

L6 – Sustainability for Hydropower

Dr. Elena Vagnoni
elena.vagnoni@epfl.ch

Topics of the lecture

- What is sustainability?
- Sustainability principles and challenges for hydropower
- Sustainability standards for hydropower plants

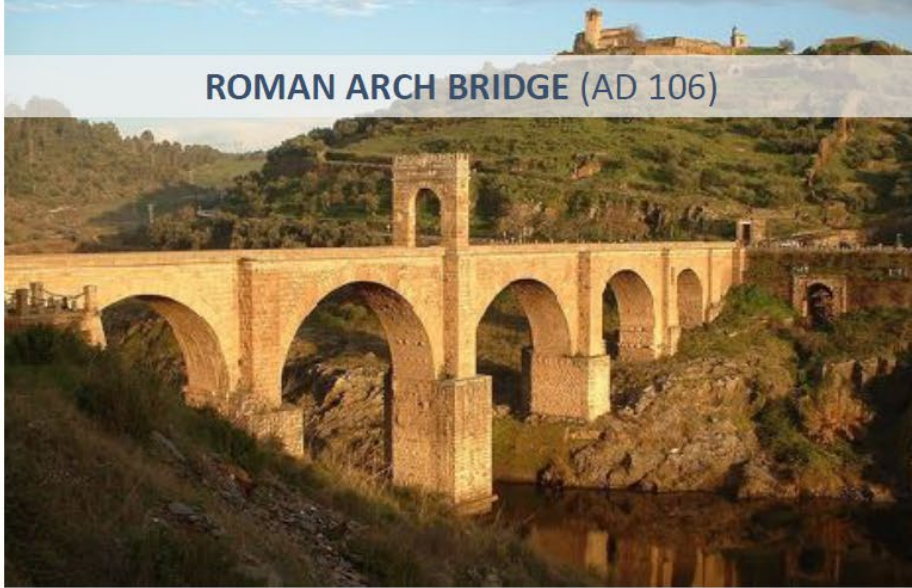
A big thanks to Prof. Jian-hua Meng and Barbara Fischer-Aupperle!

Faculty of Civil Engineering, HTWG Konstanz
University of Applied Sciences, Germany

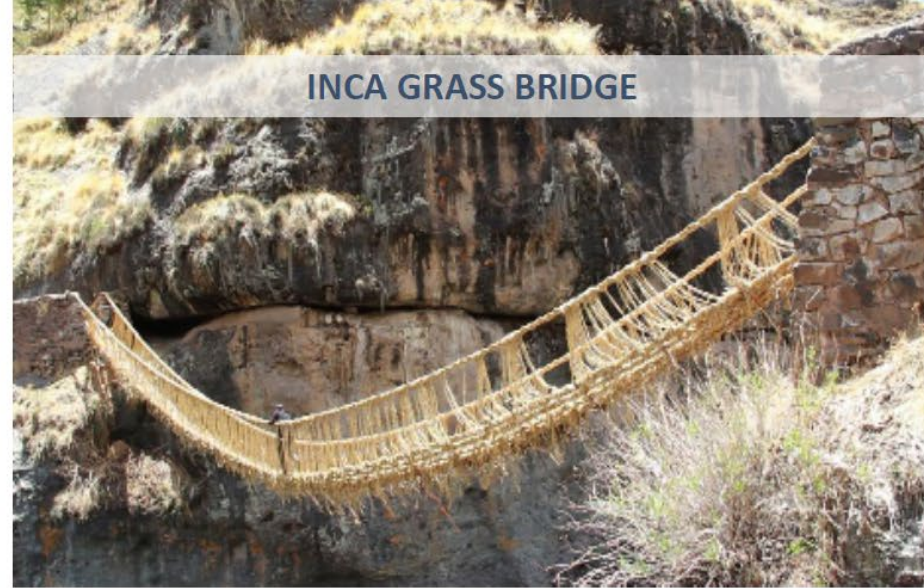
Co-founder and Board Member GWNET

What is truly sustainable?

