



# Goals of Hydropower R&D funding: the European viewpoint

IEA Hydro Forum, Tokyo 4<sup>th</sup> February 2019

Thomas SCHLEKER, PhD

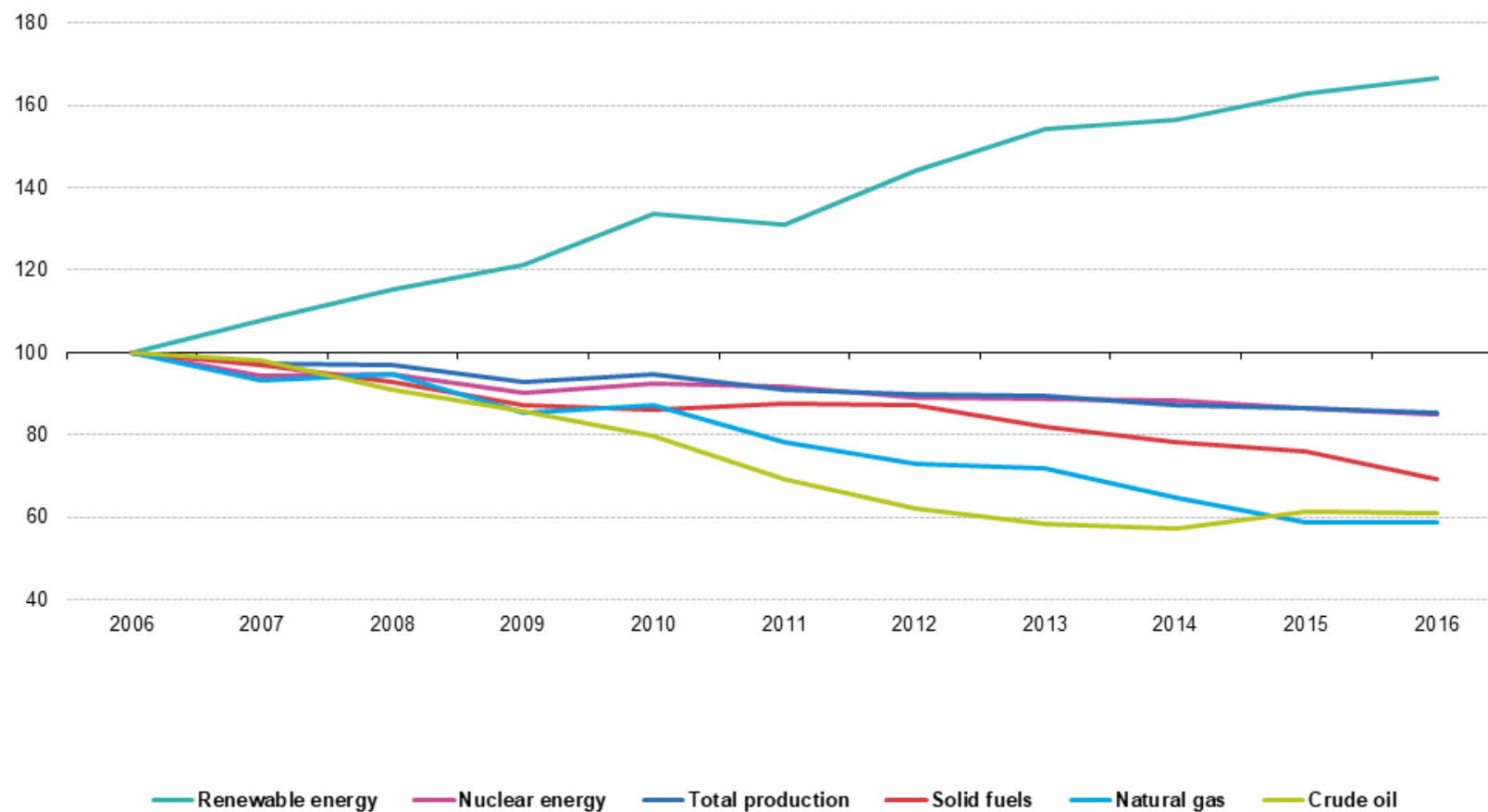
European Commission  
DG Research & Innovation, Renewable Energy Sources

