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Hydropower capacity expansion in the African continent under different socio-economic & climate policy scenarios

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Sharing not permitted

AFRICAN ENERGY & POWER SYSTEM

FUTURE ENERGY DEMAND AND HYDROPOWER CAPACITY EXPANSION

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From 40 GW (2020) to 132 / 156 / 166 GW (2050)

+ 93 / 107 / 117 GW (increase) (Pappis et al., 2019)

Figure 4. Electricity demand projections per power pool in the reference scenario

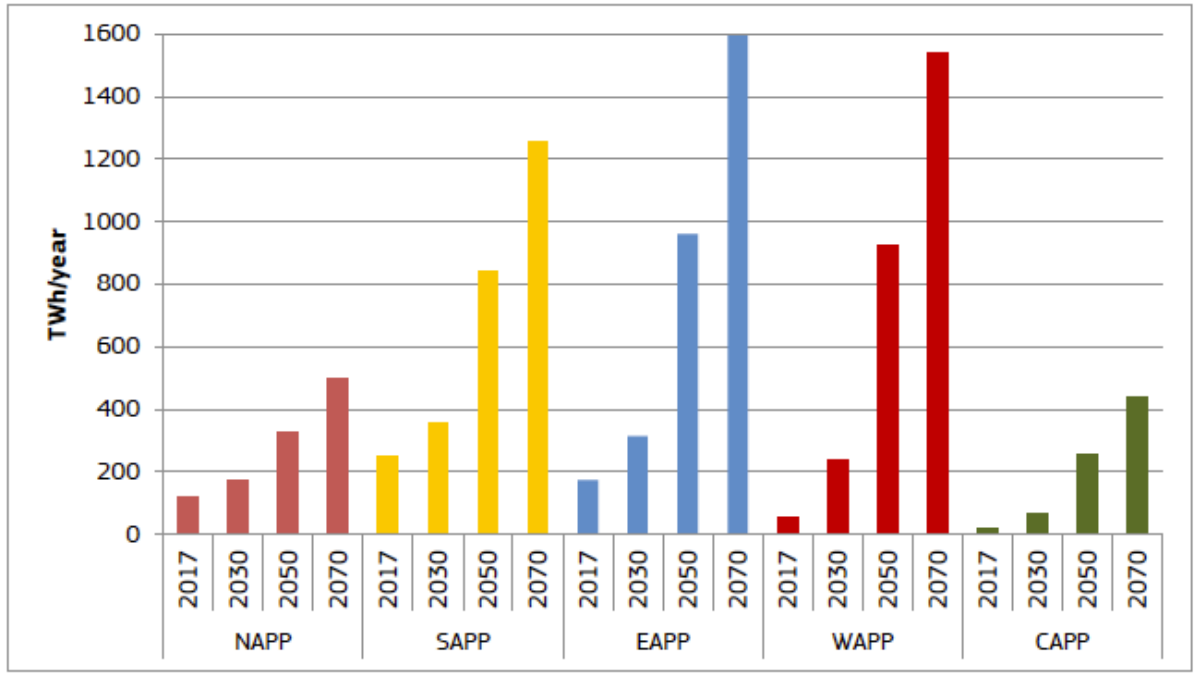
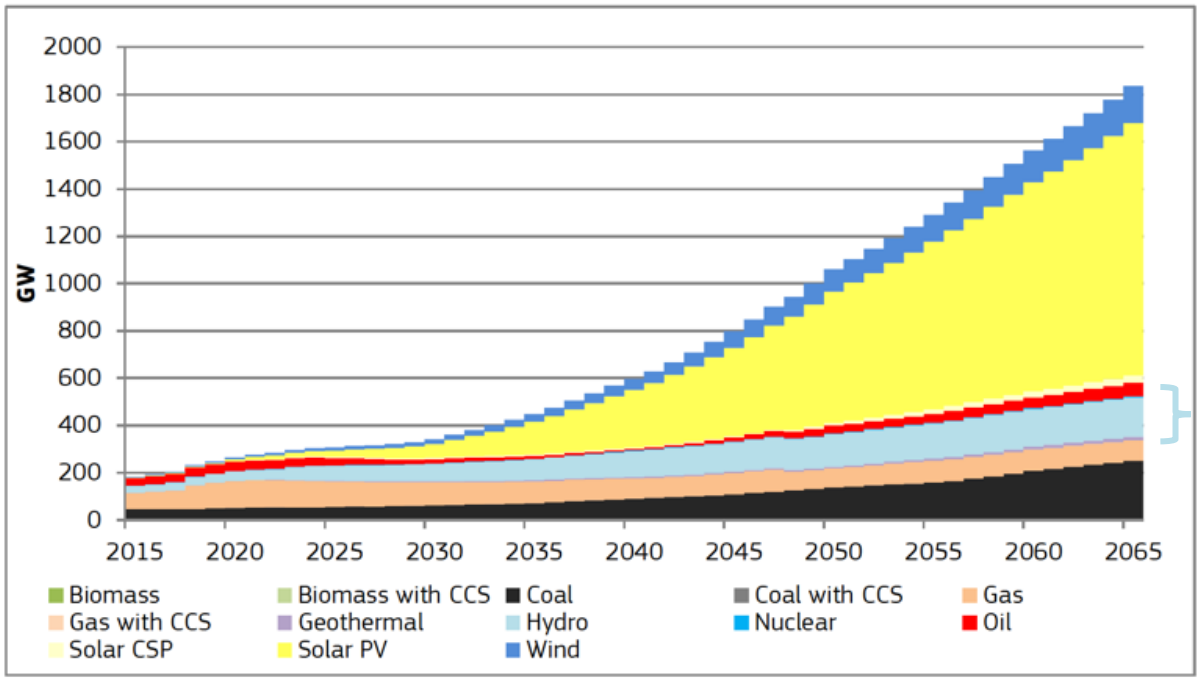


