

HYDROPOWER PRESSURE ON EUROPEAN

RIVERS

THE STORY IN NUMBERS - SUMMARY REPORT



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EXECUTIVE SUMMARY

The hydropower sector is booming worldwide. Europe is no exception to this trend, even though most of the hydropower potential on the continent has already been harnessed. A large part of the increase is due to the development of small hydropower plants (0.1-10 MW).

This study presents the first inventory of hydropower in the whole of Europe¹, and overlays them with Europe's protected areas.

The inventory shows regional differences and highlights the regions most vulnerable to new hydropower developments. Often, these house some of Europe's most pristine and biodiversity-rich rivers.

KEY FINDINGS

Hydropower presence in European rivers is massive: The inventory reveals a total of 30,172 plants in Europe. Out of these, 21,387 already exist, 8,507 are planned to be built, and 278 are already under construction. Figure ES 1 illustrates their spatial distribution, and highlights the density of existing plants.

Most hydropower plants are small hydropower plants: The high number of hydropower plants in Europe can be explained by the dominance of small plants (Figure ES 2). Small hydropower plants come with a large ecological impact because they are numerous and disrupt river continuity, whilst contributing minimally to electricity production.

Hydropower development is happening in most regions of Europe: Hydropower plants (often small hydropower plants) are under development in all countries (Figure ES 3). However, there are strong differences of size classes and development dynamics. In Western European countries, hydropower increase is realised mostly by pumped-storage plants and the upgrade of existing hydropower plants. In Portugal, the Balkan countries, some Eastern European countries and Turkey, the number of large run-of-the-river plants increases each year. Hot spots of development of medium and large hydropower plants in Western Europe are Portugal, Switzerland and Austria. Hydropower in Norway and Scotland is growing steadily, especially for small hydropower plants and pumped storage ones. The most dynamic development can be found in the Balkan region, Turkey and some Eastern European countries. Albania and Turkey are also developing large hydropower plants.

1. The project area is comprised of all continental EU countries including Switzerland, Norway and Iceland, and stretches towards the eastern and south eastern borders of Europe including the Balkans, Belarus, Ukraine and Turkey. Overall, this mapping covers an area of 6,687,608 km² (for the sake of comparison, the largest river included in this mapping – the Danube basin – covers around 800,000 km²).