# Outline

- *EU Energy Policy framework*
- *EU-Energy Research Policy framework*
- *Opportunities and Challenges for Hydropower from R&D perspective*
- *Ongoing Research Activities and Outlook*

## Development of the production of primary energy (by fuel type), EU-28, 2006-2016

(2006 = 100, based on tonnes of oil equivalent)



Source: Eurostat (online data code: nrg\_100a)

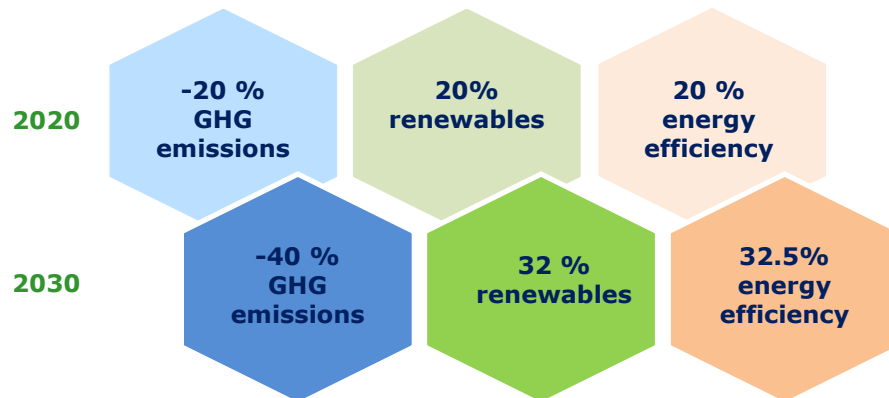
eurostat 

# Policy Framework



## "Clean Energy for all Europeans"

- Putting energy efficiency first
- Demonstrating global leadership in renewables
- Delivering a fair deal for consumers

