

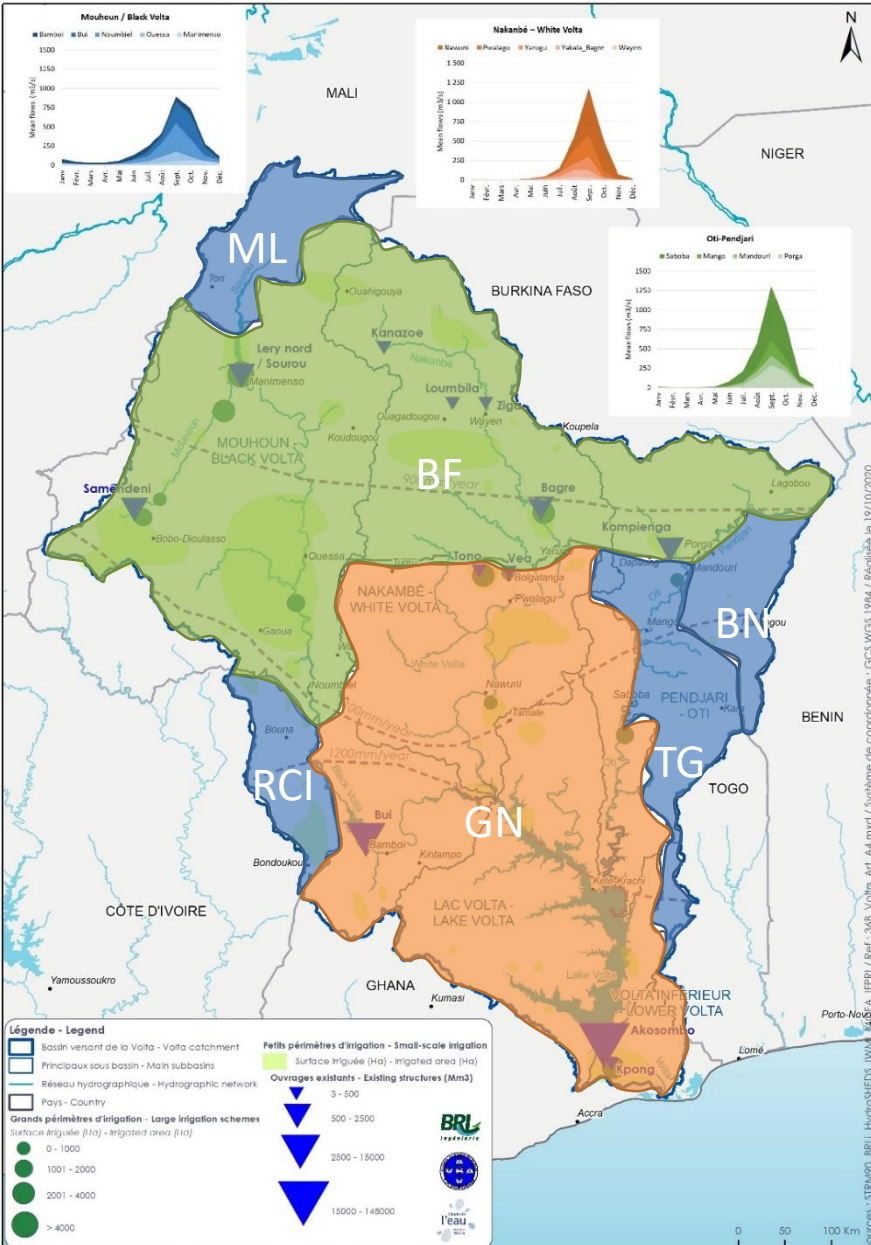
*Hydroelectric production in Akosombo, and the development of irrigated agriculture upstream, a fair balance to be found to reconcile regional energy and food security.*

