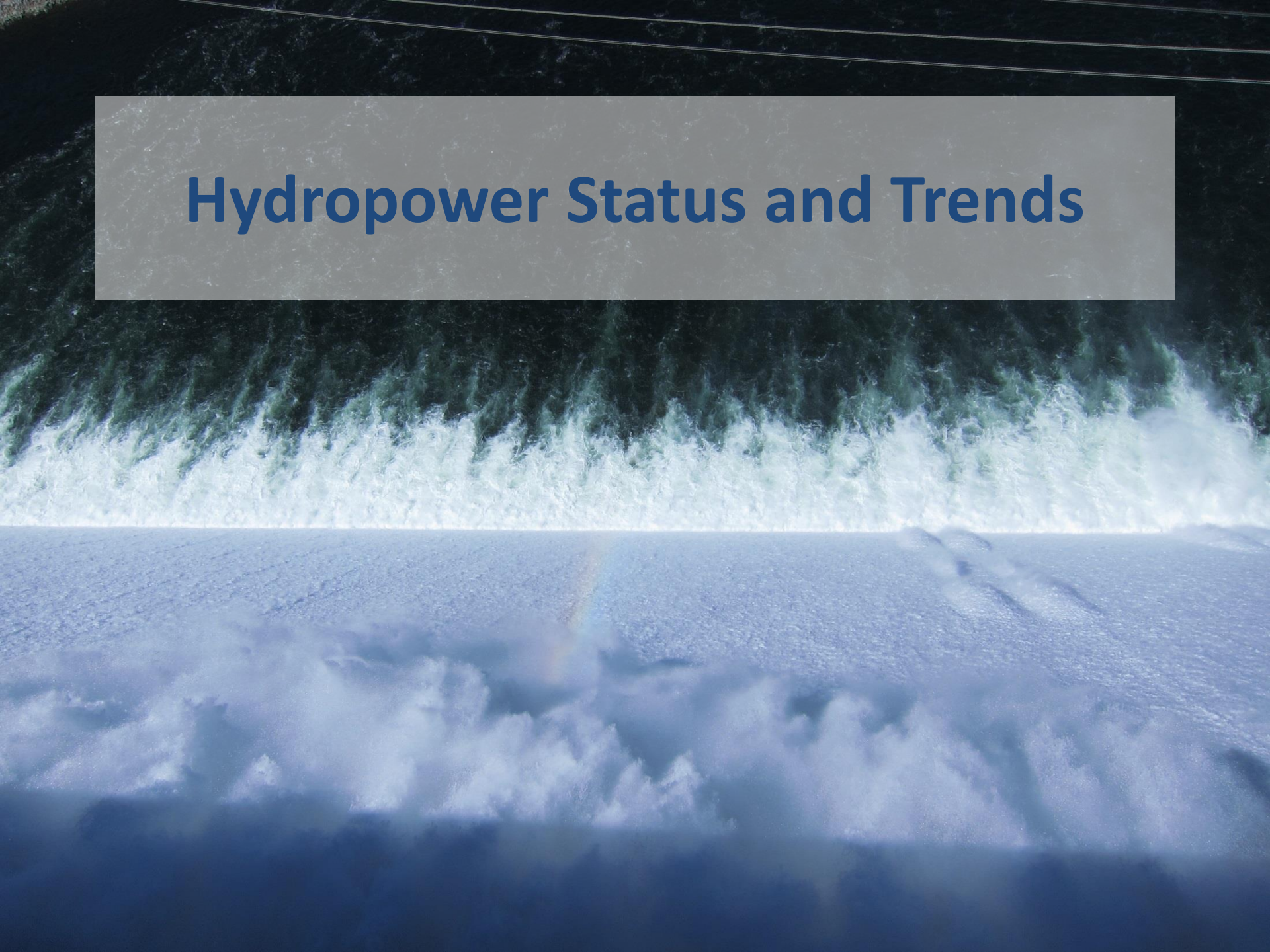
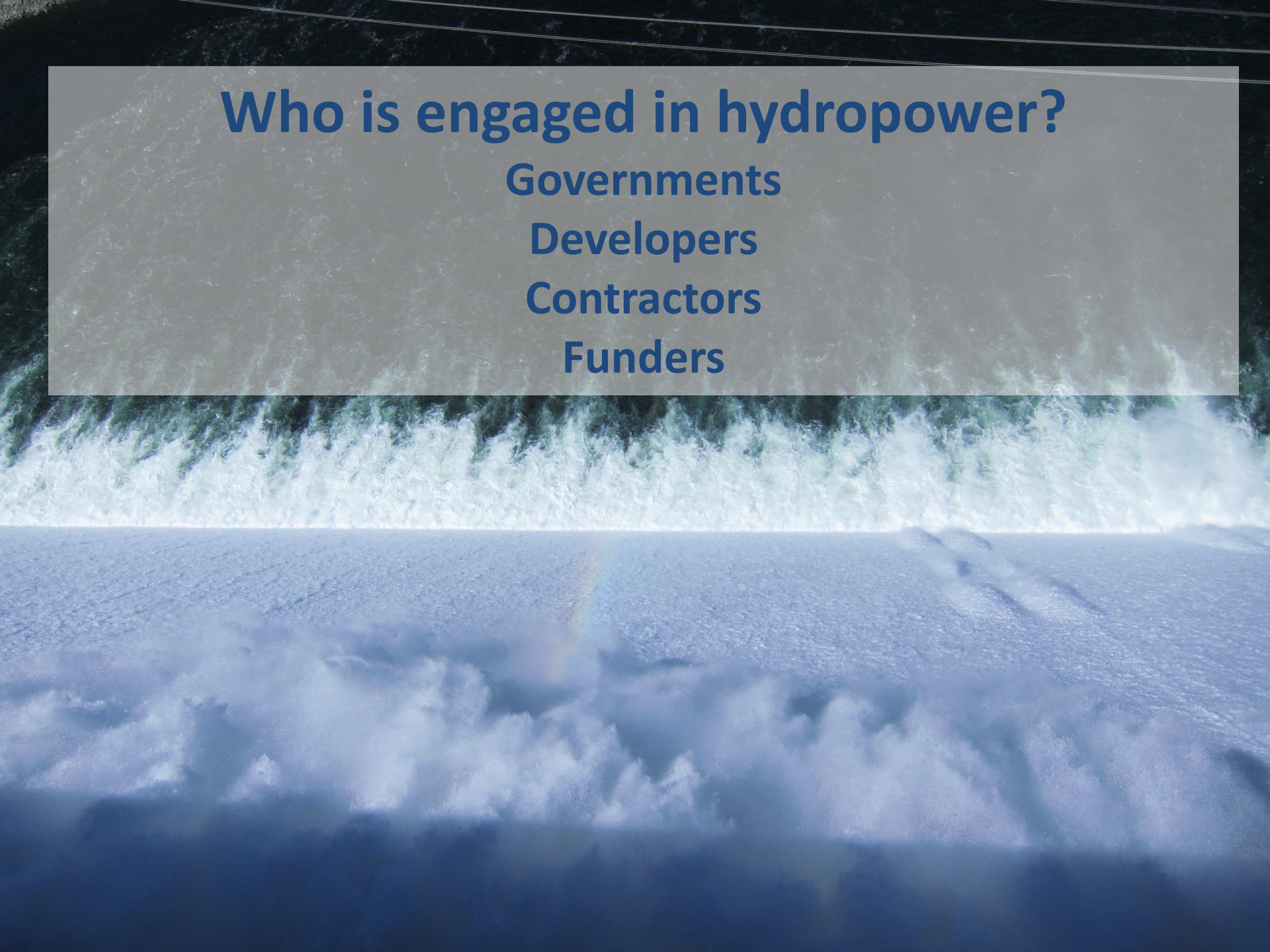