Figure 25. Power generation capacity in Africa in the Reference scenario



AFRICAN HYDROPOWER ATLAS

MORE THAN 300 NEW HYDROPOWER PROJECTS FOR 100GW (Sterl et al., 2021)

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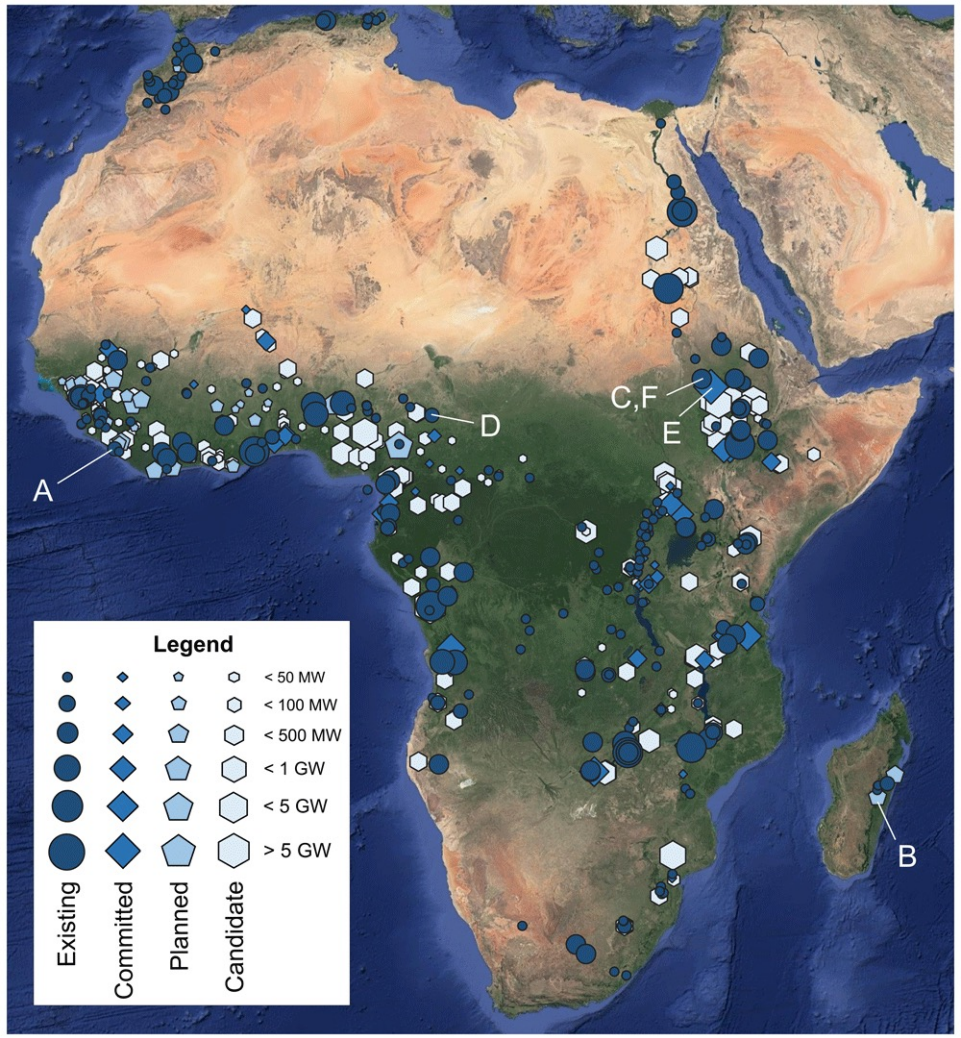

