iha
international hydropower association

Climate Change: Challenges and Opportunities for Hydropower

Overview of IHA initiatives on Climate Change issues

ICOLD Technical Committee Y

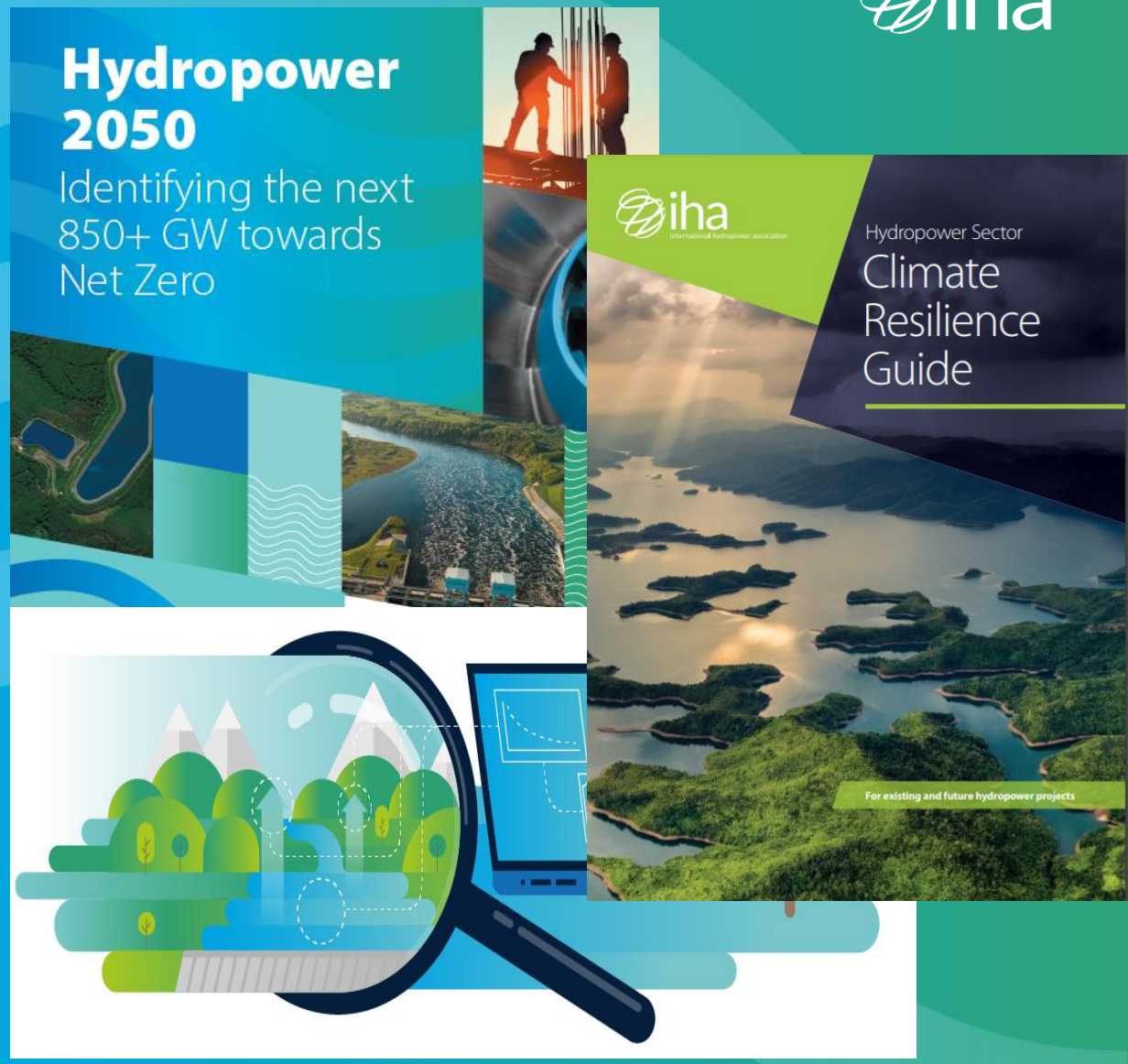
CIGB ICOLD

COMMISSION INTERNATIONALE DES GRANDS BARRAGES

INTERNATIONAL COMMISSION ON LARGE DAMS

Agenda

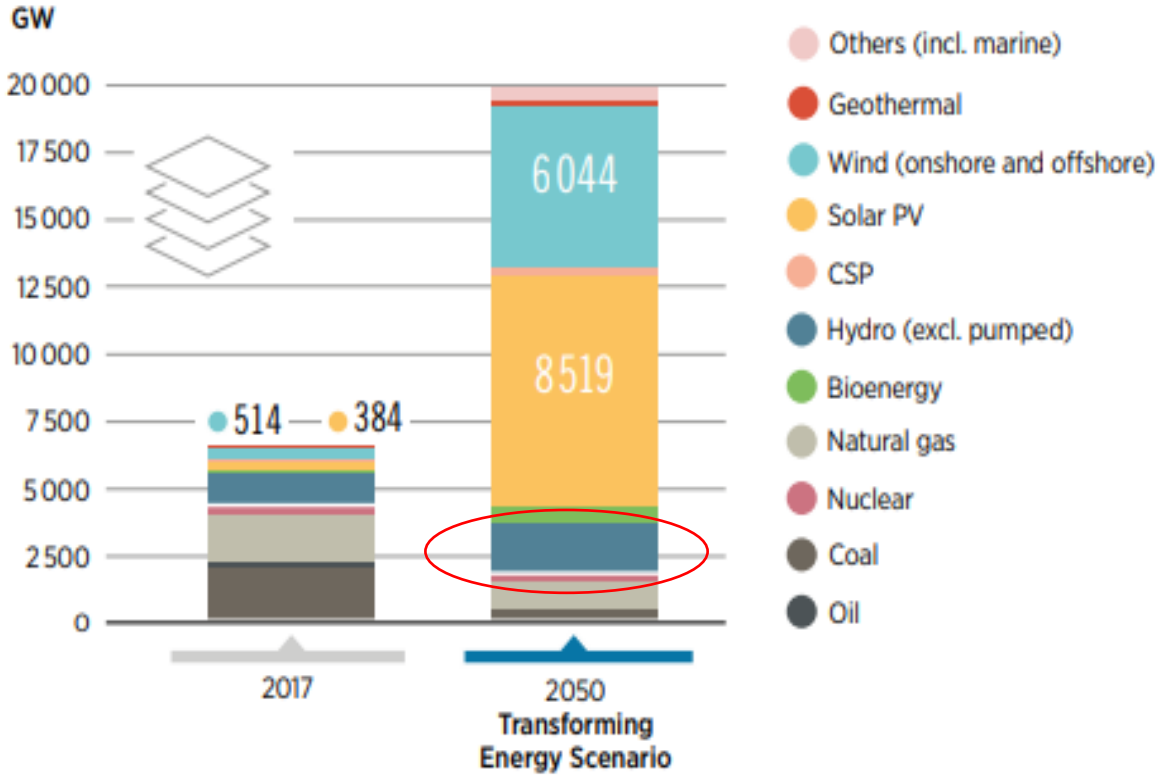
- Hydropower 2050 vision
- GHG emissions and the G-Res tool
- IHA Climate Resilience Guide



We need hydropower to meet Net Zero targets:

- To limit temperature rises to <2C world needs at least 850 GW additional by 2050
- Hydro can fill the hole left by coal
- Hydropower's role will increasingly shift to enhancing system flexibility and supporting variable wind and solar PV