Hydropower Status and Trends

What makes hydropower so attractive?

- **lowest-cost source in many countries** → can facilitate access to electricity for the 1.3 bn people still without
- **low-carbon source** → if it all replaced coal, could reduce CO_2 emissions by 3.8 bn t/year; value at a ‚social cost of carbon' of USD 40/t: USD 152 bn/year
- **high-value, dispatchable source** → can enable energy storage and integration of wind and solar
- **indigenous source** → can reduce requirements for fuel imports and increase energy security
- **economic development opportunity** → exports of power or of power-intensive aluminium, hydrogen etc.



Who is engaged in hydropower?

Governments

Developers

Contractors

Funders

Governments

Examples from Latin America

Mexico: Comisión Federal de Electricidad (CFE) prepares 15-year masterplans and prepares, implements (with funds from the MoF), and operates almost all projects

Brazil: Public agencies prepare almost all projects, basin by basin, including environmental assessments, up to the point of auctioning development licenses off to private or public developers

Chile: no masterplan, private developers obtain water rights and prepare projects for environmental approval, funding from private banks and private equity

Developers

- The largest hydropower companies are all state-owned:
  Hydro Québec, RusHydro, Itaipu, Three Gorges Corp., Huaneng, U.S. Army Corps of Engineers, Statkraft, CFE Mexico, Eletrobras...
- Main reasons are financial commitments and political risks
- Most of these companies are domestically oriented and are implementing their governments‘ development agenda
- Companies that are investing in projects abroad are mostly from the private sector and from developed countries:
  Brookfield, SN Power, AES, GDF Suez, Sithe, Endesa, Origin...
- Some power companies from emerging markets are starting international engagements, often in neighboring countries

Contractors

4 POWER

Top 10 Revenue: $22,251.1 million
Sector's Revenue: $47,043.1 million

RANK 2012	RANK 2011	
1	2	GRUPO ACS
2	1	ABEINSA SA
3	4	CHINA NATIONAL MACHINERY INDUSTRY CORP.
4	3	SINOHYDRO GROUP LTD.
5	7	VINCI
6	6	SEPCOIII ELECTRIC POWER CONSTR. CORP.
7	**	SEPCO ELECTRIC POWER CONSTR. CORP.
8	**	SHANGHAI ELECTRIC GROUP CO. LTD.
9	**	METKA
10	**	DONGFANG ELECTRIC CORP.

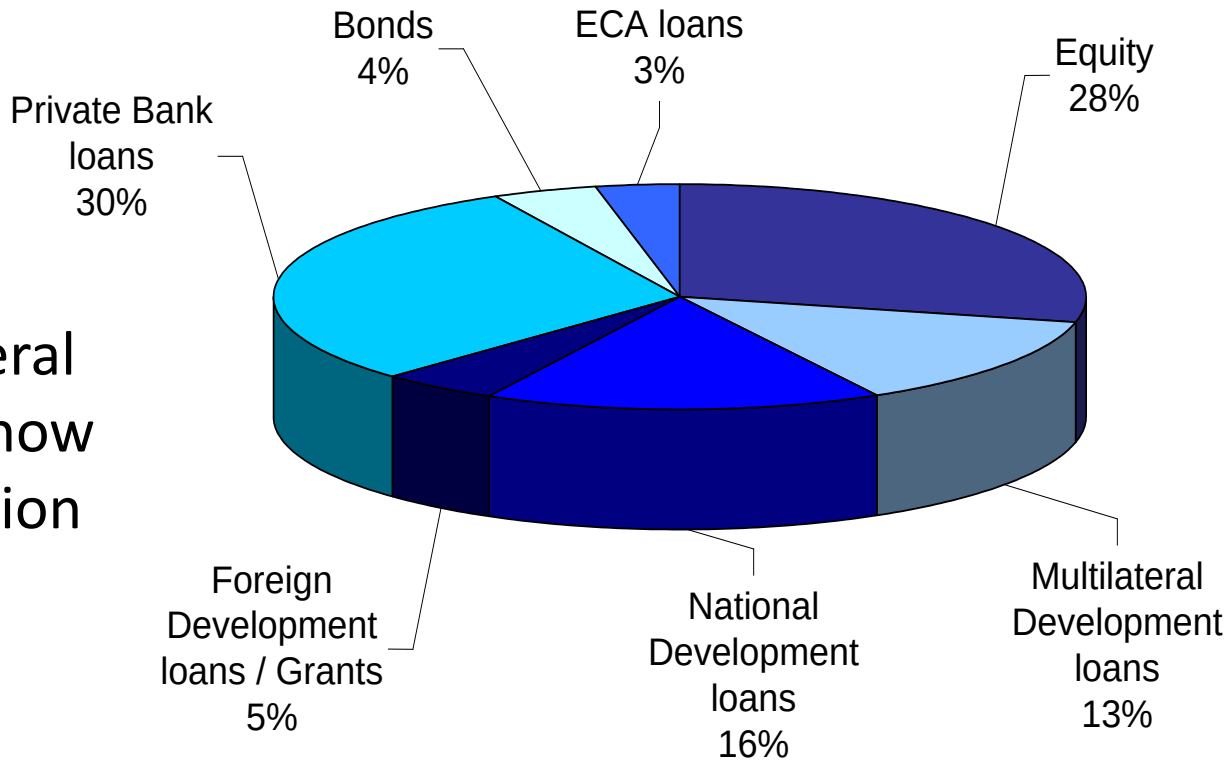
6 WATER

Top 10 Revenue: $9,291.7 million
Sector's Revenue: $15,352.9 million

RANK 2012	RANK 2011	
1	1	HOCHTIEF AG
2	**	GRUPO ACS
3	3	IMPREGILO SPA
4	4	CONSTRUTORA NORBERTO ODEBRECHT
5	**	CHINA NATIONAL MACHINERY INDUSTRY CORP.
6	7	SALINI COSTRUTTORI SPA
7	**	CHINA INT'L WATER & ELECTRIC CORP. (CWE)
8	5	VINCI
9	8	SKANSKA AB
10	**	SINOHYDRO GROUP LTD.