**Clément Balique, BRLi**

**Sébastien Chazot, BRLi**

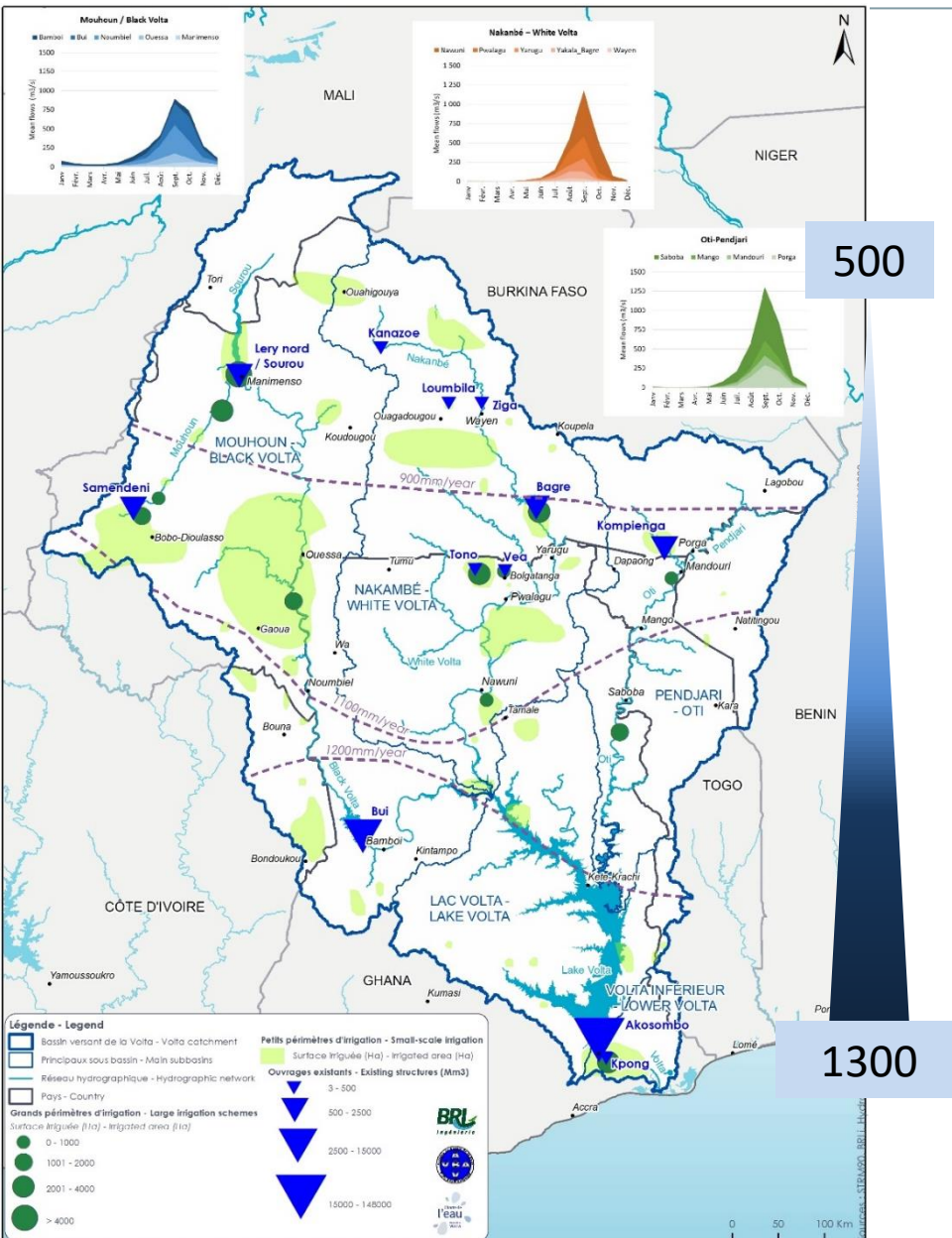






*The Volta River Basin: a transboundary river basin shared by 6 countries;*

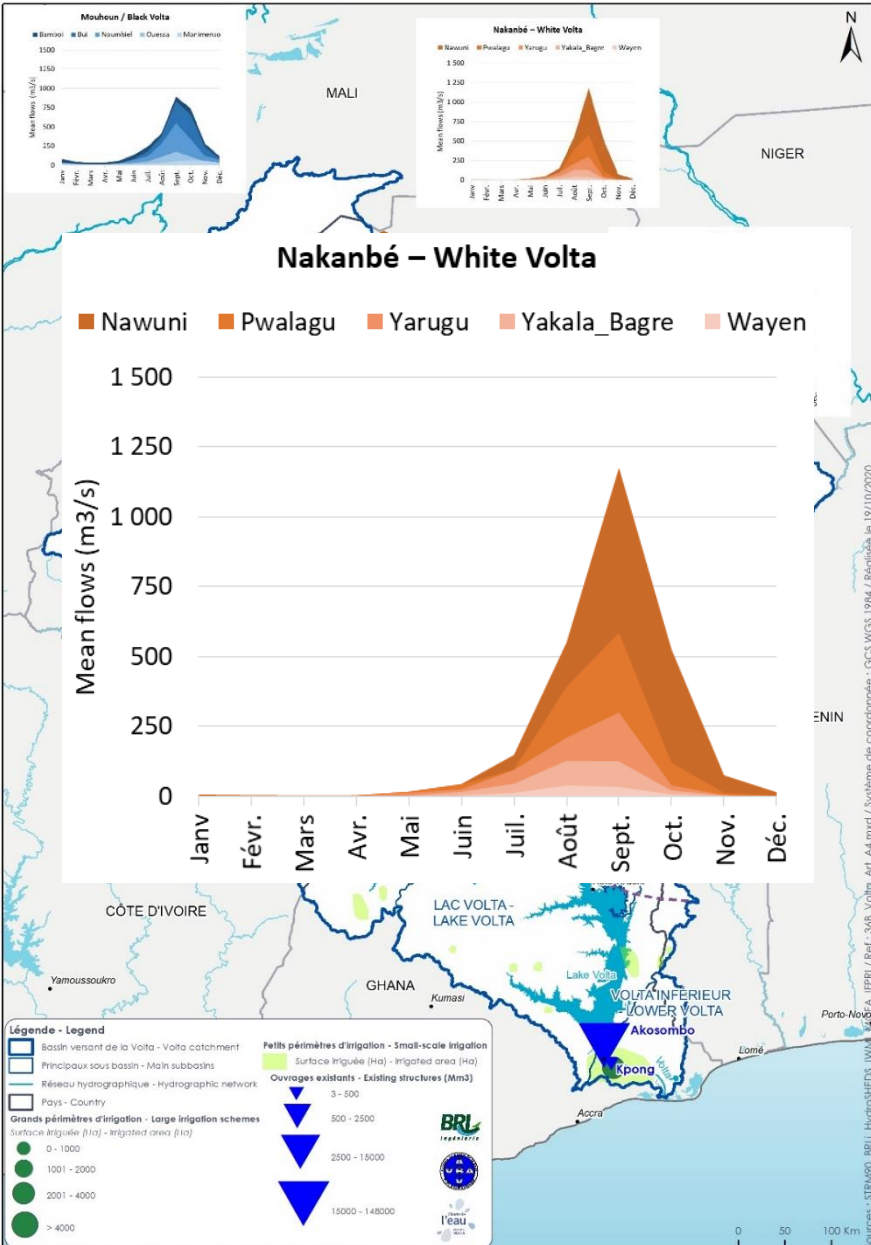




*The Volta River Basin: a transboundary river basin shared by 6 countries;*

*A North-South rainfall gradient; (between 500 and 1300 mm/year)*





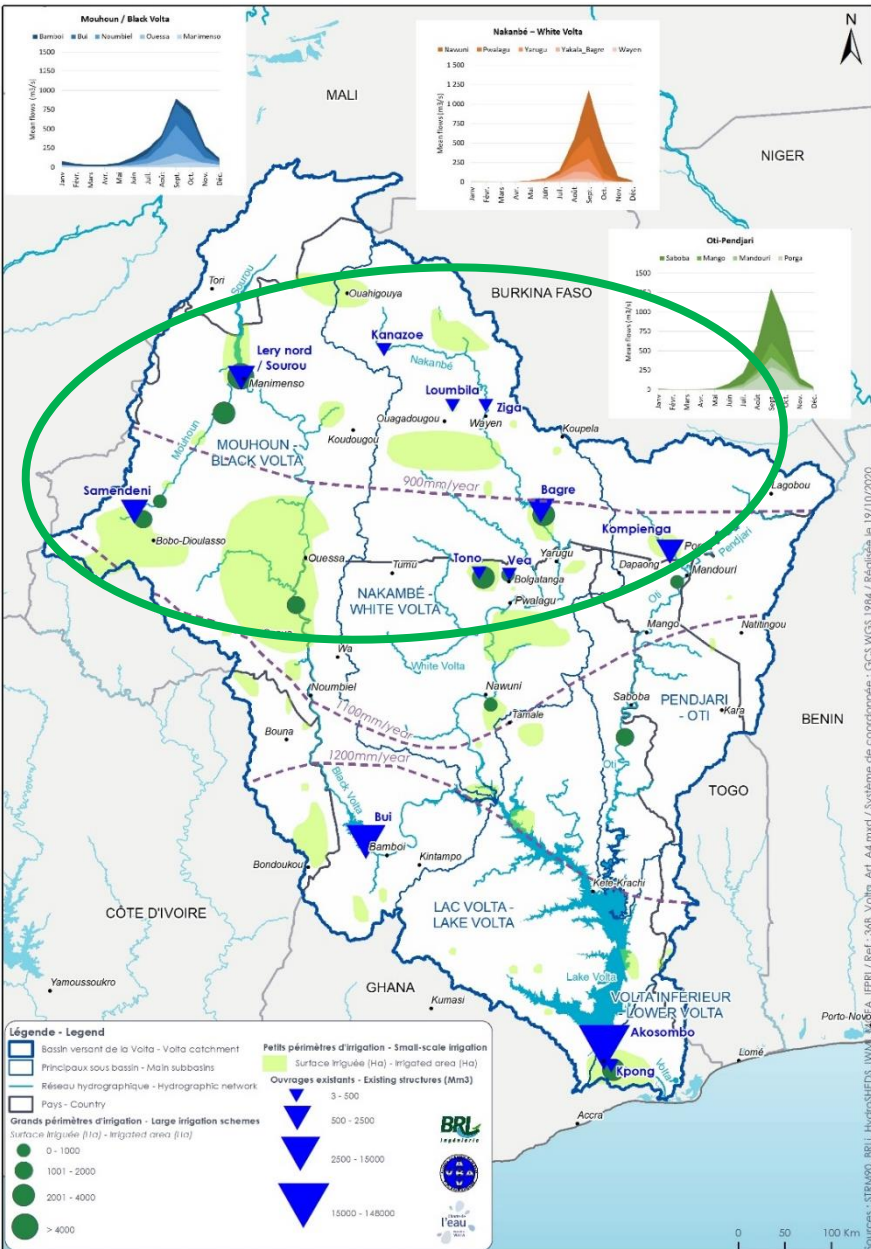
