



Hydropower Europe Forum

Hidden and Untapped Hydropower Opportunities in Existing Infrastructures

Anton J. Schleiss

**Prof. emeritus EPFL, Hon. President of the International
Commission on Large Dams (ICOLD),**

Coordinator of Hydropower Europe

**Online Workshop IEA TCP HYDROPOWER - Annex XVI
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www.hydropower-europe.eu



H2020 objectives for Hydropower: Hydropower Europe Forum

➤ **ICOLD Leader**

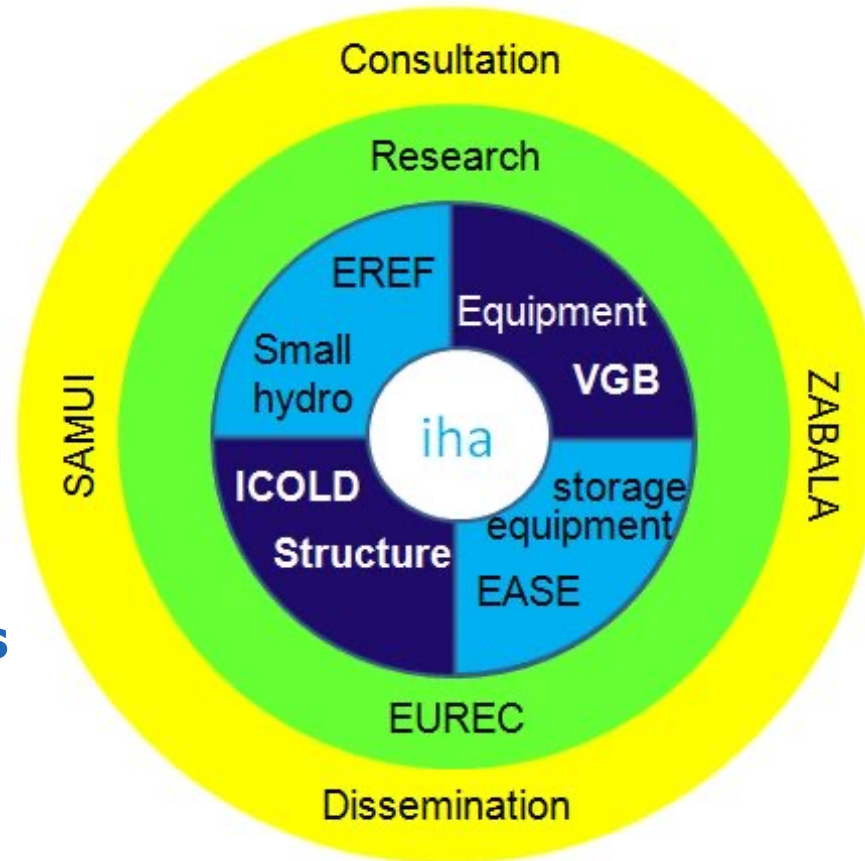


➤ **Coordinators:**

- Jean Jaques Fry
- Anton J. Schleiss

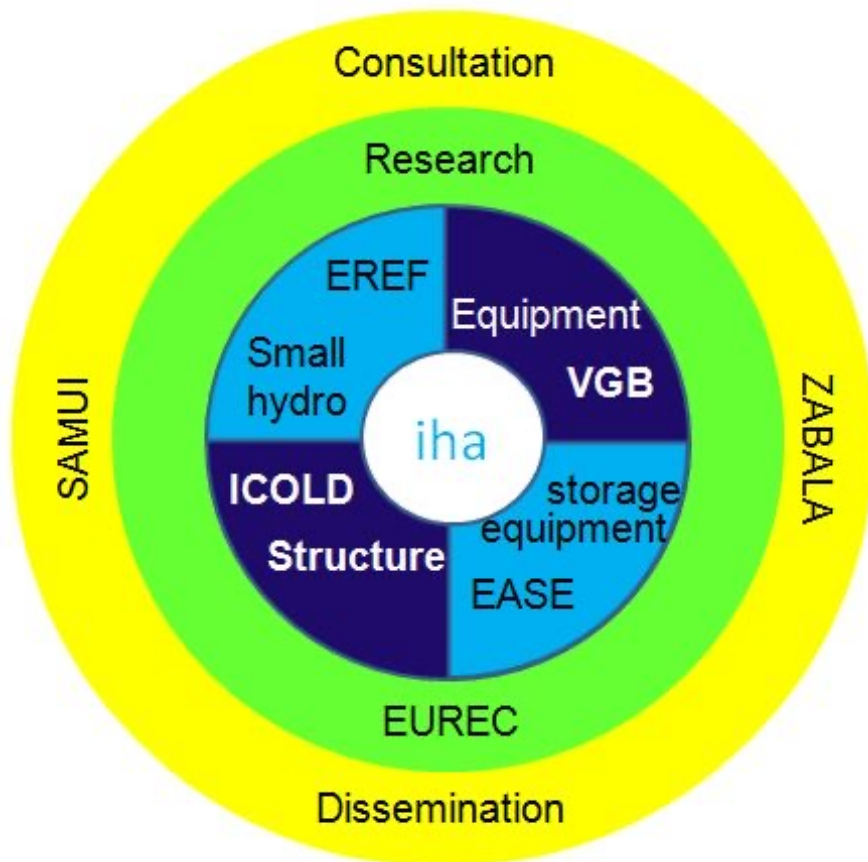
➤ **+ 7 core partners**

➤ **+ 5 third linked Parties**



| |
|---|
| EASE - European Association for Storage of Energy |
| EREF - European Renewable Energies Federation |
| EUREC - Association of European Renewable Energy Research |
| ICOLD - International Commission on Large Dams |
| IHA – International Hydropower Association |
| VGB - International Technical Association for Generation and Storage of Power and Heat |

H2020 objectives for Hydropower: Hydropower Europe Forum

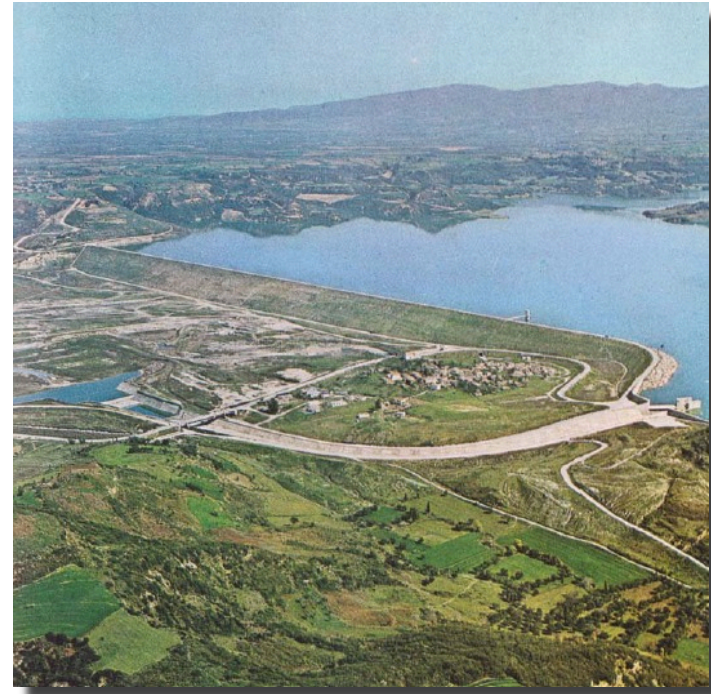


The forum will produce a **synthesis of expected research developments and research needs** for the coming decades in a **Strategic Industrial Roadmap (SIR)** and **Research and Innovation Agenda (RIA)** in the hydropower sector, targeting an **energy system with high flexibility and renewable share.**”

Hydropower as a catalyst for the energy transition in Europe

VISION "Hydropower Europe"

- 1. Increasing hydropower production** through the implementation of new environmental friendly, multipurpose hydropower schemes and by **using hidden potential in existing infrastructures.**



Pinios Dam, Greece, 50 m

Hydropower as a catalyst for the energy transition in Europe

VISION "Hydropower Europe"

2. Increasing the flexibility of generation from existing hydropower plants by adaptation and optimization of infrastructure and equipment combined with innovative solutions for the mitigation of environmental impacts.



Moiry Dam, Switzerland, 148 m

Hydropower as a catalyst for the energy transition in Europe

VISION "Hydropower Europe"

3. Increasing storage by the heightening of existing dams and the construction of new reservoirs, which have to ensure not only flexible energy supply, but which also support food and water supply and thus contribute to the Water-Energy-Food NEXUS and achievement of the Sustainable Development Goals of the United Nations.