<2C scenario, IRENA

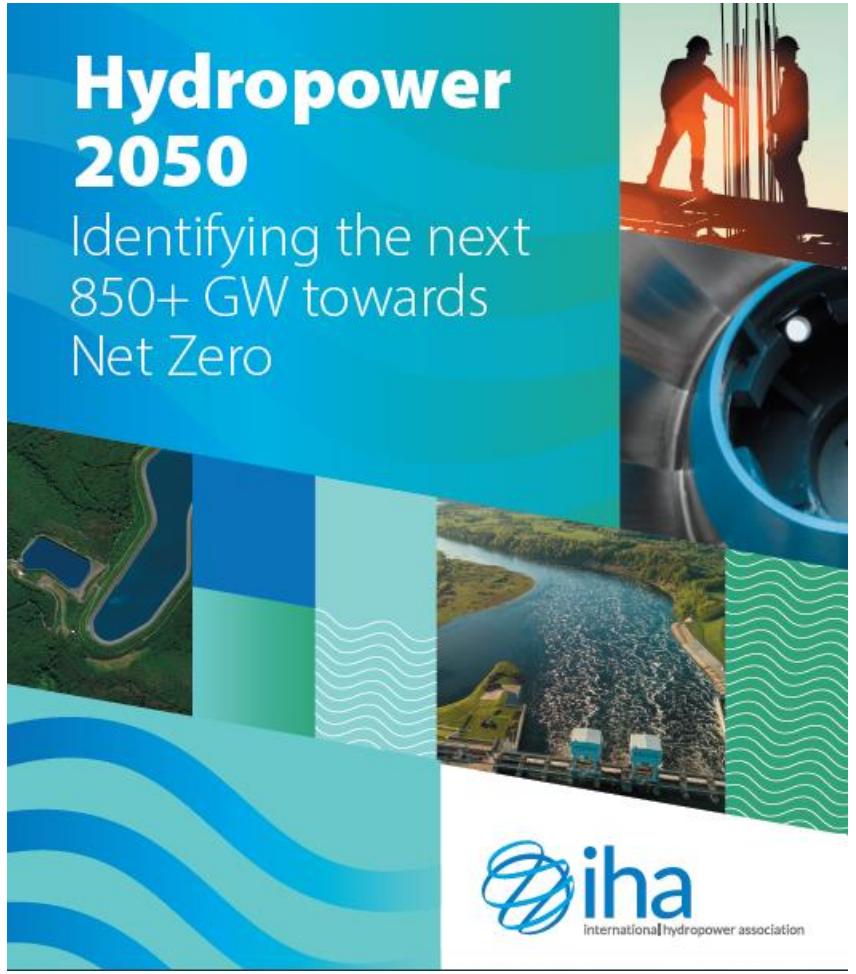


Global electricity generation by source 2050, Transforming Energy Scenario (IRENA 2020 – Global Renewables Outlook: Energy Transformation 2050)

Hydropower 2050 report

Hydropower needs to increase capacity by at least 850 GW by 2050 in order to support the energy transition and tackle climate change

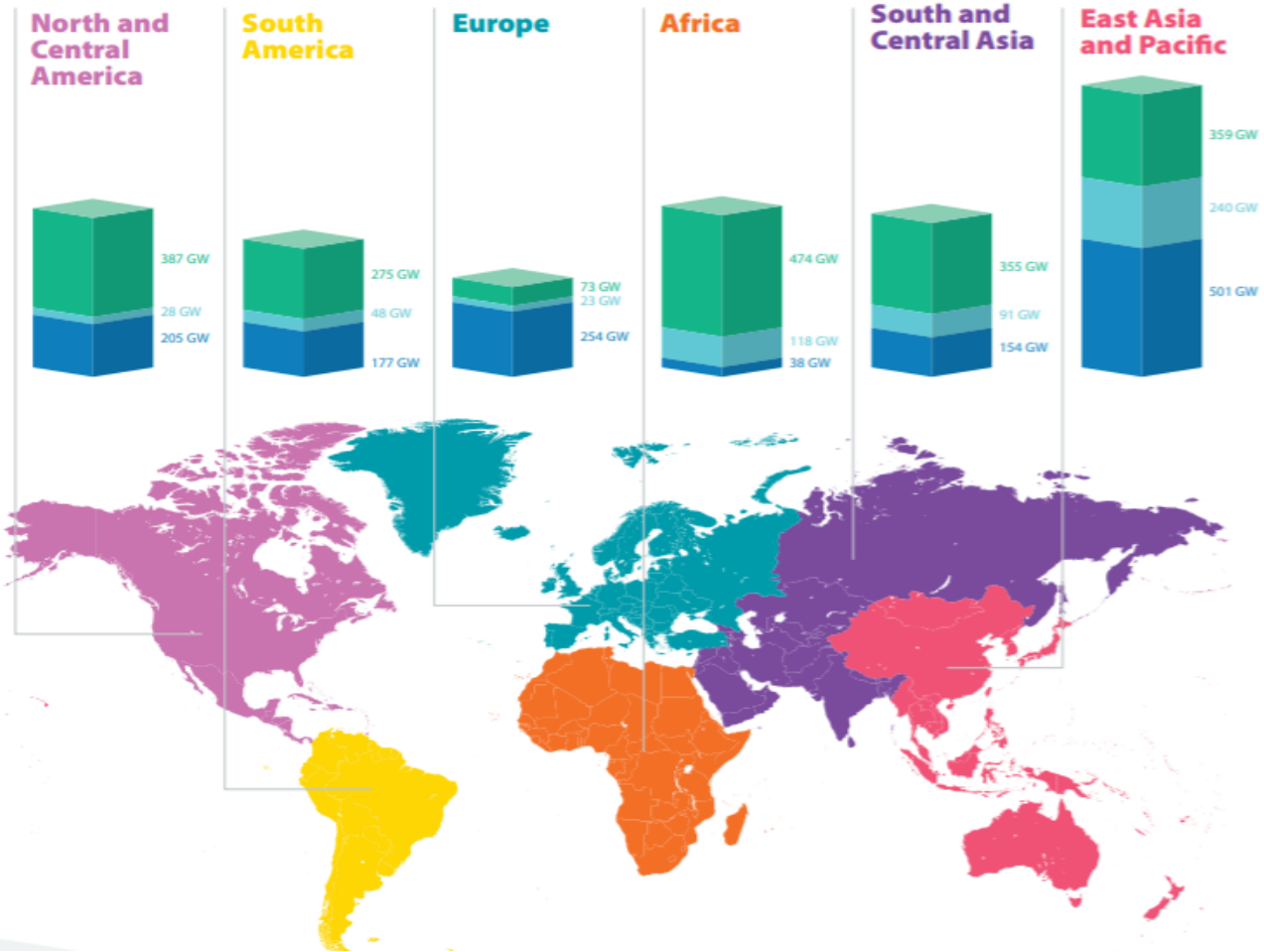
- Hydropower today
- Why we need 850+ GW
- What if we don't build new hydro?
- Sustainability
- Potential global hydropower capacity
- The hydropower 'pipeline'
- Policy recommendations



https://www.hydropower.org/publications/hydropower-2050-identifying-the-next-850-gw-towards-2050

Achieving net zero

Future hydropower development



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In most regions the potential far exceeds what is needed

Region	Indicative Potential Hydropower Capacity (GW)	Installed Capacity in 2020 (GW)
Africa	630	38
Europe	350	254
East Asia and Pacific	1,100	501
North and Central America	620	205
South America	500	177
South and Central Asia	600	154

