Management of water stocks for sustainability, safety and resource protection in the energy transition

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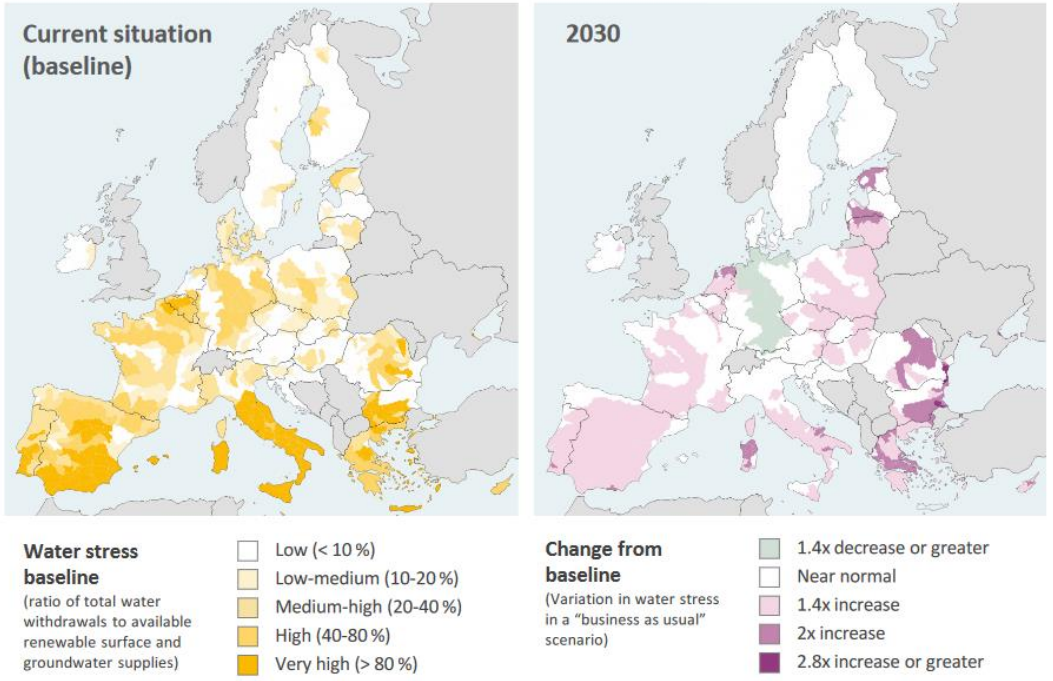
Focus on continental Italy

Po basin under the Alpine arc

Figure 1 – Water stress in the EU and future projections



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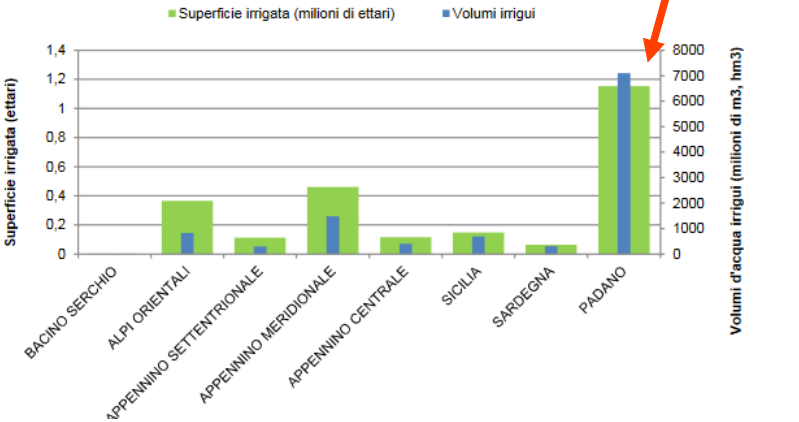
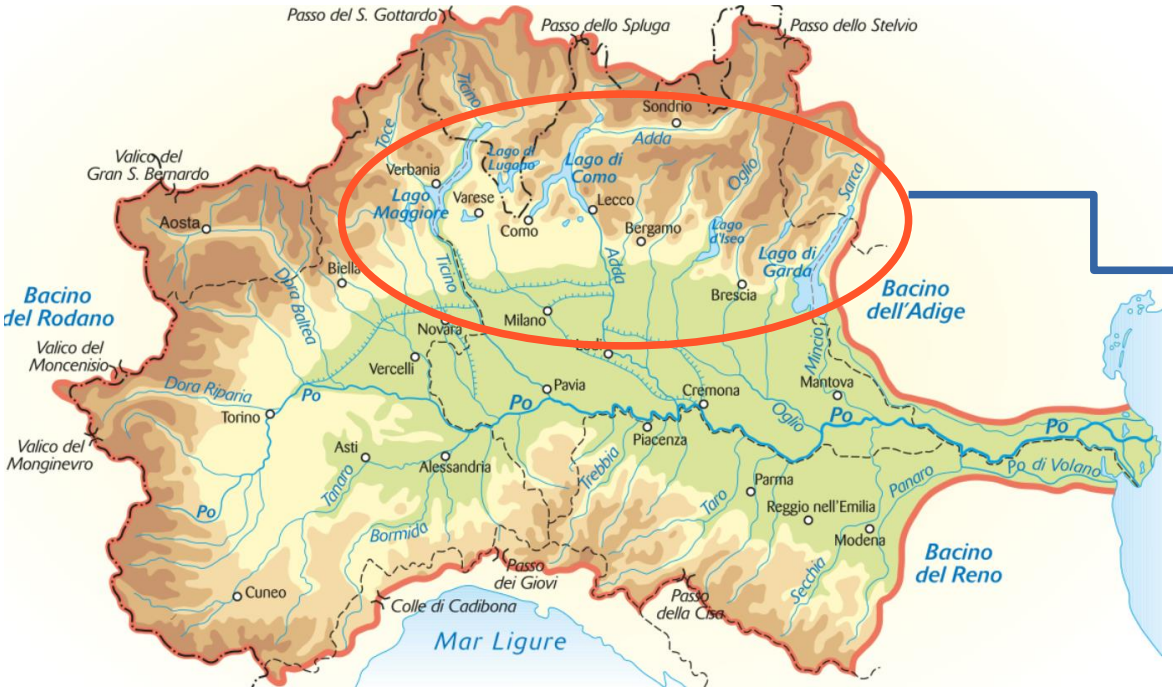
48% irrigated area, 68% agricultural water consumption