Top 10 by international revenue

Funders

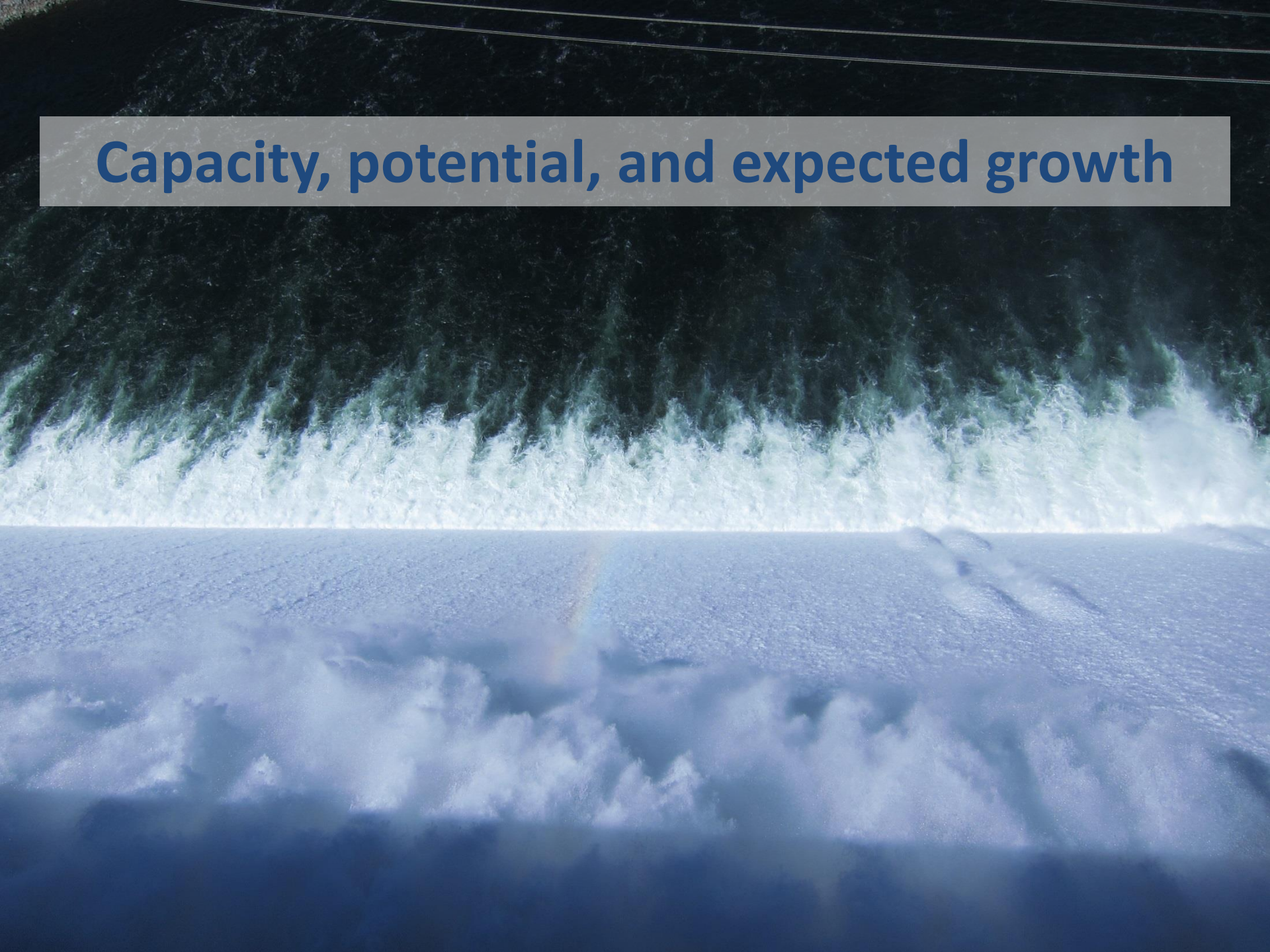


- Traditionally national budgets and multilateral development banks, now increasing diversification of sources

- Brazil – largely BNDES
  Malaysia – Islamic bonds sold to local and Middle Eastern investors
  Myanmar – largely China Dev't Bank and China Exim Bank
  Chile – equity from foreign investors and loans from private banks
- Bank experience can be important contribution to quality
- More than 50% of international project finance transactions are subject to Equator Principles

Special Role of China

Chinese companies and banks are involved in nearly half of all hydropower development outside of China, with extensive activity in Southeast Asia, Africa and Latin America

