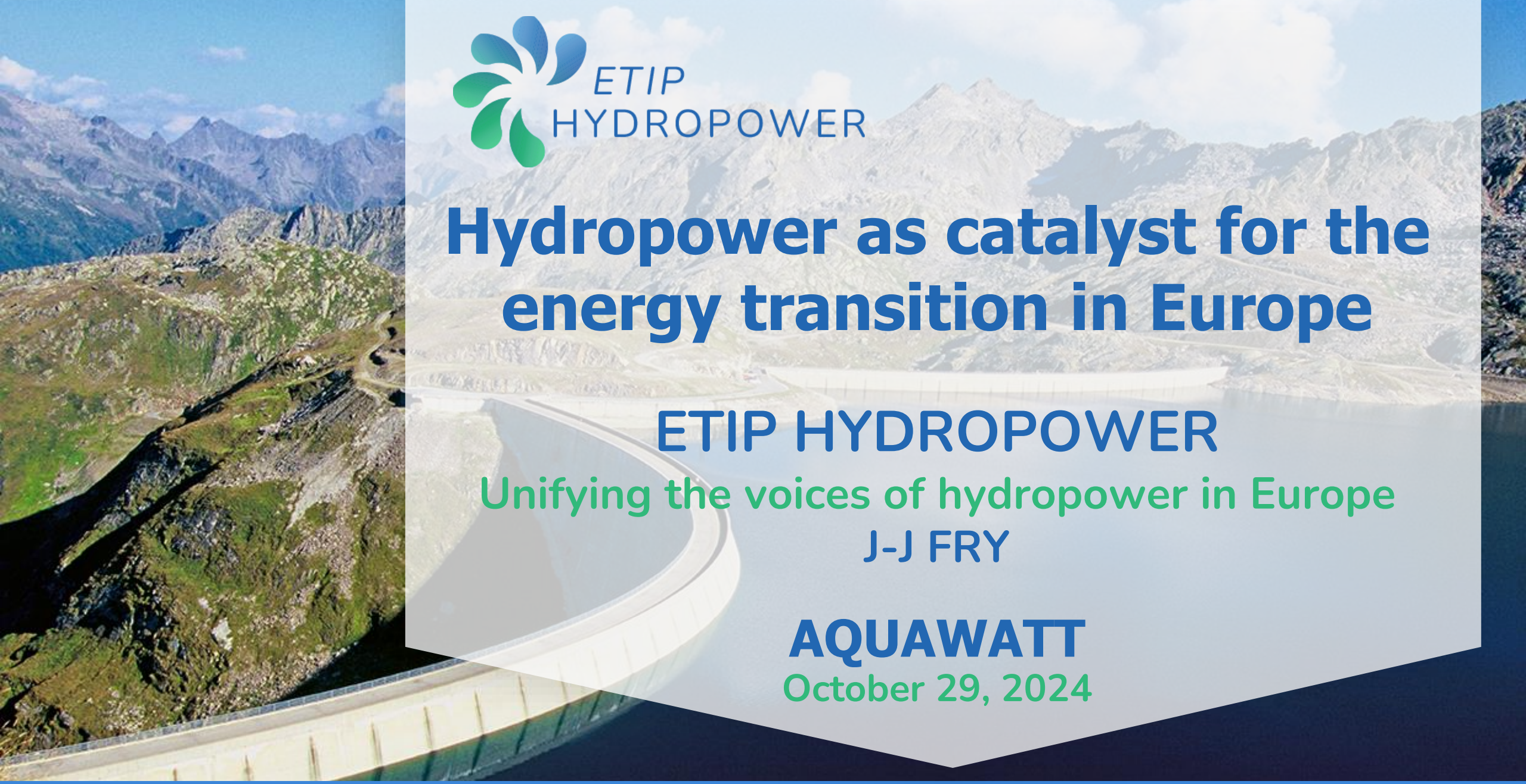


Hydropower as catalyst for the energy transition in Europe

ETIP HYDROPOWER

Unifying the voices of hydropower in Europe

J-J FRY

AQUAWATT

October 29, 2024

Funded by
the European Union

HYDROPOWER IN THE PAST

In Europe

Hydropower boosted countries development over the last century

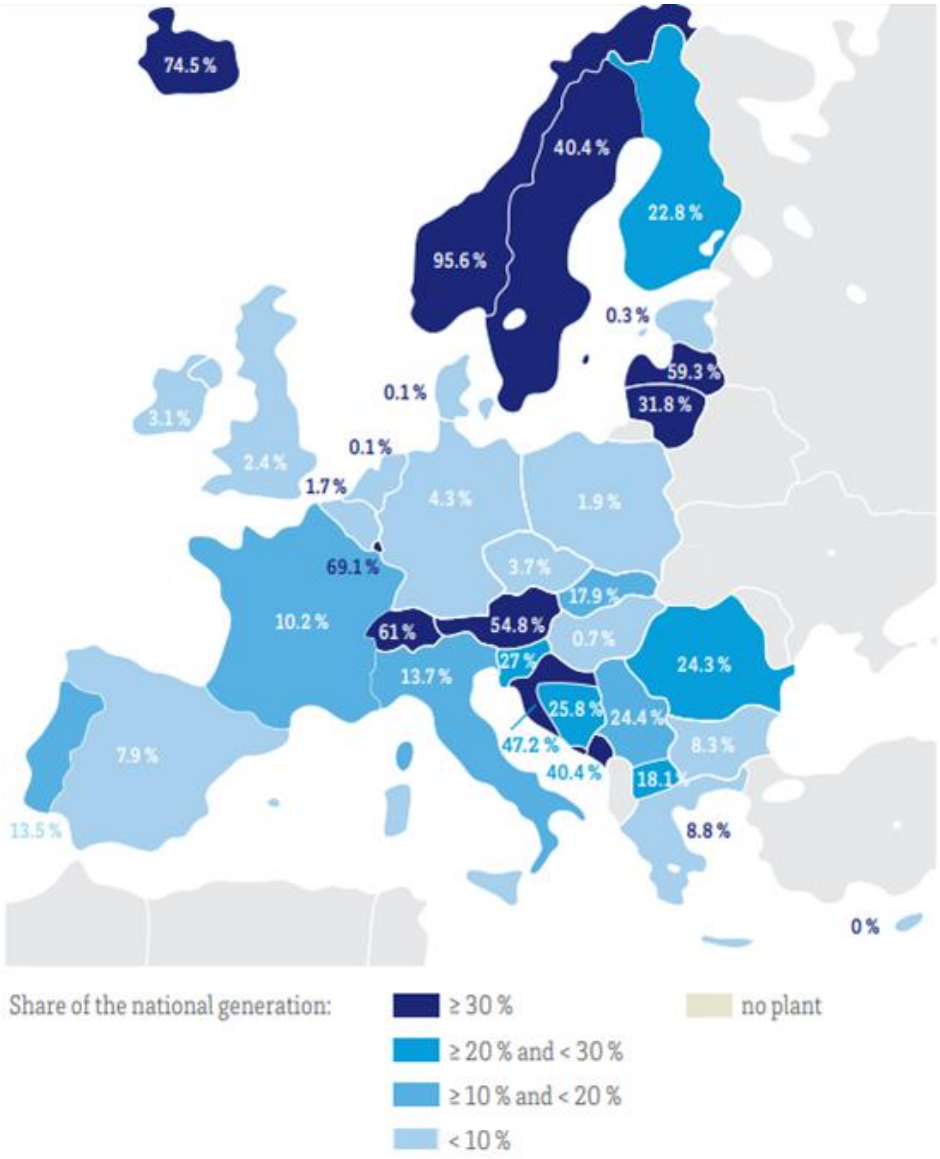
- Energy Production: Hydropower was the largest source of renewable energy globally
- Infrastructure Development: The construction of dams and hydropower plants has led to the development of extensive infrastructure, which often supports local economies.
- Economic Growth: Hydropower projects have created jobs in construction, operation, and maintenance, contributing to local and national economies.

Overall, hydropower has been instrumental in shaping energy policies and economic strategies around the world, contributing to both development and sustainability efforts

Edison's 23 MW Carlo Esterle HPP

Hydropower in the E.U.