FIGURE ES 1: Distribution of recorded hydropower plants in Europe

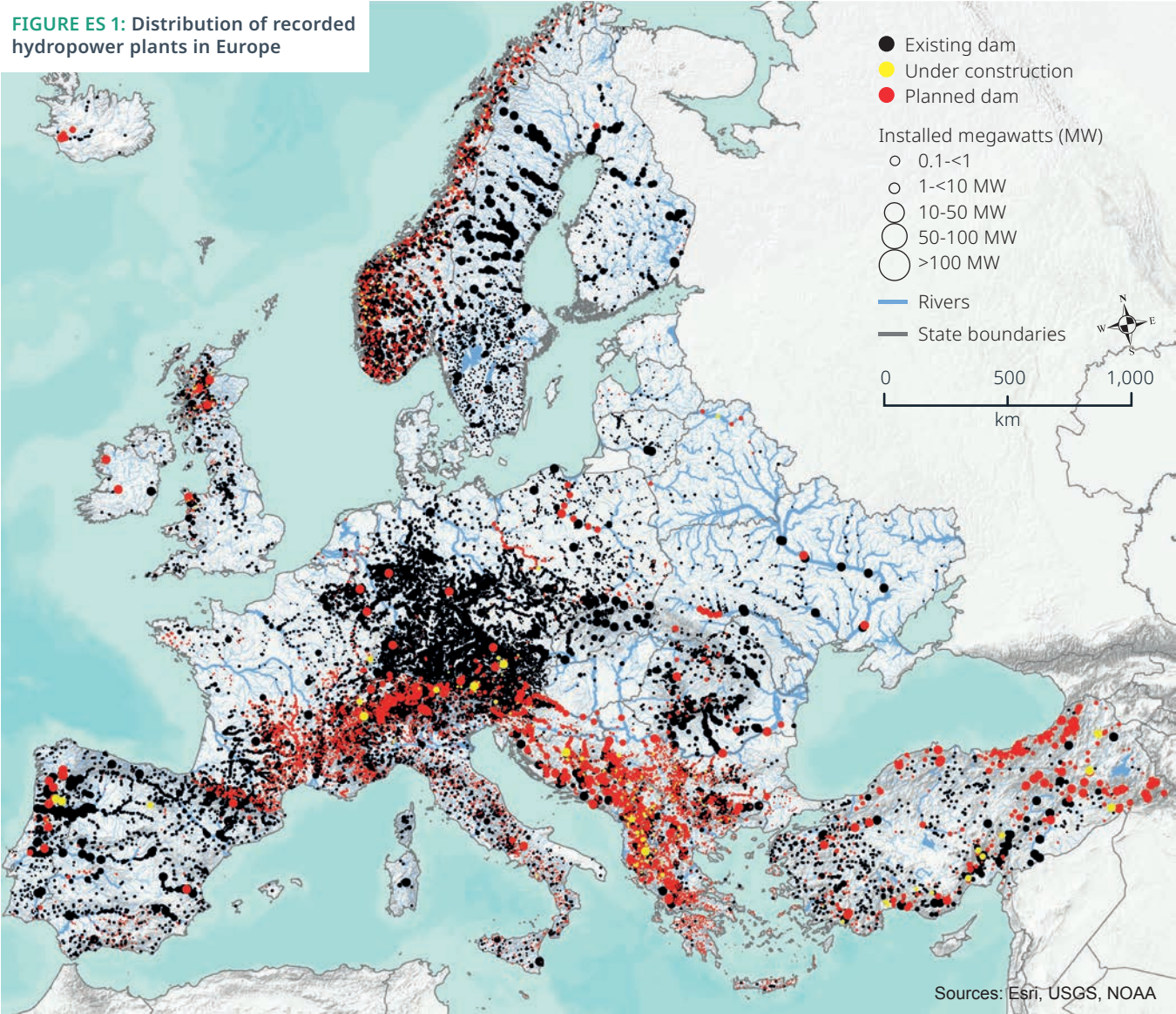
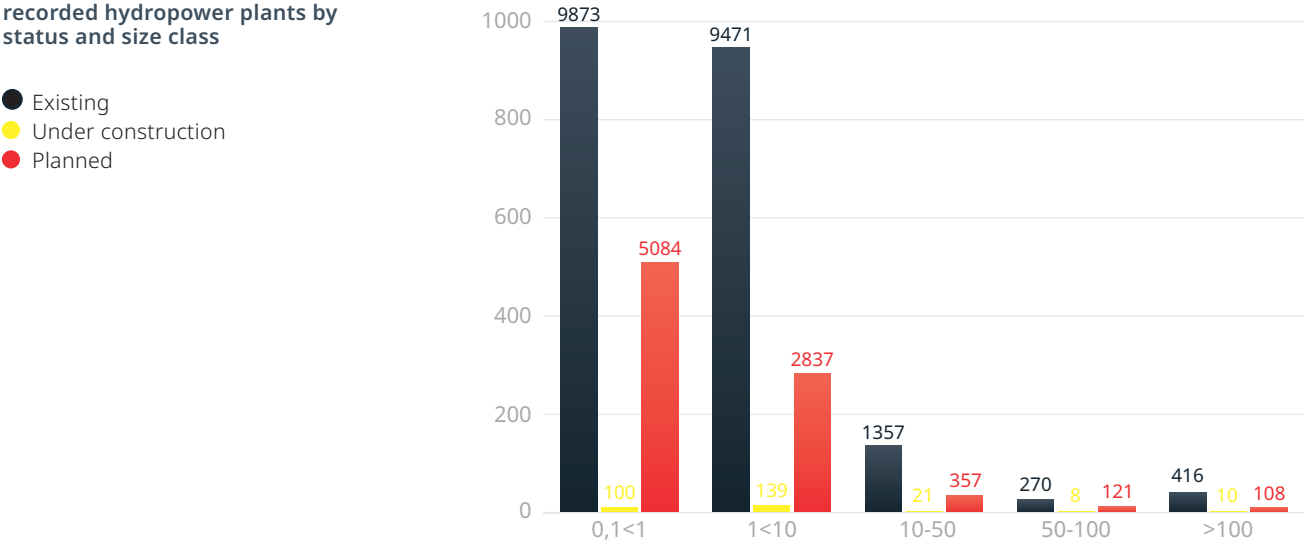


FIGURE ES 2: Distribution of all recorded hydropower plants by status and size class