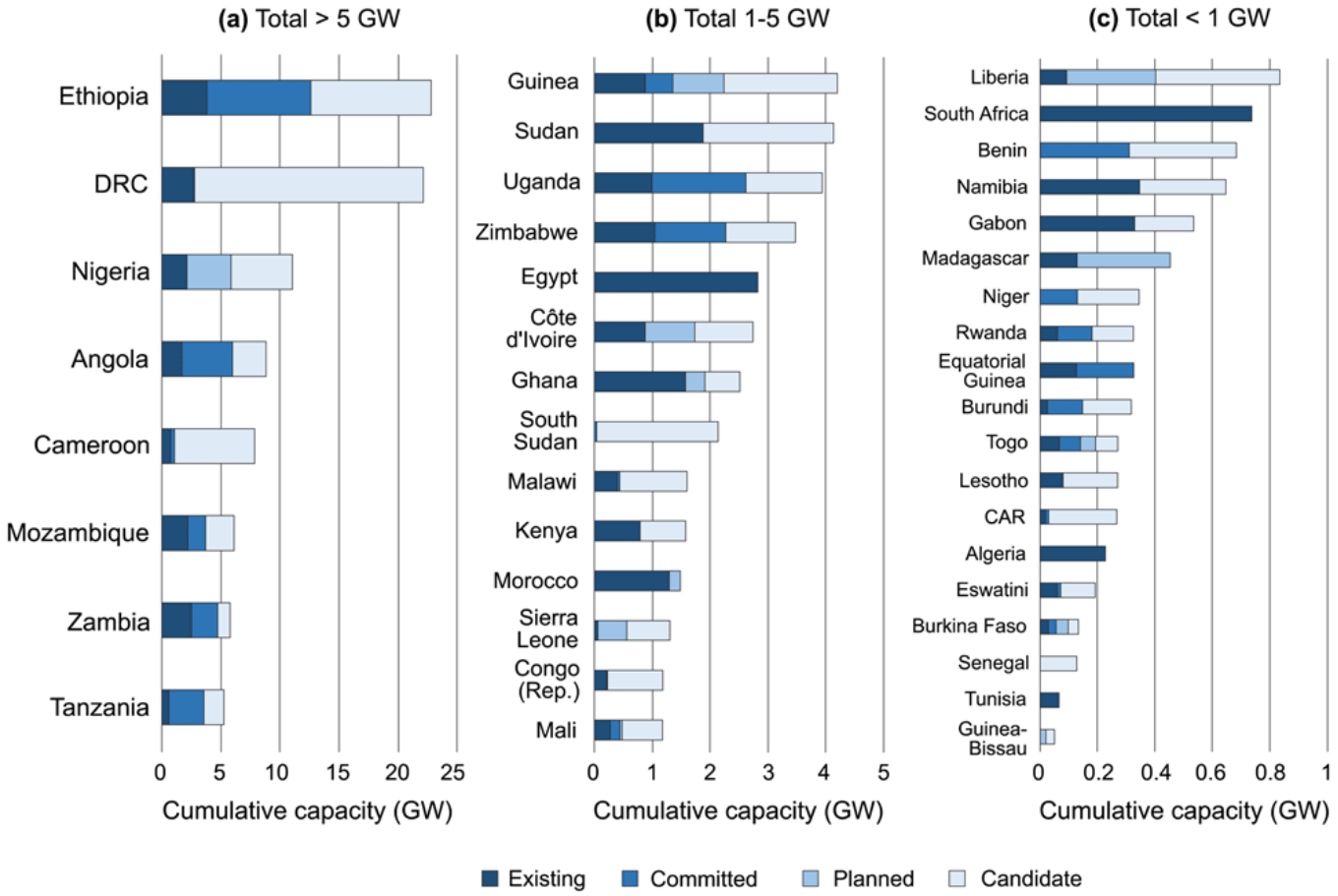

RESEARCH QUESTIONS

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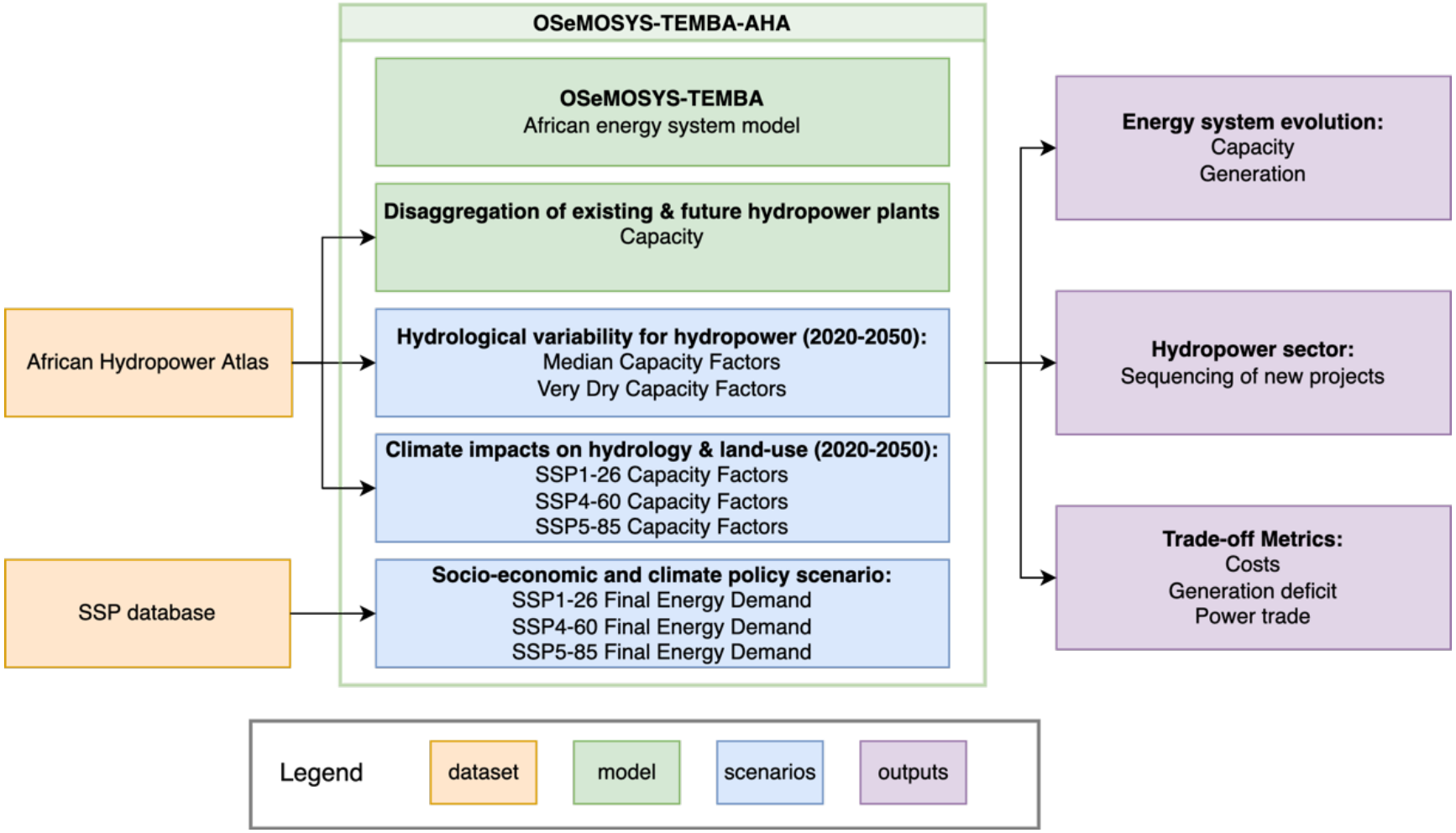
1. What is the **role of hydropower projects within future energy portfolios?**