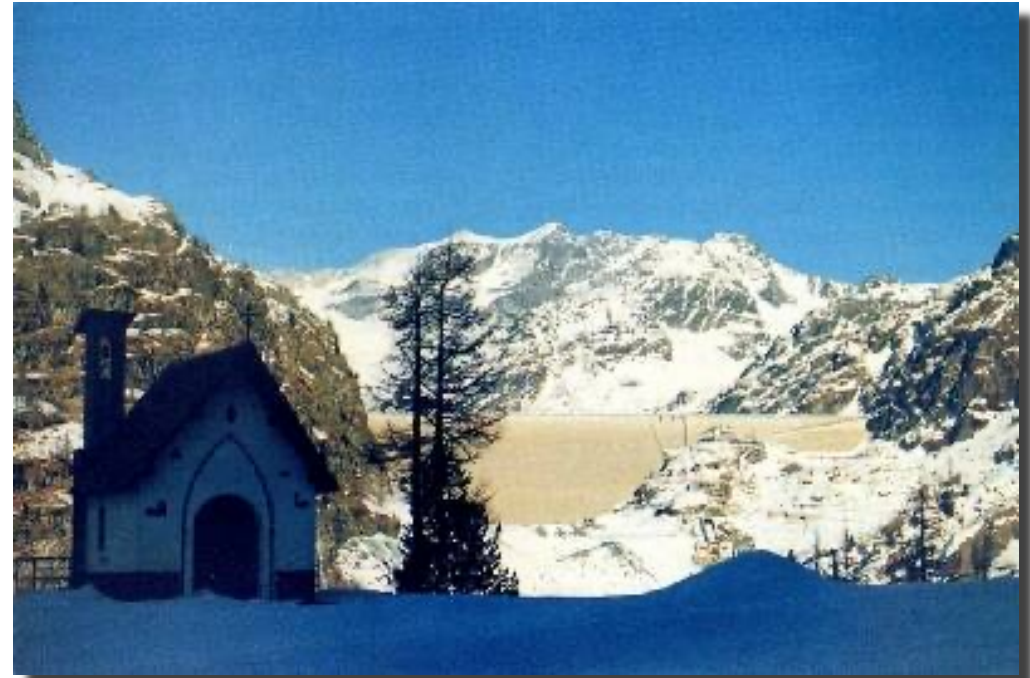


Tignes Dam, France, 180 m

Hydropower as a catalyst for the energy transition in Europe

VISION "Hydropower Europe"

4. Strengthening the contribution of flexibility from **pumped-storage power plants** by developing and building innovative arrangements in combination with existing water infrastructure.



Alpe Gera Dam, Italy, 172 m

**How the
Hydropower Europe
Forum is working
to approach the
VISION
“Hydropower as a
catalyst for the
energy transition in
Europe”?**

