GREEK HYDROPOWER PRODUCTION AND THE EUROPEAN UNION (EU) WATER FRAMEWORK DIRECTIVE: POTENTIALLY CONFLICTING INTERESTS AND SUSTAINABLE GOVERNANCE OF RIVER BASINS

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INTRODUCTION

Climate change is already affecting water availability, according to the European environmental bureau' s.

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Hydropower plants are contributing towards European union energy targets for 2020-2030 playing a key role in renewable energy directive implementation and co_2 emissions reduction as they do not pollute the air like power plants.

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Hydropower plants have many negative effects on biodiversity, river flows and aquatic communities as they cause changes in river morphology and riverine habitats.

The water framework directive (WFD) is the key point of the institutional framework of the third phase of European's union water resources management and its purpose is to establish a framework for the protection of inland surface waters, transitional waters, coastal waters, and groundwater.

First dam in Greece was built in ancient Alyzia between 1st and 5th century BC

List of large Greek dams for the purpose of electricity generation

A/A	NAME	YEAR OF CONSTRUCTION	CONSTRUCTION OPERATOR	HEIGHT	DISTRICT
1	AGIA VARVARA	2007	PPC-DEI	20	IMATHIA
2	ASOMATA	1985	PPC-DEI	52	IMATHIA
3	DAFNOZONARA	2010	TERNA ENERGIAKI	28	AITOLOAKARNANIA
4	THISAVROS	1996	PPC-DEI	172	DRAMA
5	ILARIONAS	2012	PPC-DEI	130	KOZANI
6	KASTRAKI	1969	PPC-DEI	96	AITOLOAKARNANIA
7	KREMASTRA	1965	PPC-DEI	165	AITOLOAKARNANIA
8	LADONAS	1955	PPC-DEI	56	ARKADIA
9	LOUROS	1954	PPC-DEI	22	PREVEZA
10	MESOBOYNOY	2009	PREFECTURE OF KOZANI	32	KOZANI
11	MESOXORA	2009	PPC-DEI	150	TRIKALA
12	METSOBITIKOS	2011	PPC-DEI	11	IOANNINA
13	PIGES AOOU	1999	PPC-DEI	78	IOANNINA
14	PLATANOBRISI	1998	PPC-DEI	95	DRAMA
15	POLIFITO	112	PPC-DEI	112	KOZANI
16	POURNARI	1981	PPC-DEI	87	ARTA
17	POURNARI II	1998	PPC-DEI	15	ARTA
18	PRAMORITSA	2007	PREFECTURE OF KOZANI	57	KOZANI
19	SISANIOU	2006	PREFECTURE OF KOZANI	35	KOZANI
20	SMOKOBO	1996	Υ.ΠΕ.ΧΩ.Δ.Ε*	109	KARDITSA
21	STRATOS	1988	PPC-DEI	26	AITOLOAKARNANIA
22	SIKIA	2013	Υ.ΠΕ.ΧΩ.Δ.Ε*	170	TRIKALA-KARDITSA
23	SFIKIA	1985	PPC-DEI	82	IMATHIA
24	TAYROPOS	2006	PPC-DEI	83	KARDITSA

* Ministry of Regional Planning, Building and Urban Development

MATERIALS AND METHODS

Purpose

Assess both Hydroelectric power generation and Water Resources Management in Greece considering the conflicts that arise between hydropower-related electricity production and water courses conservation