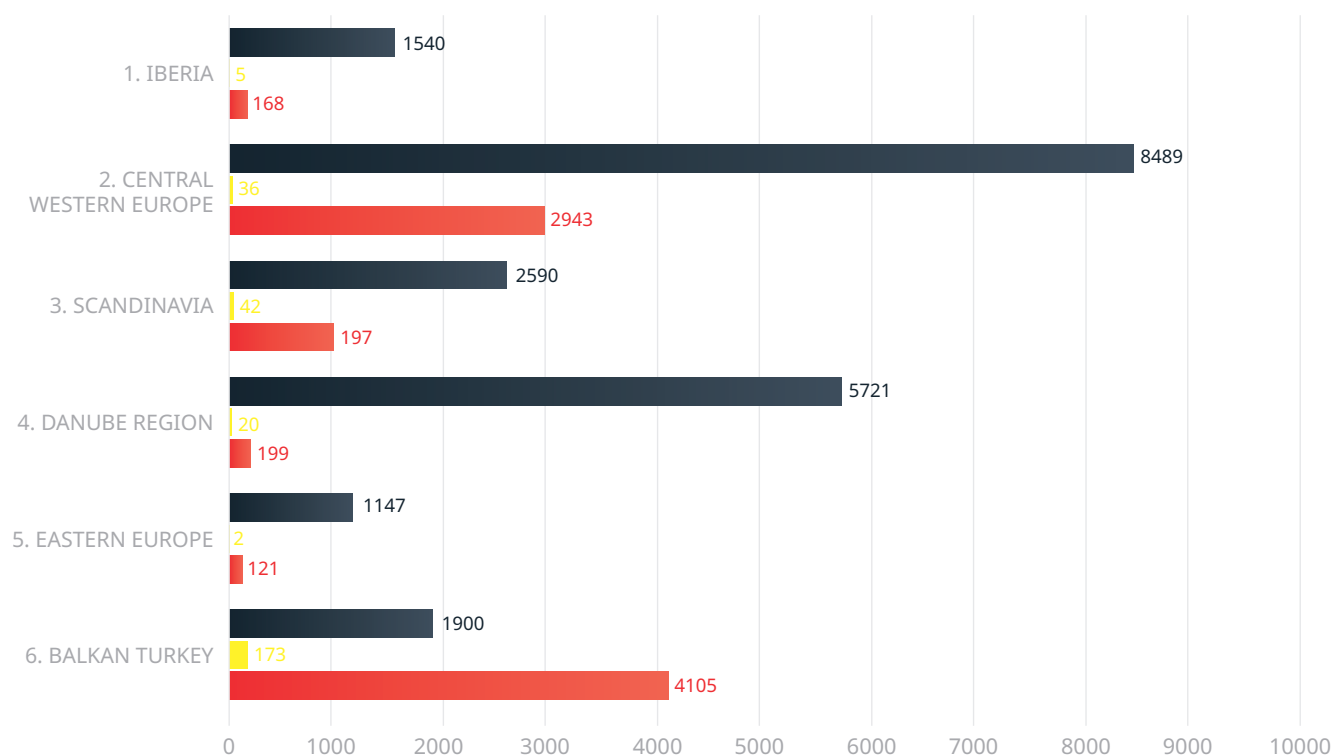


FIGURE ES 3: Distribution of hydropower plants in the different regions

- Existing
- Under construction
- Planned

Protected areas are not spared from hydropower development: 21% (6,409) of hydropower plants in Europe are located in protected areas, with 3,936 existing, 2,396 planned, and 77 currently under construction.

Figure ES 4 shows the overlay of hydropower plants with the underlying network of protected areas, split into three categories of types of protected areas. Figure ES 5 shows the number of hydropower plants in each of these categories. Currently category II, which includes Natura 2000 areas, is home to the most hydropower plants (4,739). Out of the 2,396 plants planned in protected areas, 572 are located in the highest category of protected areas, which includes national parks, World Heritage sites, Ramsar sites or biosphere reserves.