We Can with Hydropower

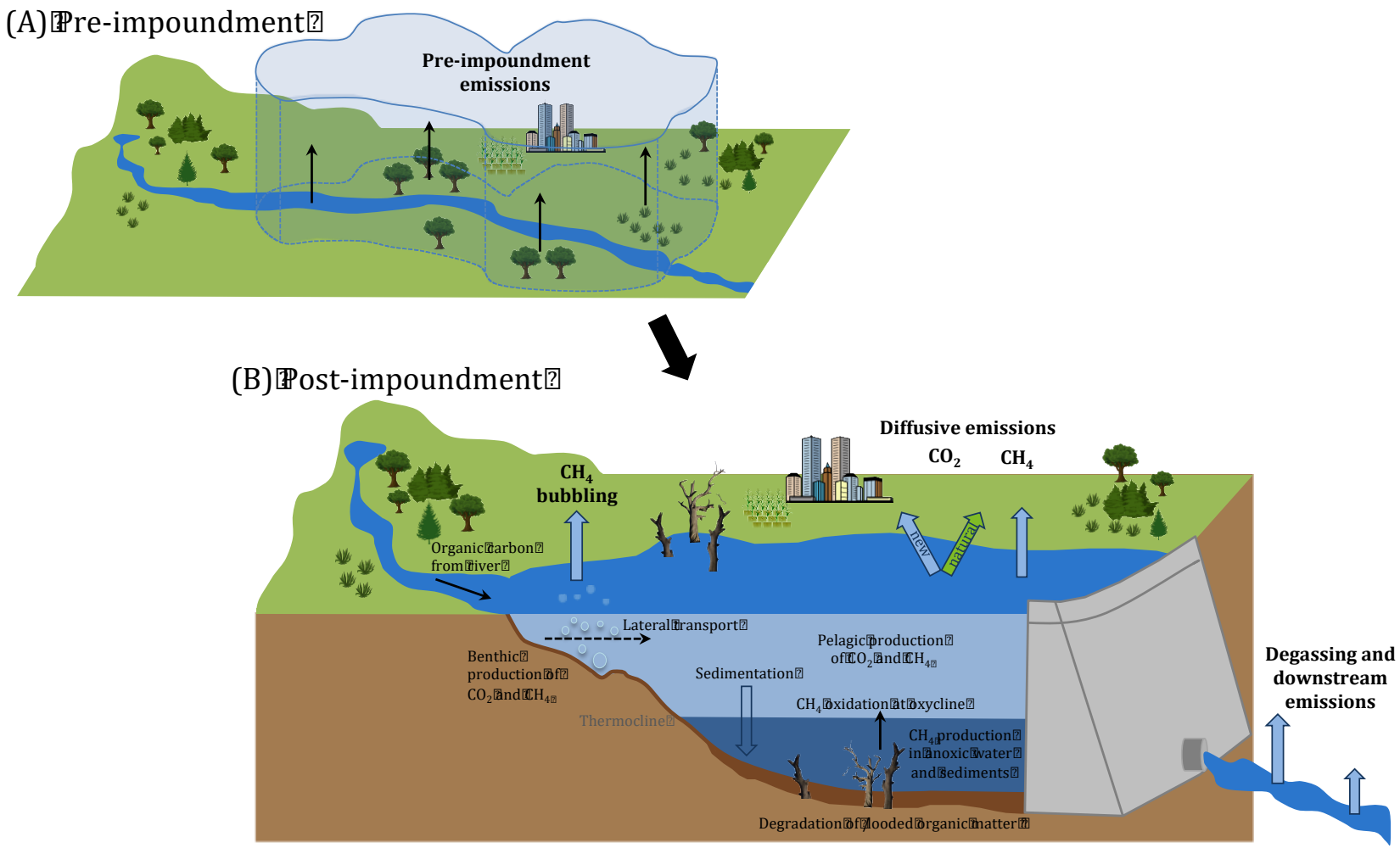
- Hydropower as a solution to climate change is key message of all IHA communications
- #WithHydropower campaign https://with.hydropower.org/
- IHA ensure high-level presence at global climate events such as COP26, COP27
- Sustained engagement and advocacy towards policymakers, investors and the public

with.hydropower.org
#WithHydropower

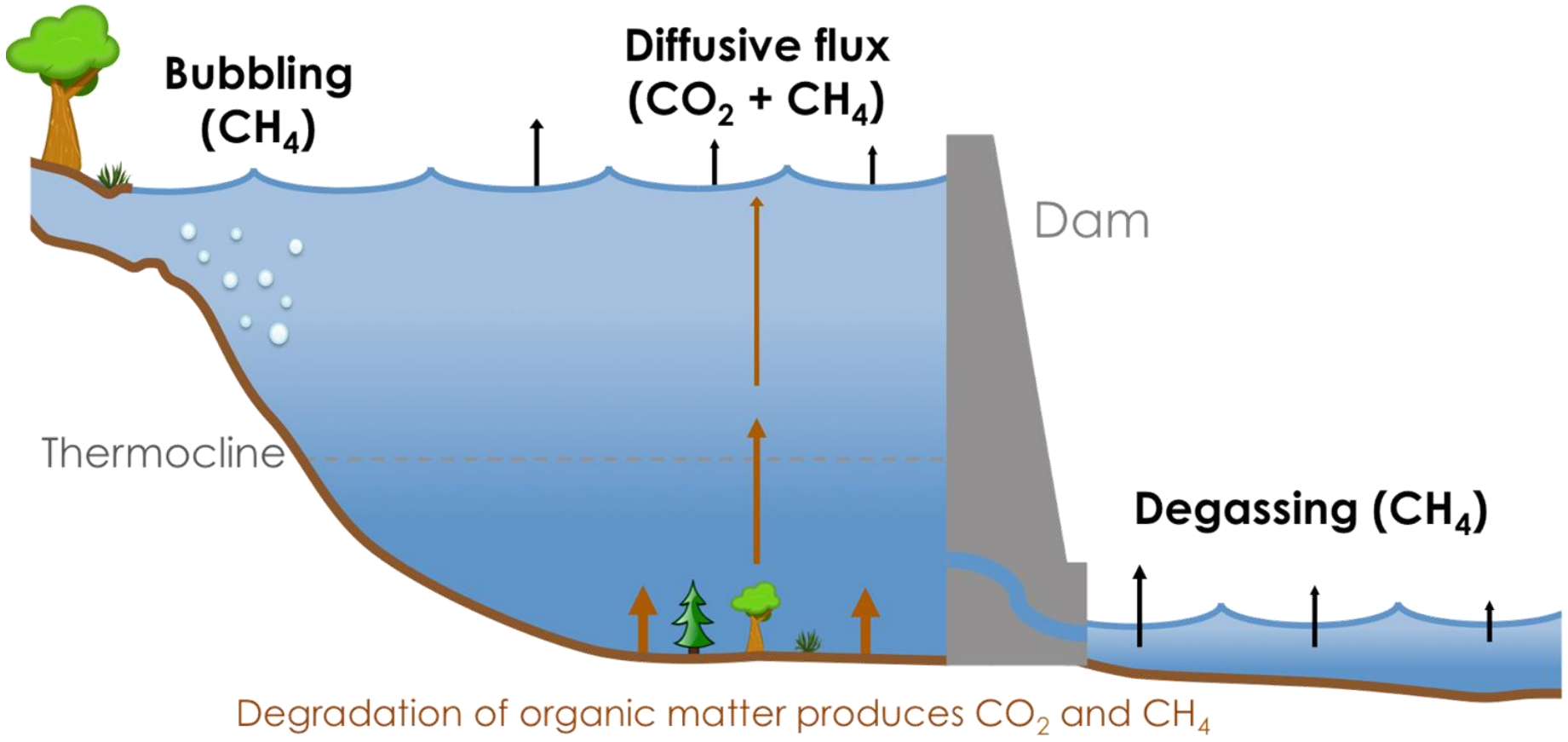
GHG emissions from reservoirs

- How do they form?
- How to measure: G-res tool

GHG Emissions from reservoirs



GHG Emissions from reservoirs



Measuring Emissions from reservoirs

G-res tool

- Simple-to-use, web-based tool that can be used to predict GHG emissions from reservoirs without going to the field to take measurements.
- Launched May 2017
- **https://g-res.hydropower.org/**

Initiative partners:

iha international hydropower association

United Nations Educational, Scientific and Cultural Organization

UNESCO Chair in Global environmental change

Université du Québec à Montréal (Canada)