The approach that we developed is organised in three building steps

1st step
Hydroelectric power generation in Greece

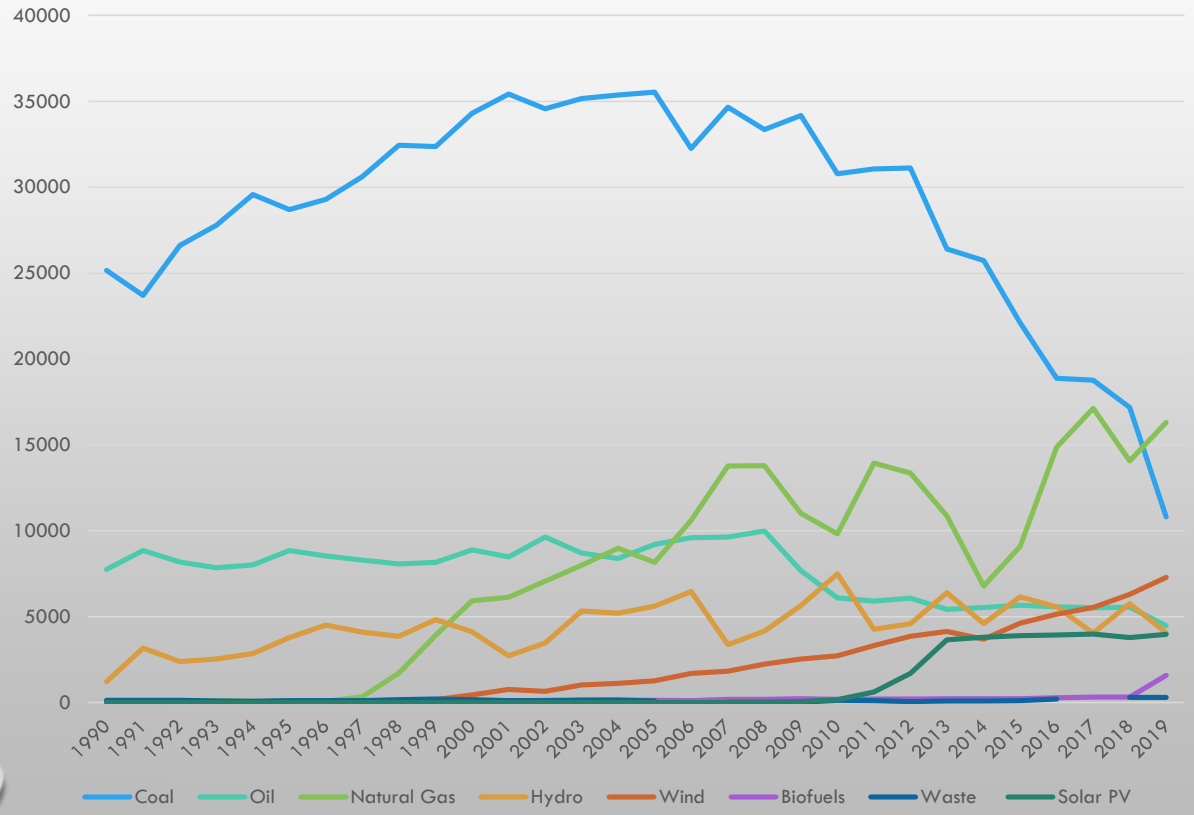
2nd step
Definitions of hydropower utilisation and water protection at WFD 2000/60

3rd step
Designation of heavily modified water bodies within the context of WFD implementation in Greece