- Hydropower accounted for :
- 10% of gross electricity generation in 2018 (EU-28 + Switzerland, Norway and Iceland)
- 36% of all renewable electricity generation in Europe (including Turkey)
- Total installed capacity of 251 GW (including Pumped Storage Capacity, IHA, 2020)
- 653 TWh of generation in 2019
- 55 GW of Pumped-storage plants capacity
- 44% of generation in Nordic countries and 37% in Alpine countries
- In ITALY 13% HPP>10MW generate 88% Hydro energy

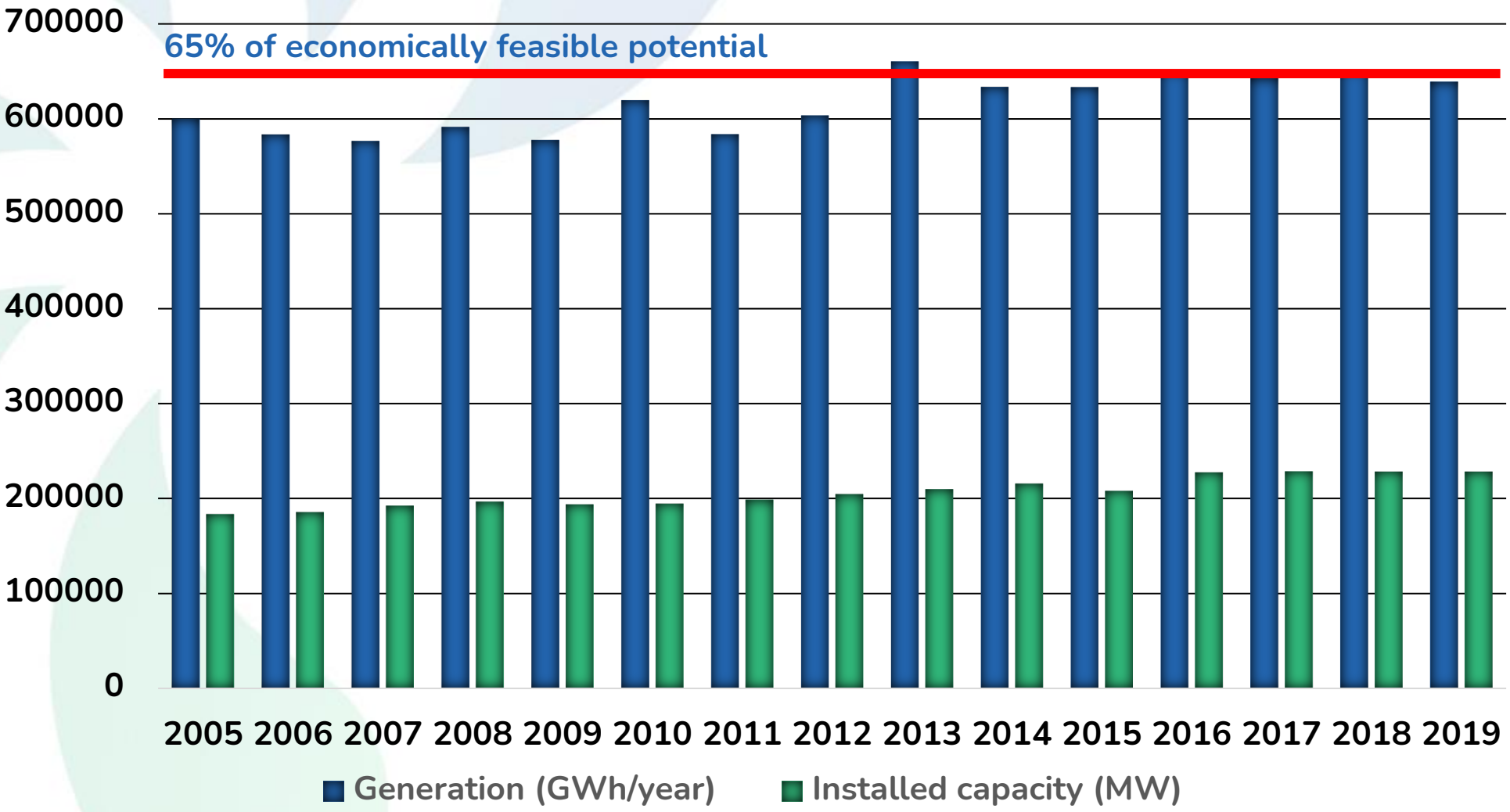


Hydropower in construction in Europe

Installed capacity in MW under construction since 2005 without Turkey

According Hydropower & Dams World Atlas 2022

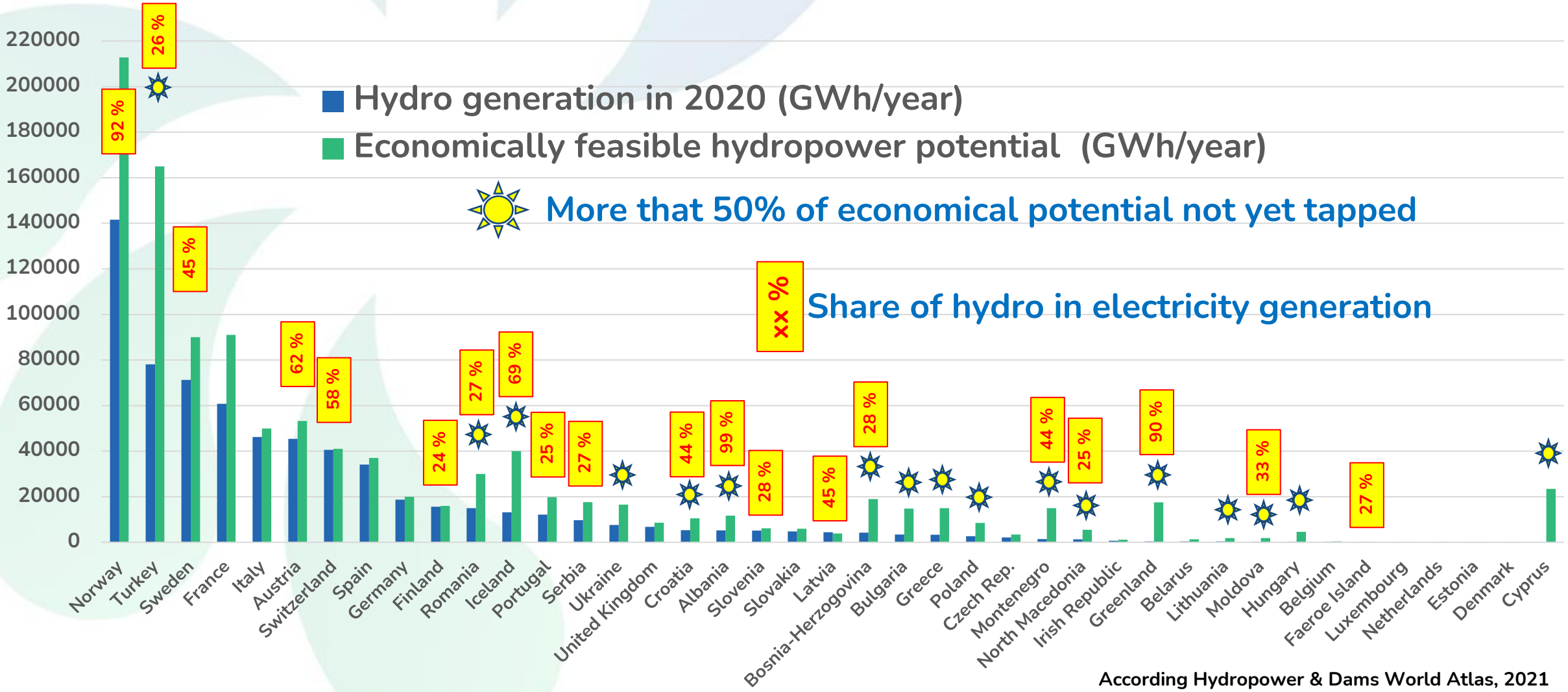
Developed potential in Europe
(with Turkey)



According Hydropower & Dams World Atlas 2020

ETIP HYDROPOWER

Potential of Hydropower in Europe



According Hydropower & Dams World Atlas, 2021

Looking back over 150 years of hydropower

At the turn of the 19th century, hydropower launched the global electrification of cities