In collaboration with:

Luke Natural Resources Institute Finland

SINTEF

Mott MacDonald

World Bank Group

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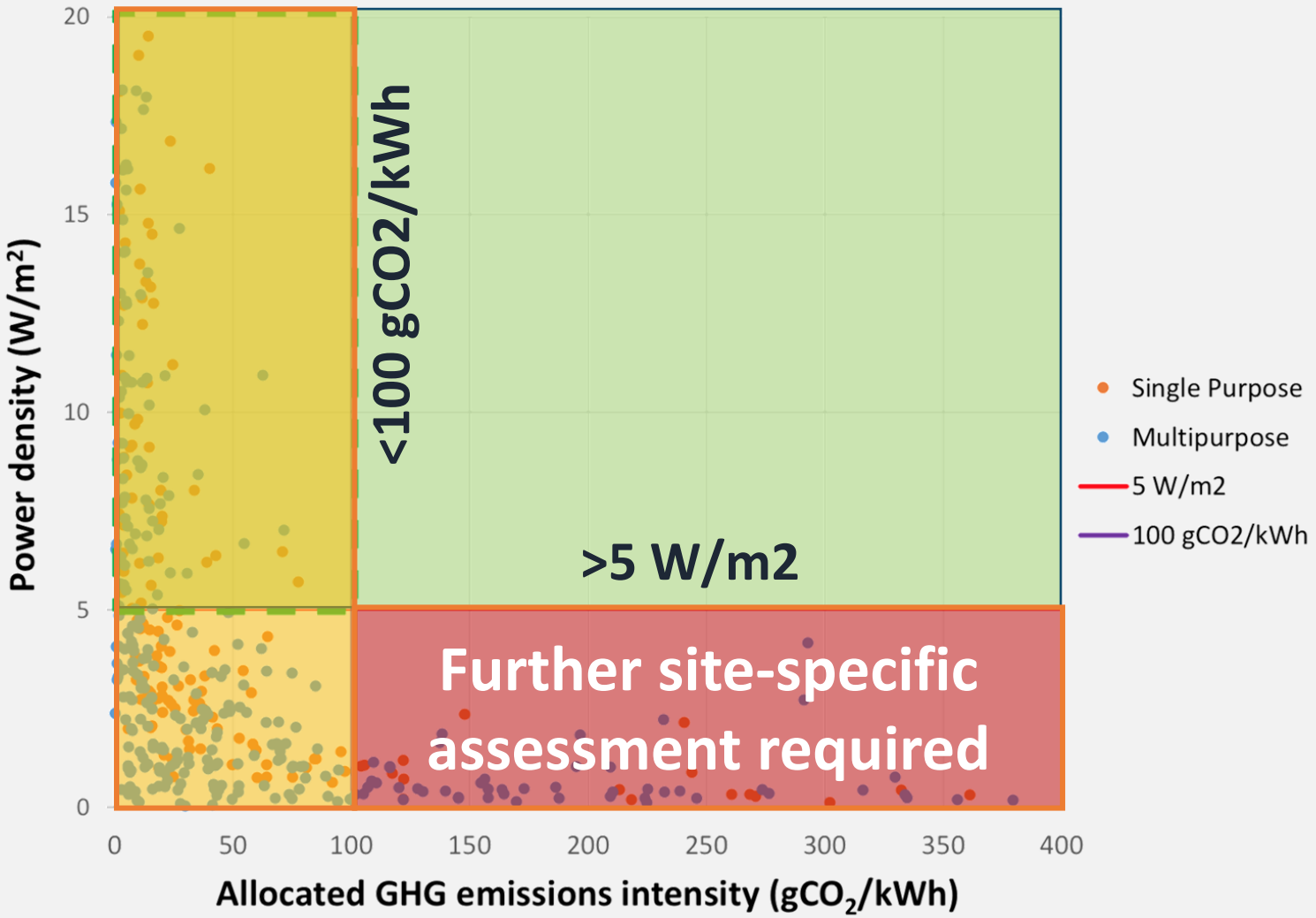
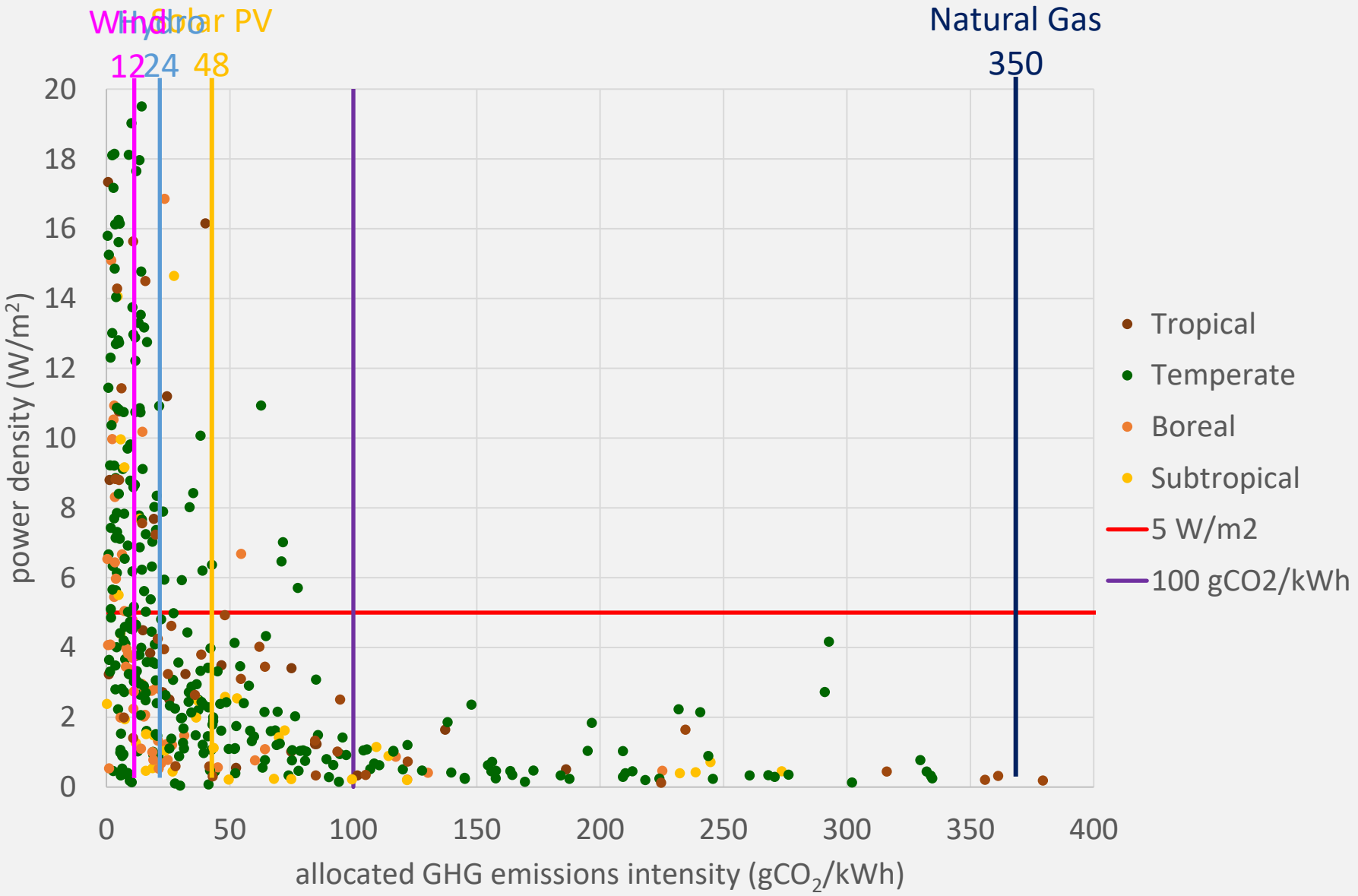
Results analysis 500 reservoirs:



Emissions intensity of ~500 reservoirs
Source IHA

Results analysis 500 reservoirs:

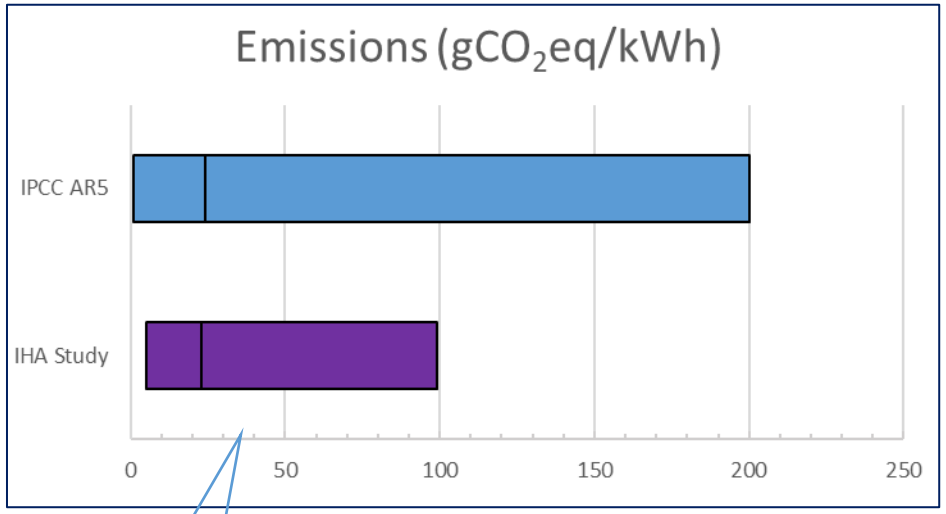


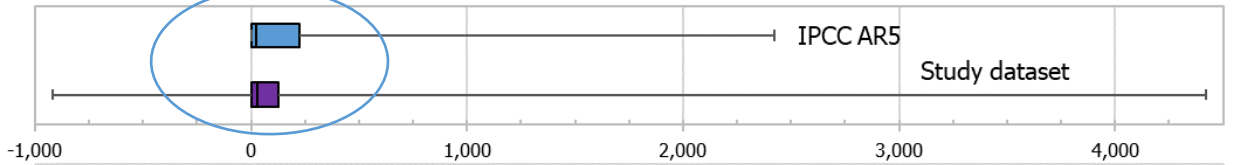
Hydropower GHG emissions

Results of 2021 study* confirm hydropower is a **low-carbon technology**

Hydropower global median life-cycle emissions: 23 gCO_2-eq/kWh

Aligned with IPCC and the range between 25th and 75th percentile is smaller





	Study dataset	IPCC AR5
Min	-922	0
Q1	5	1
Median	23	24
Q3	99	200
Max	4295	2200

** Water Security and Climate Change: Hydropower Reservoir Greenhouse Gas Emissions (2021)*

GHG eligibility requirements

Use G-res tool for site specific GHG estimations

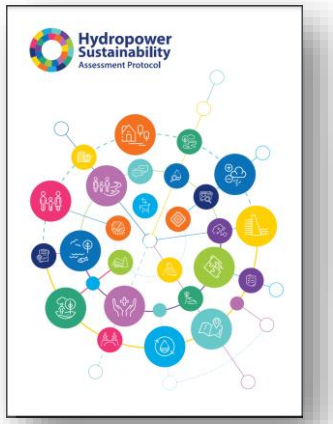
Assessing the net greenhouse emissions of a reservoir using such G-res tool is now an expectation for:

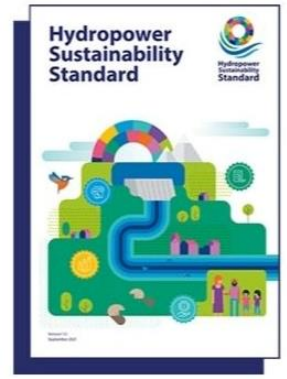
- ✓ demonstrating sector´s basic good practice
- ✓ financing a hydropower project through climate finance*
- ✓ sustainability reporting

Thresholds:

- ❑ a power density of **more than 5 W/m²** or
- ❑ an emissions intensity of **less than 100 gCO_2e/kWh.**

2018 2020 2021





** New projects (after year 2020) should have < 50 gCO2-eq/kWh*

Adaptation
Resilience Guide

The guide provides a practical and useful approach for **identifying**, **assessing** and **managing** climate risks to enhance the climate change resilience of new and existing hydropower projects.

It provides international industry good practice on how to **incorporate climate resilience** into hydropower project **planning, design and operations**.
2019

