



ENERGY

Water and energy – a Norwegian perspective

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DNV GL: a quality assurance and risk management company

OUR PURPOSE:
TO SAFEGUARD LIFE, PROPERTY
AND THE ENVIRONMENT

OUR VISION:
GLOBAL IMPACT FOR A SAFE AND
SUSTAINABLE FUTURE




MARITIME



OIL & GAS



ENERGY



BUSINESS
ASSURANCE



DIGITAL
SOLUTIONS



150+ years

100+
countries

100,000
customers

12,500
employees

5%
of revenue spent on
R&D

Hydropower in Norway – the land of plenty

Hydropower Status Report 2019

Europe installed capacity

COUNTRIES BY ADDED CAPACITY IN 2018 (MW*)

1 st	2 nd	3 rd	4 th	5 th
Turkey	Norway	Austria	Iceland	Italy
1,085	419	385	100	88

EUROPE CAPACITY BY COUNTRY*

Rank	Country	Total installed capacity (MW)
1	Norway	32,256
2	Turkey	28,358
3	France	25,519
4	Italy	22,926
5	Spain	20,378
6	Switzerland	16,948
7	Sweden	16,466
8	Austria	14,535
9	Germany	11,258
10	Portugal	7,347

* including pumped storage

Key




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- An aerial photograph of a river valley. The river flows from the top left towards the bottom center, where a large concrete dam is visible. The surrounding hills are covered in dense forest with trees in various shades of brown, orange, and yellow, indicating autumn. A small green field is visible on a hillside to the right of the river. The overall scene is a natural landscape with a man-made structure (the dam) integrated into it.
- 98 % hydropower; 32 GW
 - Decreasing share due to wind power increase
 - Theoretical potential >600 TWh annual production
 - Economic potential >200 TWh
 - Protected: 50 – 55 TWh
 - Current annual capacity: 136 TWh \pm 30 %
 - Remaining potential: 23 TWh
 - Reservoir capacity: 87 TWh
 - 50 % of European storage capacity