*The Volta River Basin: a transboundary river basin shared by 6 countries;*

*A North-South rainfall gradient; (between 500 and 1300 mm/year)*

*95% of run-off spread over 6 months. Mean flow: 185 m<sup>3</sup>/s*







**Upstream: A strong development of the hydro-agricultural potential (towards food security).**

Today  
45,000 ha



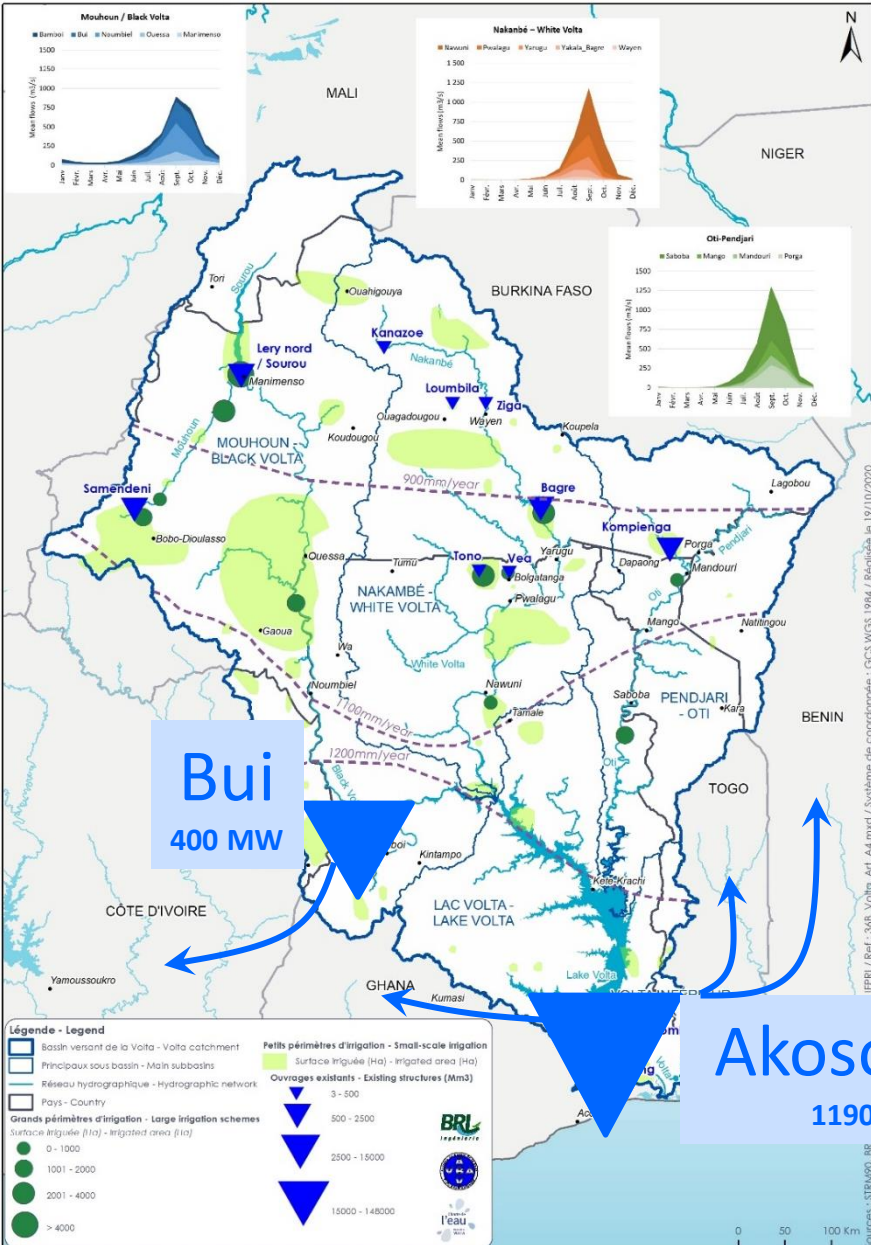
Tomorrow  
+42,000 ha



Long term/potential  
+ 400,000 ha ?