ROMAN ARCH BRIDGE (AD 106)

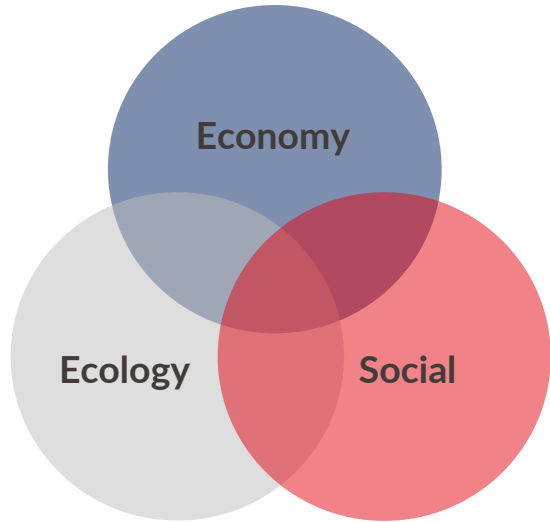


INCA GRASS BRIDGE



Sustainability definition

Origin as a tri-dimensional concept



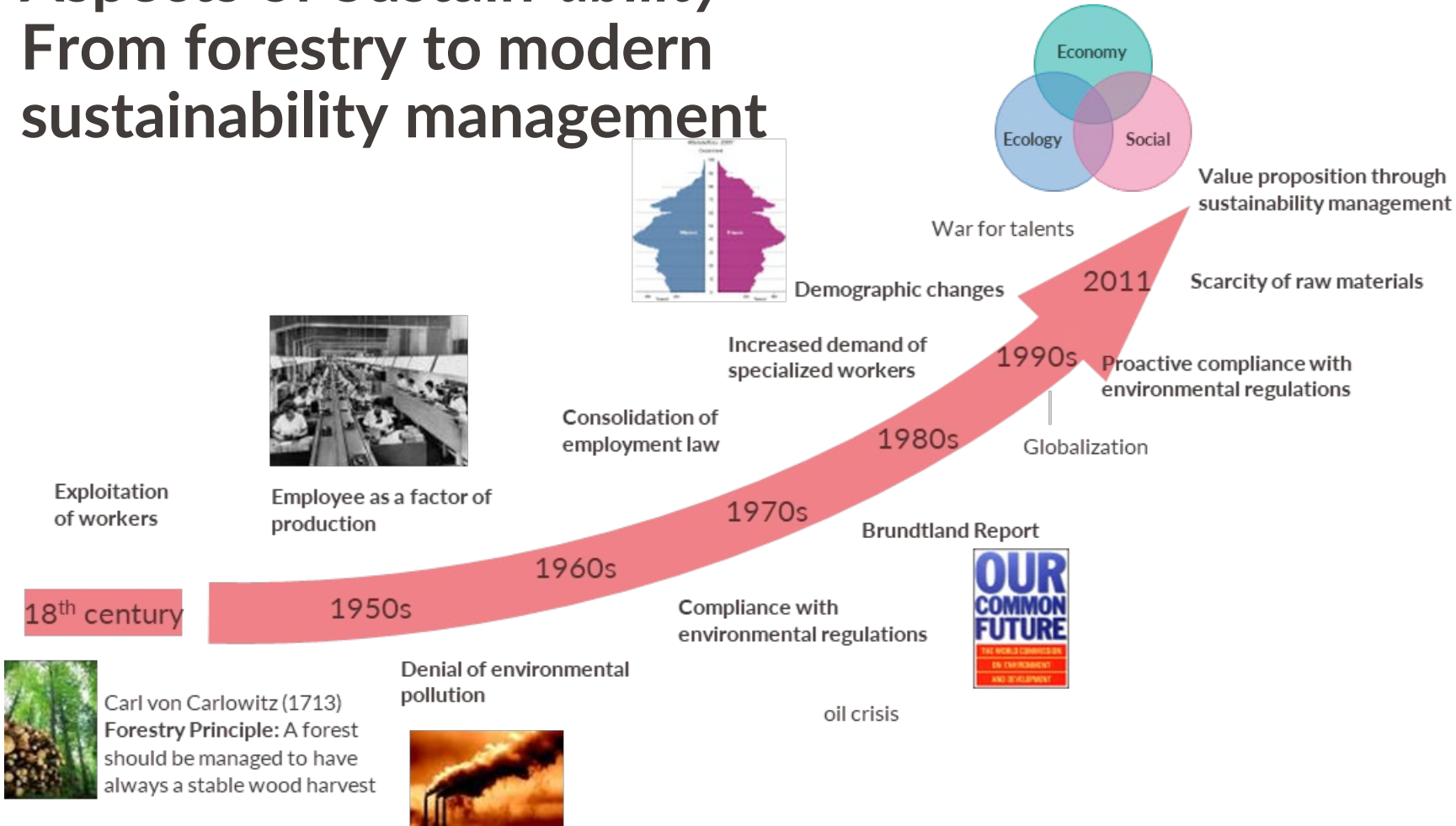
Brundtland Report, 1987

- "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs."

Rio Conference, 1992

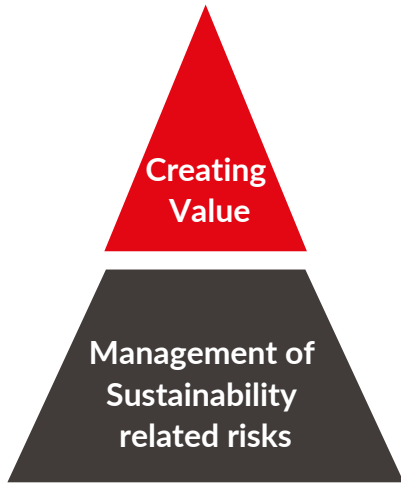
- Economical, ecological and social aspects should therefore always be considered equally.
- They are the basis for sustainability approaches and benchmarking within sectors and organizations and can be assessed against a set of parameters given.

Aspects of Sustain-ability From forestry to modern sustainability management