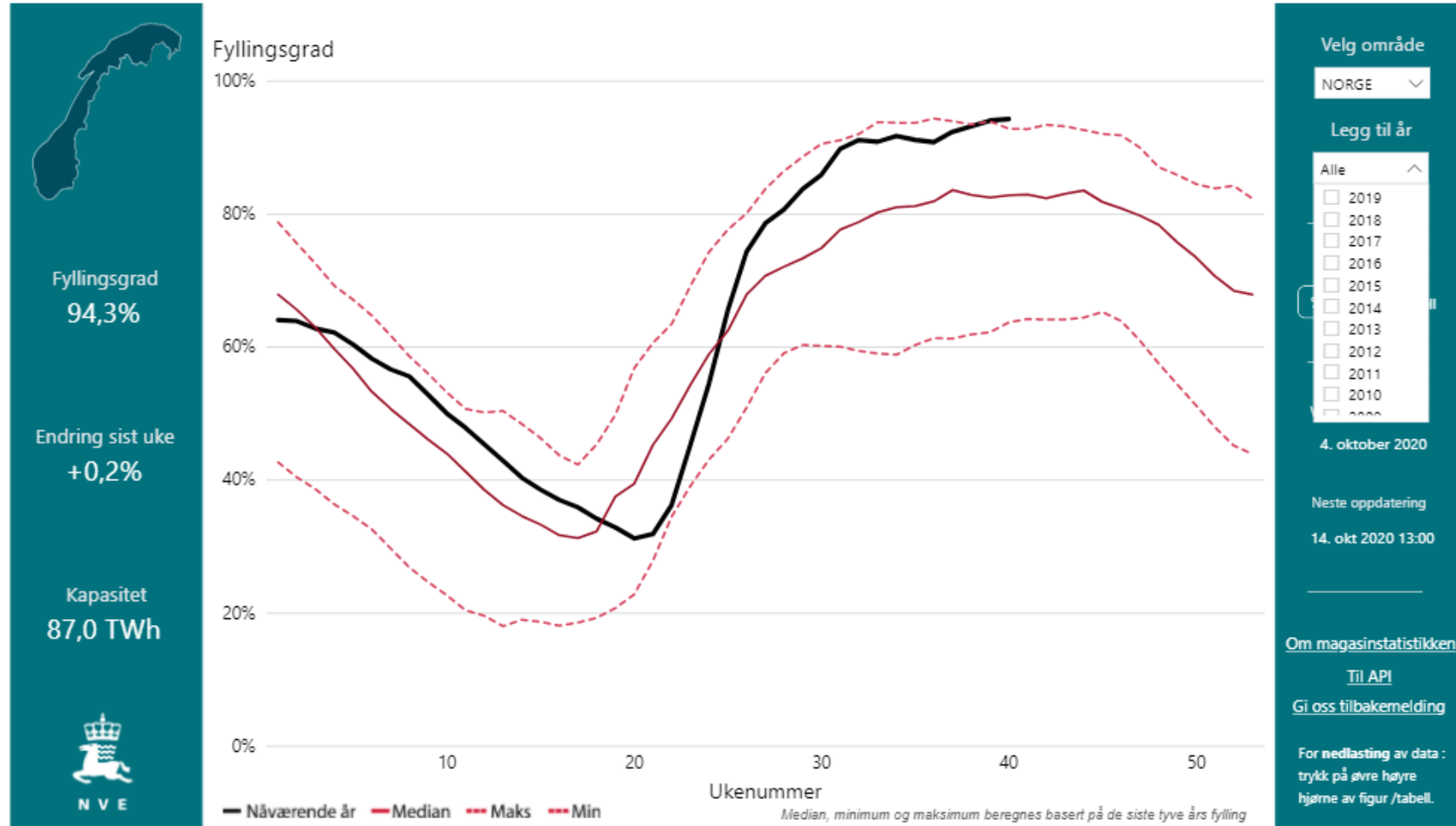
Photo: Statkraft

An aerial photograph showing a village in Norway severely affected by flooding. A large, turbulent river of grey water has inundated the area, surrounding a church with a steeple and a cemetery. A bridge is partially submerged and damaged. Houses are visible on the left, some with their lower floors underwater. Debris, including logs and wood, is scattered in the floodwaters. The text "Climate change: Warmer, wetter and wilder" is overlaid in white on the left side of the image.

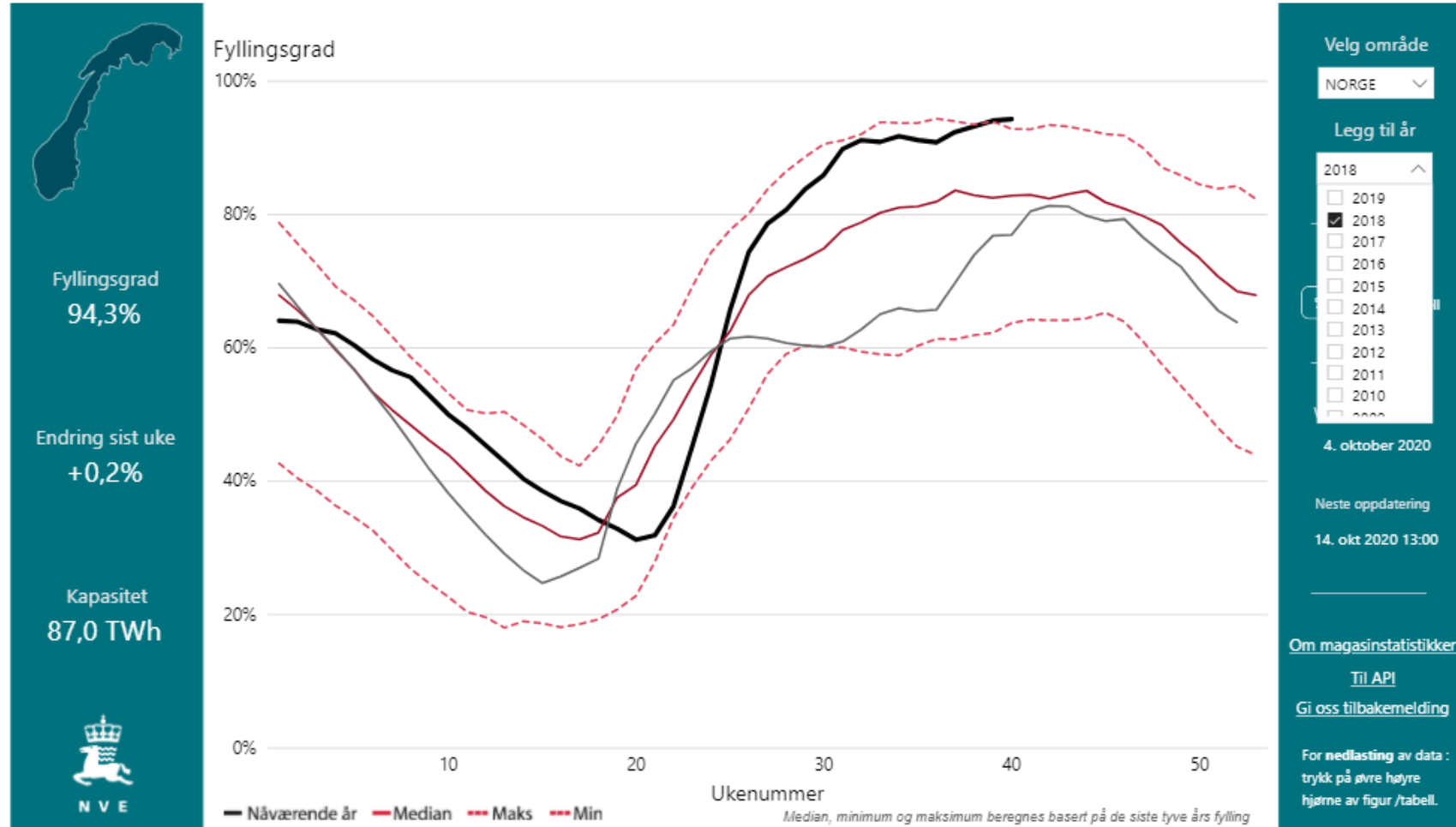
Climate change: Warmer, wetter and wilder