2. What are the **trade-offs** behind **large-scale hydropower capacity expansion**?

3. Which **river basins** should **prioritize new hydropower** projects?

OSEMOSYS-TEMBA-AHA Model

LARGE-SCALE MULTISECTORAL HYDROPOWER CAPACITY EXPANSION MODEL



CURRENT HYDRO EXPANSION PLAN

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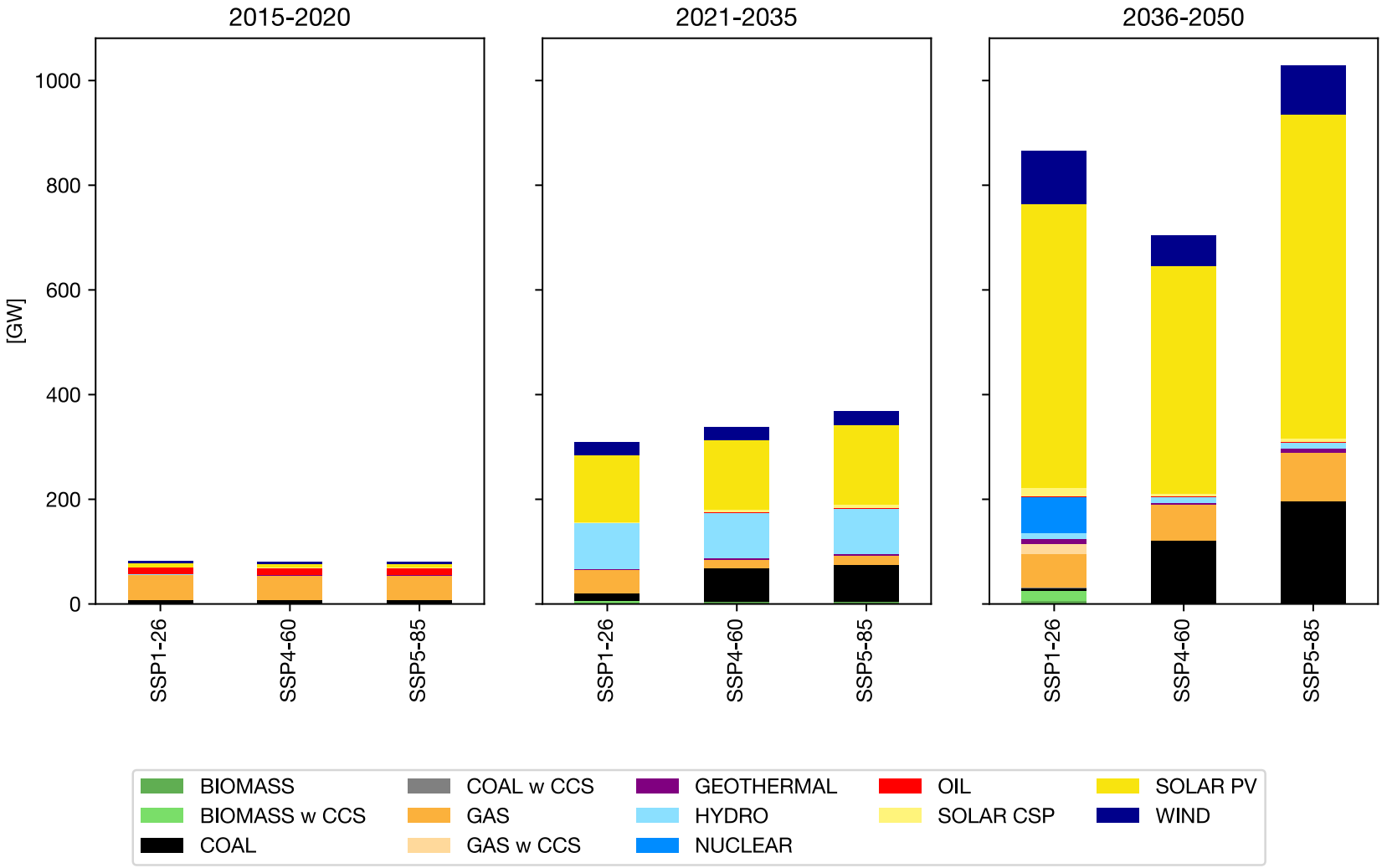
CONSTRAINED TO CURRENT HYDROPOWER CAPACITY EXPANSION PLANS