Value Contribution of Sustainability

Create value, take opportunities, manage risks



Creating value

- New technologies
- new products for new requirements

Cost savings

- Reduction in the electricity, natural gas, fuels, and water consumption
- Waste reduction

Strengthening of market position

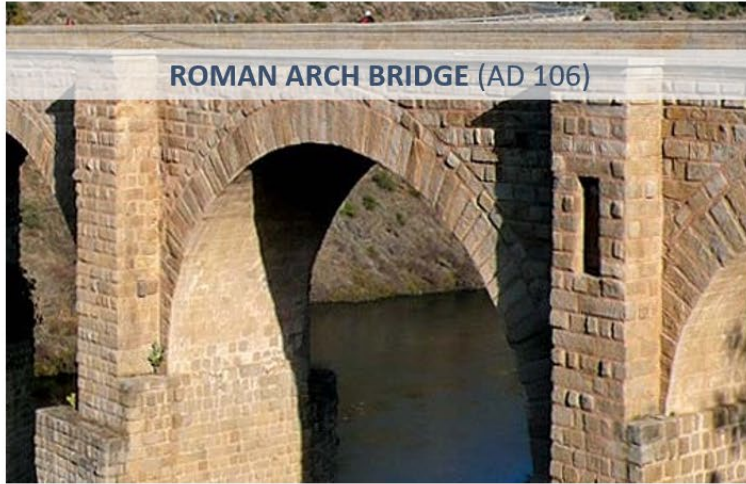
- Avoidance of reputational risks
- Increase the attractiveness for employees

Sustainability Action Areas



Organizations' sustainability action areas and corresponding goals need to be defined, reported, and published under the consideration of essentiality.

Not so easy to assess what is really sustainable!



