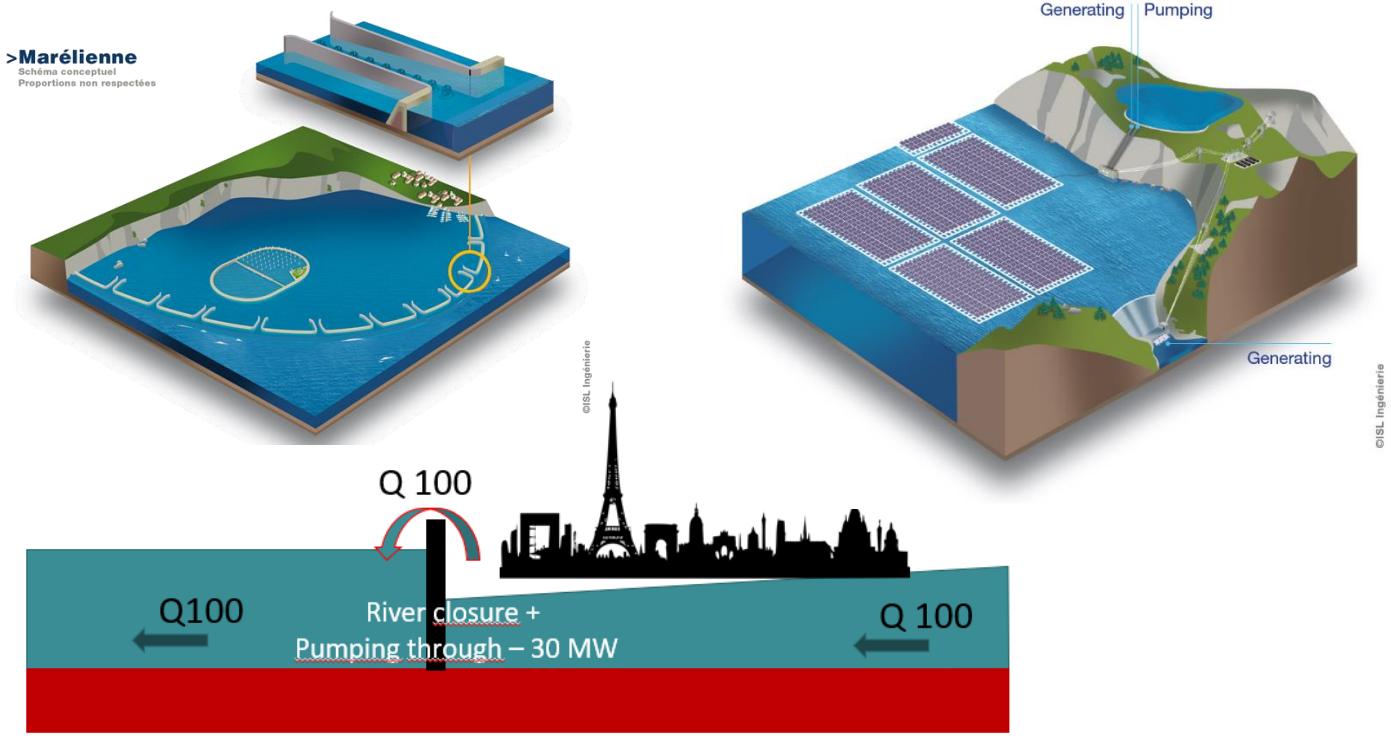
$$\frac{C\$ + C\$}{B\$ + B\$}$$

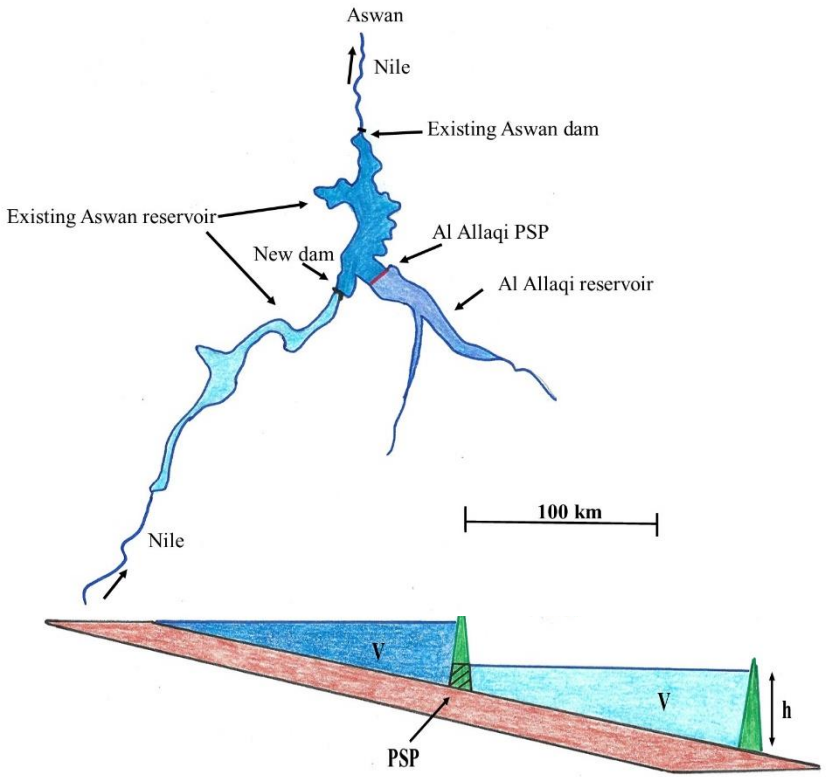
A TYPICAL EXAMPLE …
very different from one project to another



Benefit / Cost ratio	B$ and C$ only	including B$ and C$
Water for irrigation	B/C = 1.22	0.93
… + drought reserve	B/C = 0.98	1.77
……+ PSP	B/C = 1.01	2.12
……+ flood mitigation	B/C = 0.89	2.20

Future reservoirs could (should!) often be different from the past. This requires … imagination & innovation!





But Imagination & innovation will not be enough.

Sustainable solutions require also:

> Incorporating non-monetizable costs & benefits. Difficult, but essential.

> Lower discount rates. DR are a political issue, DR above 4% often discourage long term sustainable development and lead to inappropriate projects.