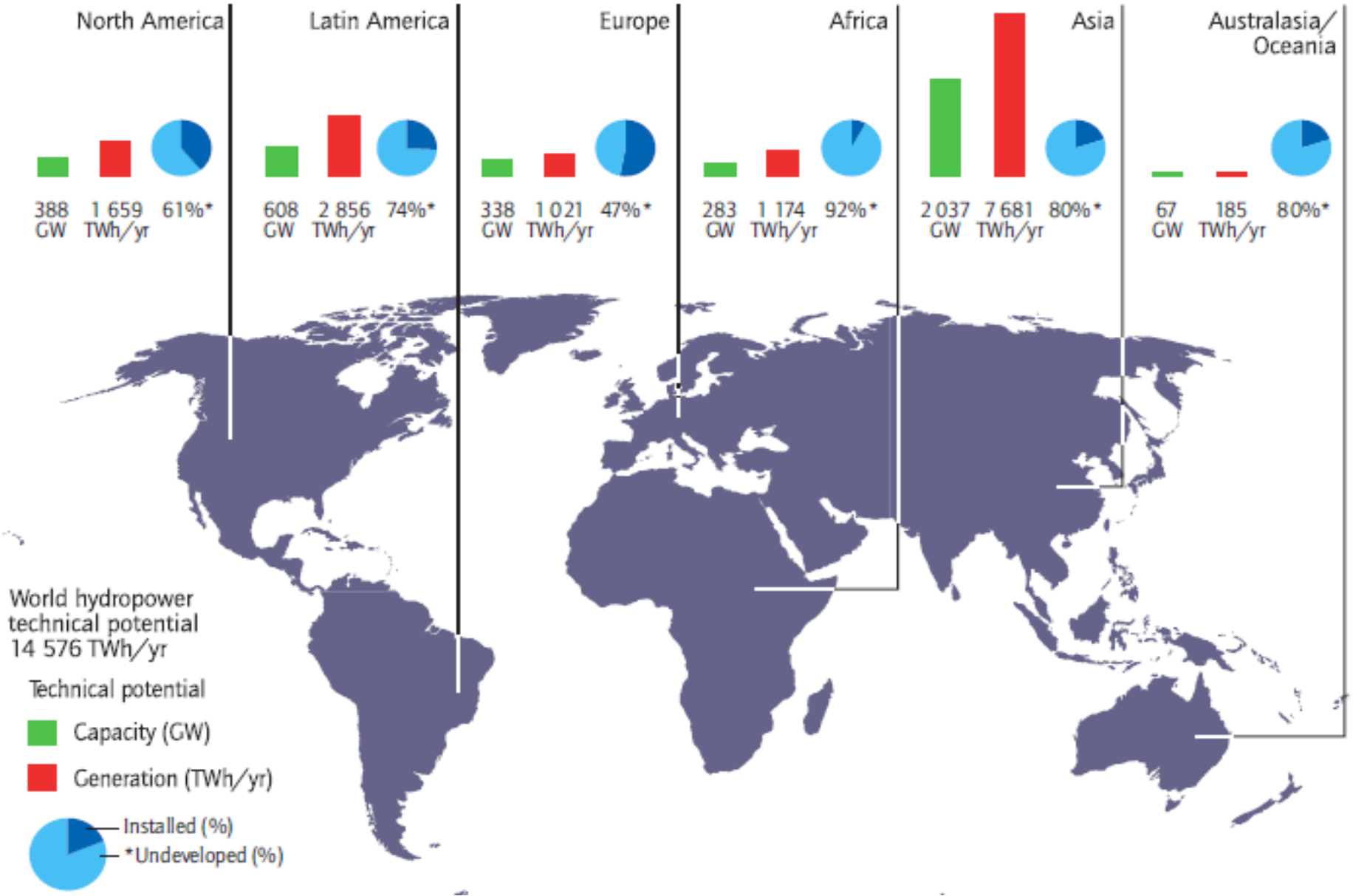


Capacity, potential, and expected growth

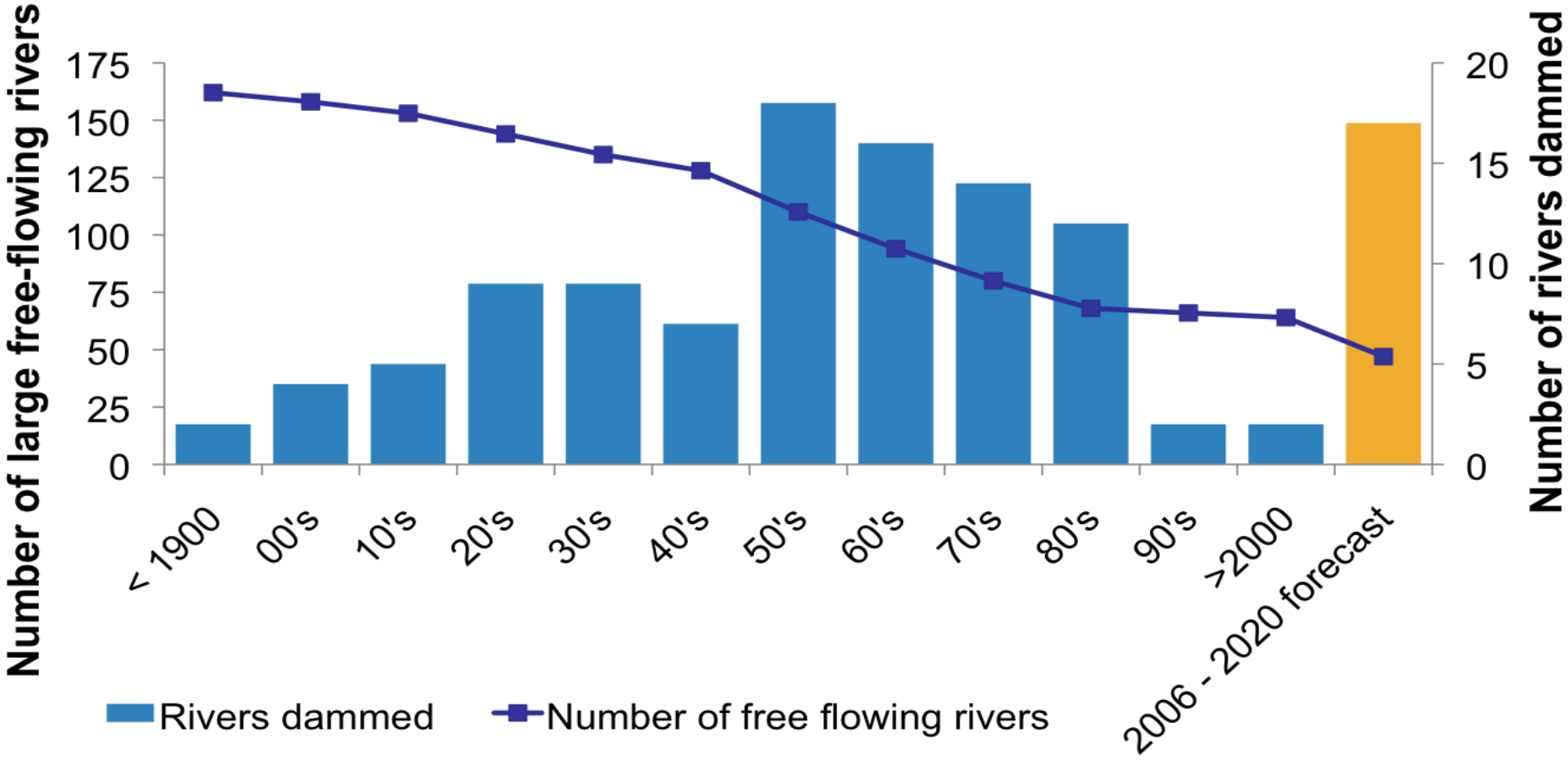
Top 10 hydropower producers

Country	Hydro electricity (TWh)	Share of electricity generation (%)
China	694	14.8
Brazil	403	80.2
Canada	376	62.0
United States	328	7.6
Russia	165	15.7
India	132	13.1
Norway	122	95.3
Japan	85	7.8
Venezuela	84	68
Sweden	67	42.2