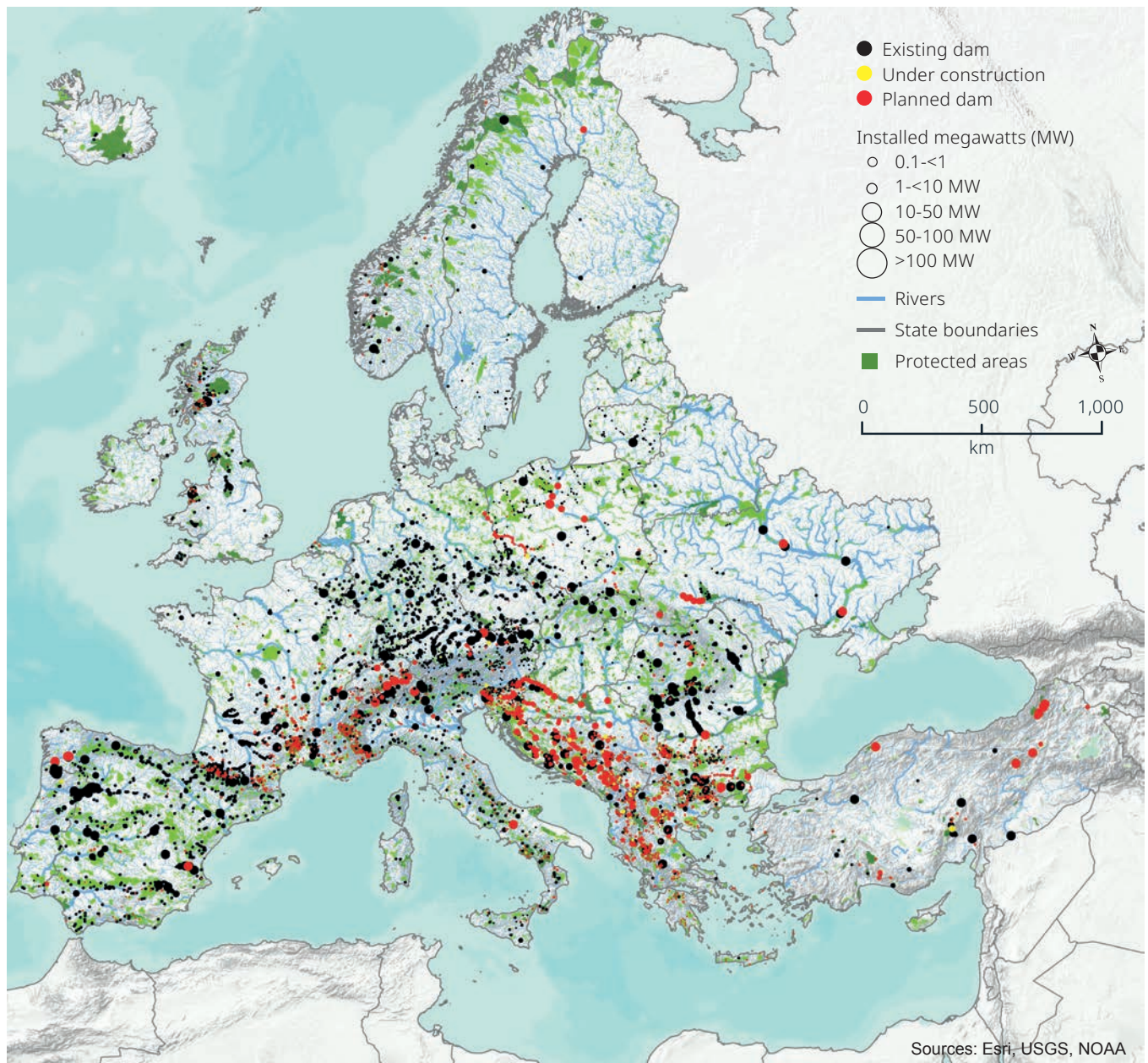


FIGURE ES 4: Hydropower plants in Europe in protected areas. The protected areas have been categorised as follows:

Category 1: National parks, Ramsar sites, World Heritage sites, biosphere reserves