RESULTS

HYDROPOWER TODAY

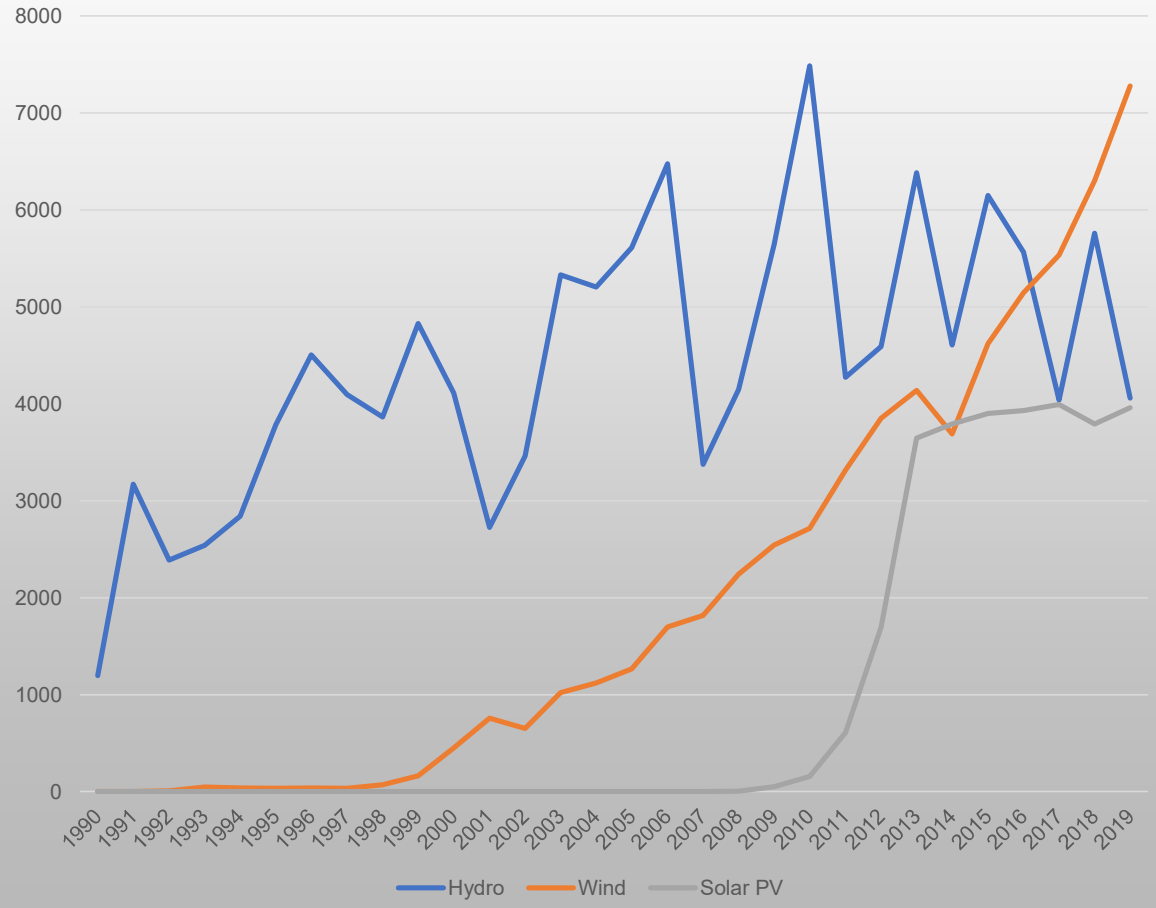
Electricity generation by Source in Greece 1990-2019



Hydroelectric installed capacity for 2019 in Greece, which accounts towards 8.4% of the total installed capacity

HYDROPOWER TODAY

Renewable electricity generation by source for Greece 1990-2019



Among the main res (wind, solar, hydro), the installed power of hydroelectric energy amounts to 27% in Greece for 2019

THE WATER FRAMEWORK DIRECTIVE 2000/60: HYDROPOWER UTILISATION AND WATER PROTECTION

The main environmental objectives of the Directive are in particular to achieve "good ecological and good chemical status" for surface water bodies in general and "Good ecological potential" as the status of a heavily modified or an artificial body of water by 2015. The WFD also requires the reduction and ultimate elimination of priority hazardous substances and the reduction of priority substances to below set quality standards.

WFD

According to no 23 of Article 2 "*Heavily modified water body, means a body of surface water which as a result of physical alterations by human activity is substantially changed in character, as designated by the Member State in accordance with the provisions of Annex II.*" and member States may designate a body of surface water as artificial or heavily modified, when (Article 4 paragraph 3) : (a) the changes to the hydromorphological characteristics of that body which would be necessary for achieving good ecological status would have significant adverse effects on