Photo: Riksantikvaren

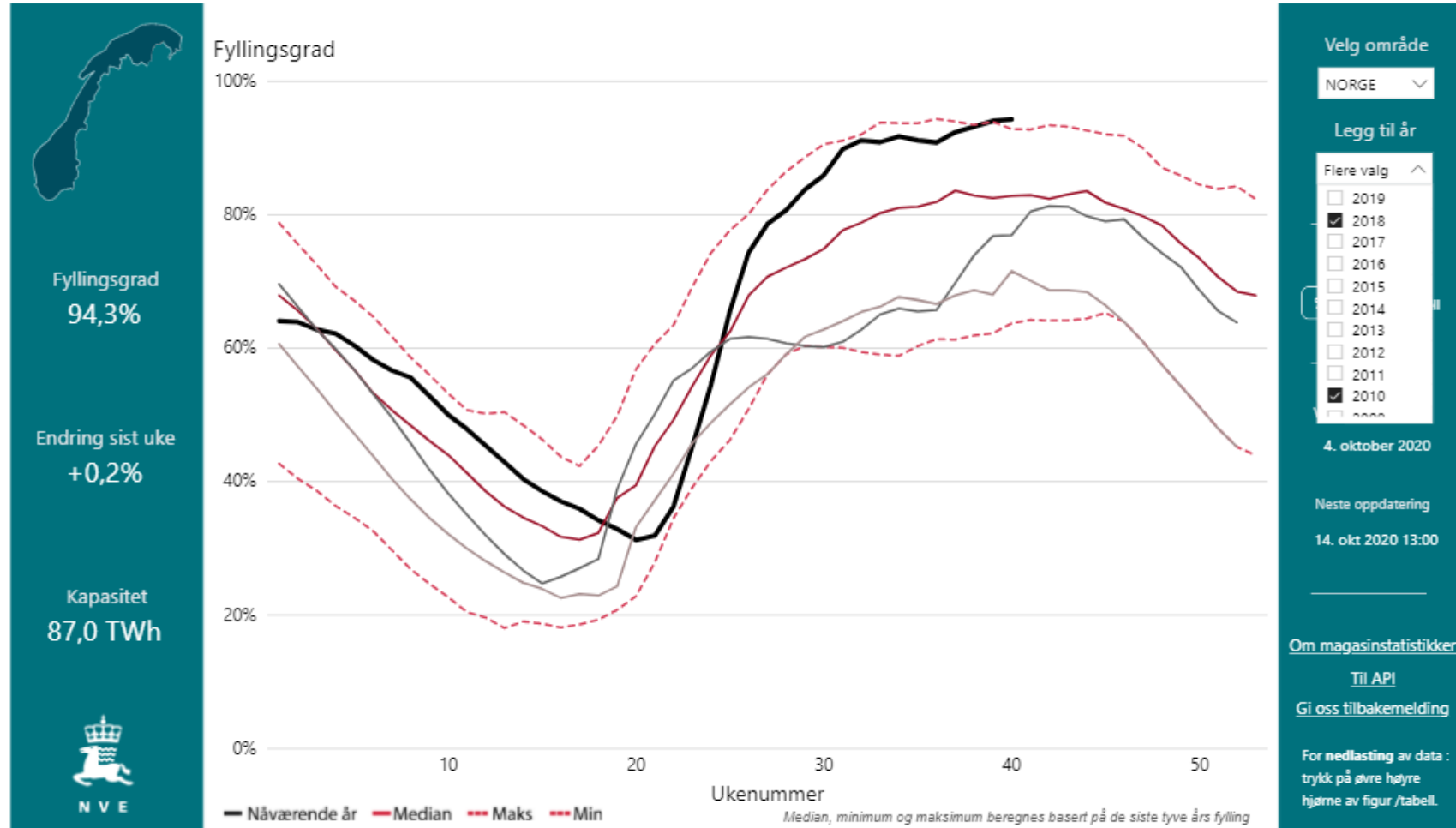
Increased weather volatility & expected precipitation



Increased weather volatility & expected precipitation



Increased weather volatility & expected precipitation





Requirements to protect marine life

Photo: BKK

A photograph of a river flowing through a forest. In the foreground, there are many large, grey and brown rocks partially submerged in the water. The water is calm and reflects the surrounding greenery. The background is a dense forest of tall trees with green leaves. The text "Utilities invest in spawning grounds and ensure there is sufficient flow during spawning periods" is overlaid on the upper part of the image in white, bold font.