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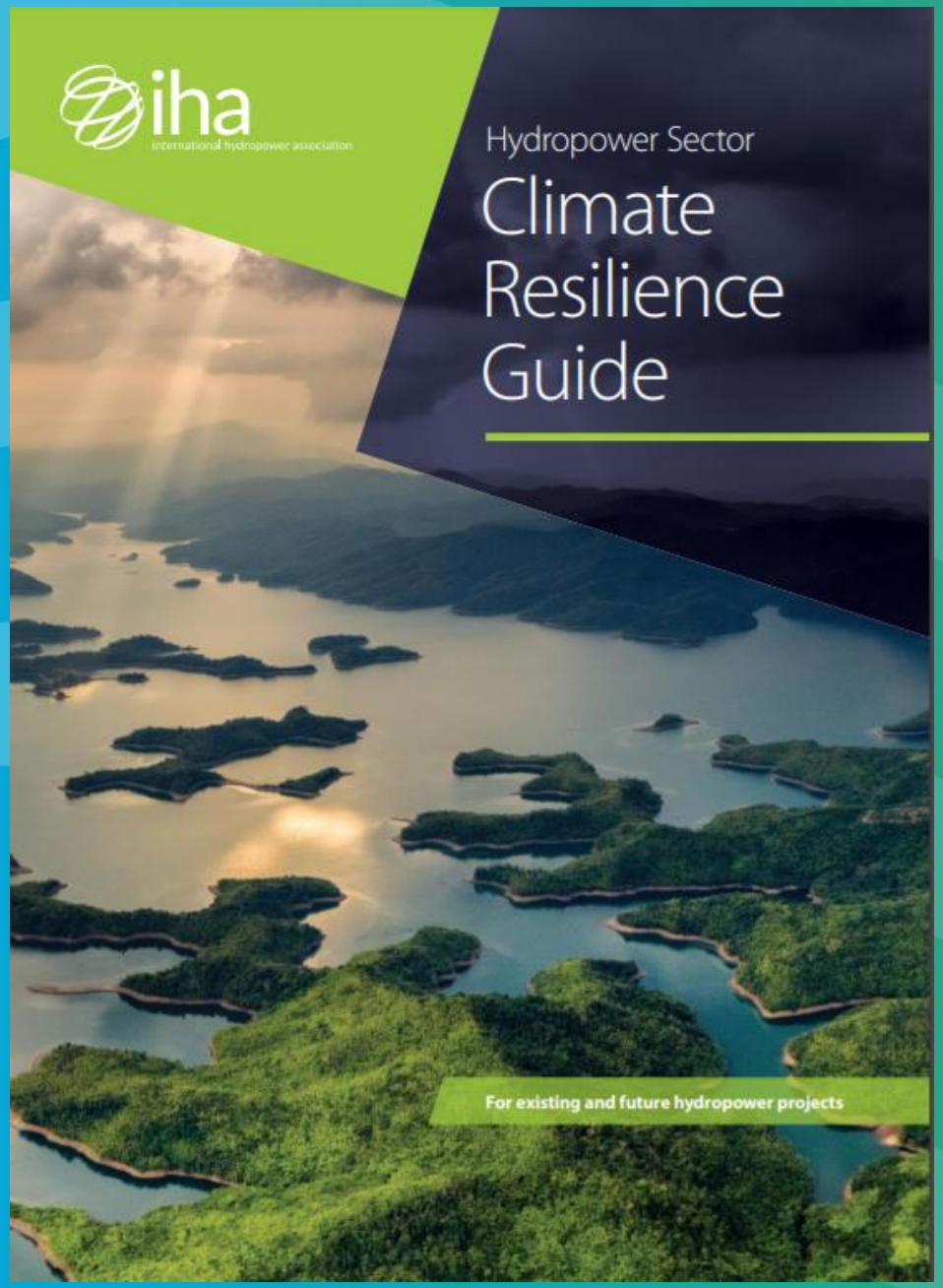
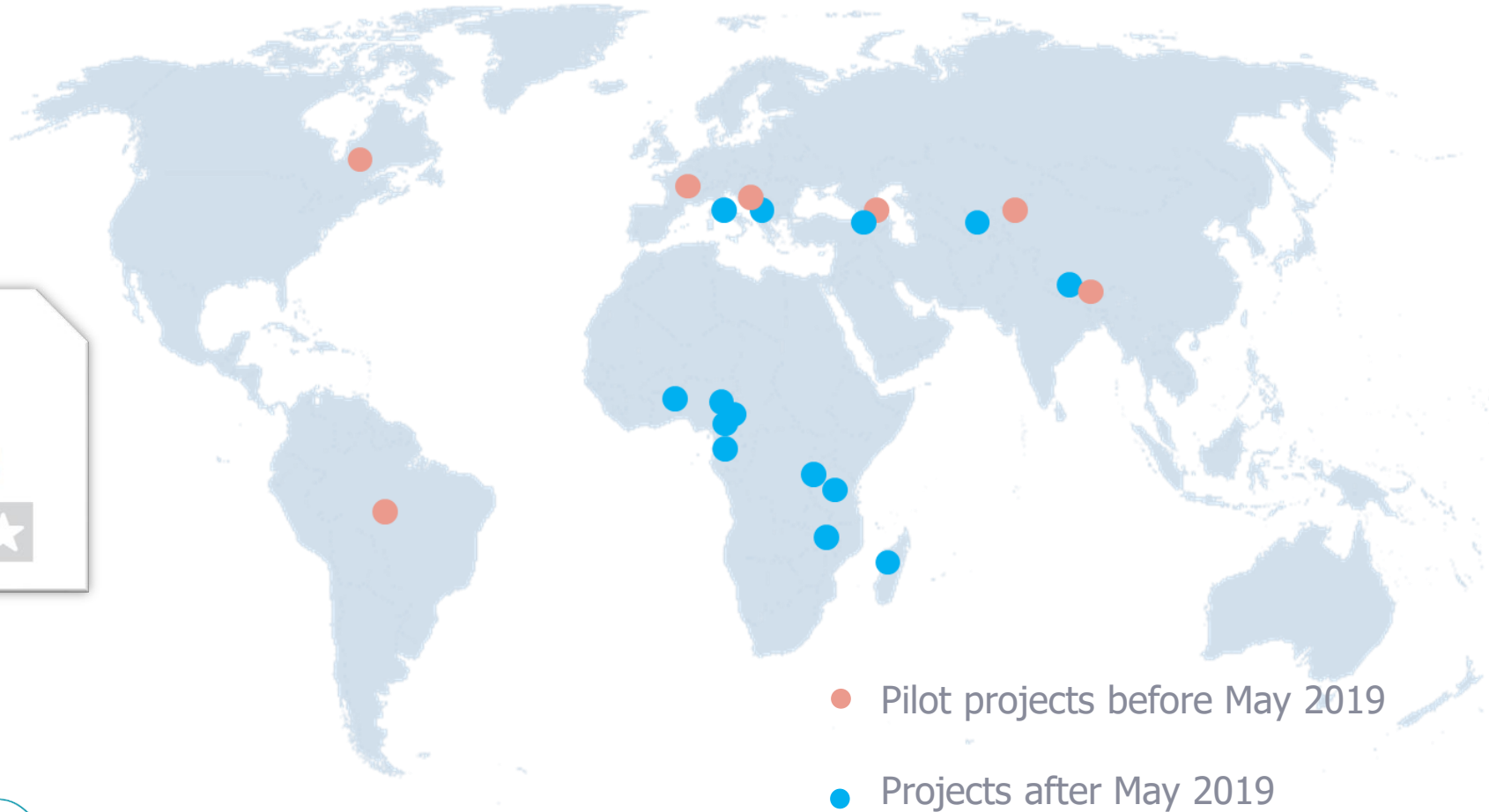


A guide for the hydropower sector

Worldwide application

Industry welcomed the guide

Financial institutions are the majority of the organisations to request the guide be applied.



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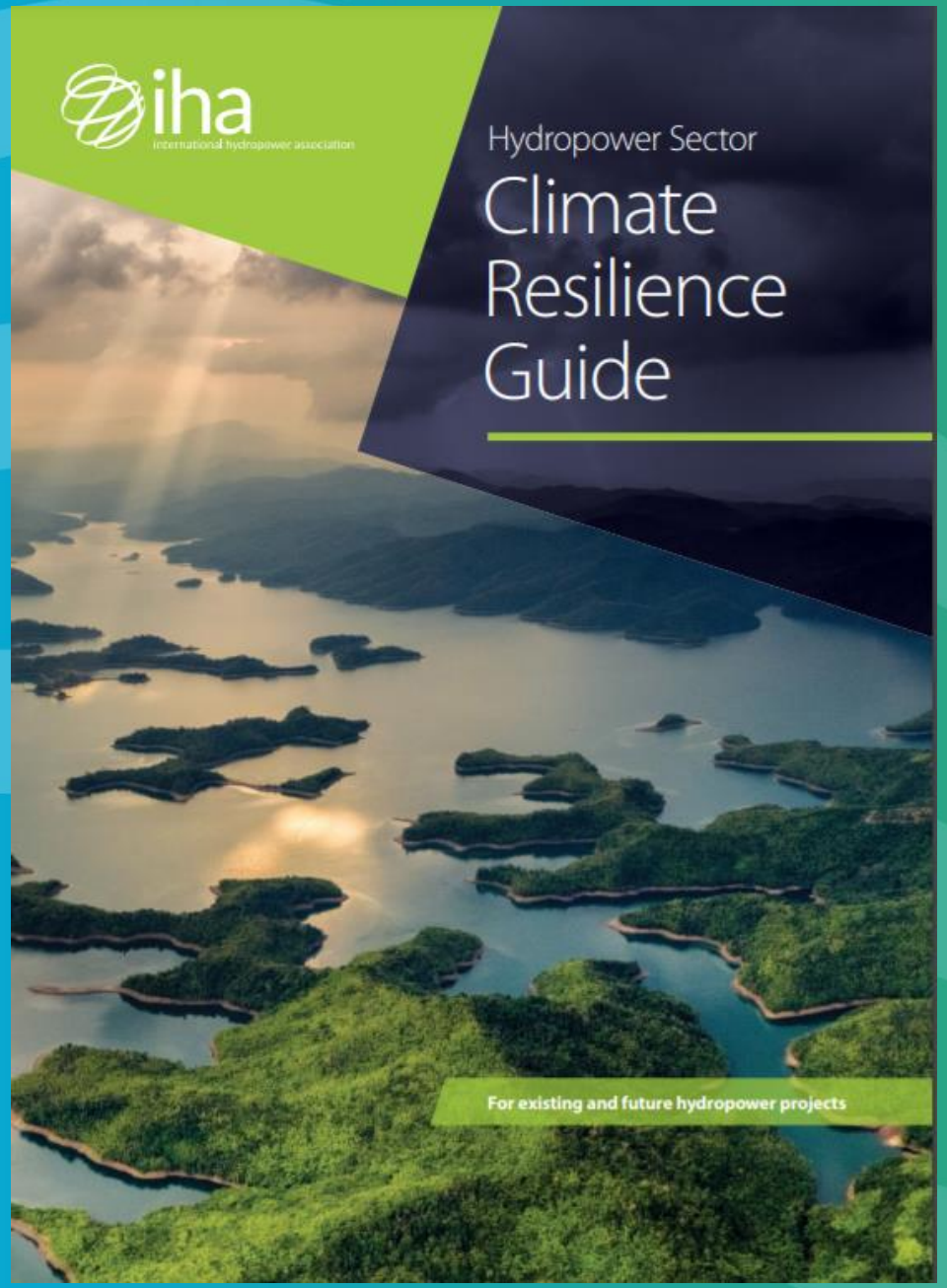
Six Core Principles