Technical potential

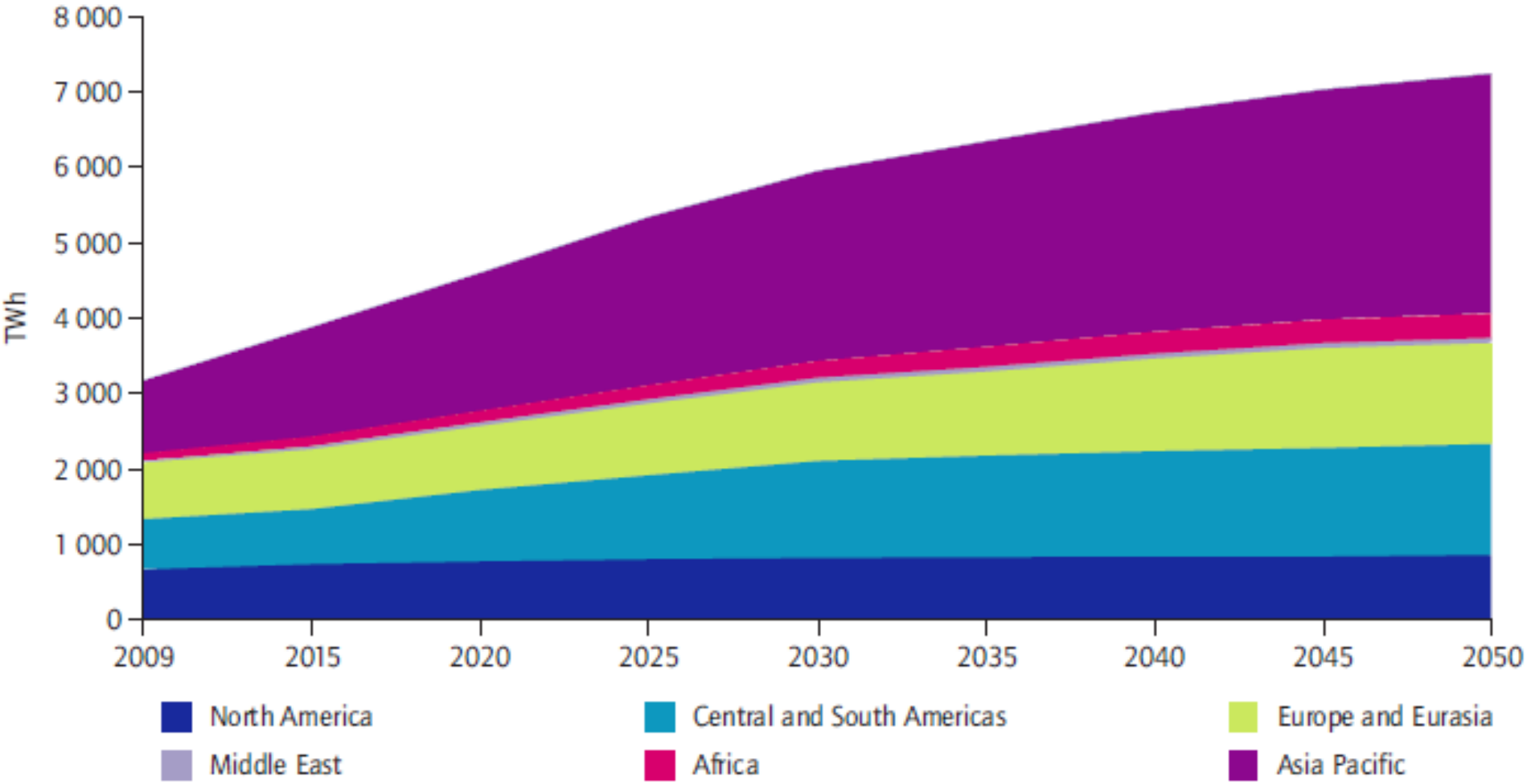


Historical trends in large dams construction

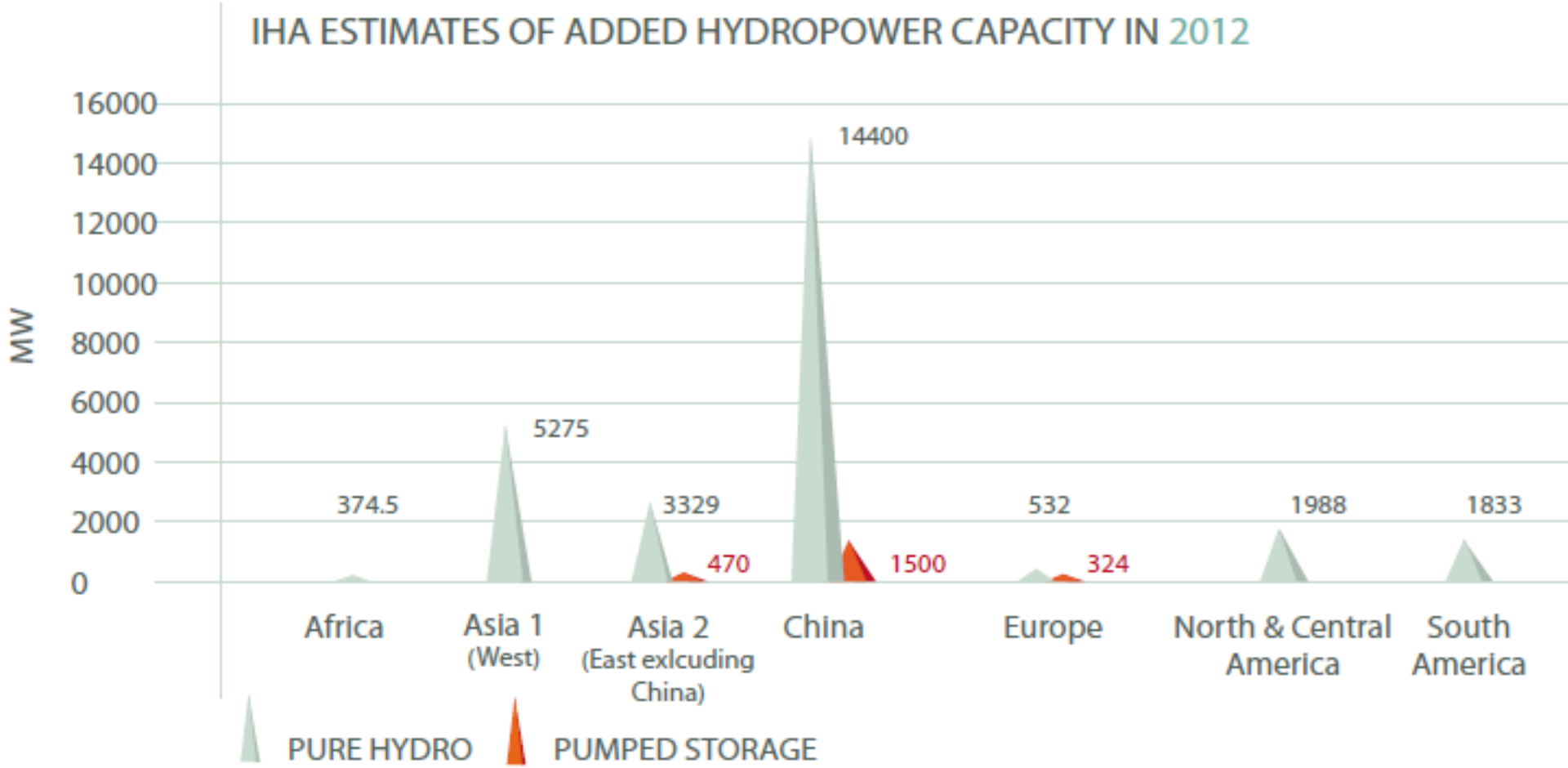


IEA 2°C scenario: Hydropower generation may double by 2050