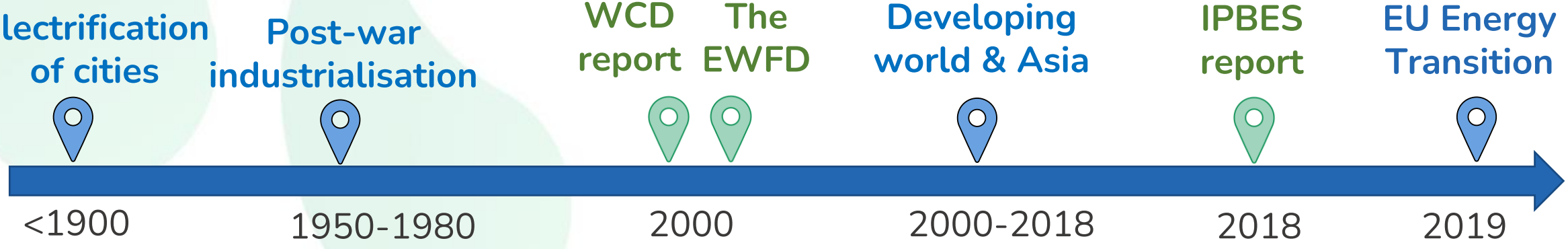
For over a century, up to the 1980s, hydropower was considered as a basis for industrial and social development across the world

a report issued by the World Commission on Dams (WCD, 2000), was generally critical about dams and suggested other alternatives for energy supplies to the developing world

Professional associations, such as ICOLD, IEA, IHA, ICID, the Banks and the European Parliament committed to support sustainable hydropower

IPBES published the Global Assessment Report on Biodiversity and Ecosystem Services

EU launched the European Green Deal to have a clean, affordable and reliable energy system in2050 in Europe



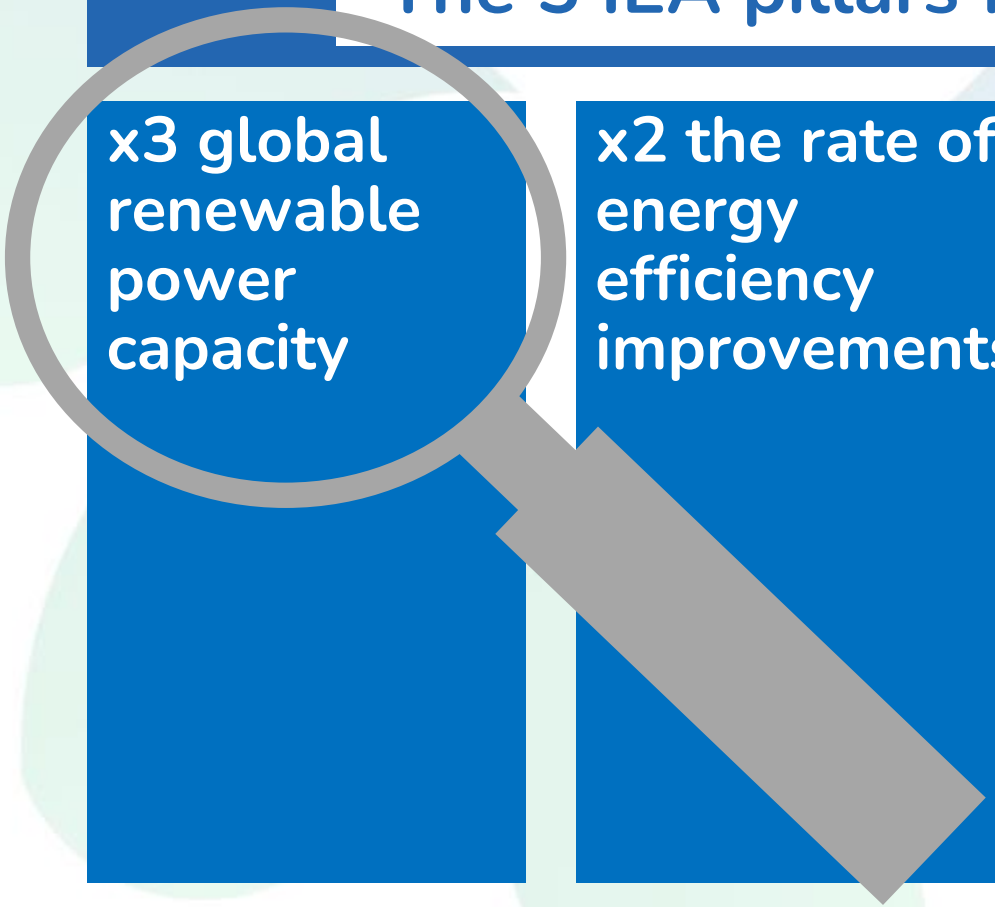
ETIP HYDROPOWER

HYDROPOWER IN THE PRESENT

European Union

Energy Transition against global warming

The 5 IEA pillars for Energy Transition before 2030



- x3 global renewable power capacity
- x2 the rate of energy efficiency improvements
- Commit the fossil fuel industry to align its activities with the Paris Agreement (i.e. cutting methane emissions by 75%)
- Establish large-scale financing mechanisms to x3 clean energy investment in emerging and developing economies
- Commit to measures that ensure an orderly decline in the use of fossil fuels

The EU commitment

2019
the **European Green Deal** for achieving carbon neutrality by 2050

2021
the **'Fit for 55'** package reducing GHG emissions by at least 55% by 2030

2022
the **REPowerEU** plan aims at reducing Europe's dependence on fossil-fuel

2023
the **Green Deal Industrial Plan** for developing the net-zero technologies

2023
the **Net-Zero Industry Act,** to prioritizing permitting and funding

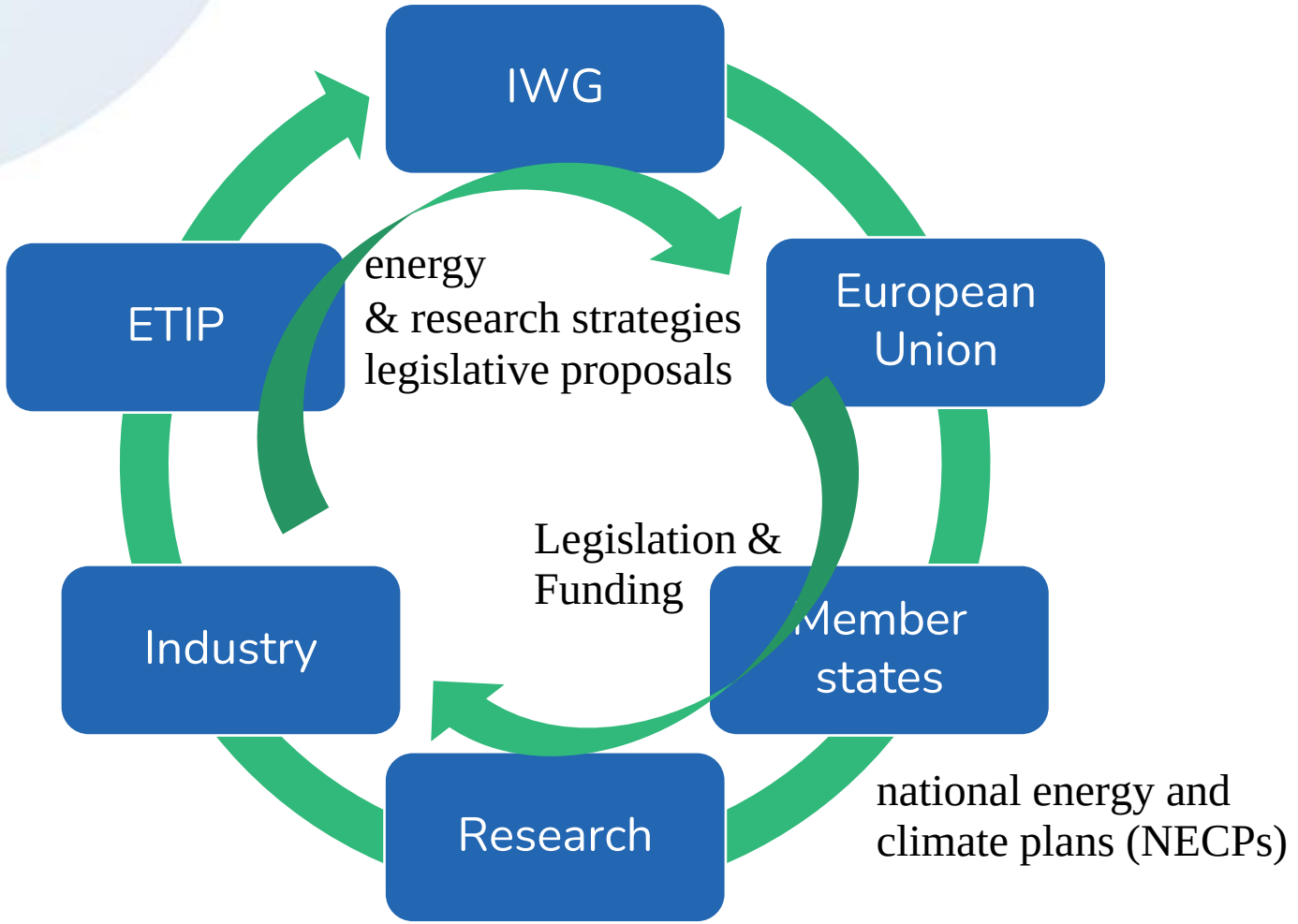
2023
the **Critical Raw Materials Act** to securing supply of critical raw materials