- Designed for longevity
- Requires very high-quality workmanship
- Low maintenance
- Long lifetime
- High initial cost
- Reusable materials
- A high load capacity



- Temporary structure
- Uses low impact materials (grass ropes)
- High stresses
- High maintenance
- Short lifetime
- Low initial cost
- Renewable materials
- Low load capacity

How to assess sustainability in hydropower plants?

Looking for a definition for hydropower

Interactive Exercise!

What to do?

- Write down terms that for you define “sustainability” applied to hydropower plants / 5 minutes
- Bring terms into your group, compare and discuss what you and others define as “sustainability” altogether/ 10 minutes

Presenting a definition

- Present the definition of „sustainability“ from your group to the full round /2-3 minutes each group

Define good practice

Hydropower Sustainability Standard



Version 1.0
September 2021

Vision and impacts



A world where all hydropower projects enable:

Healthy ecosystems



- Projects contribute to restore ecosystems and invest in forest, river and other ecosystem conservation and restoration.
- Projects apply the mitigation hierarchy to support biodiversity conservation and preservation.
- Projects maintain local ecosystem services and value.
- Projects manage impacts to ecosystems, such as erosion and sedimentation, respectively.

Prosperous communities



- Projects engage in good faith with affected communities.
- Projects respect the dignity and human rights of affected communities.
- Projects improve the livelihoods and living standards of affected communities.
- Projects share their benefits with affected communities.

Resilient infrastructure



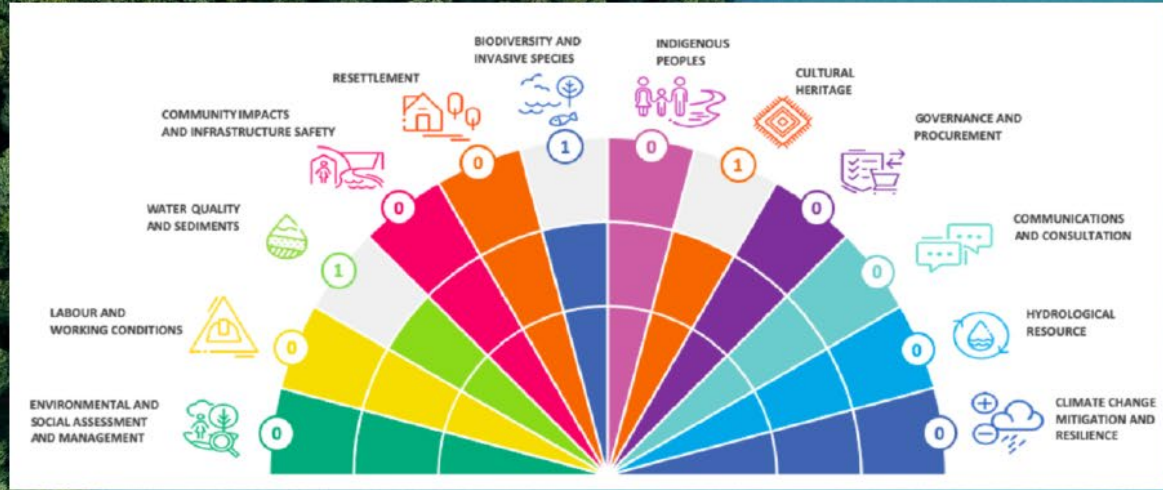
- Projects demonstrate their ability to respond to the effects of climate change.
- Projects take into account regional water needs and availability.
- Projects contribute to wider adaptation strategies and flexible grid operations.
- Projects protect communities and the environment from the consequences of dam failures and other infrastructure safety risks.