Added hydropower capacity: 100 GW



ROBUST HYDRO EXPANSION

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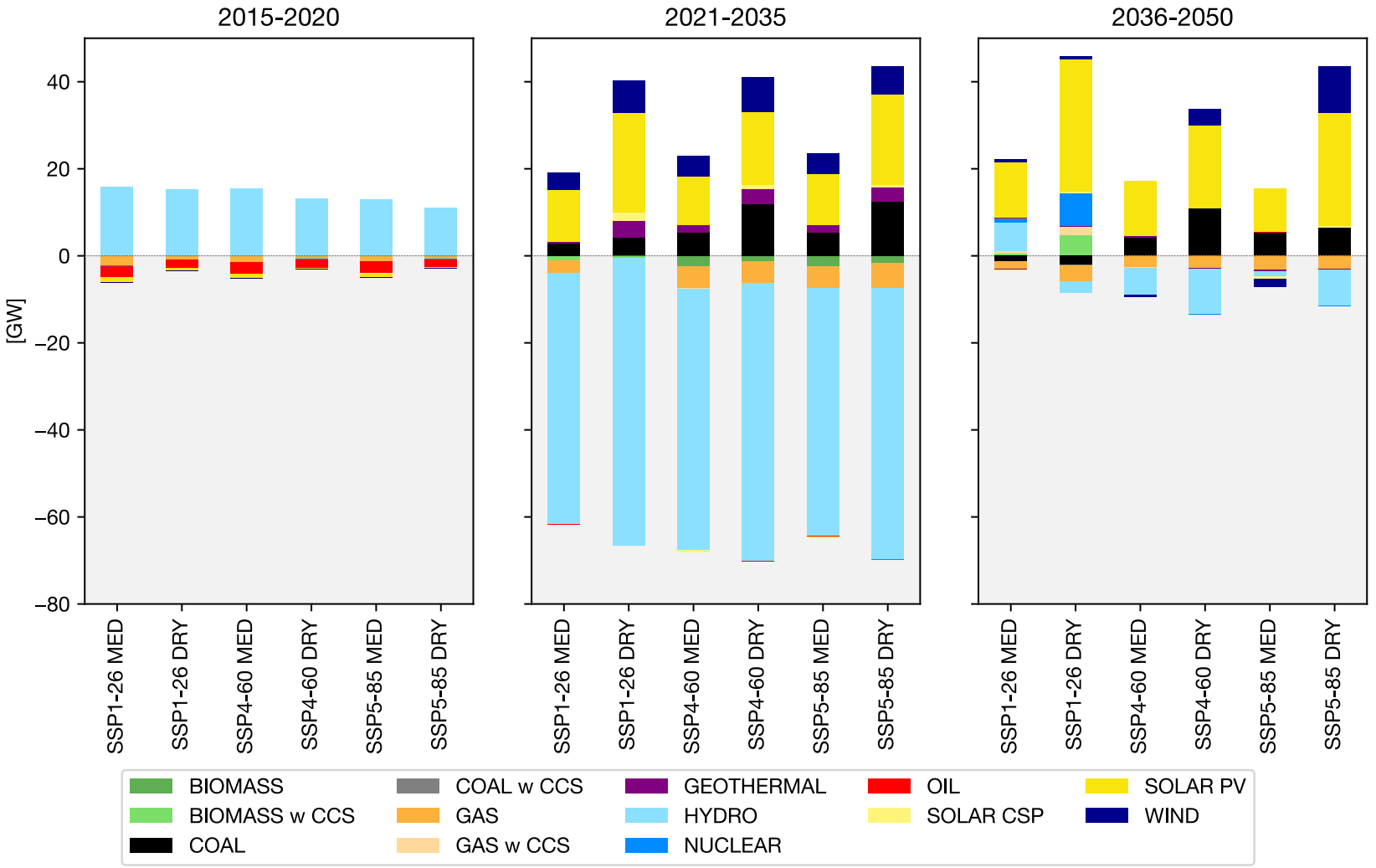
FROM MEDIAN TO VERY DRY HYDROLOGY: FOCUS ON ROBUSTNESS

Added hydropower capacity: MED (48-63 GW) & DRY (38-45 GW)