→ A great need for water storage.

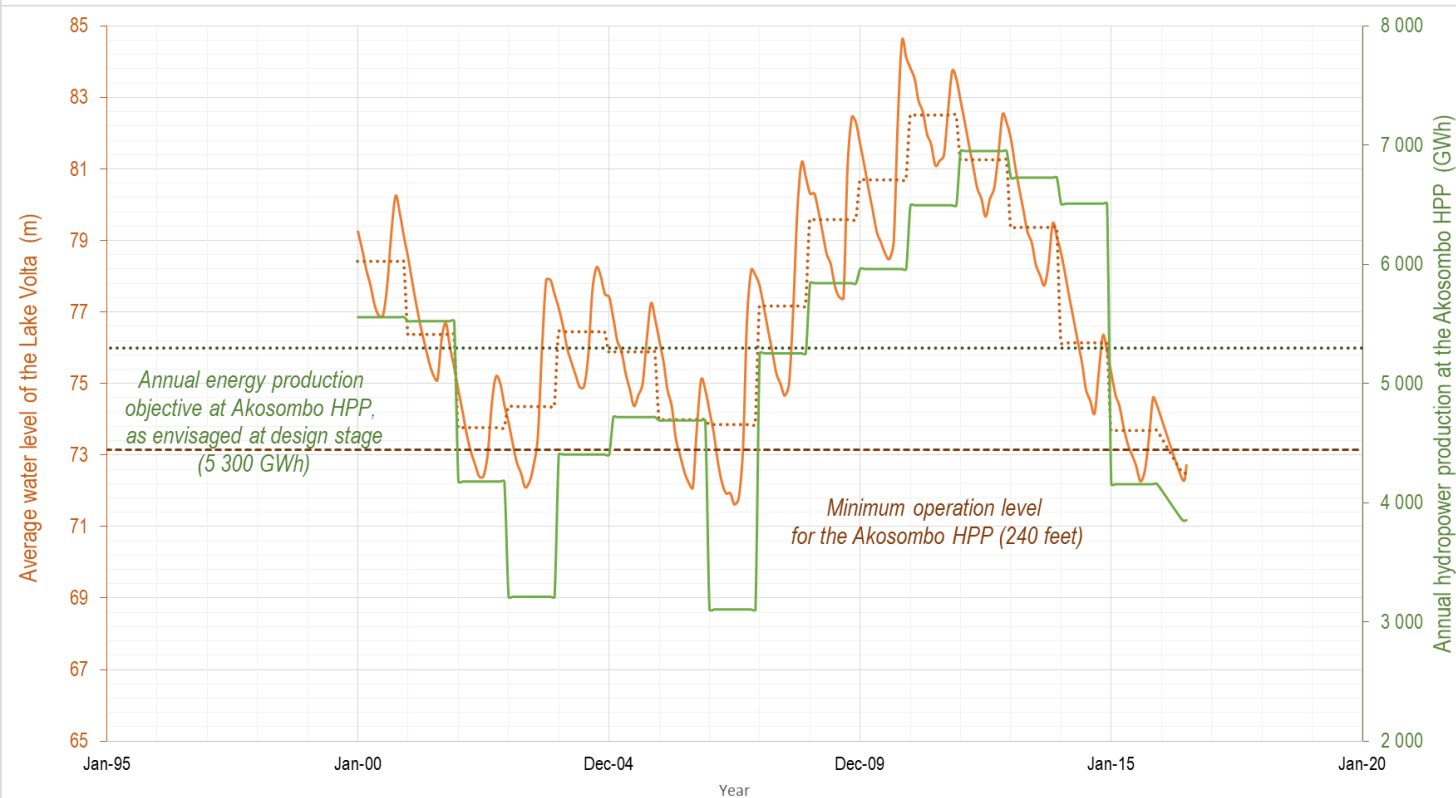
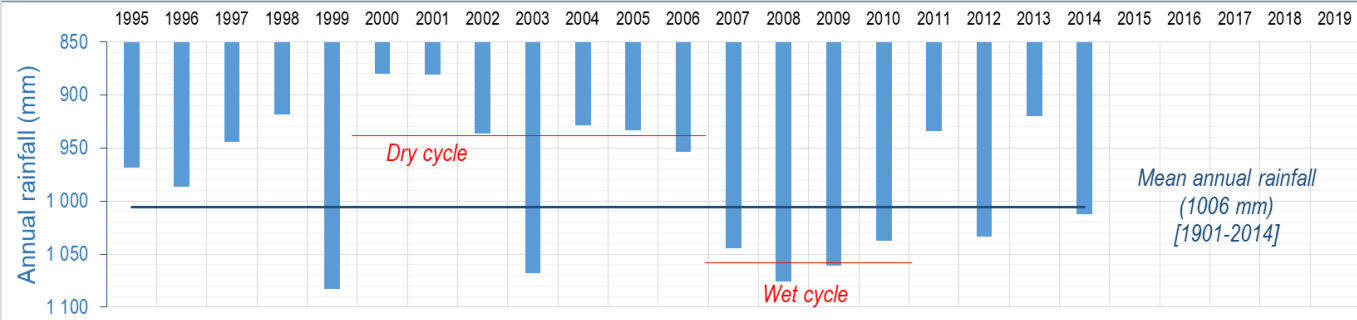




## Downstream: large hydropower plants, pillars of the regional energy security

- ✓ Installed capacity in Ghana: 1,580 MW (97% of the basin);
- ✓ Dam storage capacity: 148,000 hm<sup>3</sup> + 12,500 hm<sup>3</sup>;
- ✓ Hydropower production: ~5,000 - 7,000 GWh/year;  
→ shared with riparian countries.