1,100 GW of additional capacity ≈ 9,000 large dams ≈ $ 3.3 trillion investment

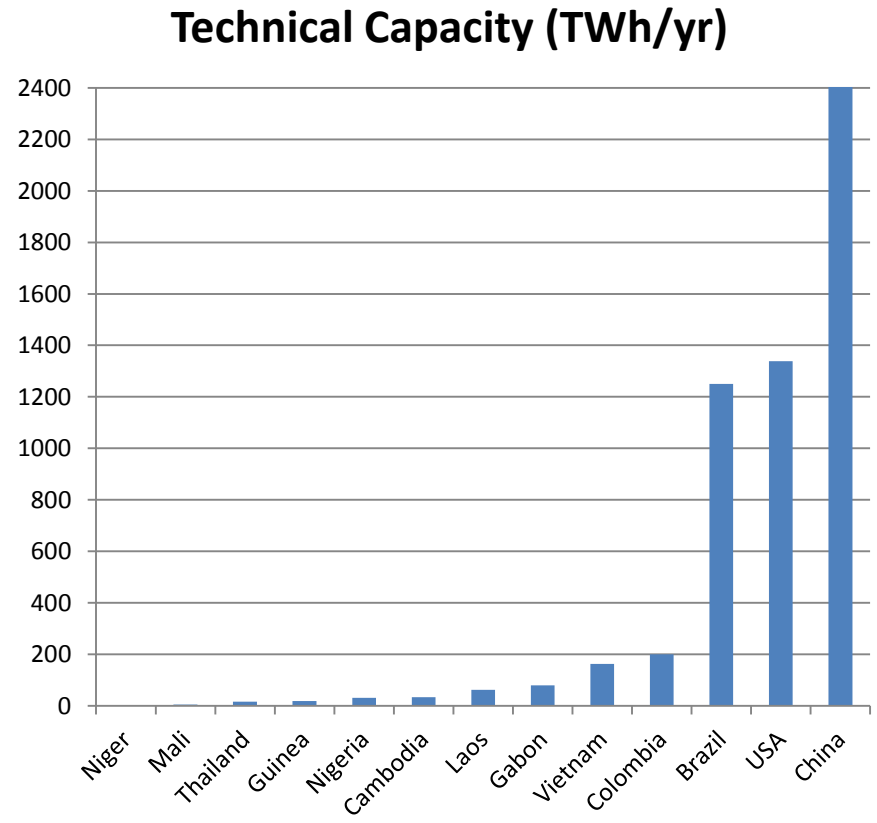


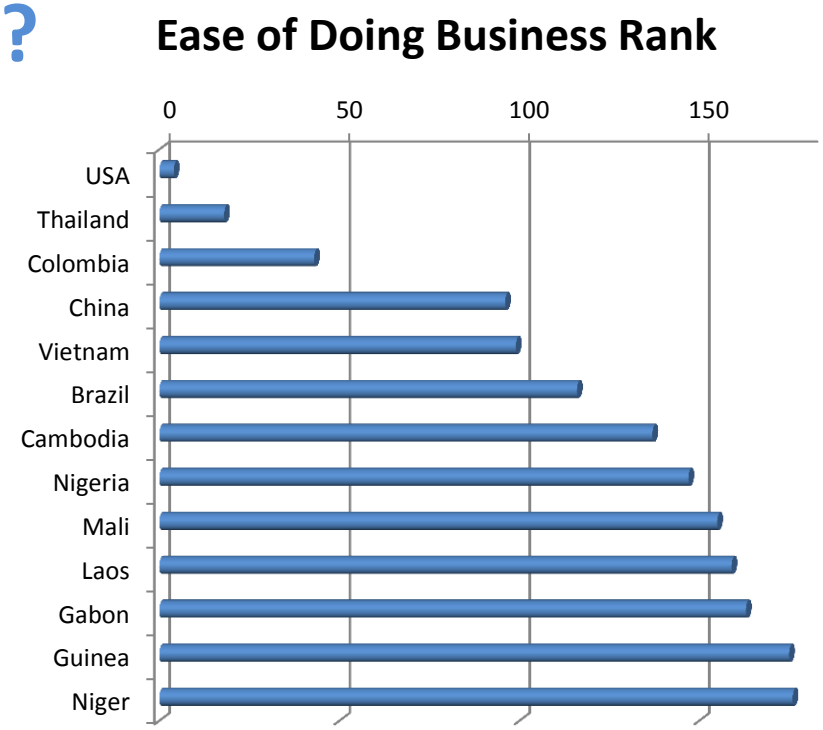
Capacity growth in 2012:
More than half in China, more than 80% in Asia



What will determine growth?