Good governance



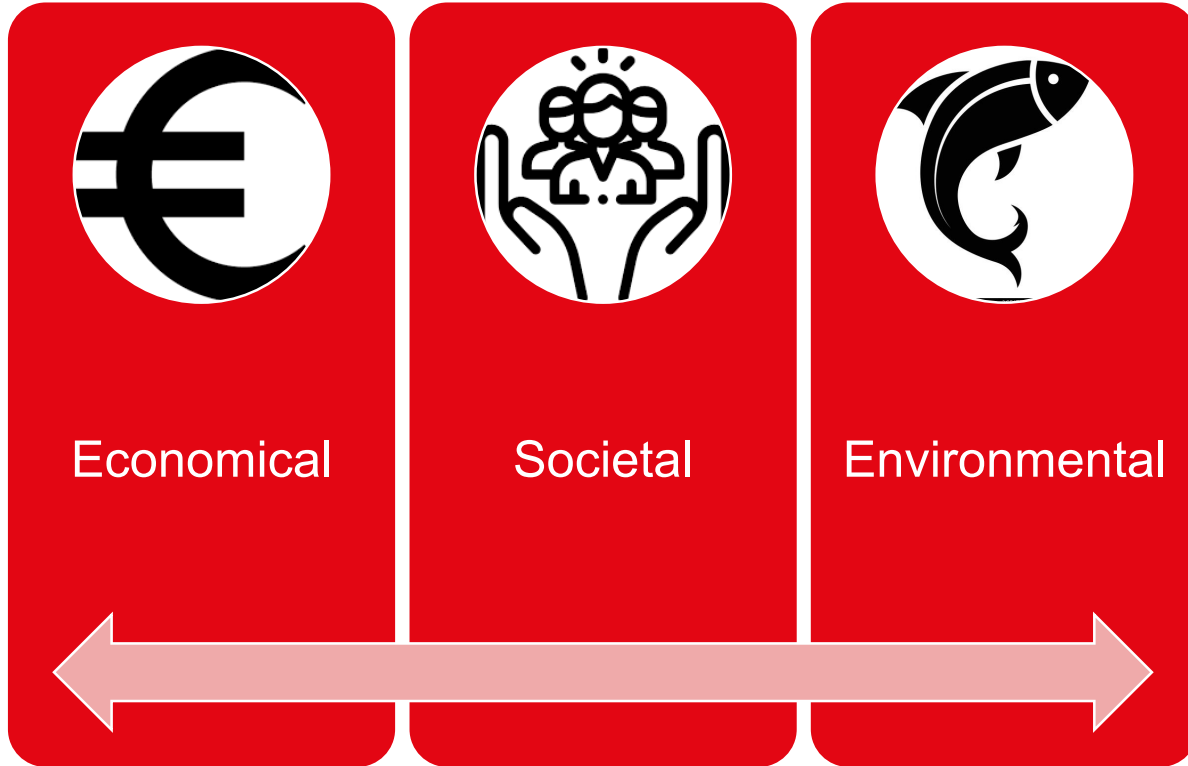
- Projects are governed by sound corporate business structures.
- Projects implement ethical and transparent policies and practices.
- Projects treat their workers fairly and respectfully.
- Projects contribute to wider development strategies and nation building.

Define good practice



Measure performance

Sustainability pillars of hydropower



Sustainability pillars of hydropower

Resilient infrastructure



- Projects demonstrate their ability to respond to the effects of climate change
- Projects take into account regional water needs and availability
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Good governance



- Projects are governed by sound corporate business structures
- Projects implement ethical and transparent policies and practices
- Projects treat their workers fairly and respectfully
- Projects contribute to wider development strategies and national planning

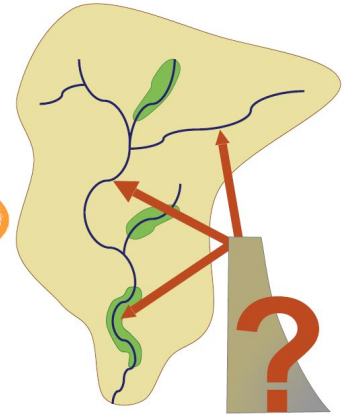
Sustainability pillars of hydropower

Healthy ecosystems



- Projects contribute to restore ecosystems and invest in forest, river and other ecosystem conservation and restoration
- Projects apply the mitigation hierarchy to support biodiversity conservation and preservation
- Projects maintain local ecosystem services and values
- Projects manage impacts to ecosystems, such as erosion and sedimentation, responsibly