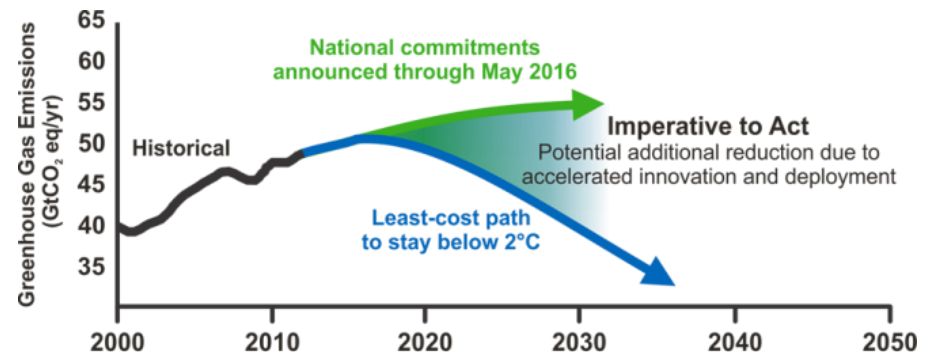


Research and Innovation

## Paris Agreement

*Holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels*

*Accelerating, encouraging and enabling innovation is crucial...*



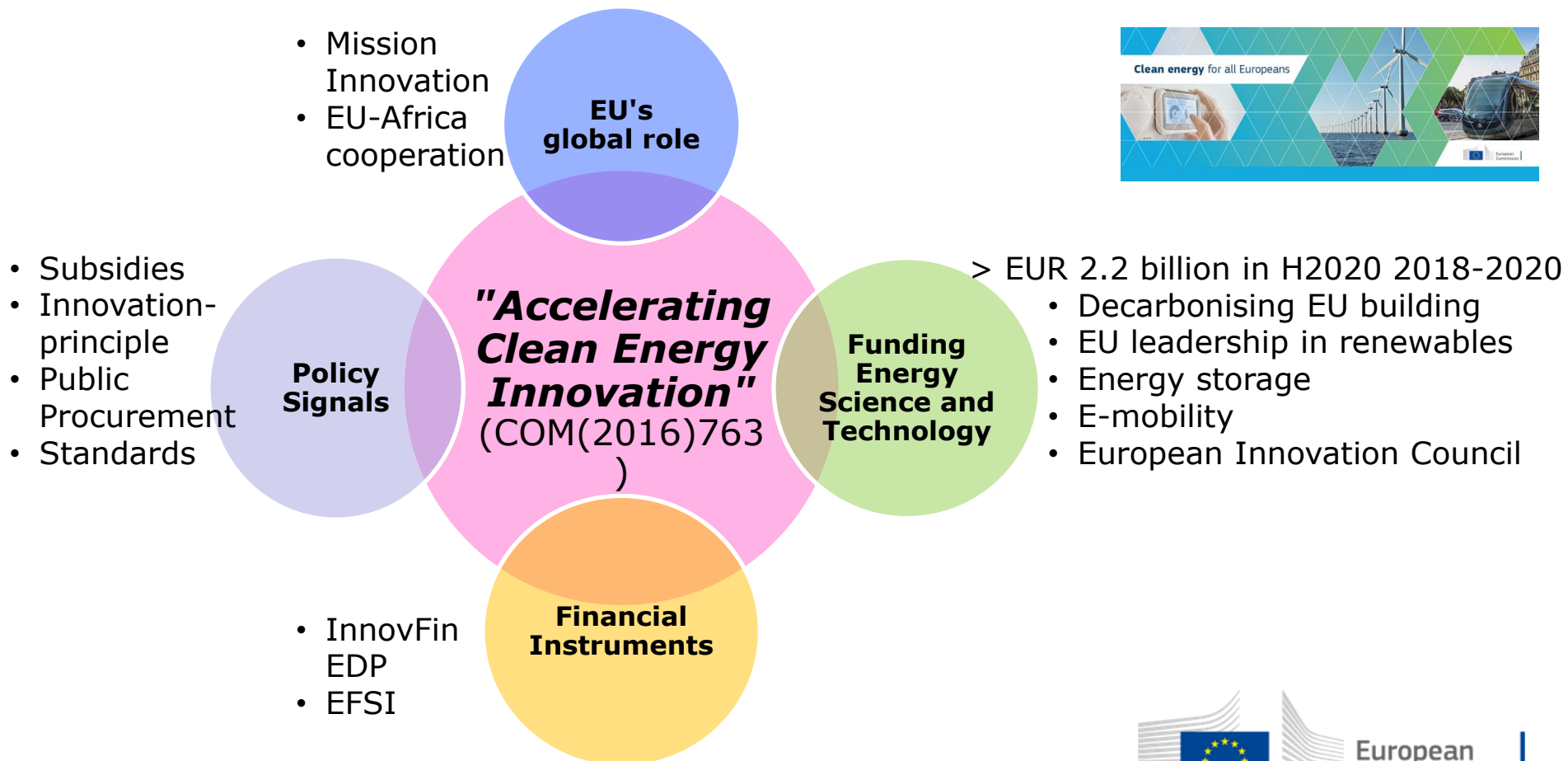
Adapted from UNFCCC, Synthesis report of INDCs, May 2016

## Other EU policy priorities

- Digital Single Market
- Jobs, Growth and Investments
- EU as a strong global actor
- ...

# Accelerating Clean Energy Innovation

- ✓ R&I 5<sup>th</sup> pillar of the Energy Union
- ✓ New EU R&I strategy for the coming years
- ✓ Energy Union Winter Package/Clean Energy for all European 30.11.2016



# The Strategic Energy Technology Plan (SET Plan) - *coordinating research and innovation across Europe*



Overall objective: Accelerating the development and deployment of low-carbon technologies through cooperation among EU countries, companies, research institutions, and the EU itself, based on common priorities, targets and actions.

## Priority Actions:

- 1&2. Improving performance and reducing cost of renewable energy
3. Smart solutions for consumers
4. Smart Resilience and Secure Energy System
5. Energy Efficiency in Buildings
6. Energy Efficiency in Industry
7. Batteries and e-Mobility
8. Renewable Fuels and Bioenergy
9. Carbon Capture Utilisation and Storage
10. Nuclear Safety