- ✓ All stages
- ✓ All types
- ✓ All scale
- ✓ All geographies and weather
- ✓ Key functions
- ✓ All levels of data

www.hydropower.org/climateresilienceguide



A guide for the hydropower sector

Innovative methodology

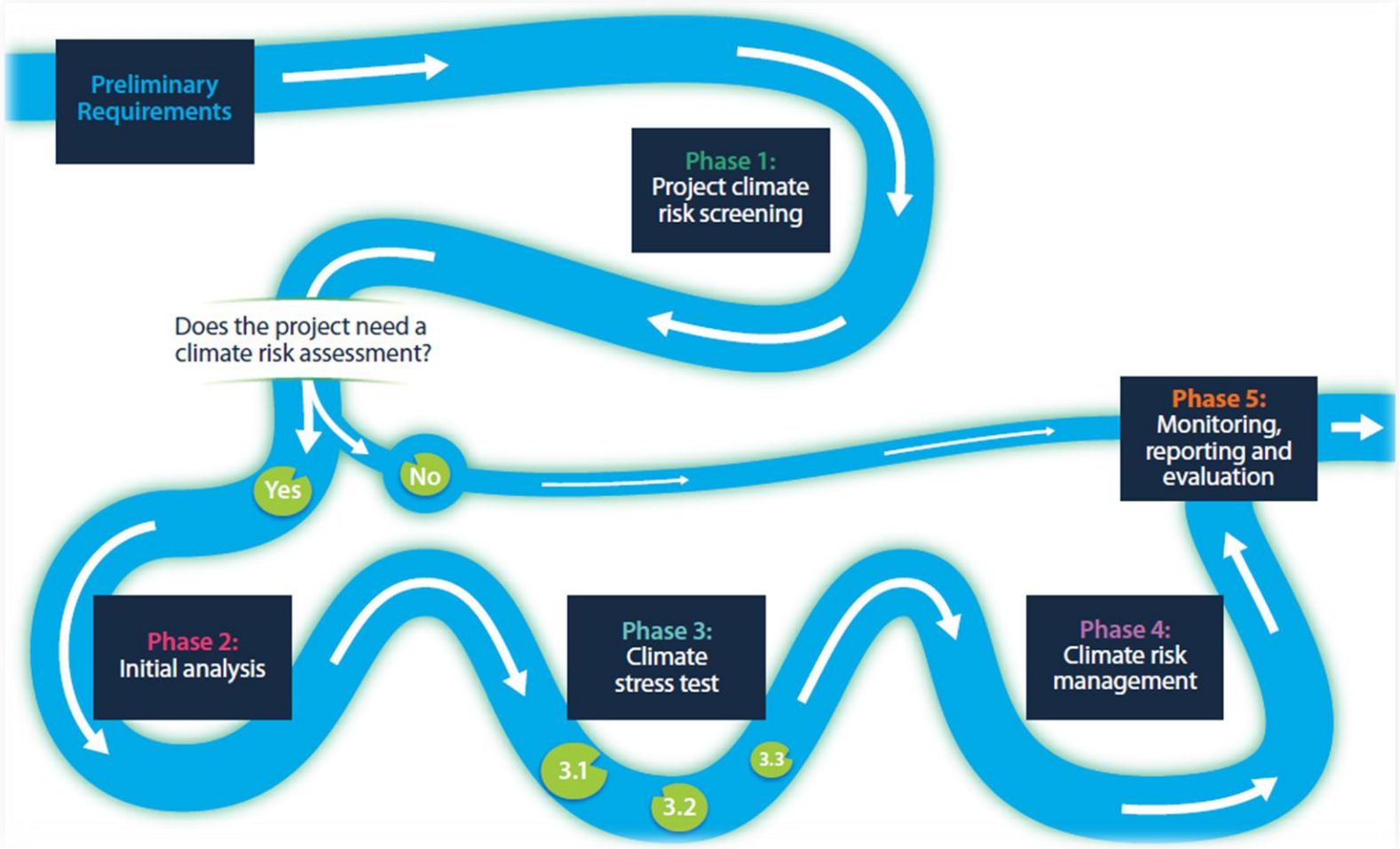
Addressing uncertainty

Decision Making under Uncertainty (DMU)

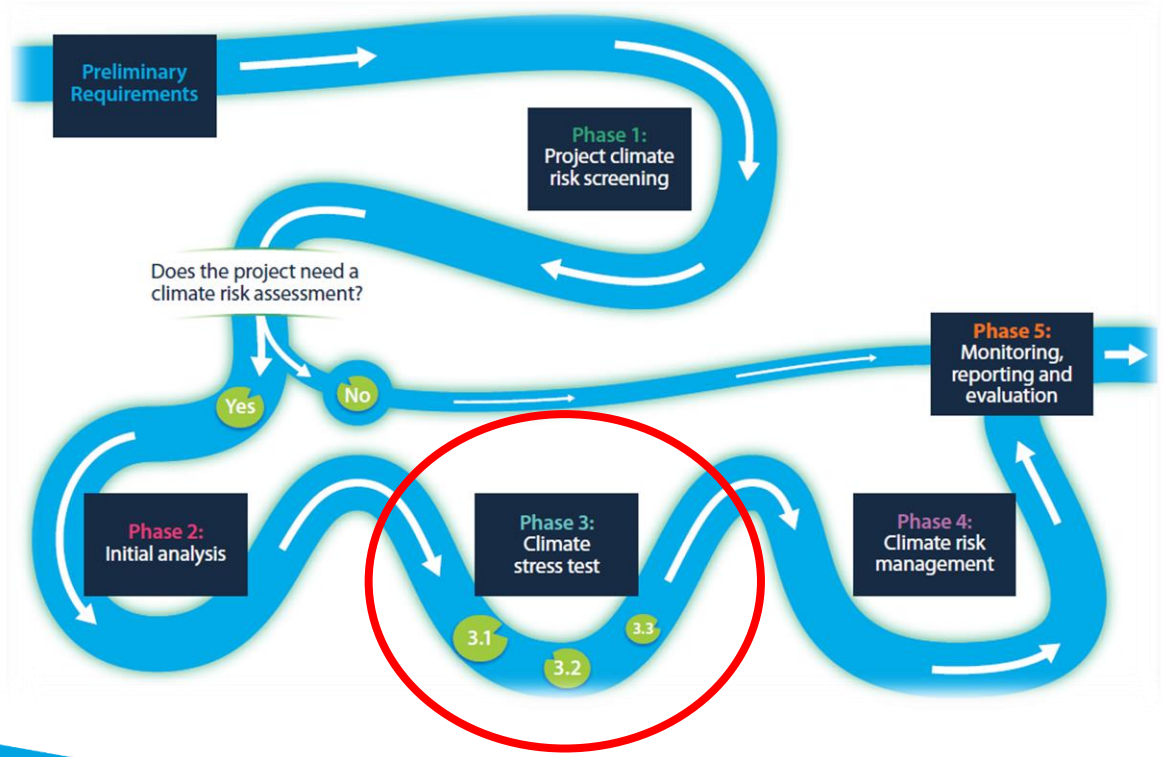
Bottom-up approach

Stress test to find system risks

Monitoring, Evaluation and Reporting plan



Phase 3: Climate stress test



3.1 Comprehensive Approach

3.2 Semi-comprehensive approach

3.3 Limited approach

Providing guidance

Resilience measures

Annex A. Climate stressors list

For electricity production
- Generation shifts
- Load factor changes
- Min environmental flows variations