Category 2: Natura 2000, Emerald areas for Eastern Europe, nature reserves

Category 3: Landscape protection

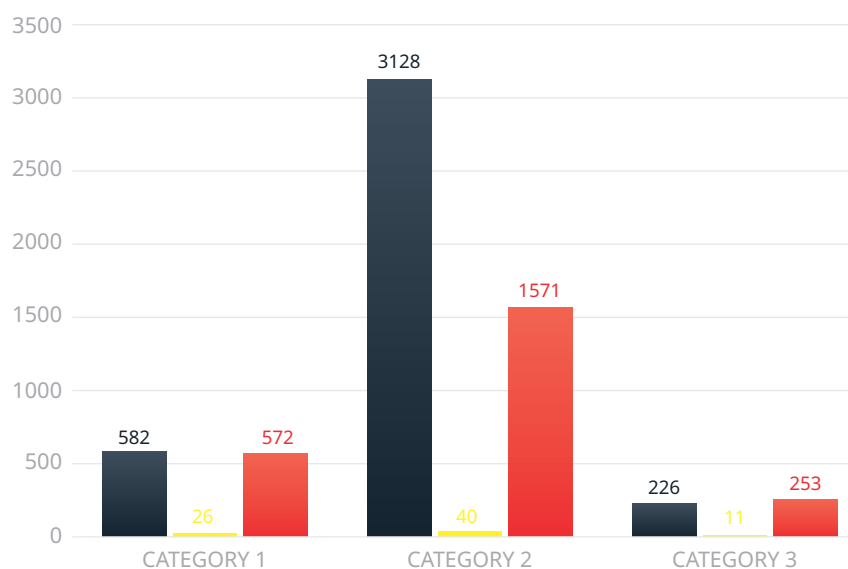
FIGURE ES 5: Hydropower plants in Europe inside of protected areas. The protected areas have been categorised as follows:

Category 1: National parks, Ramsar sites, World Heritage sites, biosphere reserves

Category 2: Natura 2000, Emerald areas for Eastern Europe, nature reserves

Category 3: Landscape protection

● Existing
● Under construction
● Planned



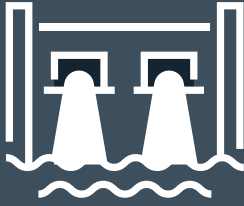
Findings discredit further hydropower development in Europe: The number of hydropower plants in Europe is already exceptionally high and their overlap with protected areas reveal a tremendous pressure on Europe's biodiversity, and for specific projects a disregard for Europe's nature protection laws. Nonetheless, projects are still being planned across Europe, some within protected areas.

The significant hydromorphological changes caused by hydropower plants are one of the main reasons why water bodies are failing to reach good ecological status under the EU Water Framework Directive. The past 10 years clearly show, for instance in the Balkans and Turkey, how quickly entire originally pristine river stretches can be degraded by being turned into impoundments. New hydropower projects in the last remaining free-flowing or intact rivers in Europe must be prevented. Planned hydropower projects, especially in protected areas, should not be allowed to move forward considering their severe impacts on Europe's biodiversity.

THE STORY IN NUMBERS:

● All of Europe ● Within the EU

Total number of recorded hydropower plants in Europe/ EU:



21,387/ 19,268
existing



278/ 122
under construction



8,507/ 5,734
planned

Country with highest intensity of hydropower*

*based on potential used, density and number of hydropower plants



Switzerland



Austria



Norway



France



Germany



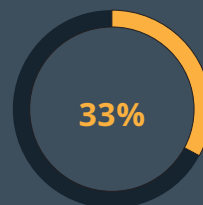
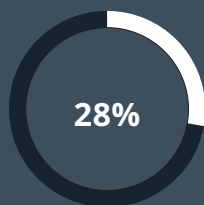
Portugal

Total amount of existing hydropower plants in protected areas in Europe/EU

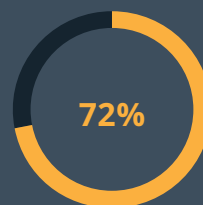
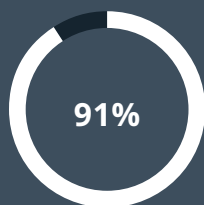