Water stocks: the Central Alpine water tower

What we need is more reservoirs?



hydroelectric reservoirs: ~ 1 Gm³

Pre-Alpine, regulated lakes: ~ 1,2 Gm³

-It is very **difficult** to significantly increase these huge storage volumes,

-it is very **easy** to lose capacity (sediment accumulation, dam safety issues, etc.)

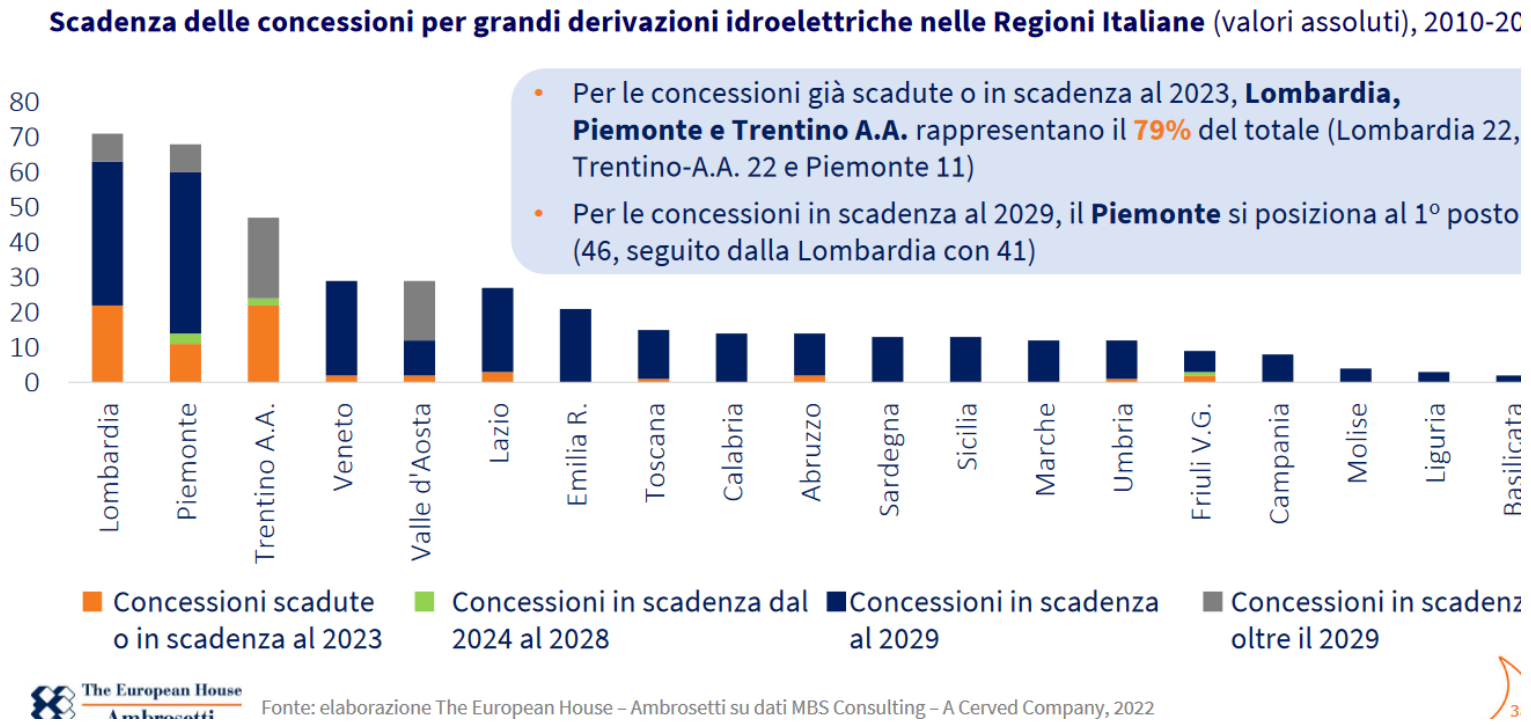
priority of investments is maintenance, safety, infrastructure renovation, optimization and technological upgrading