A project's location determines the limits of achievable usefulness and sustainability



Sustainability pillars of hydropower

Prosperous communities



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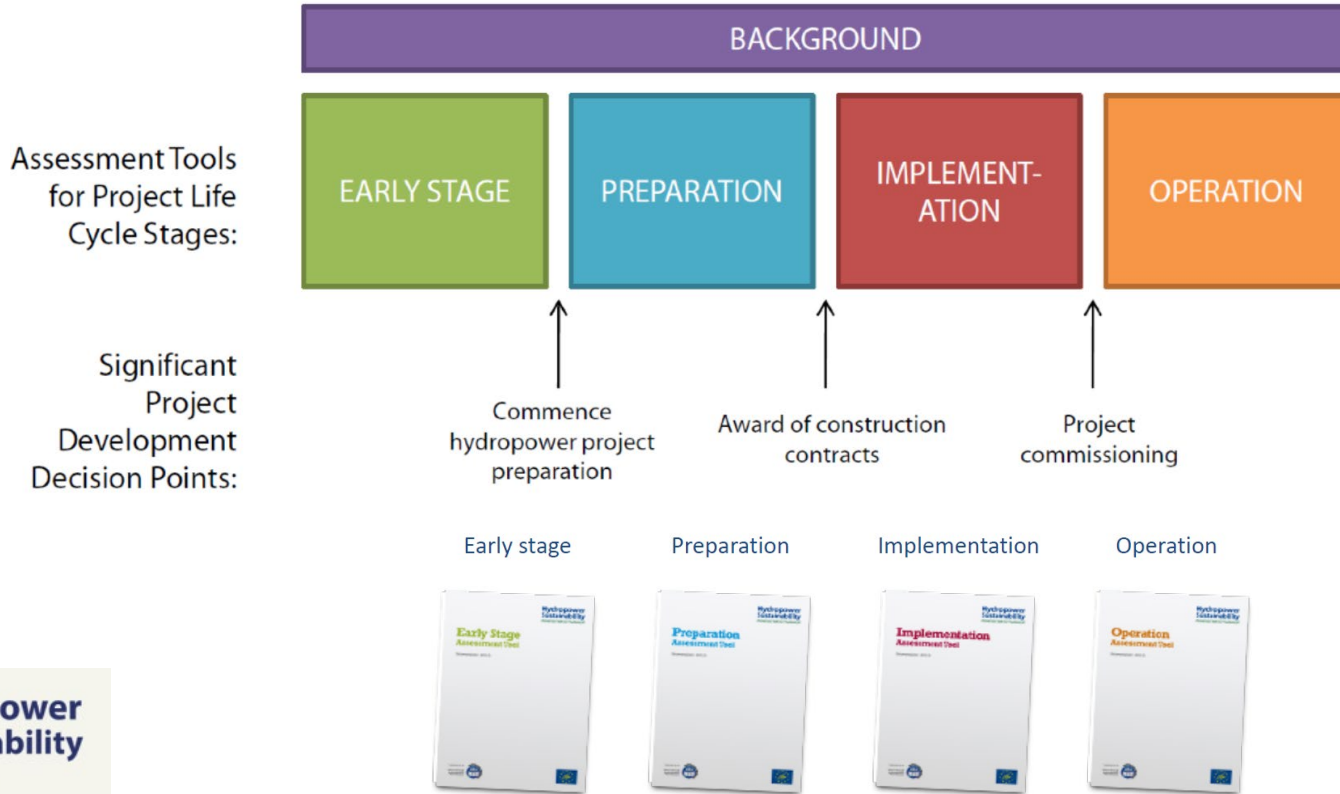


Societal acceptance and positive impacts on local communities are part of sustainability evaluation of projects.