For access road
- Increased debris
- Increase risk of slope instability

For reservoir
- GLOFs
- Sediment load increase

Annex C. Examples of adaptation measures

For electricity production
- Improvement of hydrological forecasting tools
- Reassessment of the type of scheme (base load/peaking and run-of-river/storage)
- Revised optimal minimum operating level

For access road
- Debris screens, drainage and culverts
- Additional slope protection

For reservoir
- Glacial monitoring
- Controlled glacial reservoir breach
- Change of dam type to allow overtopping
- Additional sediment management strategies

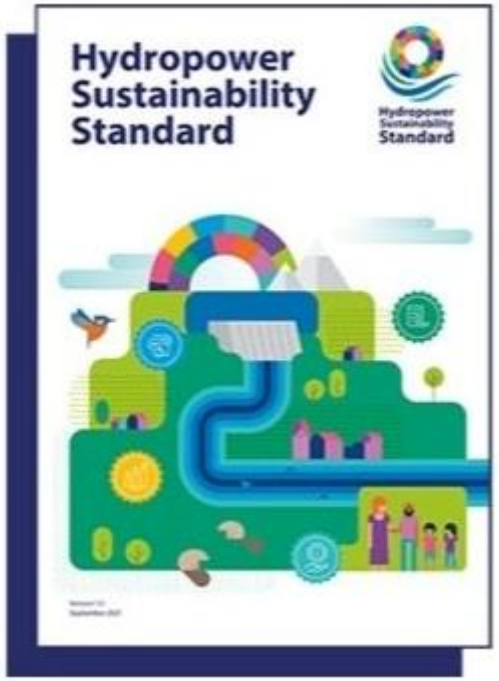
functional

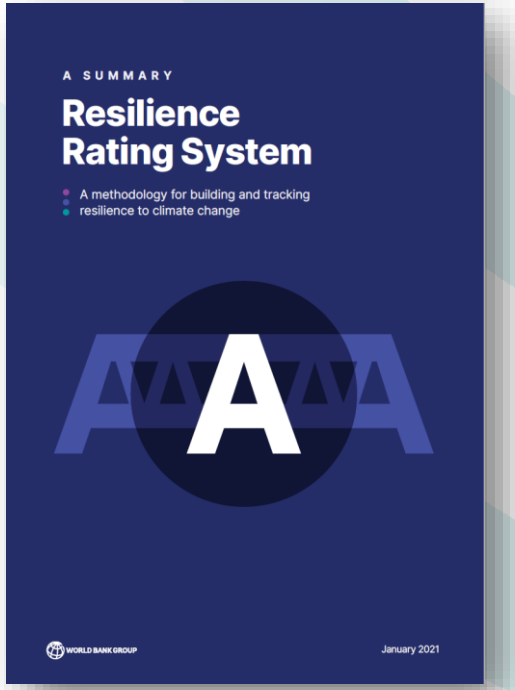
structural

www.hydropower.org/climateresilienceguide

Alignment with other frameworks

Used as a reference for international institutions, multilateral banks





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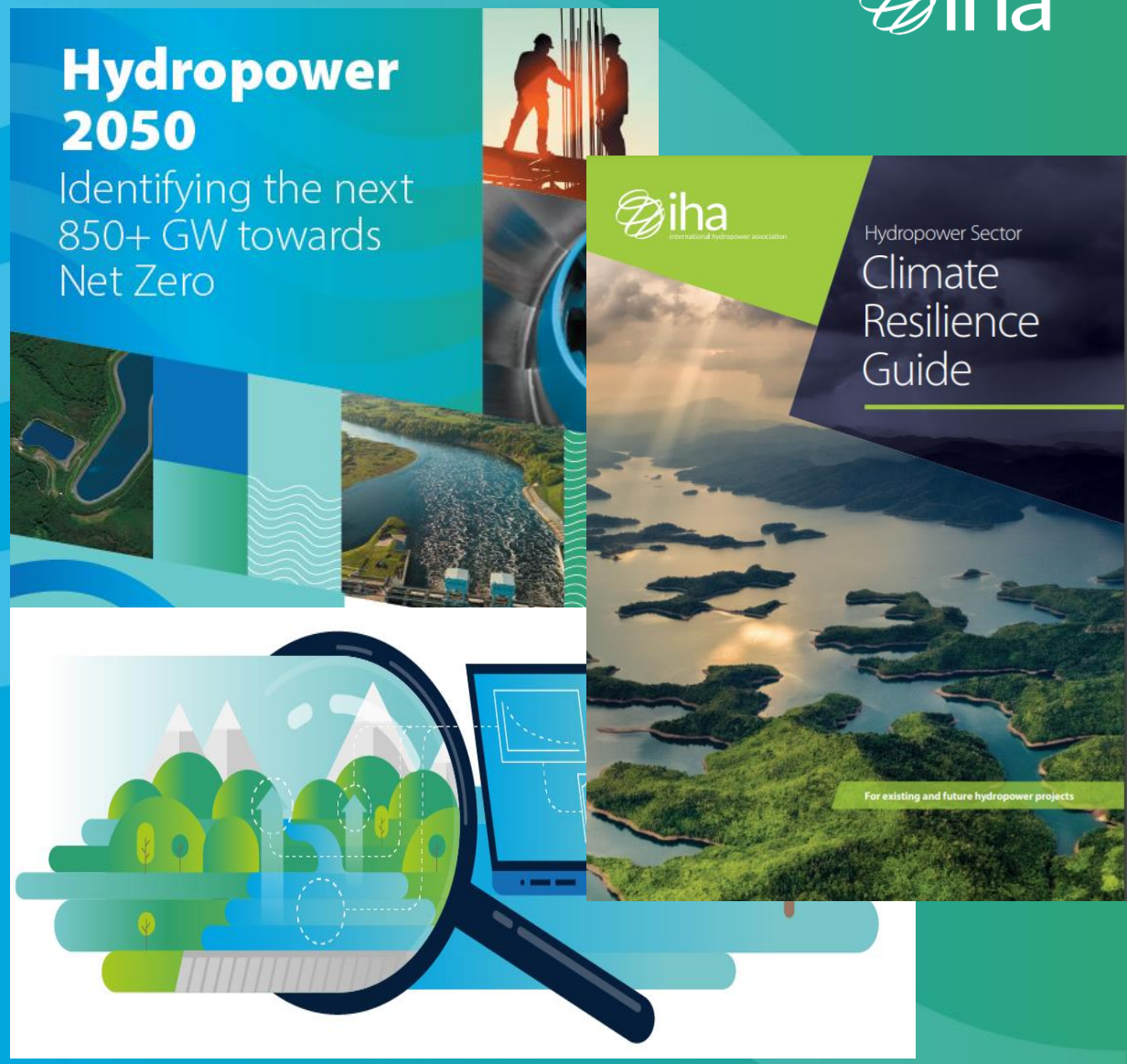
Conclusion

- Opportunity: We need more hydropower!
- Challenge: Reservoirs result in net GHG emissions; can be evaluated with the G-Res tool
- Challenge: Effects of Climate Change on infrastructure: Resilience Guide



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Thank you

- with.hydropower.org/
- g-res.hydropower.org/
- www.hydropower.org/climateresilienceguide