### Defining priorities

- SET-Plan Communication 2015

### Setting targets

- Declaration of Intent

### Implementation Plans (IP)

- Temporary Working Groups

### Execution of IPs

2013 Technology Map of the SET-Plan  
2014 Towards an Integrated Roadmap



European  
Commission

# Mission Innovation



## Overall objective:

To reinvigorate global efforts in clean energy innovation, Mission Innovation members share a common goal to develop and scale breakthrough technologies and substantial cost reductions. MI members aim to seek to double public clean energy research & development investment over 5 yrs

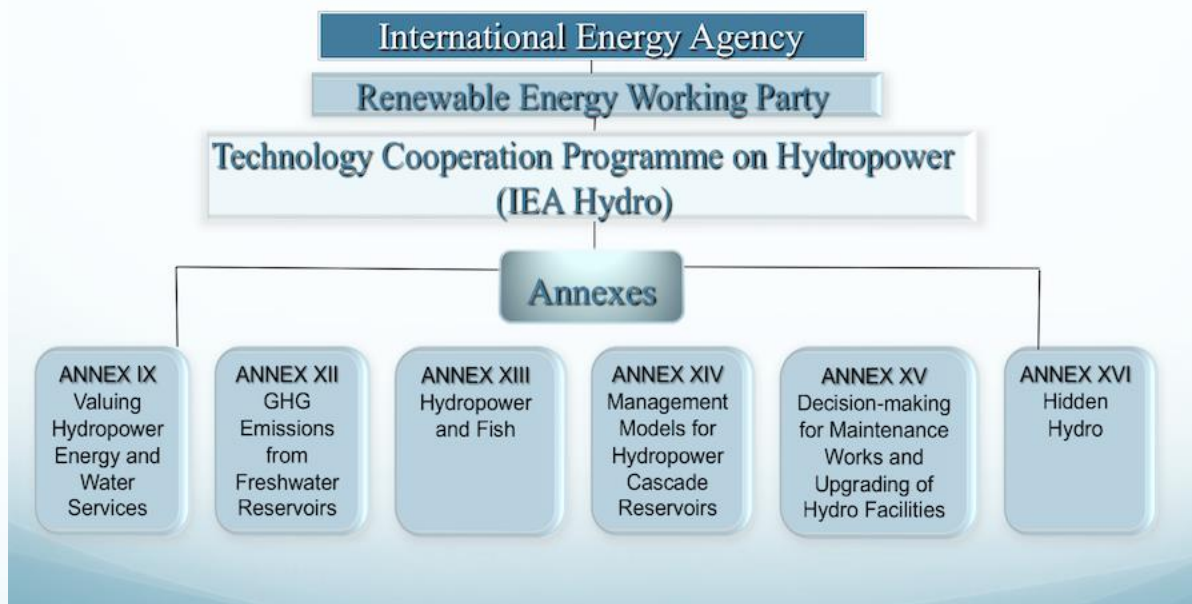
## **EC is proactively engaged :**

- 150 Million € on MI-relevant calls by 2020 in Horizon 2020
- Engaged in all the ( Innovation Challenge (IC)
  - ✓ smart grids, off-grid access to electricity, CCS, biofuels, solar fuels, clean energy materials, H&C buildings; hydrogen



THE INTERNATIONAL ENERGY AGENCY TECHNOLOGY  
COLLABORATION PROGRAMME ON HYDROPOWER

# IEA Hydropower



[www.ieahydro.org](http://www.ieahydro.org)