2023
the **Renewable Energy Directive** raising the share of RES to 42.5% by 2030

2023
the **Energy Efficiency Directive** to reduce the EU's 2020 final energy consumption by 11.7% by 2030

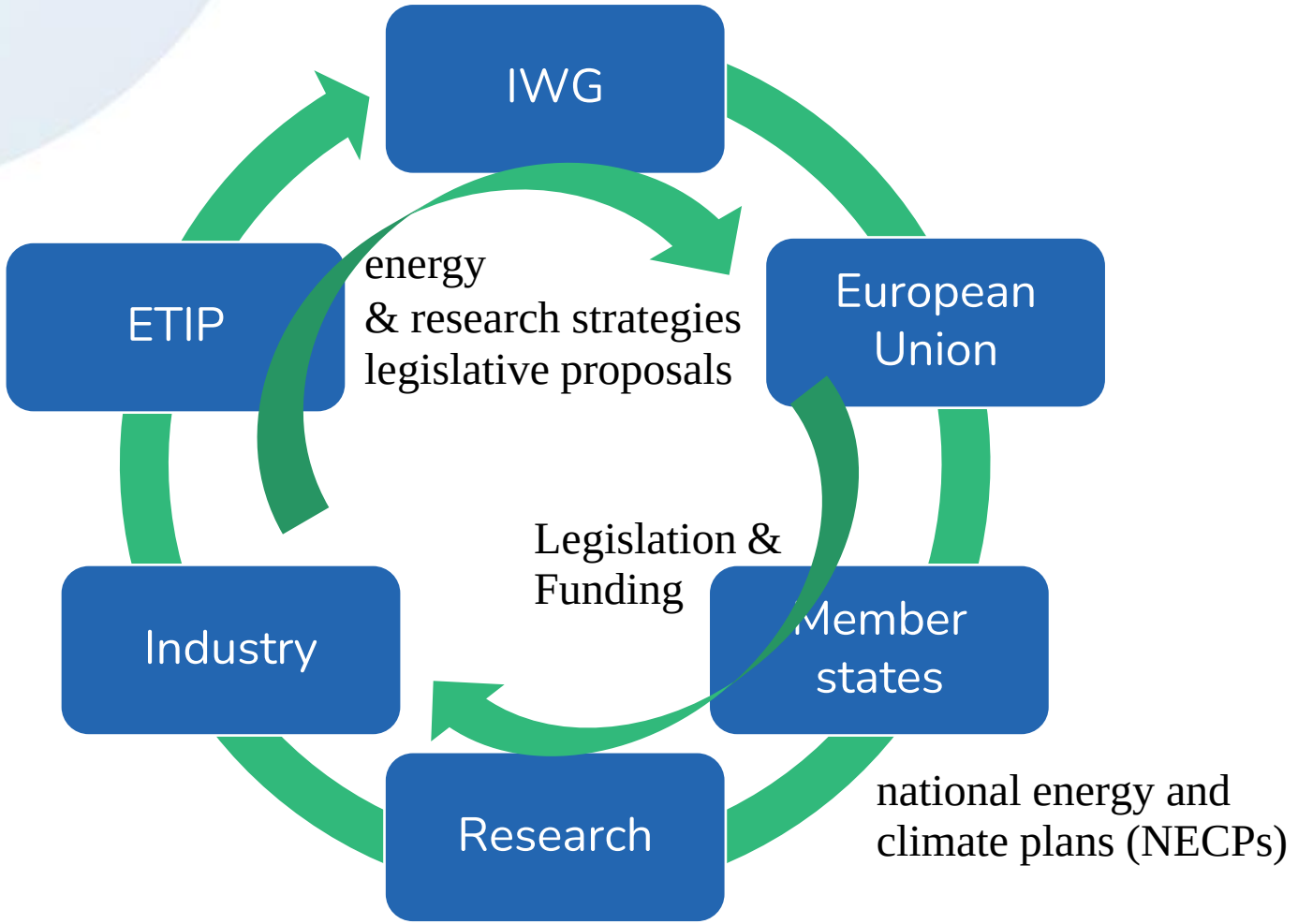
For boosting Climate Neutrality by 2050 the E.U. setup the SET Plan

- The Integrated Strategic Energy Technology plan (SET Plan) gathers representatives of Member States and Associated Countries, industry and research on clean energy in the SET Plan Steering Group since 2007
- It aims to accelerate the Energy Transition through the development of low-carbon technologies in a fast and cost-competitive way



SET Plan coordinates strategies of EU, member states, industry and research

- SET Plan is coordinating R&I agendas for low-carbon energy solutions at ETIP level and National level
- SET Plan informs EU energy and research strategies and legislation
- SET Plan mobilizes political support and investment in clean energy technologies from public and private sectors



The European Technology Innovation Platforms (ETIPs) and Hydropower

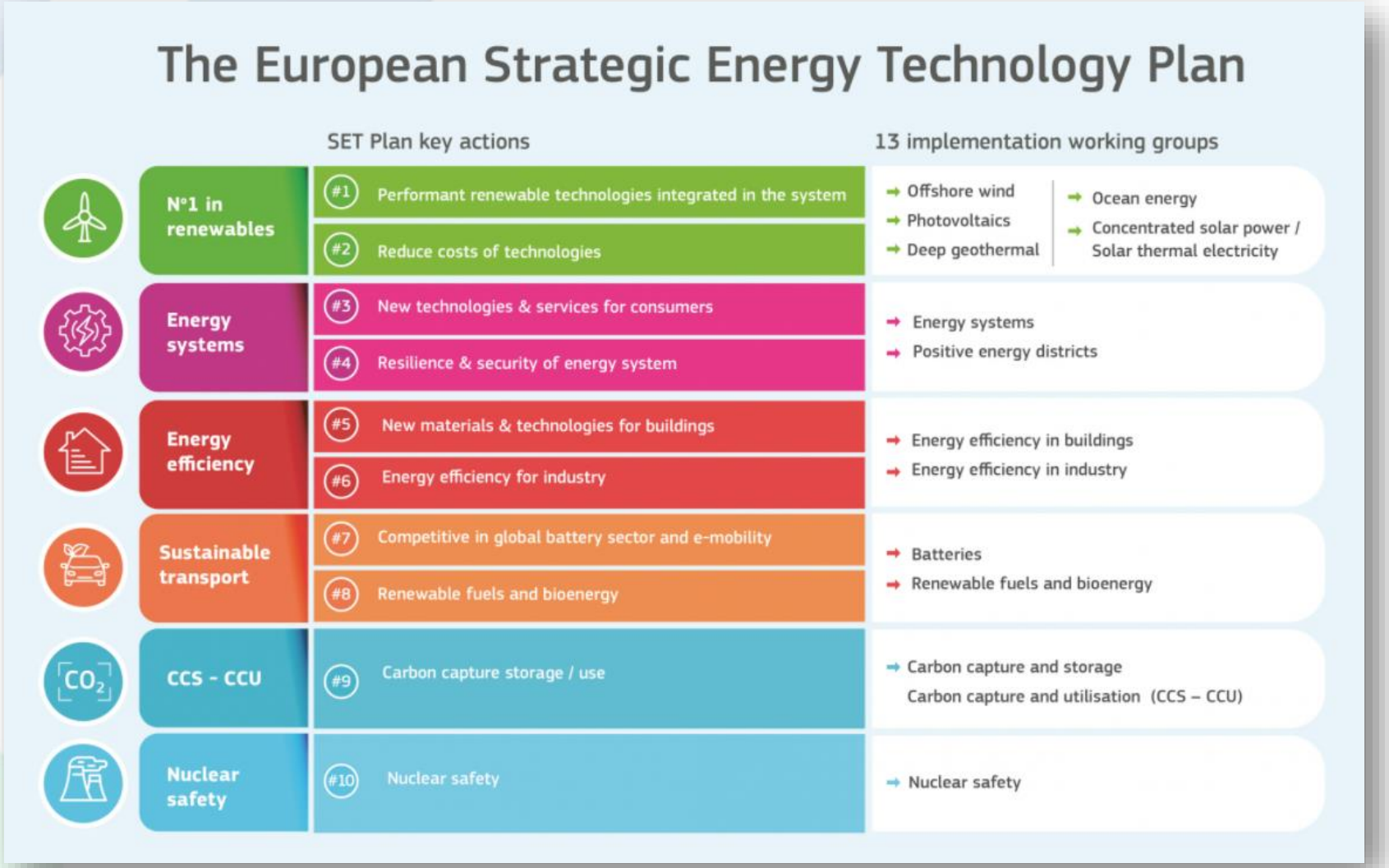
- ETIP gathers and fosters collaboration among all stakeholders of the value chain within the same technology focusing on the clean energy transition
- ETIP defines Research & Innovation Agenda (RIA) priorities for its sector
- ETIP defines Strategic Industry Roadmap (SIR) to overcome barriers to the deployment of R&I outcomes