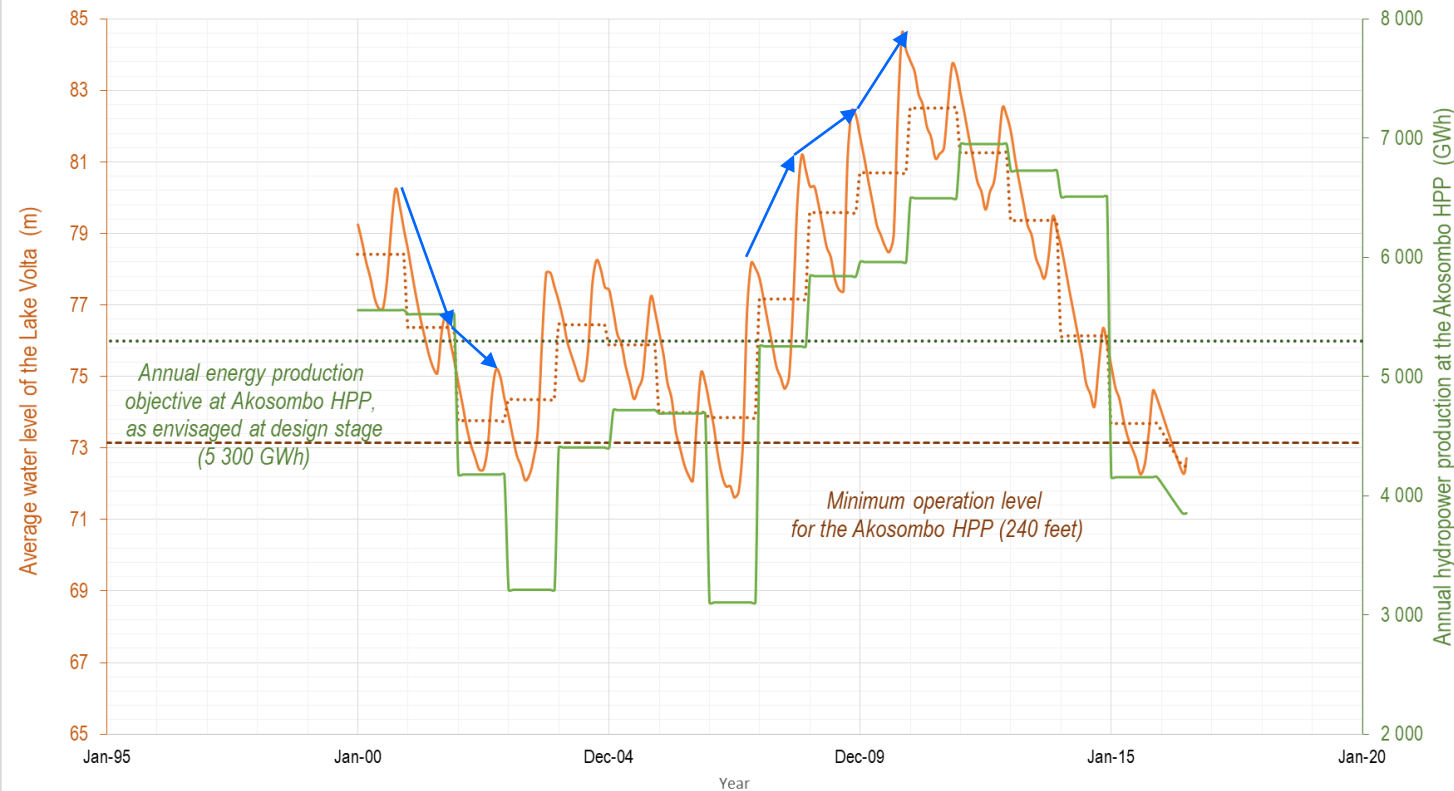
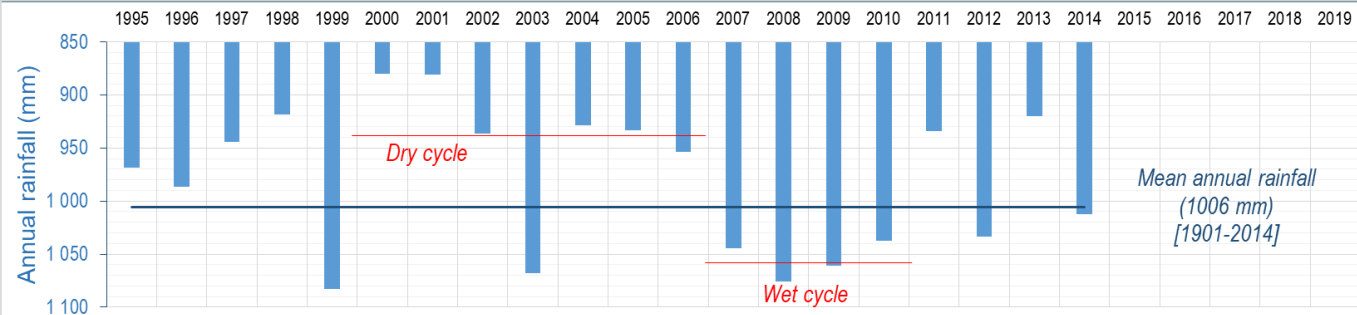


- Monthly mean water level
- Annual mean lake water level
- Minimum operation level at the Akosombo HPP
- Production objective
- Annual hydropower production