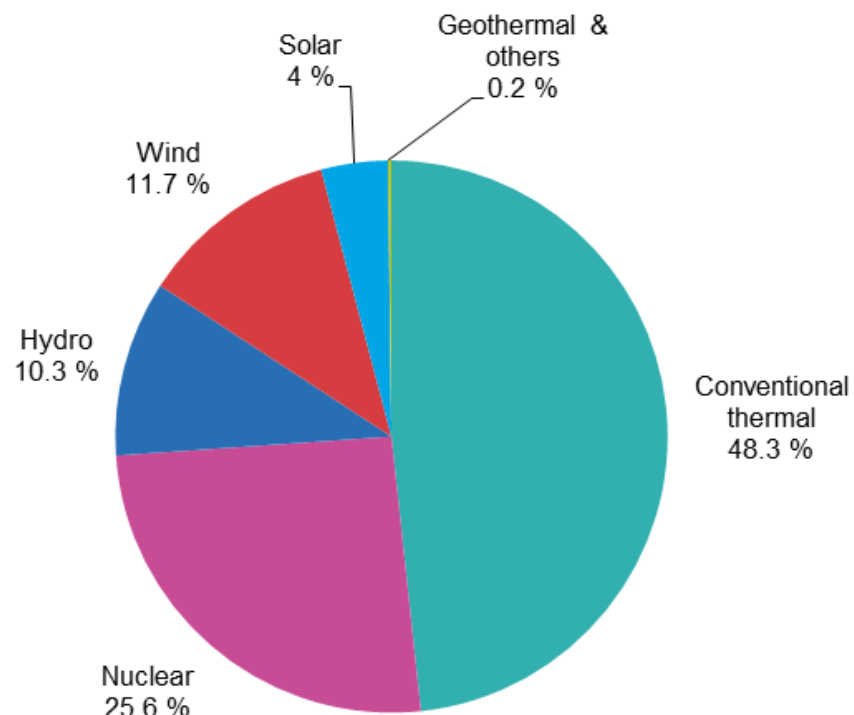
THE INTERNATIONAL ENERGY AGENCY TECHNOLOGY  
COLLABORATION PROGRAMME ON HYDROPOWER

# IEA Hydropower

## Annex XVI -Draft

- *Subtask 1: Updating Hydropower Inventories*
- *Subtask 2: Improving Performance from Existing Hydropower*
- *Subtask 3: Adding Power to "Non-power Dams" and Water Management Facilities*
- *Subtask 4: Hydropower Technology Research and Innovation in the context of Hidden Hydropower opportunities*

## EU-28 Electricity production by source, 2017 (in %)



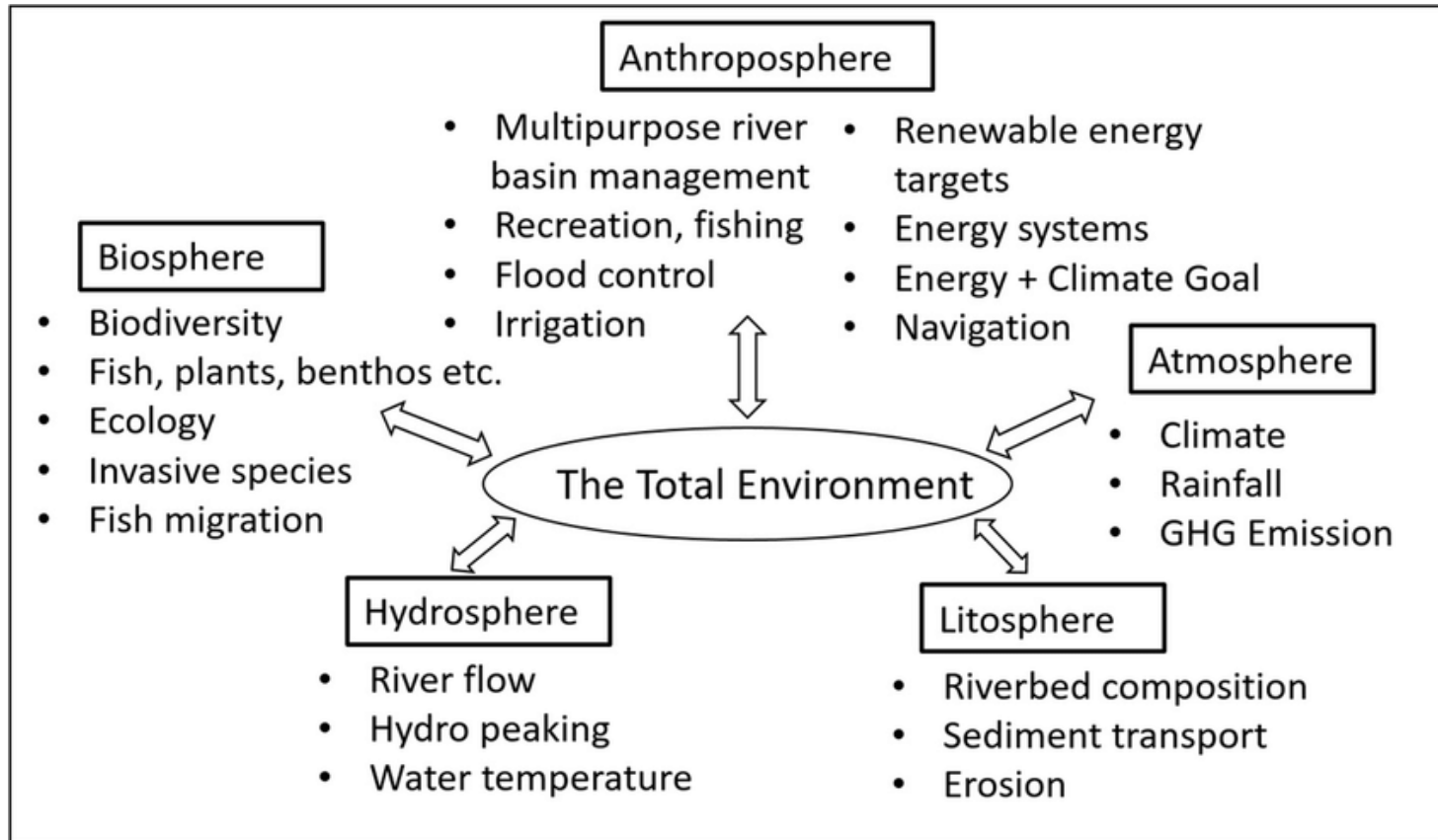
Source: Eurostat (online data code: nrg\_105m)