Age of the dams of North-Western Italy: is it a safety and reliability issue?

Number of large dams in Italian regions (source: Ministero Infrastrutture e Trasporti)

Region	Number 'large dams'	Total basin Volume (M mc)	Avg. age (years)
Lombardia	77	4036	81
Piemonte	59	374	82
Sardegna	59	2505	59
Toscana	50	321	68
Sicilia	46	1105	52
Trentino Alto-Adige	37	648	68
Emilia-Romagna	24	159	79
Calabria	21	484	52
Lazio	21	521	77
Veneto	18	238	75
Campania	17	293	55
Marche	16	119	63
Abruzzo	14	370	67
Basilicata	14	910	50
Liguria	13	61	92
Friuli V-G	12	191	71
Umbria	9	429	61
Puglia	9	541	41
Valle d'Aosta	8	142	84
Molise	7	203	37
Total Italy	**531**	13650	68

The issue of non-renewal of hydroelectric concessions: how can operators develop and implement investment projects on the dam and derivation system, in the absence of reasonable time horizons for the pay off?



Fonte: elaborazione The European House – Ambrosetti su dati MBS Consulting – A Cerved Company, 2022

Water stocks: the Alpine central water tower

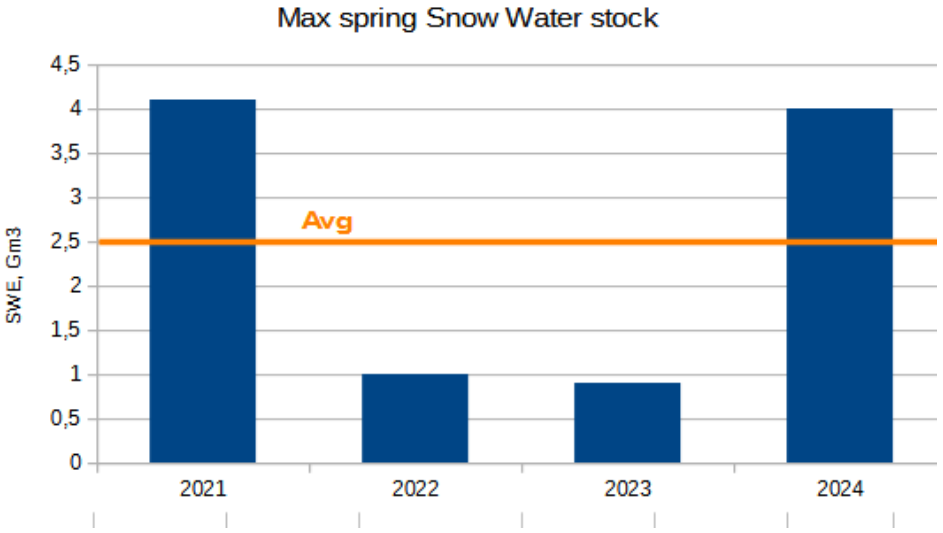
What we need is more reservoirs?

Hydroelectric reservoirs: ~ 1 Gm^3

Pre-Alpine, regulated lakes: ~ 1,2 Gm^3

Snow accumulation:
Seasonal reservoir, up to*
4 Gm^3
April – July (!)