# Which hydropower production strategy?





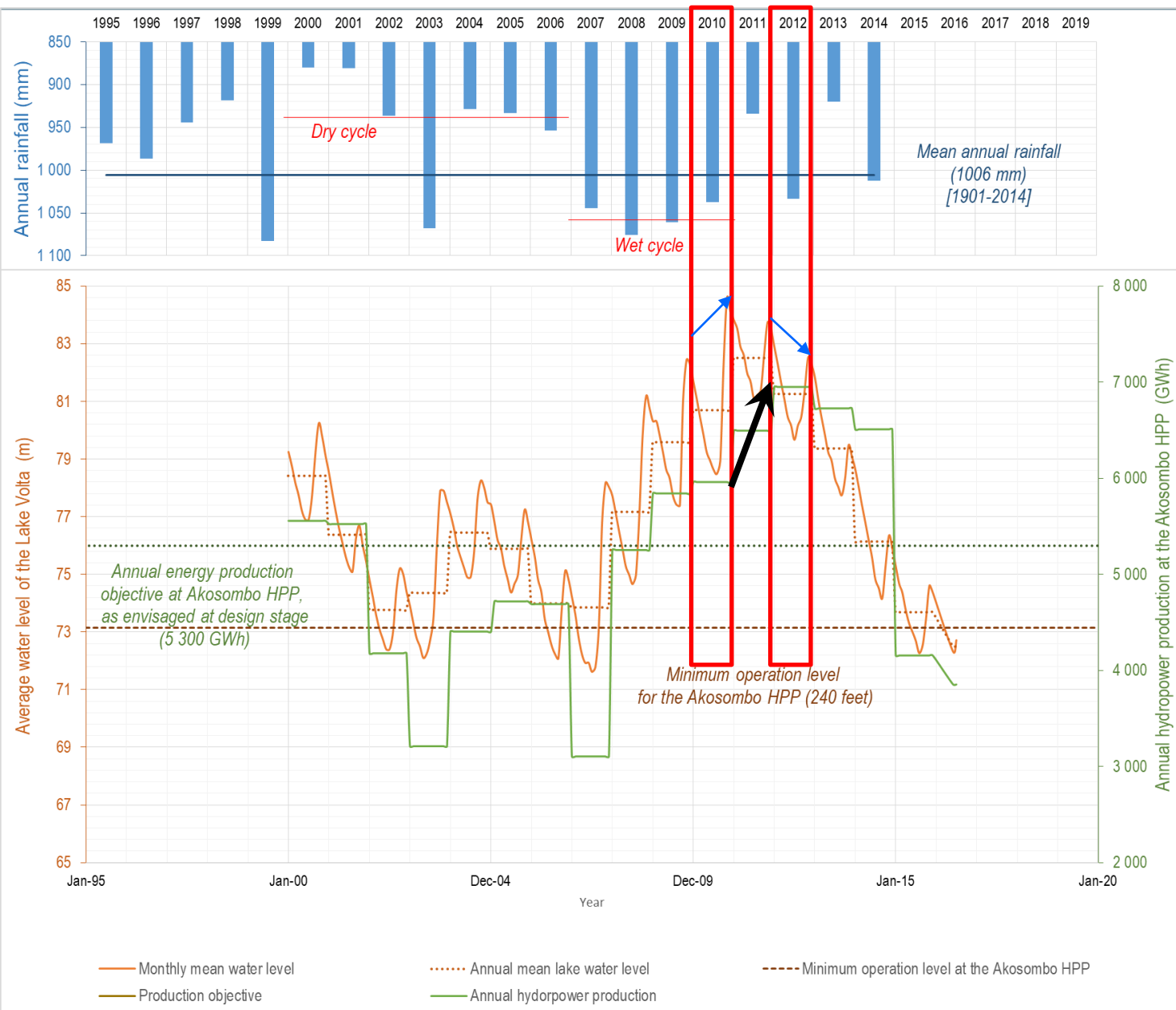


— Monthly mean water level     
 - - - Annual mean lake water level     
 - - - Minimum operation level at the Akosombo HPP  
— Production objective     
 — Annual hydropower production

## Which hydropower production strategy?

- ✓ A strong dependence on the hydrological cycle despite the large interannual storage capacity;





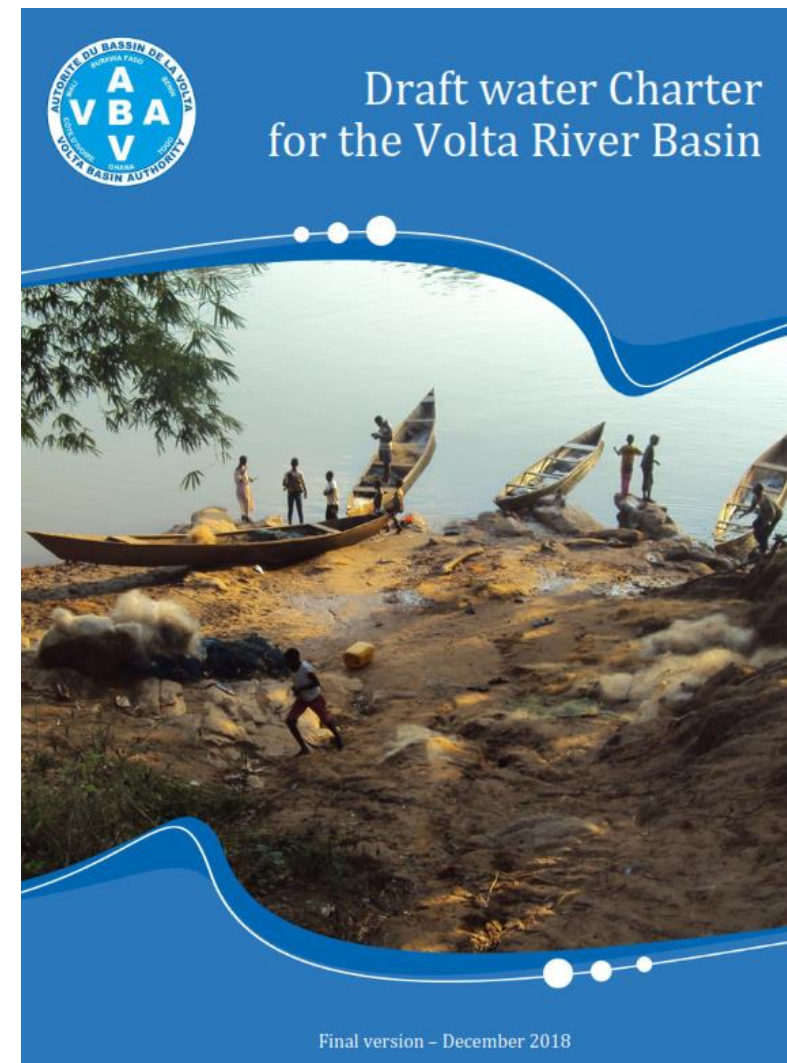
### Which hydropower production strategy?

- ✓ A strong dependence on the hydrological cycle despite the large interannual storage capacity;
- ✓ In the recent years: **short-term maximisation of the hydropower production.**



## *A Water Charter as a tool for reconciling energy security, food security and water for the environment*

- Strive for a balance maximising upstream uses and minimising their downstream impacts;
  - economic development
- **Definition of a reasonable level of abstraction.**