ETIP	website
Wind energy	https://etipwind.eu/
Solar Photovoltaics	https://etip-pv.eu/
Ocean energy	https://www.etipocean.eu/
European Geothermal Energy Council	https://etip-geothermal.eu/
Smart Networks for Energy Transition	https://www.etip-snet.eu
Renewable Heating and Cooling	https://www.rhc-platform.org
Bioenergy	https://www.etipbioenergy.eu
Batteries Europe	https://batterieseurope.eu
CCS Platform	https://zeroemissionsplatform.eu
Sustainable Nuclear Energy	https://snetp.eu
Hydropower	https://etip-hydropower.eu

Up to now ETIP HYDROPOWER is a project. It requires an official recognition by the SET Plan to be an official ETIP

Hydropower is looking for a seat in the SET Plan

- Implementation Working Groups (IWG) align priorities of industry and scientific communities of ETIPs with SET Plan Implementation plans
- There is no Implementation Working Group for Hydropower
- First meeting with SET Plan 14-15 November



Hydropower lags behind the other renewable energy sources

- A key action is to help **unify** the hydropower sector, presenting a **single voice on key issues.**
- This function does not duplicate the role of existing groups and associations – it enhances.
- That's the ETIP role to work with the other organizations to confirm complementary roles and converge on a single voice

3160 NGO were lobbying in Brussels In 2019

ETIP HYDROPOWER
a very young organisation

H2020 call LC-SC3-CC-4-2018 launched the HYDROPOWER EUROPE project.

950 stakeholders of the hydropower sector have been registered up to now in the consultation platform of the HYDROPOWER EUROPE forum.

The HYDROPOWER EUROPE forum released in 2021 a synthesis of expected research developments and research needs in an Research Innovation Agenda (RIA) for the coming decades and a Strategic Industry Roadmap (SIR) in the hydropower sector.

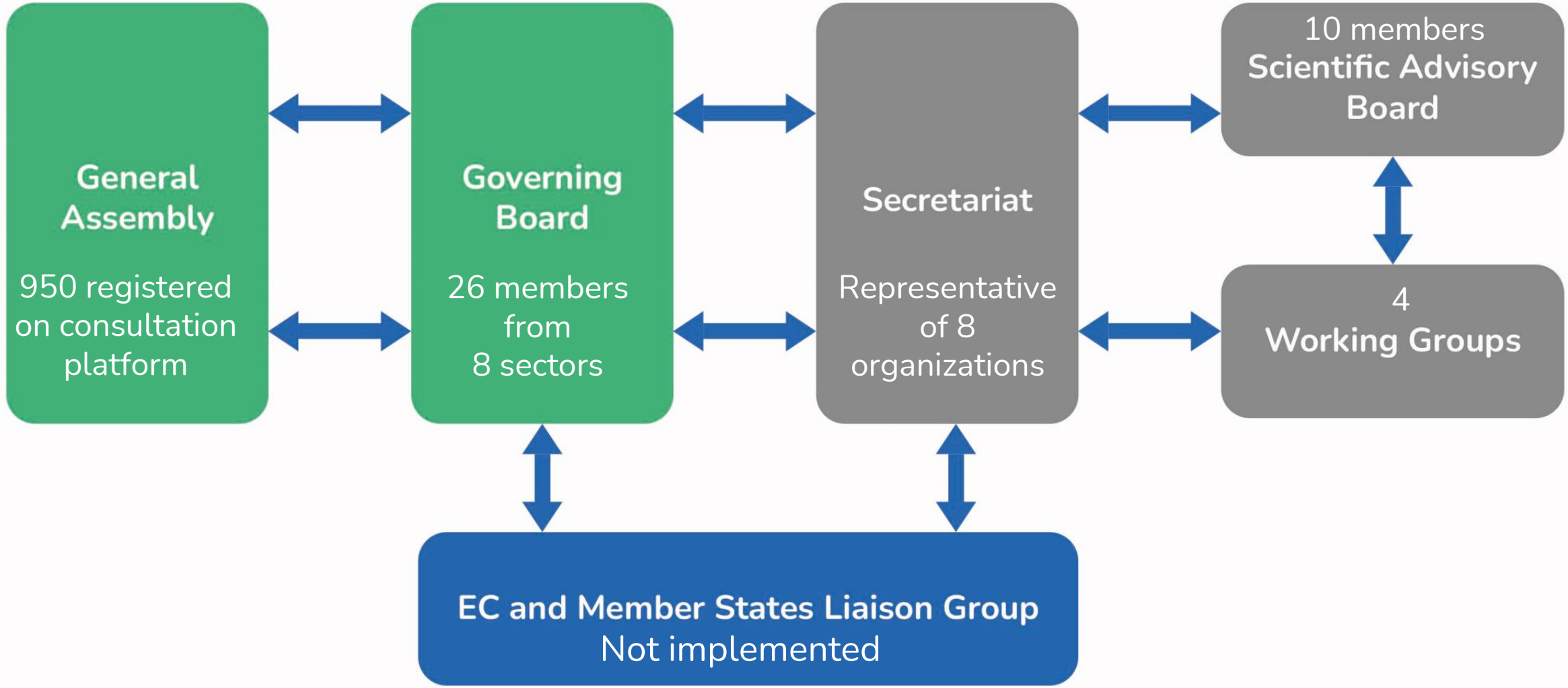
Horizon Europe call HORIZON-CL5-2021-D3-01-17 funded HYDROPOWER EUROPE Consortium (8 international organizations and 2 communication agencies) for the secretariat to ETIP HYDROPOWER up to 2025

ETIP HYDROPOWER Secretariat

The secretariat celebrating the excellent 2024 hydropower generation!