The consultation process



Approach of Hydropower Europe Forum - the RIA and the SIR

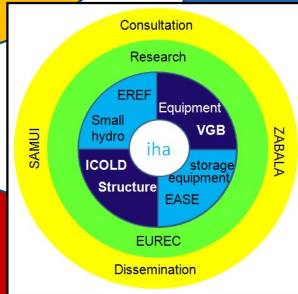
R&I
Priorities

RIA
Recommandations



Barriers

SIR
Steps to new
hydro deployment



Untapped opportunities in existing hydropower infrastructures

Catalogue of opportunities

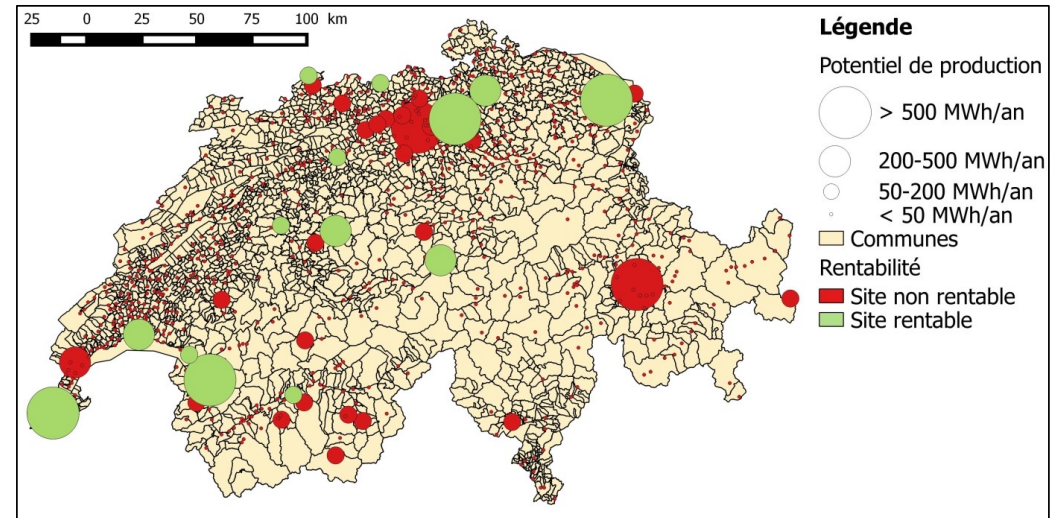
(retrofitting, upgrading, refurbishment, modernization)

- Dam heightening **+E+Flexibility**
- Reduction of head losses in existing waterways (pressure and shafts, penstocks) **+P+E**
- Increase of installed power in RoR (new and/or additional machines) **+P+E**
- Increase of installed power in SPP by adding new parallel waterway & new powerhouse **+P+Flexibility**
- New more flexible electro-mechanical equipment, start and stop improvement **+E+Flexibility**
- Digitalization and inflow forecast **+E+Flexibility**
- Use of storage in waterway systems and RoR **+P+Flexibility**

Hidden opportunities in existing non hydropower infrastructures

Catalogue of Opportunities

- Water supply networks **+P+E**
- Wastewater sanitation networks (before and after treatment plants) **+P+E**
- Irrigation channels **+P+E**
- Non powered dams (irrigation, drinking water supply, flood retention basins, artificial snow basins) **+P+E**
- Ship locks **+P+E**



Example:
Hydropower potential in wastewater sanitation plants after treatment in Switzerland (Bousquet et al.; Aqua&Gas 2015)

Research topics related to hidden and untapped hydropower opportunities*

*according preliminary version of RIA of Hydropower Europe

- **Innovative concepts of hydropower infrastructure adaptation and tapping hidden hydro**
Priority Very High (8.1±0.57)
- **Improvement of equipment operation at minimum load**
Priority High to Very High (7.9±0.97)
- **Developing a seamless, integrated and knowledge-based system from components and system conditions, as well as resources to optimize revenue generation from energy and flexibility markets**
Priority High to Very High (7.6±0.64)
- **Integration of weather and flow forecast with production plans, flood reduction risks, environmental flows and other water uses and making optimization and ensembles operational**
Priority Very High (8.1±0.81)

Research topics related to hidden and untapped hydropower opportunities*

*according preliminary version of RIA of Hydropower Europe

- **Development, testing and industrialization of innovative smooth non-metallic repairing techniques for penstock, gates, using polymers, resins, etc.**
Priority Very High to High (7.90±0.79)
- **Development of near-superconductive materials and innovative insulation materials that are carbon based**
Priority Medium High (6.50±0.25)
- **Development of geomembranes with friction reducing surface morphologies + Development of equipment which allows fast application of such geomembranes in existing tunnels (i.e. 1 to 2 km per week)**
Priority Medium High (6.1±0.58)
- **Pilot projects validating and exploiting innovative solutions for hidden hydro at existing water infrastructures like drinking and waste-water networks, ship locks, irrigation canals, tailrace channels of large hydropower plants**
Priority Very High (8.1±0.65)

What is the potential of hidden and untapped hydropower opportunities in existing infrastructures in Europe?

Increase of annual hydropower production (100% = 2020)

(without installation of new parallel waterways, increase of withdrawals from existing intakes, floating PV)

- ❖ **EU: +10%**
- ❖ **Europe +12%**

Interconnecting existing reservoirs

- ❖ **EU: +4 TWh**
- ❖ **Europe +29 TWh**

Reference:

Quaranta et al. (2021). A clean energy source: Assessing the energy potential of retrofitting the European hydropower fleet.

Energy Conversion and Management (under revision)



**Thank you for your
attention**

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