COSTS, DEMAND DEFICIT, & ENERGY FLOWS

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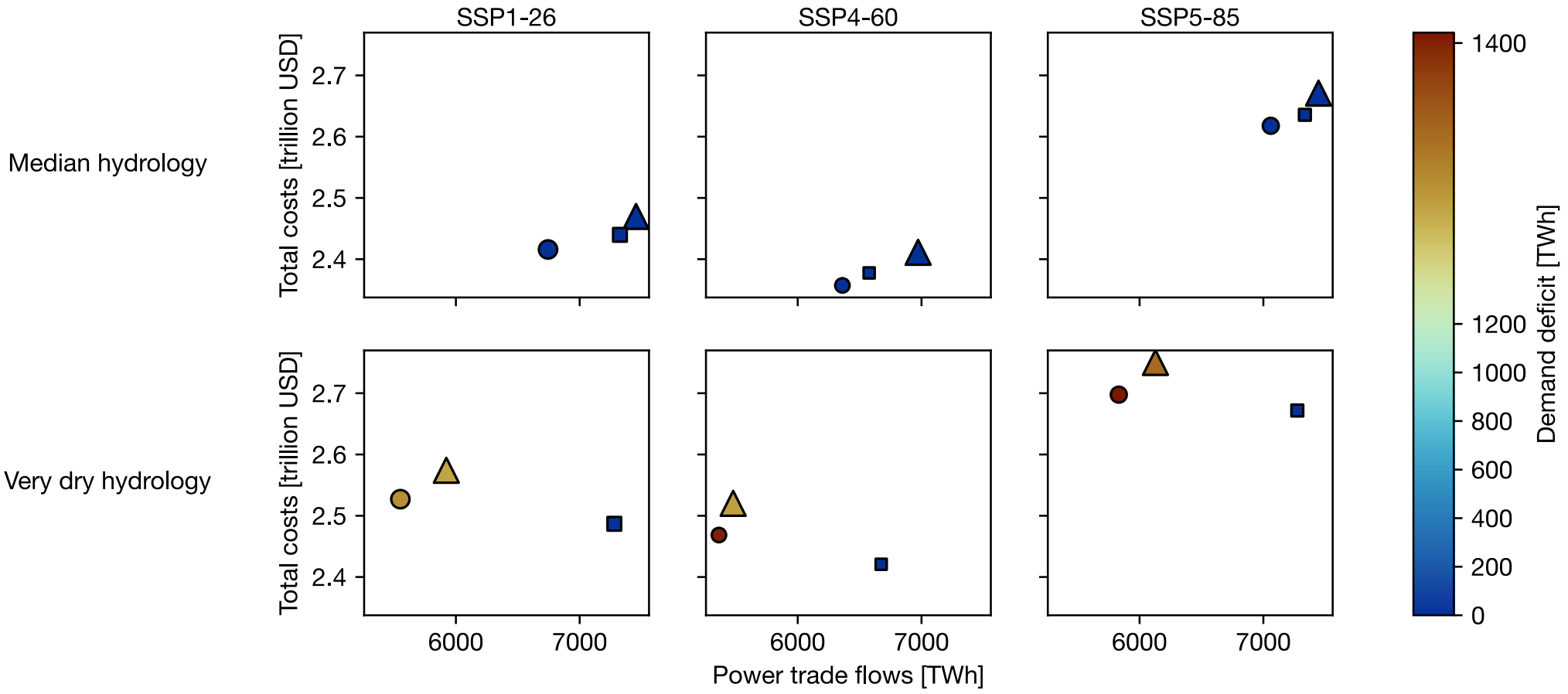
RELIABILITY COMES WITH MODEST COST INCREASE BUT REQUIRES LARGE POWER FLOWS BETWEEN COUNTRIES



Capacity expansion scenario

△ Optimal (AHA) ○ Optimal (Avg) □ Optimal (Dry)

Hydropower capacity added [GW]