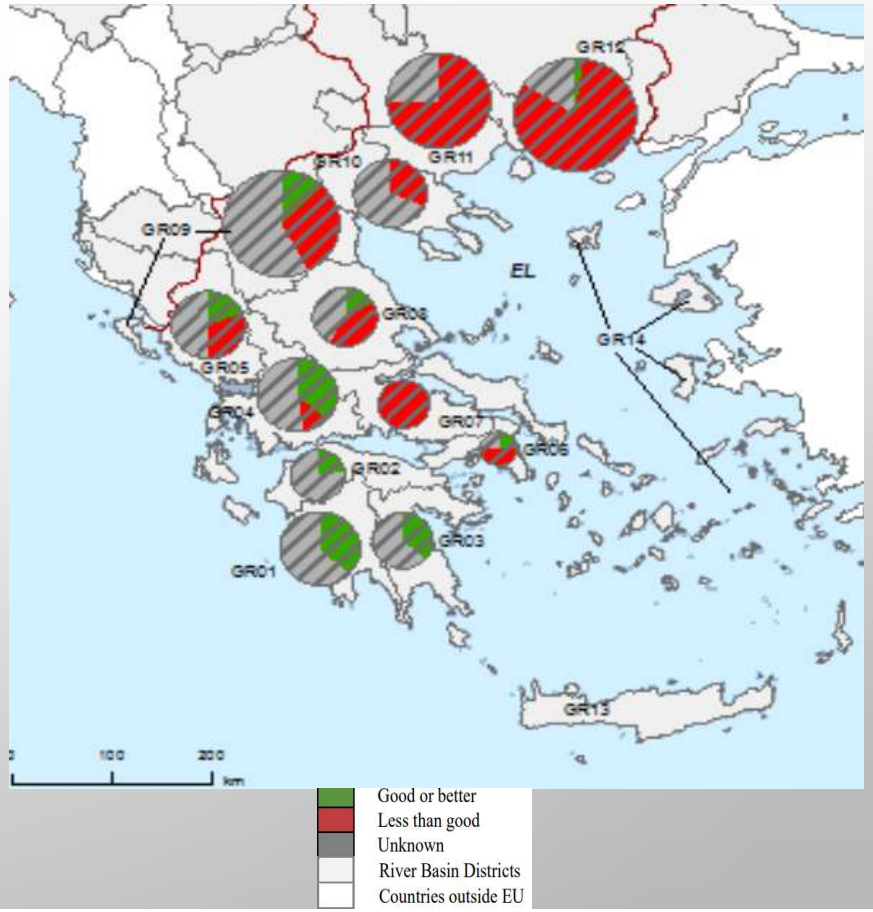
DESIGNATION OF HEAVILY MODIFIED WATER BODIES IN GREEK LEGISLATION IN ACCORDANCE WITH WFD

Greece has classified the HMWB's in accordance with the guidelines of the European Commission and the provisions of WFD beginning with an early stage identification of heavily modified water bodies and the measures need to be taken in order to achieve good ecological potential of the water body.

Overview of Implementation of Greek RBMR's

RBMP	Public Consultation	Competent Authorities	SW's characterization /typology	Reference Conditions	Significant Pressures	Protected Areas	Water Pricing Policies	Monitoring	SW's ecological/ chemical status	HMWB/ AWB	Environmental objective-exemptions	PoM
GR01	Yes	Yes	Yes	Partly	Yes	Yes	Yes	Partly	Incomplete	Yes	Partly	Yes
GR02	Yes	Yes	Yes	Partly	Yes	Yes	Yes	Partly	Incomplete	Yes	Partly	Yes
GR03	Yes	Yes	Yes	Partly	Yes	Yes	Yes	Partly	Incomplete	Yes	Partly	Yes
GR04	Yes	Yes	Yes	Partly	Yes	Yes	Yes	Partly	Incomplete	Yes	Partly	Yes
GR05	Yes	Yes	Yes	Partly	Yes	Yes	Yes	Partly	Incomplete	Yes	Partly	Yes
GR06	Yes	Yes	Yes	Partly	Yes	Yes	Yes	Partly	Incomplete	Yes	Partly	
GR07	Yes	Yes	Yes	Partly	Yes	Yes	Yes	Partly	Incomplete	Yes	Partly	
GR08	Yes	Yes	Yes	Partly	Yes	Yes	Yes	Partly	Incomplete	Yes	Partly	Yes
GR09	Drafts have been completed											
GR010	Drafts have been completed											
GR011	Yes	Yes	Yes	Partly	Yes	Yes	Yes	Partly	Incomplete	Yes	Partly	Partly
GR012	Yes	Yes	Yes	Partly	Yes	Yes	Yes	Partly	Incomplete	Yes	Partly	Partly
GR013	Consultations just started											
GR014	Consultations have not yet started											