eurostat 

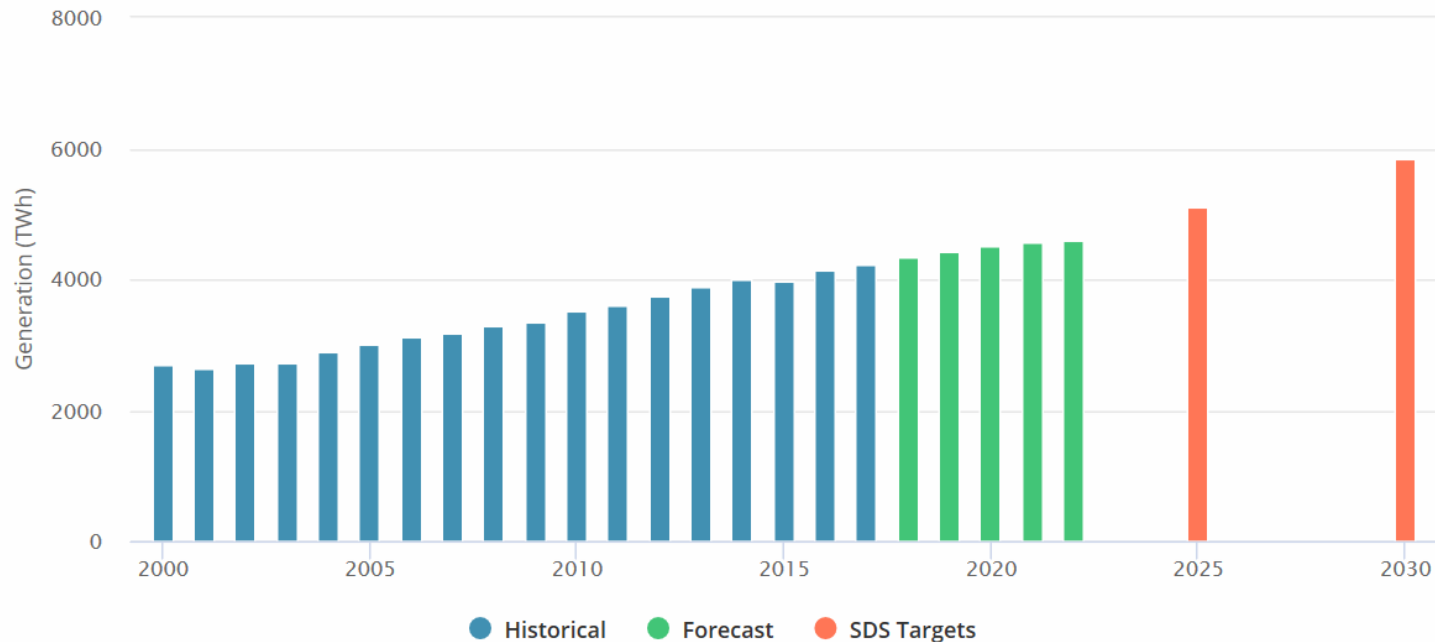
# Hydropower and Environment

- *Birds and Habitats Directives, The Water Framework Directive WFD, the Nature Directives, the Floods Directive, the SEA and EIA Directives...*
- *EC (2018): Guidance document on the requirements for hydropower in relation to EU Nature legislation*