△ 99 GW	○ 48 GW	□ 38 GW
△ 99 GW	○ 63 GW	□ 45 GW

POWER TRADE FLOWS

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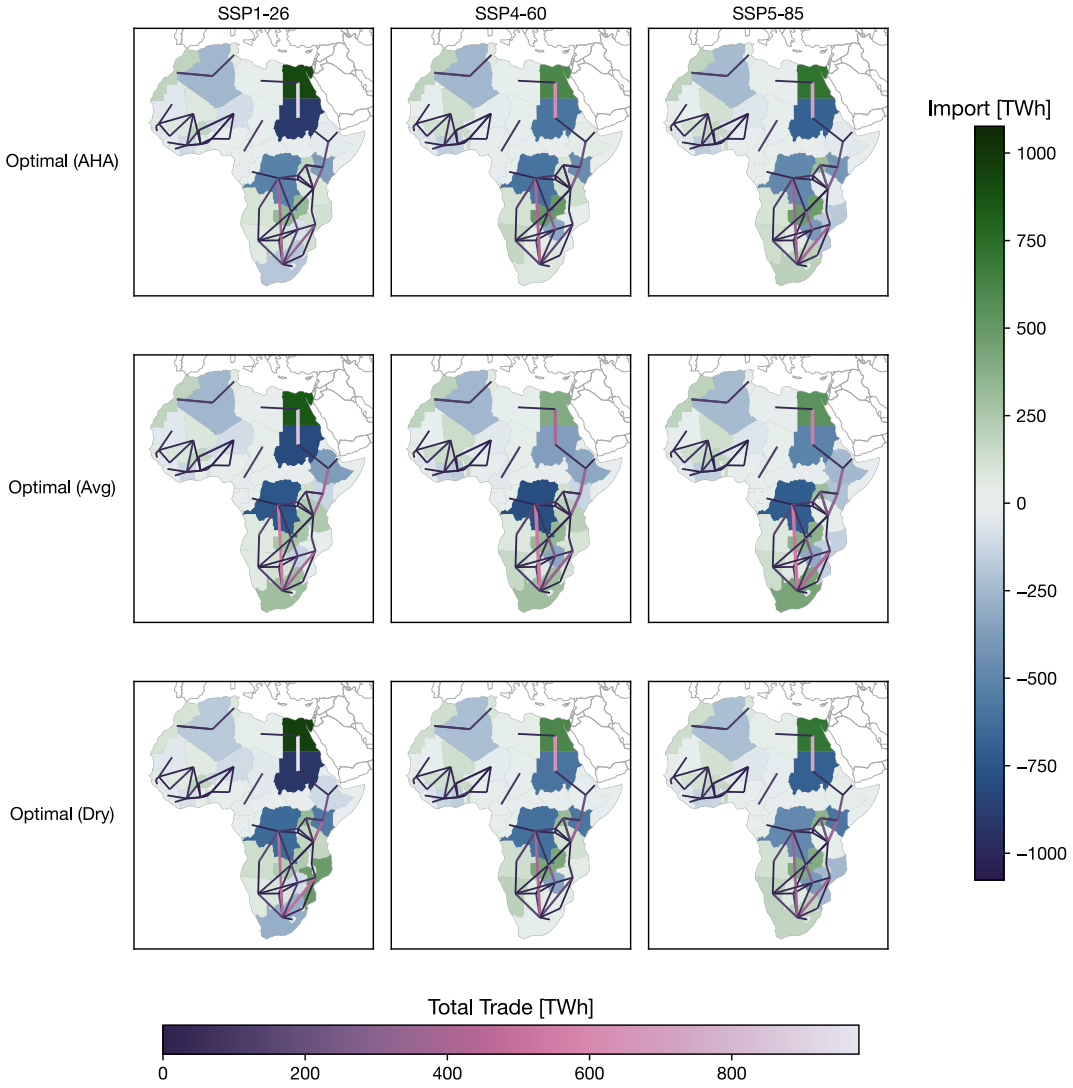
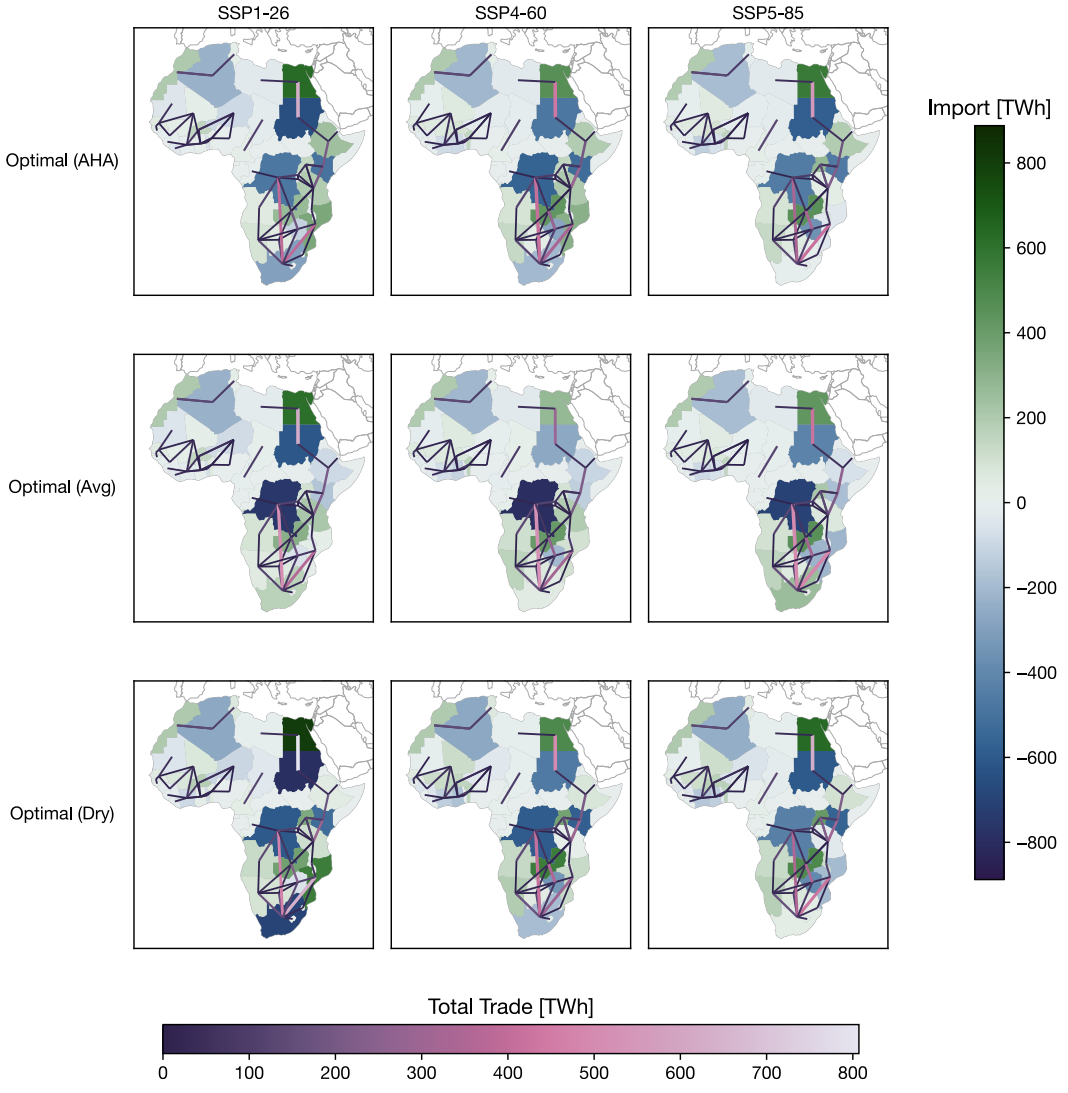
IS TRADE RELIABLE BETWEEN THESE COUNTRIES?