From the left yo the right:
NUÑEZ AGUIRRE Iraia (ZABALA)
BIANCOTTO Matteo (IHA)
SPADARO Federico (EASE)
SCHLEISS Anton (ICOLD)
GARCIA RODRIGUEZ Janire (ZABALA)
MISECH Andrej (EUREC)
MORRIS Mark (SAMUI)
JAWAID Tasniem (EREF)
FRY Jean-Jacques (ICOLD)
ESTRELLADO Lee William (VGBe)

The ETIP HYDROPOWER structure



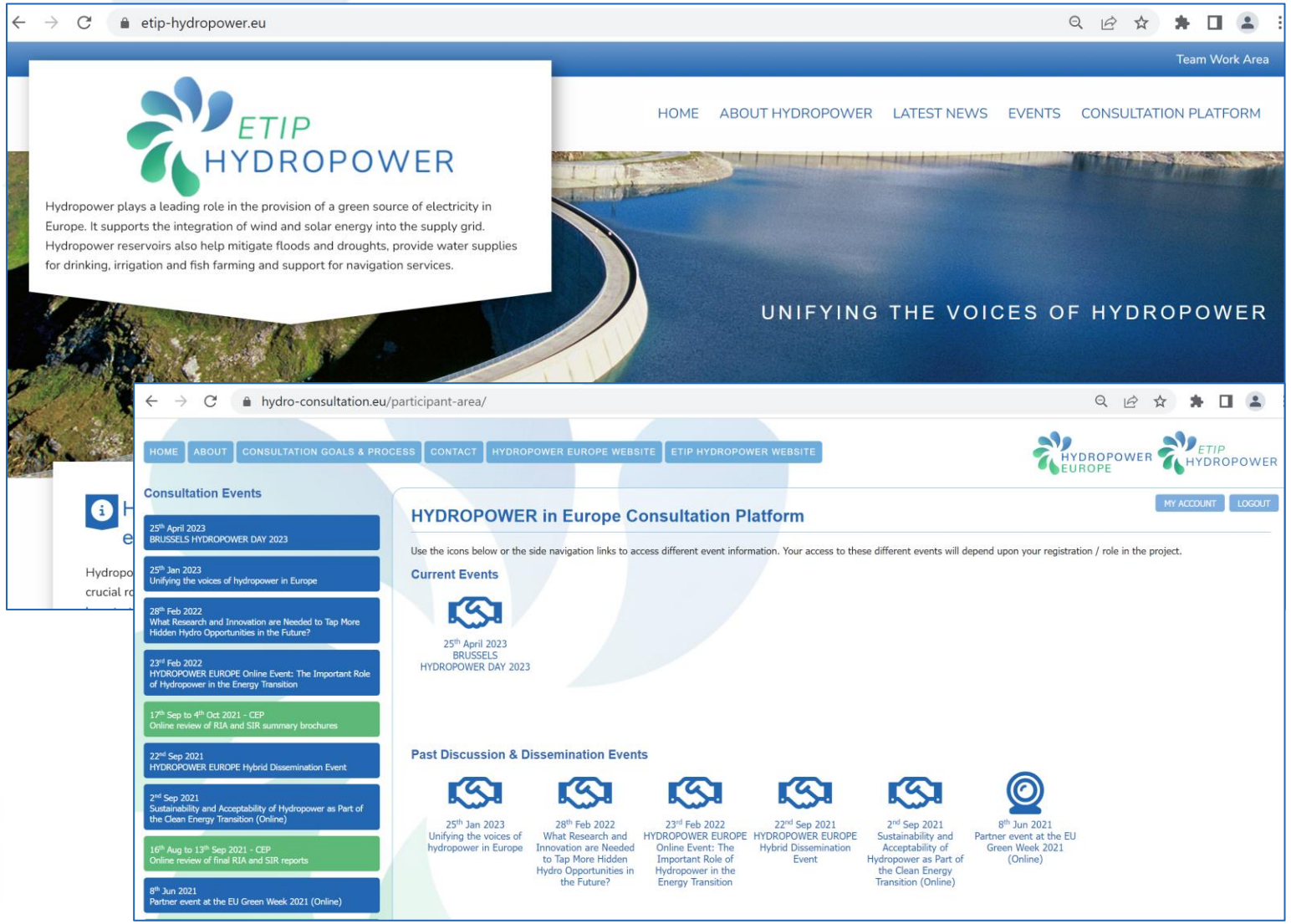
The 4 Established Working Groups

3 topic-specific and 1x cross-cutting Working Groups (WG) engage active stakeholders and knowledge co-creation and help to facilitate consensus-based strategic advice and to identify priority actions.

- WG1: Hydropower role for flexibility and storage
- WG2: Hydropower and Biodiversity
- WG3: Hydropower and Climate change (adaptation and mitigation)
- WG-A: Overview on past and current European R&I projects for hydropower - Horizon Projects: follow-up and results dissemination

ETIP HYDROPOWER
Communication and dissemination

- information via our website at www.etip-hydropower.eu
- active social media accounts such as Linkedin
- Consultation and communication events via our consultation platform at https://hydro-consultation.eu with currently around 950 consultees registered…



ETIP HYDROPOWER

HYDROPOWER IN THE FUTURE

Energy Transition

ETIP HYDROPOWER

Advantages of hydropower are key for Energy Transition

- **Excellent** low CO_2 emission
- **Excellent** energy gain and pay back factor
- **Excellent** efficiency
- **Excellent** flexibility
- In-country **independent** energy creating local jobs and financial resources
- **Energy Security**: Hydropower enhances energy security for many countries by diversifying the energy mix and reducing dependence on fossil fuels.
- **Climate Change Mitigation**: by providing a renewable energy source, it plays a role in reducing greenhouse gas emissions and combating climate change.
- **Climate Adaptation**: by providing **flood** and **drought** protection
- Supporting UN **Global Sustainable Goals** : drinking water, irrigation, fish farming, river navigation, …

Moreover energy crises reveals the role of hydropower

- The energy crisis after the start of the war in Ukraine revealed the crucial role of hydropower to ensure a safe supply of electricity
- Storage and pumped-storage hydropower will be the most vital to avoid blackouts in the next critical winters in case of gas supply problems
- There is a renaissance of hydropower in Europe: 9’000 MW to 12’000 MW are at the moment under planning

Construction of Kühtai PSH (2023) © Perzlmaier

The SIR is urging to increase social awareness for hydro deployment

ETIP HYDROPOWER

Barriers

Strategic Industry Roadmap 2021:
Step 1 to new hydro deployment:
Increase social awareness

Collect a catalogue of examples of best practice of successful multi-purpose projects creating a win-win situation between all stakeholders

Develop innovative approaches to address environmental issues and biodiversity protection with comprehensive approaches allowing compromises

Increase awareness of European citizens of the importance of hydropower development

The Working Groups will help to increase social awareness & innovation

- They will draft synthetic white papers with key “popularized” and accessible messages to increase decision-makers and public awareness of the role of Hydropower.
- They will identify emerging trends, technological breakthroughs, and market opportunities, shaping the future direction of the hydropower sector, through targeted discussions and expert consultations.
- They will serve as incubators of innovation, fostering interdisciplinary collaboration and cross-sectoral partnerships.

© Pict rider

WG1 - Hydropower role for flexibility and storage

General Scope

- Establish and communicate what flexibility and storage needs mean
- Show the key and increasing role of Hydropower in response to these flexibility and storage needs, including market evolution consideration
- Identify implications for operation, maintenance and resilience of existing equipment, identify the potential of innovations

Organisation

The WG is divided into 3x Sub-Groups (SG):

- SG1: Flexibility Definition
- SG2: Technical Aspects
- SG3: Economic Aspects

- **Chair :** Eduard Doujak (TU Wien Austria)
- **Co-chairs :** Liv R Hultgreen (NTNU Norway) Irena Beloreshka (NEK Bulgaria)
- **Working group members**: 70
- **Secretariat**: vgbe energy

WG2 - Hydropower & Biodiversity

General Scope

- ❑ Highlight existing solutions to key biodiversity issues discussed at national and EU levels: RED III and the Nature Restoration Regulation at national level
- ❑ Produce concise fact-sheets with representative case studies
- ❑ Identify needs for developing environmentally compatible solutions

Organization

- **Chair-Team**:
  - **Chair:** Christoph Hauer (BOKU University Vienna, Austria)
  - **Co-Chairs:** Natalie Rojko (Germany) and Anastasius G. Youtsos (Greece)
- **Working Group Members**: 31 (plus Chair Team)
- **Secretariat** : European Renewable Energy Federation (EREF)

WG3
Hydropower and Climate Change

Scope

- ❑ Communicate what are the key issues in relation to climate change, both in terms of risks and opportunities
- ❑ Illustrate issues with some representative case studies
- ❑ Identify R&I needs to develop solutions to limit risk, and foster opportunities

Organisation

The task is divided into 3 Sub-Groups (SG):

- ➢ Sub-WG1: Adaptation (resilience)
- ➢ Sub-WG2: Mitigation (reduction of GHG emissions)
- ➢ Sub-WG3: Water-energy nexus

- **Chair:** Benjamin GRAFF (CNR, France)
- **Co-Chairs:** Silvia Richard (Conexig France) Ibrahim Halil Demirel (University Turkey)
- **Working Group Members**: 36 (plus Chair Team)
- **Secretariat** : Association of European Renewable Energy Research Centers (EUREC)