- Remaining technical hydro capacity
- Relative costs of power sources
- Growth in power demand
- Investment climate

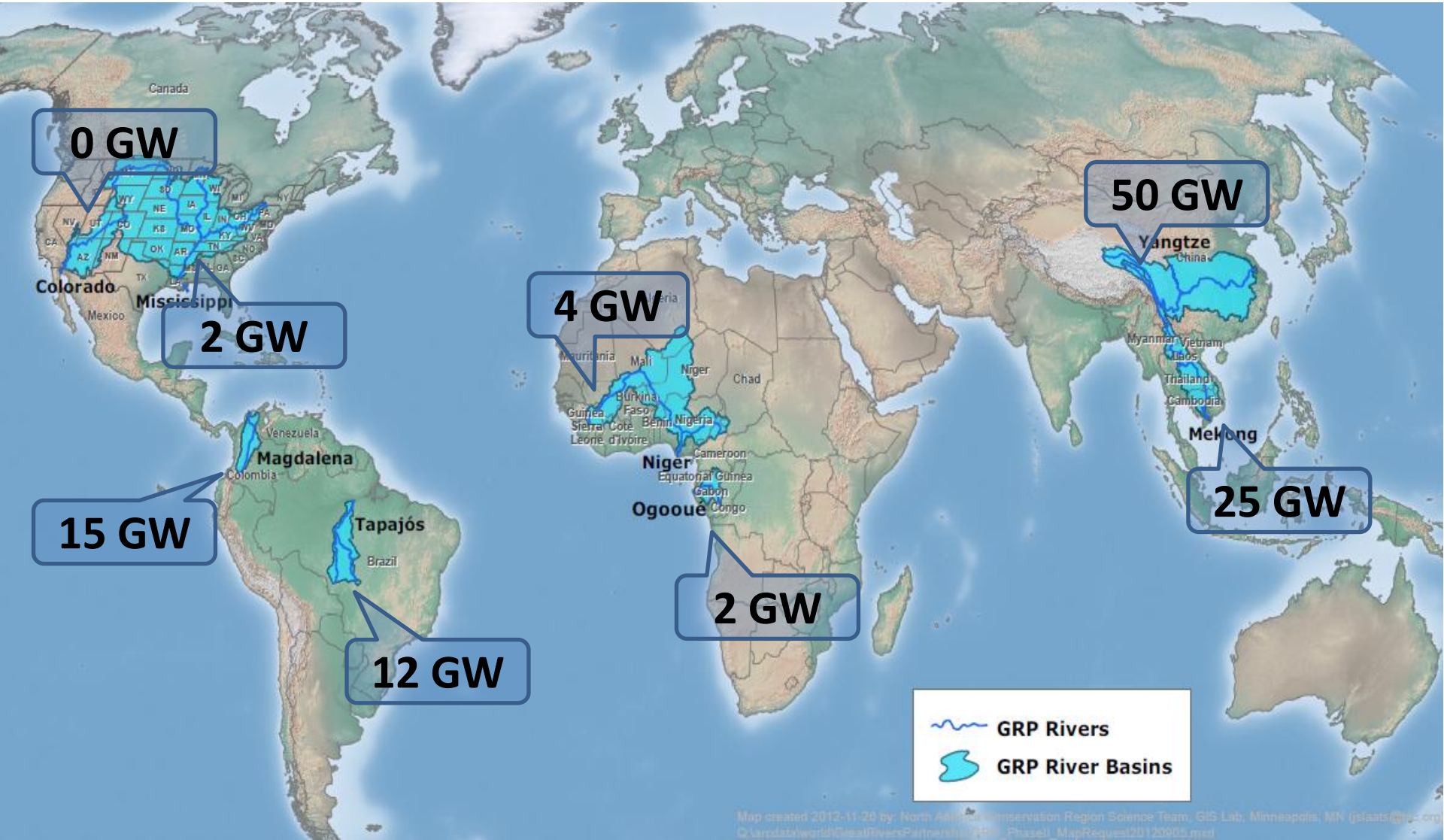




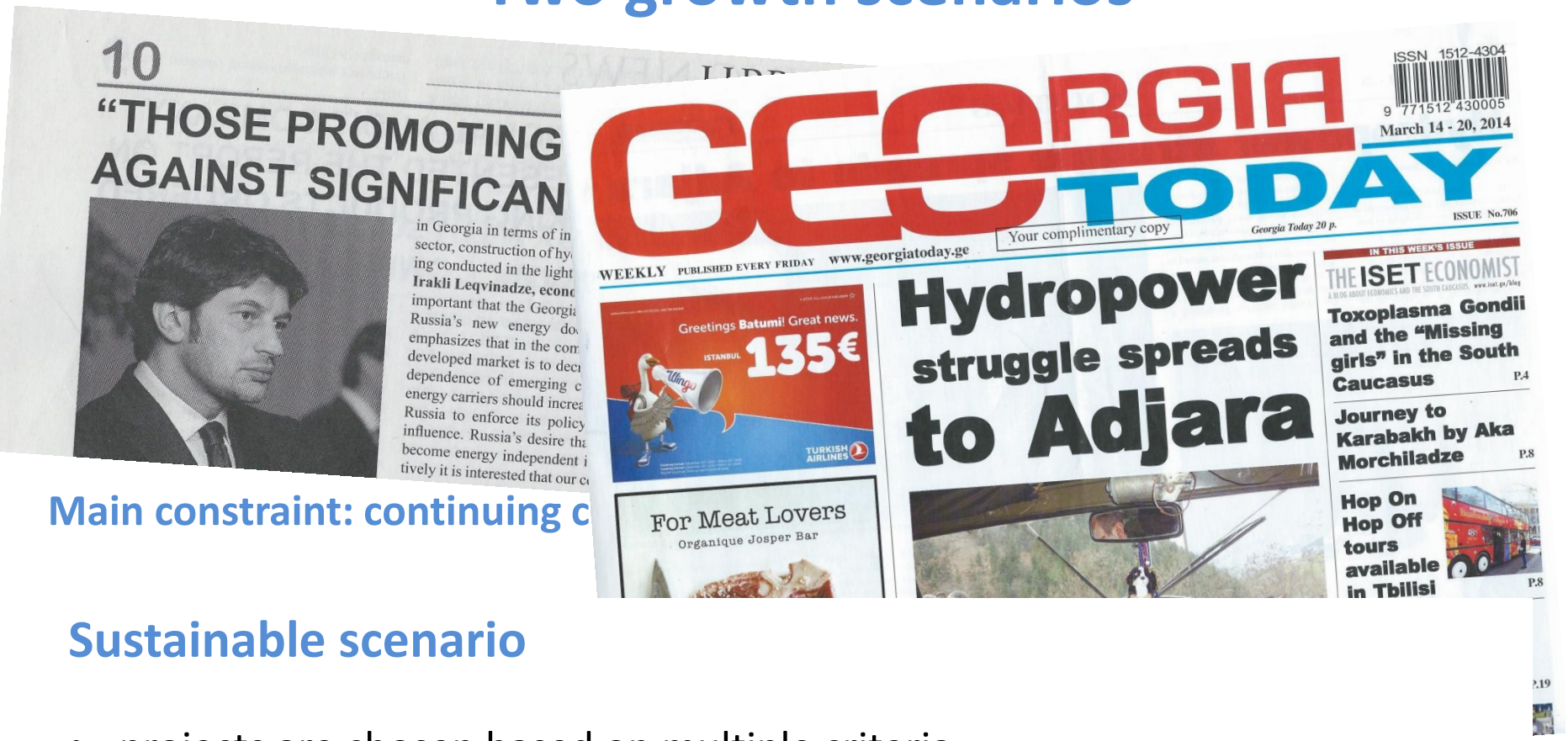
„The significant increase in hydropower capacity over the last 10 years is anticipated in many scenarios to continue ..., with **various environmental and social concerns representing perhaps the largest challenges** to continued deployment if not carefully managed."