MEDIAN HYDROLOGY



VERY DRY HYDROLOGY



PRIORITIES & RISKS FOR HYDRO INVESTMENTS

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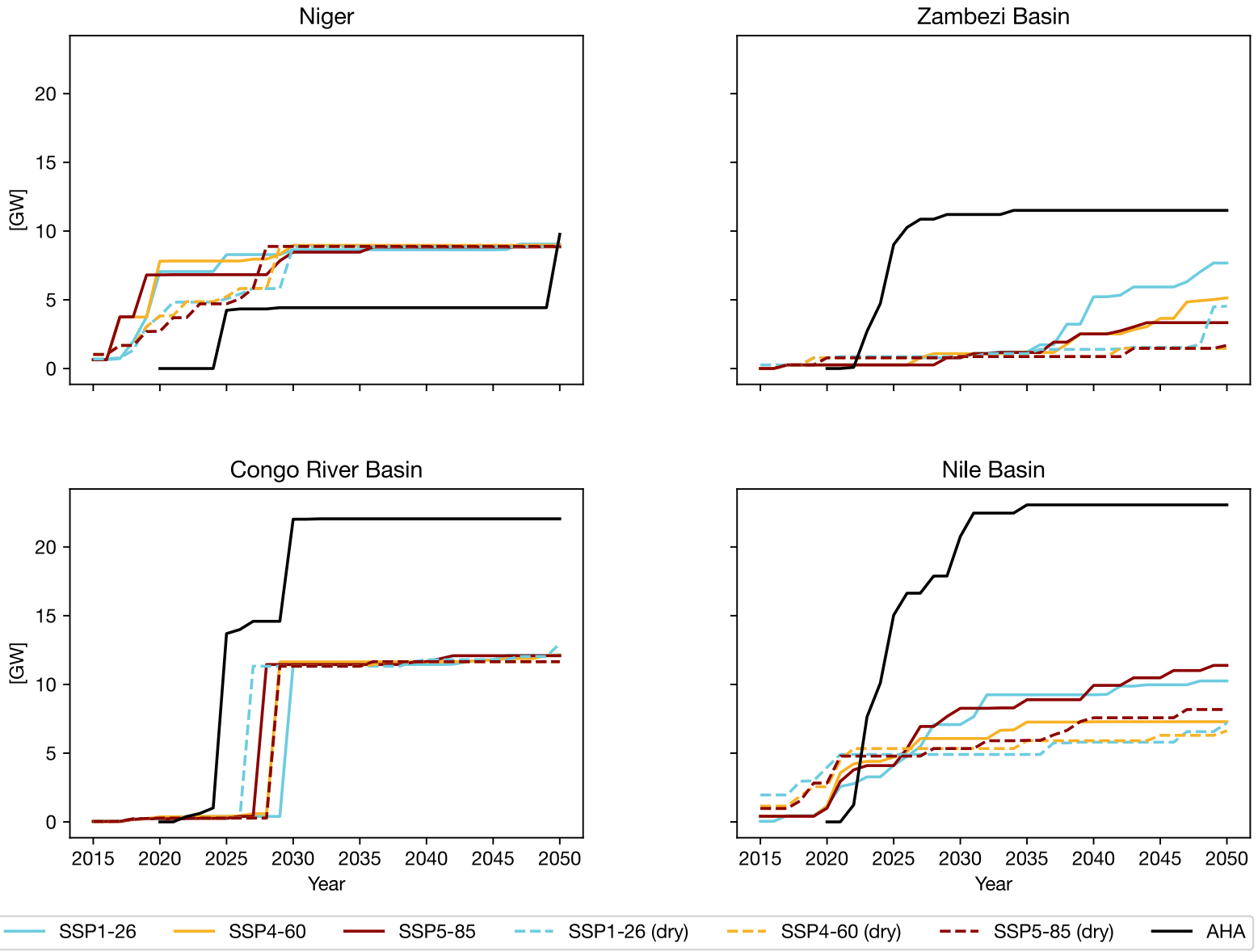
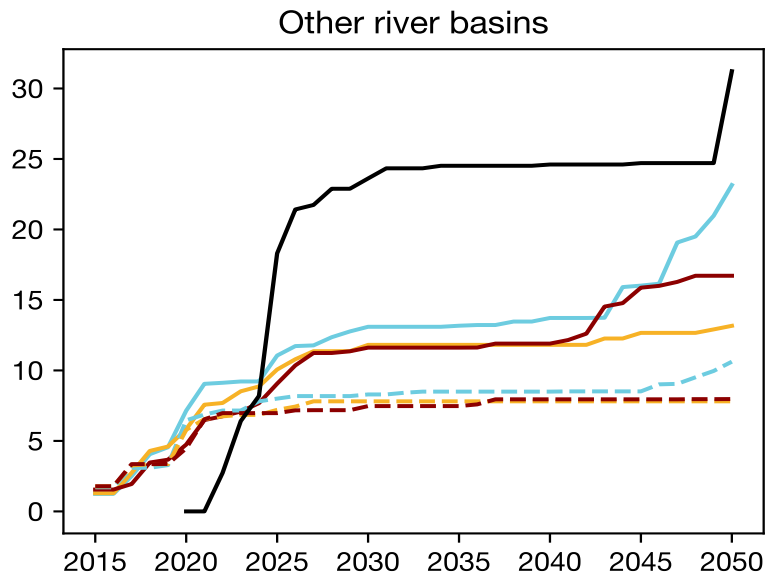
WEST AFRICA TO BE PRIORITIZED, UNCERTAIN DEVELOPMENT IN SAPP & EAPP





SUMMARY

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1. Around **34-62 % of planned hydropower is needed** in order to satisfy **energy demand** and achieve **climate policy targets**.

2. **Reliability** comes at similar costs but **requires higher power flows**.

3. Regions of interest for hydropower development:
    1. **Niger** (West Africa) is a basin **to prioritize**
    2. **Risky** investments in **Nile, Zambezi & smaller river basins**

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