The Snow Water stock



The more relevant water reservoir in Central Alps is the snow, providing some 2.5 Gm^3/y water in late spring/early summer

Dams are crucial to modulate the flow and extend the water flow period in summer

Critical issues:

- global warming is **anticipating the thaw season** (first half of June)

- the increase in frequency and intensity of extreme events affects the **seasonal snow accumulation**

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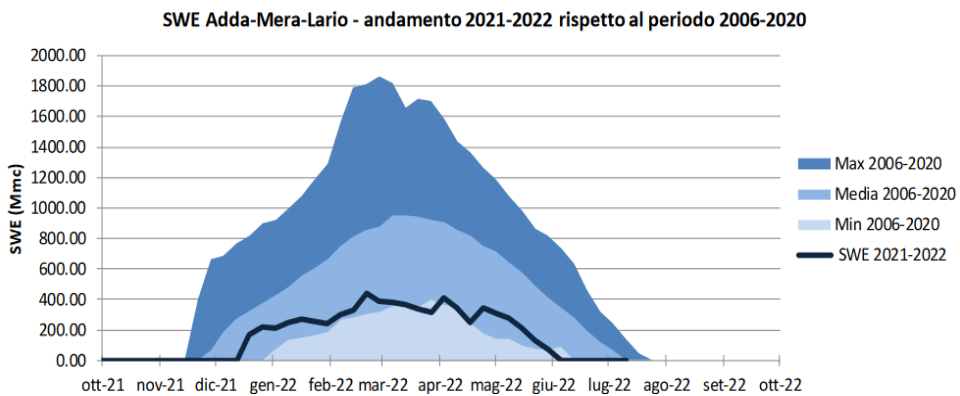
LATE SUMMER IRRIGATION NOT GUARANTEED



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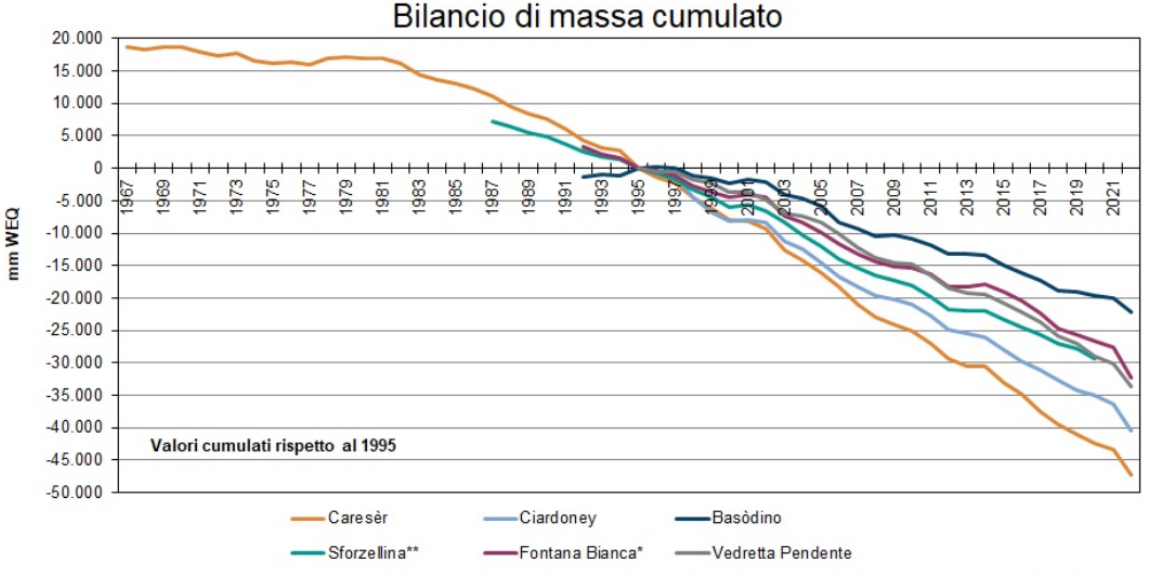
Glaciers melting:
Water reserve available in late summer
EXTINCTION IN PROGRESS

The inexorable disappearance of the Alpine glacial masses will deprive the surrounding plains of the late summer supply of water from glacial melting.



Addressing water scarcity by managing its abundance

In the climatic trends observed so far, what changes *structurally* is not the volume of meteoric contributions but

↓ The net balance (the temperature rise leads to greater summer evapotranspiration)

↓ The seasonal (late-summer) availability (thinning of glacial reserves, advance of the melting of mountain snows)

Possible adaptive responses:

- Better management of summer crops (maize): early varieties, cover crops, rotations
- Replacement of maize with less water-demanding forage crops
- Diversification of crop and production systems, mitigating excessive livestock specialization
- Change of irrigation systems, can be helpful but it is not necessarily the most effective response in agroecological and economic terms

Winter recharge of the aquifer as a slow-release water reserve

Winter flooding (water meadows, flooded meadows, rice paddies) and, in some cases, even surface irrigation, is not a waste of water, but an agro-ecosystem benefit

The winter waters, otherwise unused, if channelled onto the fields allow the aquifer to be balanced: it is the largest water reservoir of the alluvial plain.

Thanks for your attention

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