3,936 / 3,557

% of planned hydropower plants in protected areas in Europe/EU



% of small hydropower (0.1-10 MW) plants in Europe/EU



RECOMMENDATIONS

- New hydropower projects in the last remaining free-flowing or intact rivers in Europe have to be prevented. Within protected areas, hydropower development cannot be an option as it leads to the deterioration of river ecosystems. At the moment, even protected areas are not sufficiently protecting rivers.
- Due to the extremely high number of hydropower plants in all size classes and the large degree of already used hydropower potential, the planning of additional hydropower plants should be reconsidered. The increase of energy production by small hydropower plants is very limited, but the ecological impact in most cases are considerable. Another aspect that needs to be regarded is changing discharges due to climate change which increase uncertainties for many hydropower plants, such as in Portugal, the Balkans and Turkey.
- In countries with the highest density such as Austria, Norway or Switzerland, the focus should solely be on the refurbishment and where possible on renovation by increasing efficiency of already existing hydropower plants without further deterioration of the hydromorphological conditions. Licences which need to be renewed in the coming years and decades must require restoration efforts.
- Old hydropower licenses which need to be prolonged must require strong criteria on how to mitigate the environmental impacts and the public must be included in this evaluation.
- Integrated river and catchment approaches (continuity) are necessary to further assess dams also in the neighbourhood of protected areas.
- The restoration or mitigation of hydropower impacts is very expensive in comparison to the ecosystem services of free-flowing rivers. Restoration is necessary but can never substitute the protection of the last intact rivers.
- Dams have to be considerably improved to allow biota to pass the obstacle and to allow suspended sediments and in particular bedload to pass the dams.
- Hydropower must be understood as a transitional energy source supporting energy transitions, but it should be clear the middle-term energy future must rely on other sources (such as solar and wind), combined with improved energy efficiency and reduction of energy demand. Water sources but in particular intact rivers are of high importance for upcoming generations.
- The worst impacts of dams, such as the disruption of river continuity for biota, the altered sediment balance (which results in channel incision and coastal erosion) and the significant changes of hydrological regimes which affect floodplains and their ecosystem services must be mitigated or prevented from the beginning.

Country overview in numbers

To allow a country-specific analysis, the following table summarises the distribution of hydropower plants.

TABLE 1: Hydropower plant distribution by country
(colours indicate the 6 regions), status and size

Country	Existing					Planned					Under construction					Total
	0,1- <1	1-<10	10-50	50-100	> 100	0,1- <1	1-<10	10-50	50-100	> 100	0,1- <1	1-<10	10-50	50-100	> 100	
Albania	58	103	11	3	4	177	241	25	9	1	22	30	7		1	692
Austria	4007	253	38	18	27	19	61	32	3	8	6	8	2	1	2	4485
Belarus		13					2	4					1			20
Belgium	20	127	4	3	2	7										163
Bosnia and Herzegovina	41	45	3	3	9	84	158	53	12	5	5	6	1		1	426
Bulgaria	159	102	15	5	9	217	115	3	3	3		5				636
Croatia	12	26	9	3	7	46	63	29	9	2	1	1				208
Czech Republic	260	436	20	4	4	7	3				1					735
Denmark		2														2
Estonia	4	1				5										10
Finland	65	92	28	14	10	6			1							216
France	148	1009	42	21	30	830	580	2						1		2663
Germany	2135	2266	337	39	25	14	11	4	1	6		1				4839
Greece	14	65	4	2	10	898	150	8		5	3	5	1			1165
Hungary	2	12	2				1									17
Iceland		18							3	1						22
Ireland		13			1					2						16
Isle of Man		1														1
Italy	143	717	24	6	21	781	54	1	1	2		3				1753
Kosovo	2	8	2			12	58	4	1	2	1	15				105
Latvia	16	5				8										29
Liechtenstein			1													1

Country	Existing					Planned					Under construction					Total
	0,1- <1	1-<10	10-50	50- 100	> 100	0,1- <1	1-<10	10-50	50- 100	> 100	0,1- <1	1-<10	10-50	50- 100	> 100	
Lithuania	53	25			2											80
Luxembourg		5			1											6
Macedonia	47	38	5	1	2	118	52	14	4	1	9	5				296
Malta						1										1
Moldova		8	1													9
Montenegro	3	13			2	14	56	11	9	2	2	1				113
Netherlands	5	3	3			21	8									40
Norway	408	734	317	5	3	284	659	1			1	41				2453
Poland	553	267	12	7	13	25	56	5	6	1			1			946
Portugal	151	139	14	8	21	15			2	4		1	1		2	358
Romania	163	335	55	22	17	13	43	6	2	1						657
Serbia	43	32	3	2	5	698	107	17	5	3	21	9	1			946
Slovakia	9	8	18	4	7											46
Slovenia	288	30	15	6	3	184	26	30	1		4	1				588
Spain	167	902	74	23	41	122	15	3		7				1		1355
Sweden	570	143	120	9	52	15	1									910
Switzerland	213	395	103	39	45	294	110	20	7	10	1			1	1	1239
Turkey	8	530	46	18	26	25	179	85	35	36	1	1	6	4	3	1003
Ukraine	83	72	2		10				7	2						176
United Kingdom	165	336	29	5	7	144	28			4	22	6				746
Total	10015	9329	1357	270	416	5084	2837	357	121	108	100	139	21	8	10	30172

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