## Technical Approach

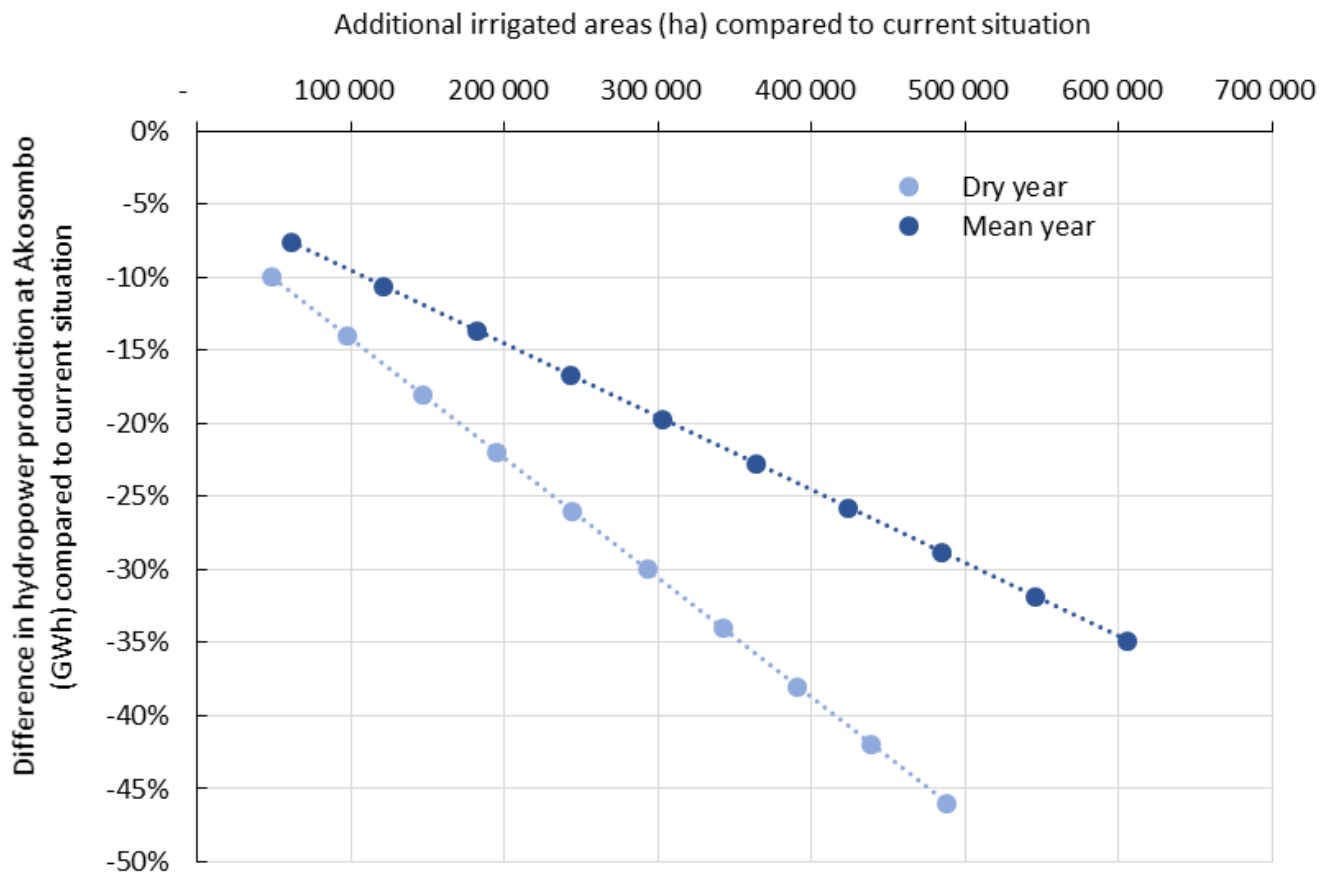
- A simplified approach to hydro-economic modelling;
- Innovative participation methods.



Quantités / Quantities		Couleurs / Colours		
	1 cube Lego (1 plot) = 50 Mm <sup>3</sup> 1 Lego brick (1 block) = 50 Mm <sup>3</sup>		Bleu Blue	Ressources en eau Water resources
	1 cube Lego (2 plot) = 100 Mm <sup>3</sup> 1 Lego brick (2 block) = 100 Mm <sup>3</sup>		Blanc White	Usages domestiques et bétail Domestic and Cattle Uses
	1 cube Lego (4 plot) = 200 Mm <sup>3</sup> 1 Lego brick (4 block) = 200 Mm <sup>3</sup>		Vert Green	Usages agricoles Agricultural Uses
	1 cube Lego (6 plot) = 300 Mm <sup>3</sup> 1 Lego brick (6 block) = 300 Mm <sup>3</sup>		Rouge Red	Production hydroélectrique* Hydropower**
	1 cube Lego (8 plot) = 400 Mm <sup>3</sup> 1 Lego brick (8 block) = 400 Mm <sup>3</sup>		Rose Pink	Capacité de régulation Regulation capacity
			Orange Orange	Débits environnementaux Environmental flows
			Drapeau rouge Red flag	Station hydrométrique de référence Reference gauging stations