WG-A - Overview on European R&I projects for hydropower

General Scope

- Follow-up the Horizon projects related to hydropower
- Create a discussion forum with short webinars:
  - 21.5. 2024: Boosting Hydropower I: Best practices for research
  - 18. 9. 2024: Boosting Hydropower II: Best practices for research
- Inform regularly with a newsletter on the progress of these projects
- Facilitate the organization of special sessions at conferences

Organization

ETIP Secretariat: ICOLD

Confirmed Members: ~20

WG-A	
Chair:	Emanuele Quaranta, JRC, Italy
Co Chairs:	Stevcho Mitovski, University Ss C&M, Macedonia
	Llias Zafeiropoulos, Ubitech Energy, Belgium

The RIA boosted Research and Innovation for hydropower development

ETIP HYDROPOWER

R&I Priorities

Research & Innovation Agenda 2021
Suggested a list of priorities for hydropower to EU calls

European Commission

RIA High priorities	EU Horizon calls	Selected Projects
▪ Digitalisation and artificial intelligence to advance instrumentation and controls	▪ Development of novel sensor technologies and digital solutions for digitization of existing hydropower plants and improving their sustainable operation.	▪ D-HYDROFLEX, Di-Hydro, iAMP-Hydro
▪ Innovation in flexibility, storage design and operation	▪ Demonstration of innovative pumped storage equipment and tools in combination with innovative storage management systems	▪ STOR-HY
▪ Monitoring systems for predictive maintenance and optimised maintenance intervals	▪ Development of hydropower equipment for improving techno-economic efficiency and equipment resilience in refurbishment situations	▪ ReHydro

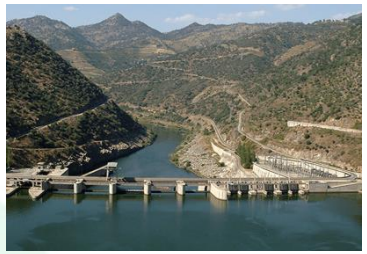
Increasing funding from EU for Hydropower: 10 M€ in FP7 → 40 Millions € in H2020

ETIP HYDROPOWER

Demonstration sites ReHydro (2024 –2028)

Demonstration sites will implement and showcase innovative solutions :

- ❑ Improve the flexibility of the existing European hydropower fleet
- ❑ Implement and demonstrate digital solutions and advanced control systems
- ❑ Improve and ensure environmental sustainability and conservation of biodiversity
- ❑ Identify European market needs in three different scenarios for future energy system development



Røldal-Suldal Power System (RSK), Norway (Lyse)

Saut-Mortier, Ain River, France (Edf)

Force Motrice de la Gougra, Rhone River, Switzerland (Alpiq)

Caderousse, Rhone River, France (CNR)

Valeira, Douro River,Portugal (EDP)

Budget: ~12 millions €

Funded by the European Union

STOR-HY Alqueva Demonstrator

First Triple Hydrid [PSP + BESS + PV] in the EU

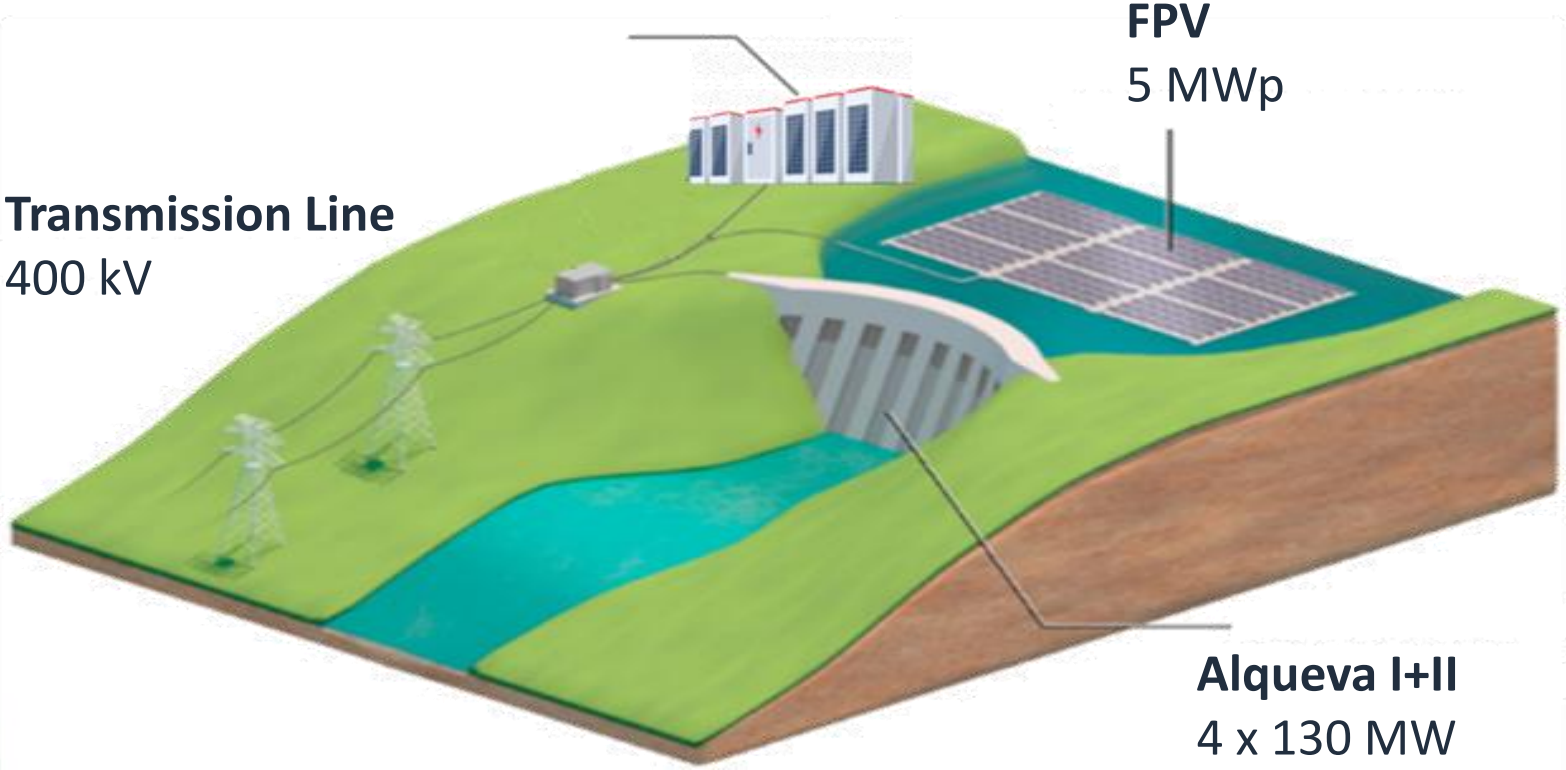
Hydro Pump Storage Plant

BESS Li-ion (LFP)