Protocol for hydropower sustainability standards

| Hydropower Protocol: Sustainability Topics | | | | |
|--------------------------------------------|-----------------------------------|----------------------------------------------|------------------------|--------------------------------------------|
| TECHNICAL | ENVIRONMENTAL | SOCIAL | ECONOMIC AND FINANCIAL | INTEGRATIVE |
| Siting and design | Downstream flows | Project affected communities and livelihoods | Economic viability | Demonstrated need and strategic fit |
| Hydrological resource | Erosion and sedimentation | Resettlement | Financial viability | Communications and consultation |
| Reservoir planning, filling and management | Water quality | Indigenous peoples | Project benefits | Governance |
| Infrastructure safety | Biodiversity and invasive species | Cultural heritage | Procurement | Integrated project management |
| Asset reliability and efficiency | Waste, noise and air quality | Public health | | Environmental and social issues management |

Protocol for hydropower sustainability standards



Certified projects

April 2024



Key:

Planned

Assessed/Certified

Case study – Santo Antonio, Brazil

Country context:

- Brazil has the largest installed hydropower capacity in South America, with two thirds of the continent's total capacity.
- Project located on the Madeira River, which is a major tributary of the Amazon, the world's largest river in terms of runoff volume.

Objectives:

- Identify opportunities to improve project performance, optimise integrated management and enable continuous improvement
- Improve stakeholder engagement and dialogue with society
- Strengthen commitments on environmental and social responsibility
- Access carbon credits

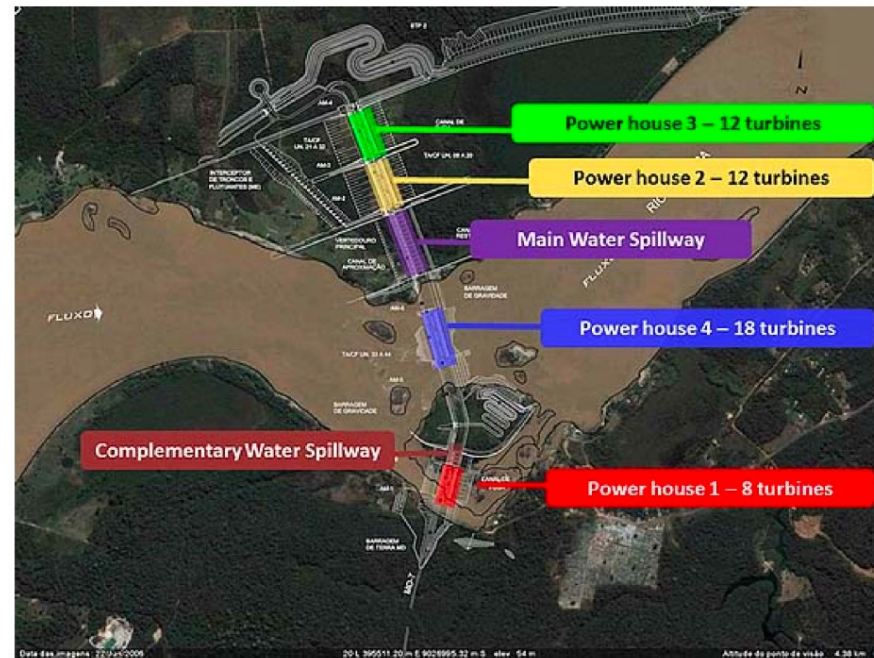


Figure 1. Overhead view of the Santo Antônio project layout, river flows from left to right.

Case study – Santo Antonio, Brazil

Installed capacity: 3,568 MW

Project owner: Santo Antônio Energia

Assessment: Hydropower Sustainability Assessment Protocol (HSAP), Implementation stage, April - August 2014

Findings:

- High standards in sustainability management.
- Considered a good model for future hydropower developments in the Amazonian region.
- Meets or exceeds basic good practice on 18 of the 20 topics assessed.

Gaps:

- Resettlement
- Conformance/Compliance
- The absence of monitoring and management for more than 50% of physically displaced households. (compliant with the law, but non conformant with company's plans).
- Evidence of a decline in livelihoods or incomes amongst households that chose the options of indemnification or a letter of credit.

Case study – Santo Antonio, Brazil