# Hydrological analysis



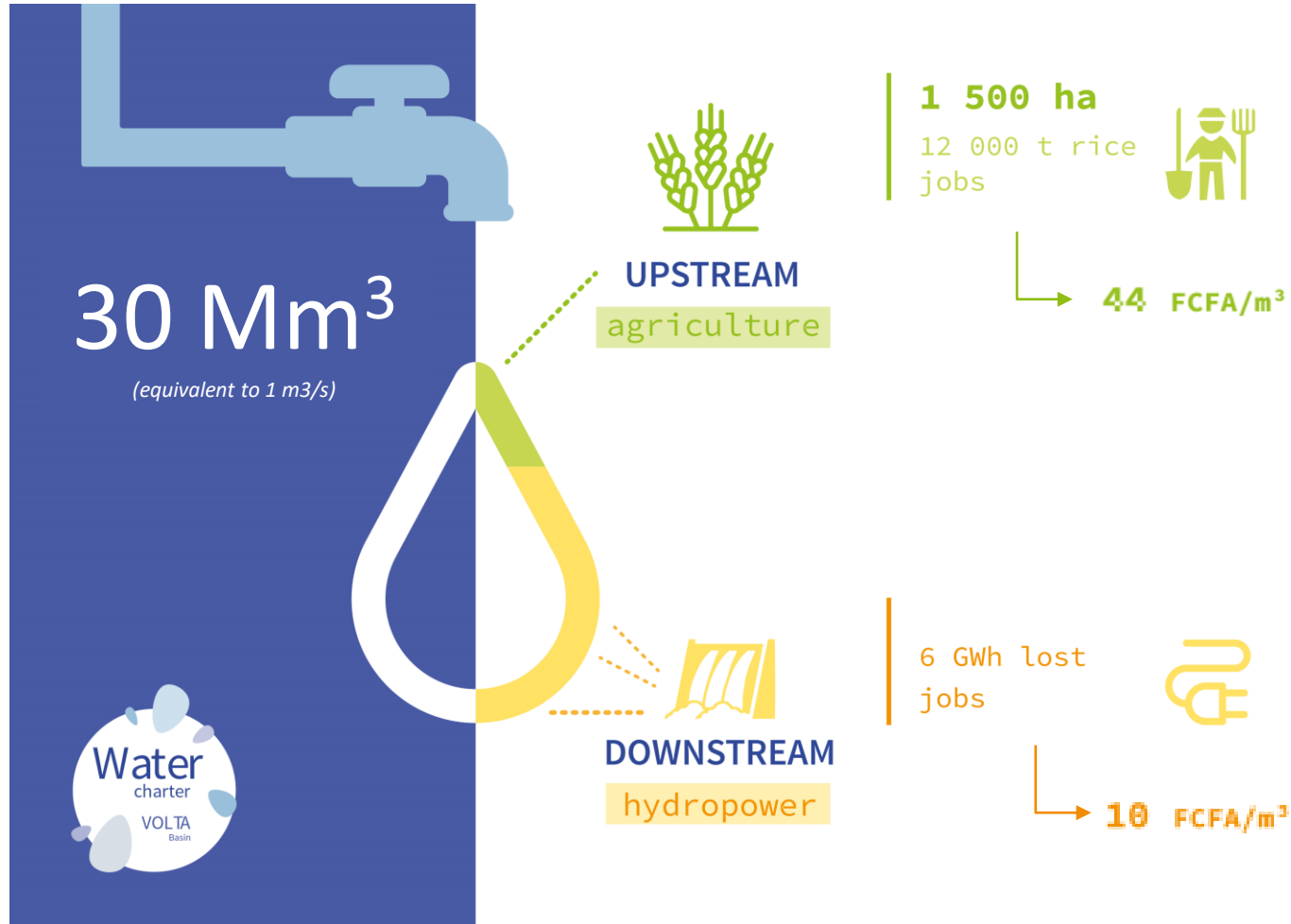
+100,000 ha upstream



-10% to -15% in dry years for the power production at Akosombo (-500 to -700 GWh)



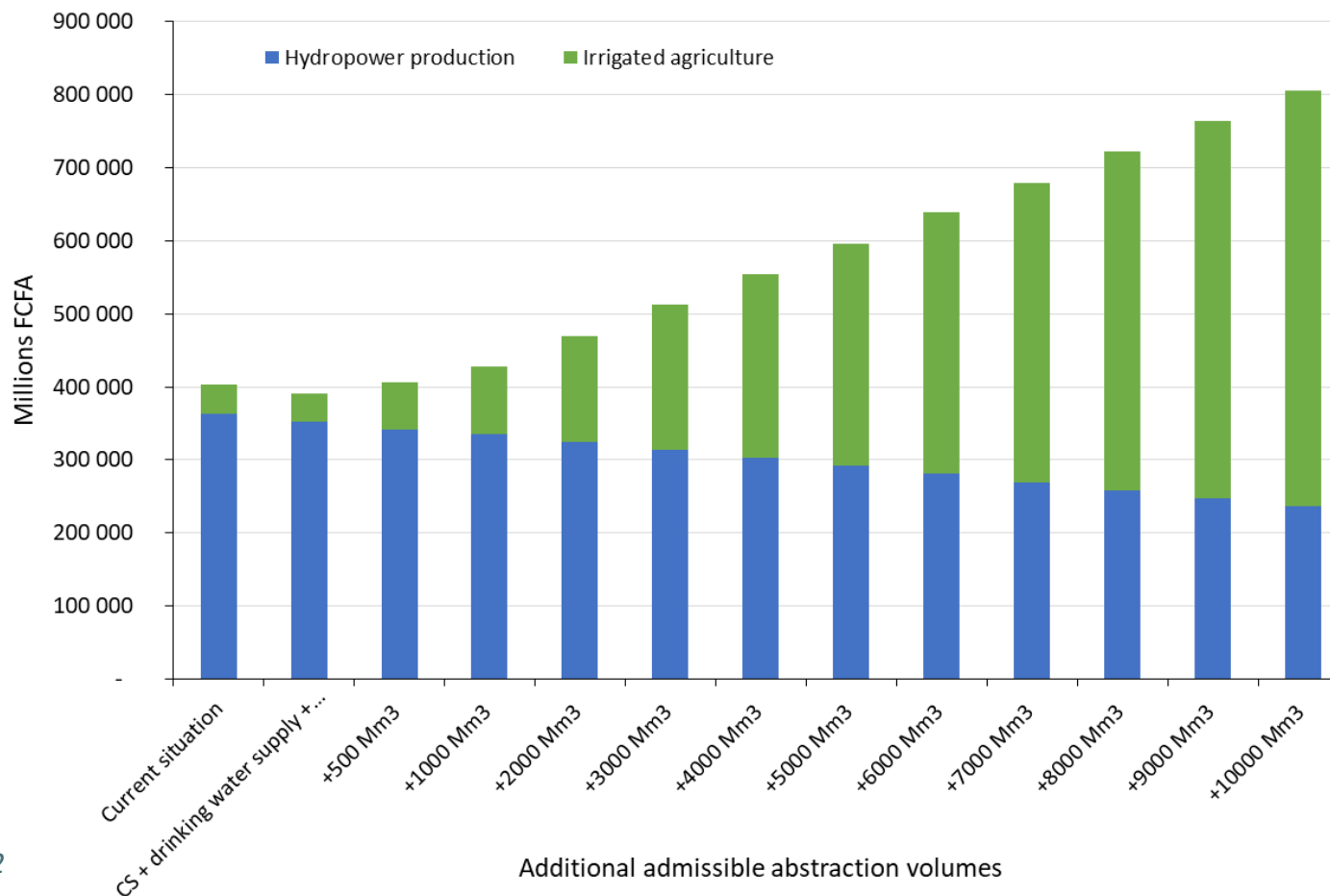
# Socio-economic analysis





# Socio-economic analysis

## Indicative estimate of the cumulative value added of hydropower and irrigated agriculture



## *An iterative process to be pursued*

- Threshold envisaged at 6,500 hm<sup>3</sup> (+5,000 hm<sup>3</sup>);
- No definitive consensus;
- A simplified approach providing orders of magnitude;
- Basis for a continuous consultative process and dialogue between riparian states.