Possible hydropower expansion in GRP basins until 2050

total of 110 GW (10% of the current global total or 5% of the 2050 global total, according to the IEA 2°C scenario)



Two growth scenarios

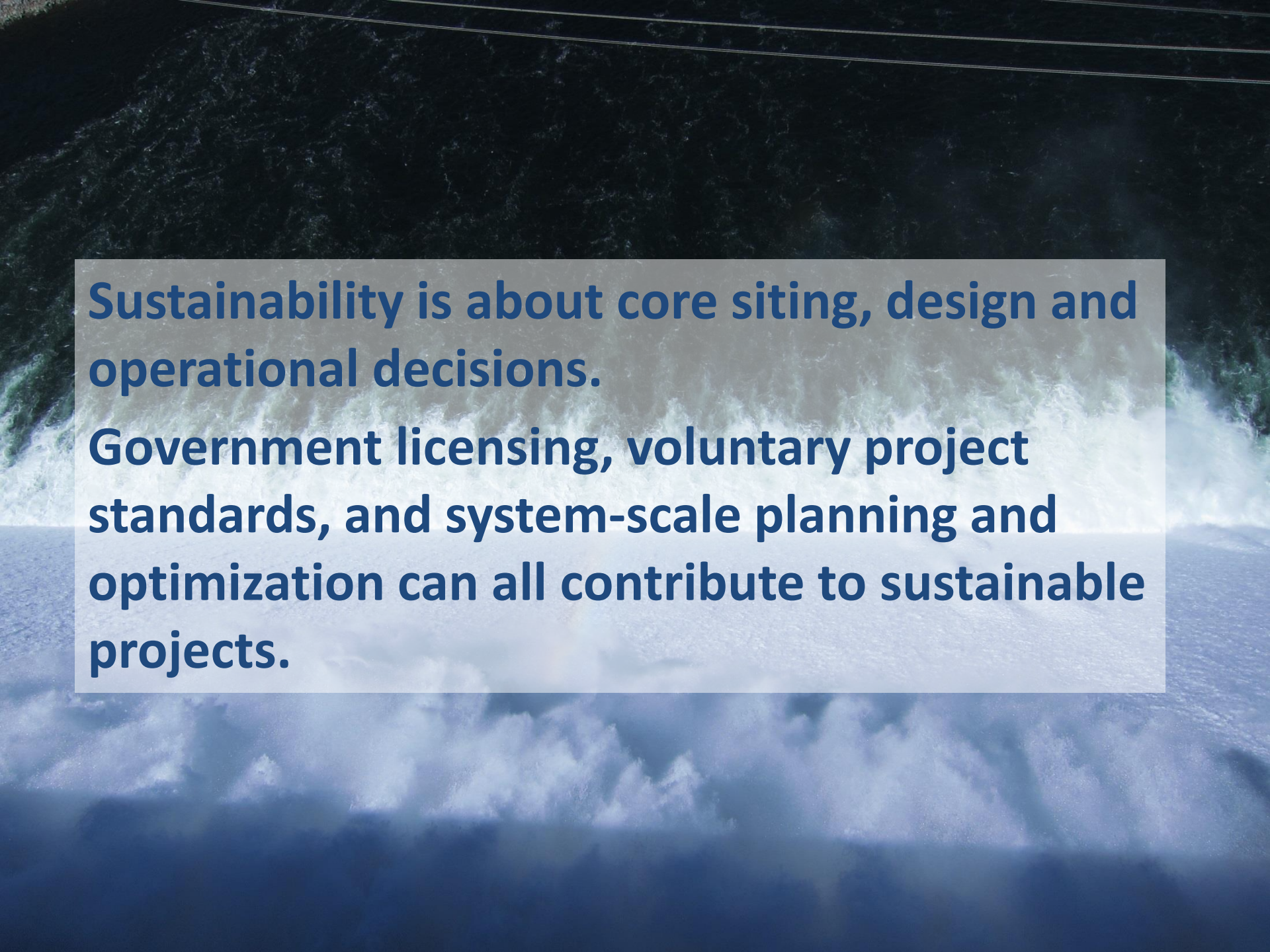


Main constraint: continuing c

Sustainable scenario

- projects are chosen based on multiple criteria
- impact and sustainability assessments are integral parts of development
- negative impacts are avoided, minimized, mitigated and/or compensated for
- benefits are shared, and projects are welcomed by communities

Main constraint: development slower, costlier?


Sustainability is about core siting, design and operational decisions.
Government licensing, voluntary project standards, and system-scale planning and optimization can all contribute to sustainable projects.

Current Trends & Global Status of Hydropower
Questions For Thought

1. Can we agree on the overarching challenge for hydropower? Can we define it?

2. What does success look like for sustainable hydropower? Can we describe it in terms of processes and outcomes?

3. Does it make sense to think of two alternative pathways for hydropower—ones that is business as usual and one that is sustainable?