Ecological potential of artificial and heavily modified bodies



Ranking of European countries by hydro percentage in total energy production

Country	Electricity Generation			
	Hydro [GWh]	Total [GWh]	Hydro/Total %	Main Energy Source
European Union (28)	38018	3.253,125	12%	Nuclear, Coal, Gas
Albania	7.782	7.782	100%	Hydro
Norway	144.005	149.333	96%	Hydro
Iceland	13.471	18.55	73%	Hydro
Austria	42.919	68.336	63%	Hydro
Switzerland	36.689	63.172	58%	Hydro, Nuclear
Sweden	62.137	156.01	40%	Nuclear, Hydro
North Macedonia	1.897	5.629	34%	Coal, Hydro
Bosnia and Herzegovina	5.641	17.767	32%	Coal, HYdro
Serbia	11.521	39.342	29%	Coal, Hydro
Portugal	16.909	60.28	28%	Hydro, Coal, Gas, Wind
Romania	18.536	65.103	28%	Hydro, Goal, Nuclear, Gas
Turkey	67.231	273.695	25%	Coal, Gas, Hydro
Slovak Republic	4.606	26.934	17%	Nuclear, Hydro, Coal
Russia	186.64	1.090.973	17%	Gas, Nuclear, Coal, Hydro
Spain	39.865	274.671	15%	Nuclear, Gas, Wind
Italy	44.257	289.032	15%	Gas, Hydro, Coal
France	64.889	555.621	12%	Nuclear
Greece	5.565	54.438	10%	Coal, Gas
Bulgaria	4.568	45.243	10%	Coal, Nuclear
Ukraine	9.304	164.494	6%	Nuclear, Coal
Germany	26.135	647.231	4%	Coal, Gas, Nuclear, Wind
United Kingdom	8.354	339.399	2%	Gas, Nuclear
Poland	2.322	166.568	2%	Coal
Hungary	259	37.781	1%	Nuclear

DISCUSSION

CONFLICTS BETWEEN HYDROPOWER PRODUCTION AND THE WFD

Legislation provisions and strict implementation of the WFD could cause potential conflict with the hydropower industry due to bureaucracy, smaller revenues, increasing of costs and reduction of hp production

RES-directive and the WFD

contradicting each other?

CONFLICT BETWEEN WATER RESOURCES PROTECTION, GOOD ECOLOGICAL POTENTIAL OF WATER AND HP PRODUCTION IN GREECE

The lack of data (hydromorphological, physicochemical, biological) in Greece make river basin management, planning of measures and establishing of monitoring systems for heavily modified surface water almost impossible.

Greece has not defined good ecological potential (GEP) and Greek authorities, given the lack of methodologies, define GEP as equal to Good Ecological Status (GES). This is implausible from the point of view of the WFD and underlying problem is the lack of assessment methods which are sensitive to hydro morphological modifications.

CONCLUSIONS

Given the fact that hydroelectricity accounted for about 23% of total Greek utility-scale renewable electricity generation it appears to be an attractive, sustainable alternative to conventional energy sources that may assist in the achievement of key performance indicators related to EU commitments to the Paris Agreement.

In this respect, WFD is a reliable tool to minimize environmental impacts of HP, provides the necessary legal means to solve potential discrepancies between hydropower utilisation, water protection and ensure good ecological potential of HMWB and contribute towards the harmonization of national legislations across the EU irrespectively of certain technical and, or physical characteristics of hydropower facilities.

Greece should develop concrete methodologies to address hydro-morphological pressures and provide a clear frame for the designation of HMWB in Greek legislation in accordance with WFD. Given the absence of a central body to implement a water resources management strategy despite harmonization of Greek legislation with the Community Framework Directive 2000/60 / EC may cause the lack of development of GEP and impede further renewable energy substitution and watercourses preservation.

THANK YOU FOR YOUR TIME