# Hydropower and Fish - IEA Annex XIII



Schleker and Fjeldstad. Sci Total Environ. 2019



IEA. All rights reserved.

## Technology innovation gaps identified for hydropower (IEA):

- Improved spatial planning and environmental assessments
- Enhance flexibility of hydropower

# Hydropower in Europe

- *Limited potential if only focused on power production but high potential in grid balancing*
- *Strong technology base*
- *Challenges and opportunities*
  - **Refurbishment**
  - **Flexible operation**
  - **Grid balancing**

# Hydropower – R&I strategy

*Overall strategy is to target the following sector challenges:*

- *Sector faces long-term challenges and requires continuous efforts*
- *To maintain European hydropower research and industry value chains*
- *Global cooperation on sustainable hydropower*

# Hydropower in FP7 and Horizon 2020

Development and laboratory testing of improved action and Matrix hydro turbines designed by advanced analysis and optimization tools



Hydropower Converters with very low head differences

Hydropower plants PERformance and flexiBle Operation towards Lean integration of new renewable Energies

**HYPERBOLE**



Fishfriendly Innovative Technologies for Hydropower

Increasing the value of Hydropower through increased Flexibility



**Hydropower Europe**

*From other SC, SME Instrument: e.g. DAFNE, AMBER  
Other programmes (e.g. LIFE), JRC*



# Renewable energy solutions for energy system level implementation

## LC-SC3-RES-16-2019

*Increase the potential and performance of dispatchable technologies to provide flexibility services to the energy system*

**TRL 3-4 to TRL 4-5**

**RIA**

**EUR 3 to 5 million**

*Penetration of a higher share of variable output renewables in the energy mix without affecting system stability*

**Development of solutions based on renewable sources that provide flexibility to the energy system**

...

**Hydropower** Development of low and ultra-low head and sea water resistant equipment (such as for example bulb-pump turbines) guaranteeing at least 70% round-trip efficiency and making low-head seawater storage and other low head applications of hydropower viable for example at unexplored locations (e.g. like at coastal dams and islands), by minimising at the same time potential impacts on fish.

**Virtual Power Plant** Increase the performance of an integrated portfolio of renewable energy sources to operate together as a Virtual Power Plant, capable of providing flexibility and ancillary services to the energy system. The solution has to be competitive compared to solutions combining variable output renewables with electrochemical storage.

# Hydropower in Horizon 2020

## WP 2018-2020

*The update of the WP for topics in 2020 is currently in preparation*

# Conclusions

- *Hydropower is an major source of renewable electricity in the EU today and will still play a crucial role in the future*
- *Hydropower R&I is important (e.g. flexibility, refurbishment, hidden hydropower opportunities)*
- *An active European Hydropower R&I value chain and community is important*
- *There is an important international dimension of Hydropower R&I*

# Commission proposal for Horizon Europe

THE NEXT EU RESEARCH & INNOVATION  
PROGRAMME (2021 – 2027)

#HorizonEU

Thomas Schleker  
**IEA Hydro Forum**  
4th February 2019



# Horizon Europe: investing in R&I to shape our future

- The vision:  
" a Europe that protects,  
a Europe that empowers,  
a Europe that defends"  
*Jean-Claude Juncker*
- Tackling **climate change**  
(35 % budgetary target)
- Helping to achieve **Sustainable Development Goals**
- Boosting the Union's  
**competitiveness and growth**



Credits: <https://www.un.org/sustainabledevelopment/sustainable-development-goals/>

# Horizon Europe: evolution not revolution

## Specific objectives of the Programme



**Thank you for your attention!**

Find out more:

<http://ec.europa.eu/programmes/horizon2020>