Floating PV Plant

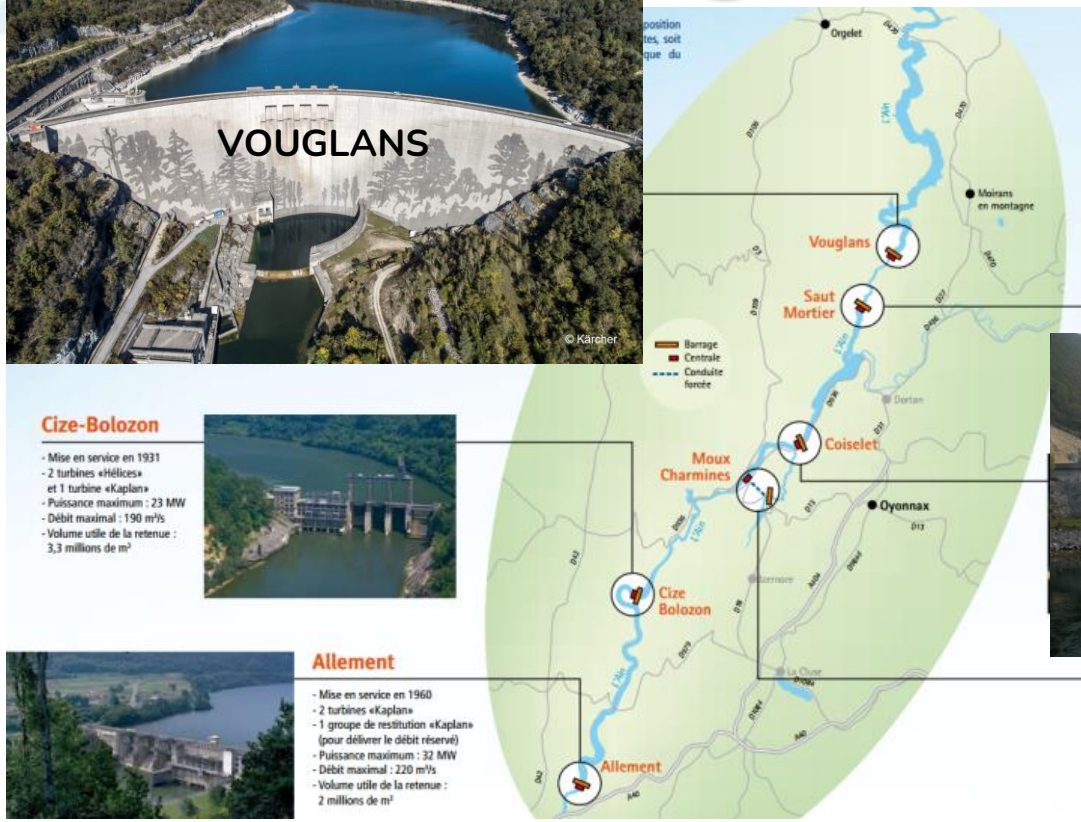
STOR-HY will demonstrate the potential of a pioneering hybrid system in adapting to new market conditions through optimal and coordinated management of the three assets to fully capitalize on energy and ancillary market opportunities

Funded by the European Union



STOR-HY –Vouglans – Saut-Mortier – Coiselet Demonstrator

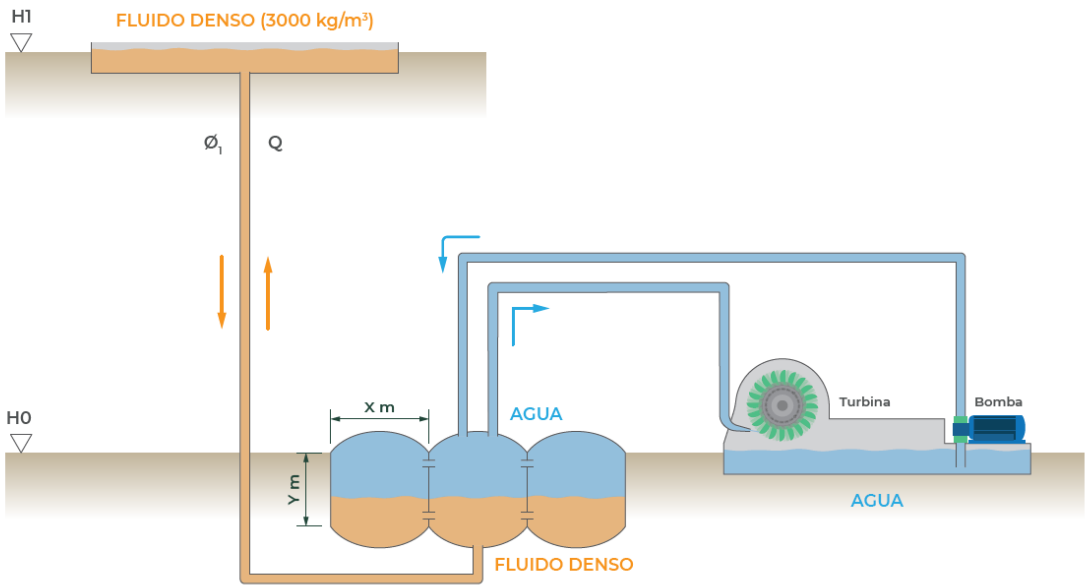
- 3 dams and plants (EDF)
  - Vouglans : 285MW
  - Saut Mortier : 44MW – 1.3Mm³
  - Coiselet : 41MW
- 2 pump turbines
  - 1 existing in Vouglans : 60 MW
  - 1 additionnal pump turbine 18MW variable speed under development in Saut Mortier
- StorHy will showcase :
  - Optimal operation of tandem PSP
    - How to maximize peak energy supply?
    - How to make best use of? Coiselet reservoir infeed
  - Under large set of constraints
    - Environment (ReHydro EU project), societal, market, water management

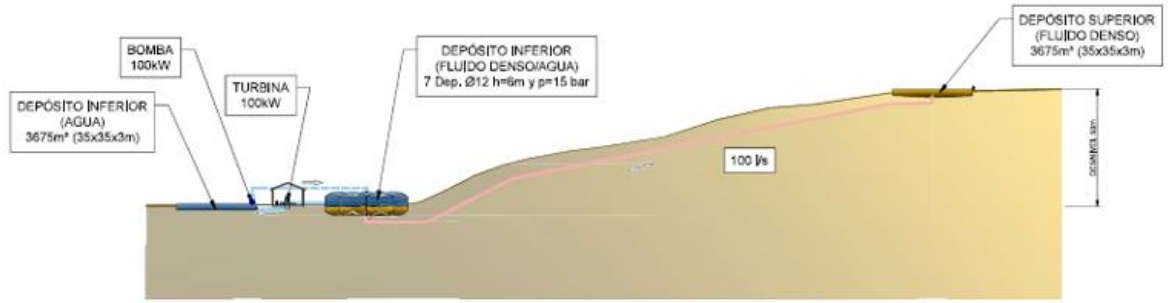


Funded by the European Union

STOR-HY – Coal mine PSP using dense fluid

- The proposed scheme will repurpose existing coal mine and/or slag heaps infrastructure.
- The innovative mechanical pumped storage. Crossflow turbine, independent pumping system, dense fluid.
- Hybridized with a Li-Batt storage system (60 kWh)
- connected to a PV system (approximately 80 - 160 kW),
- will be tested for its response to various demand profiles
- An energy management system will oversee the entire production and storage system.
- The site is equipped with a grid-ready point of interconnection (PoI).





STORHY INNOVATIVE STORAGE TECHNOLOGY AND OPERATIONS IN HYDROPOWER

Funded by the European Union

For more information on innovative hydropower projects

- The HERI Platform (Hydropower in Europe Research & Innovation Platform) (https://etip-hydropower.eu/) stores information regarding hydropower in Europe research actions, research organizations and research funding
- WG A webinars
- Hydro Day on April 8 2024 (in Brussels and on line)

ETIP handled ESEIA recommendations for boosting Hydropower R&I

1. Enhance Role of European Thematic Alliances

- AT POLICY LEVEL: Involve European Alliances from **design to implementation**.
- AT PORTFOLIO LEVEL: Jointly create **exploitation** pathways.
- AT PROJECT LEVEL: Use European Alliances as **sounding boards for new R&I topics**.

2. Foster Global Innovation Eco-system Partnerships

- Increase International Relevance by creating international innovation **ecosystem partnerships** for co-creation.
- Enhance international access to **R&I Infrastructure**.
- Implement strategies to effectively facilitate **capacity building**.

3. Prioritise Horizontal Topics in Research and Innovation

- Prioritizing cross-**cutting horizontal topics**.
- Provide support for **deep tech** projects fostering sustainability.
- Boost Excellence and Innovation by providing support mechanisms tailored to **Widening countries**.

4. Ensure Actionability of the Framework Programme

- By dedicating actions to multi-actor innovation ecosystem approach.
- Improving coordination across the innovation cycle and different TRLs.
- Simplification, to make participation more accessible and efficient.

5. Provide Room for Self-Organisation and Entrepreneurship

- Continuously take on **board novel thematic challenges**.
- Support maturation and **validation of novel ideas** from lab to business.
- Start-Ups and SME **scale-up to new markets**.

(European Sustainable Energy Innovation Alliance 2024 EEI autumn edition)

ETIP builds a Hydropower Innovation Ecosystem Partnerships

- (1) Inviting industry members to participate directly in identifying R&I actions suitable for direct collaborative action
- (2) Identifying opportunities for collaborative funding and implementation of specific R&I actions
- (3) Implementing R&I actions either through direct collaboration or contracting and disseminating of the outcomes

ETIP HYDROPOWER

Grazie per l'attenzione e arrivederci sulla piattaforma ETIP HYDROPOWER

Thank you for your attention and see you on the ETIP platform

Funded by the European Union