Utilities invest in spawning grounds and ensure there is sufficient flow during spawning periods

Photo: BKK

Management of hydropower – avoid erosion of river banks



Photo: bt.no



This is 8 TWh of stored energy

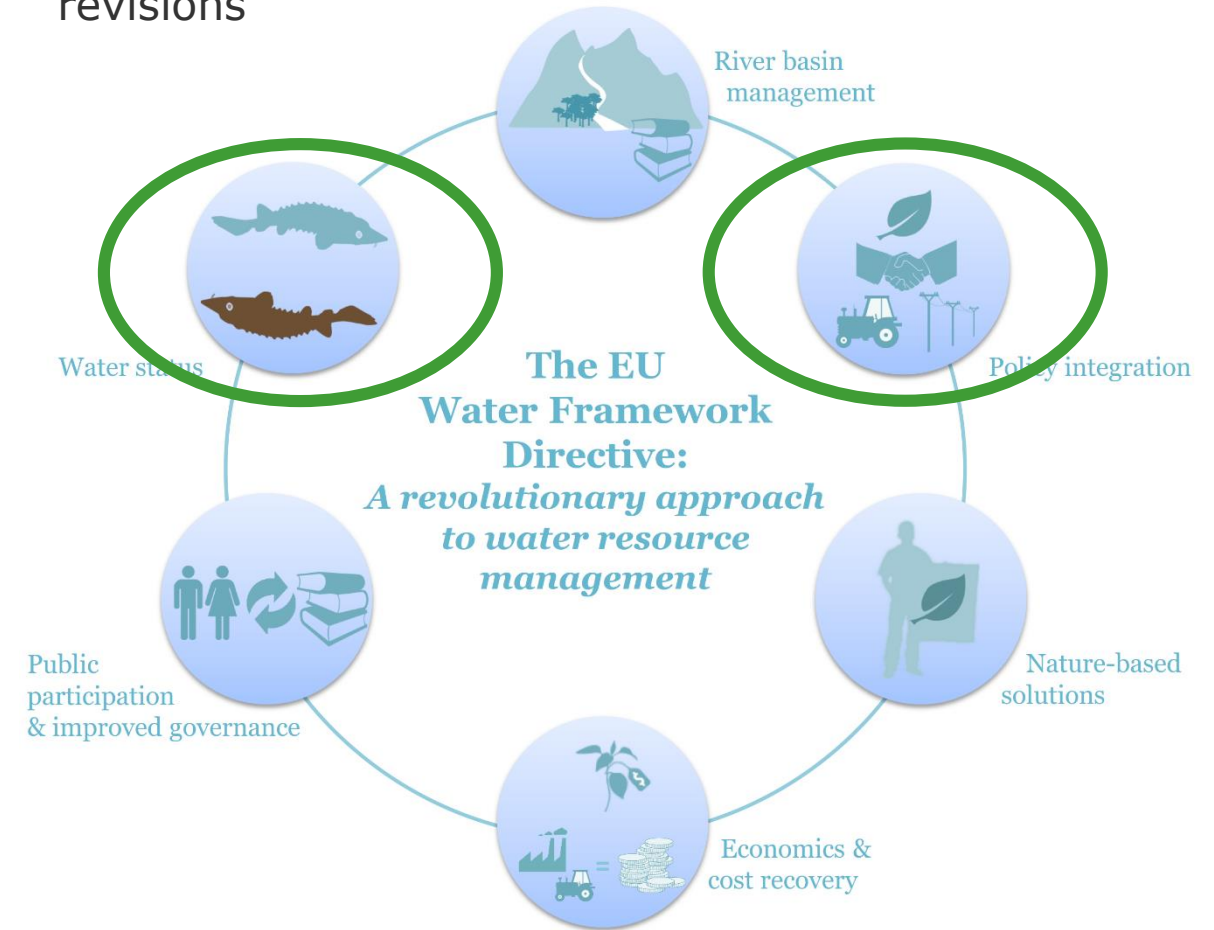
The energy sector can manage volatility

Photo: Statkraft

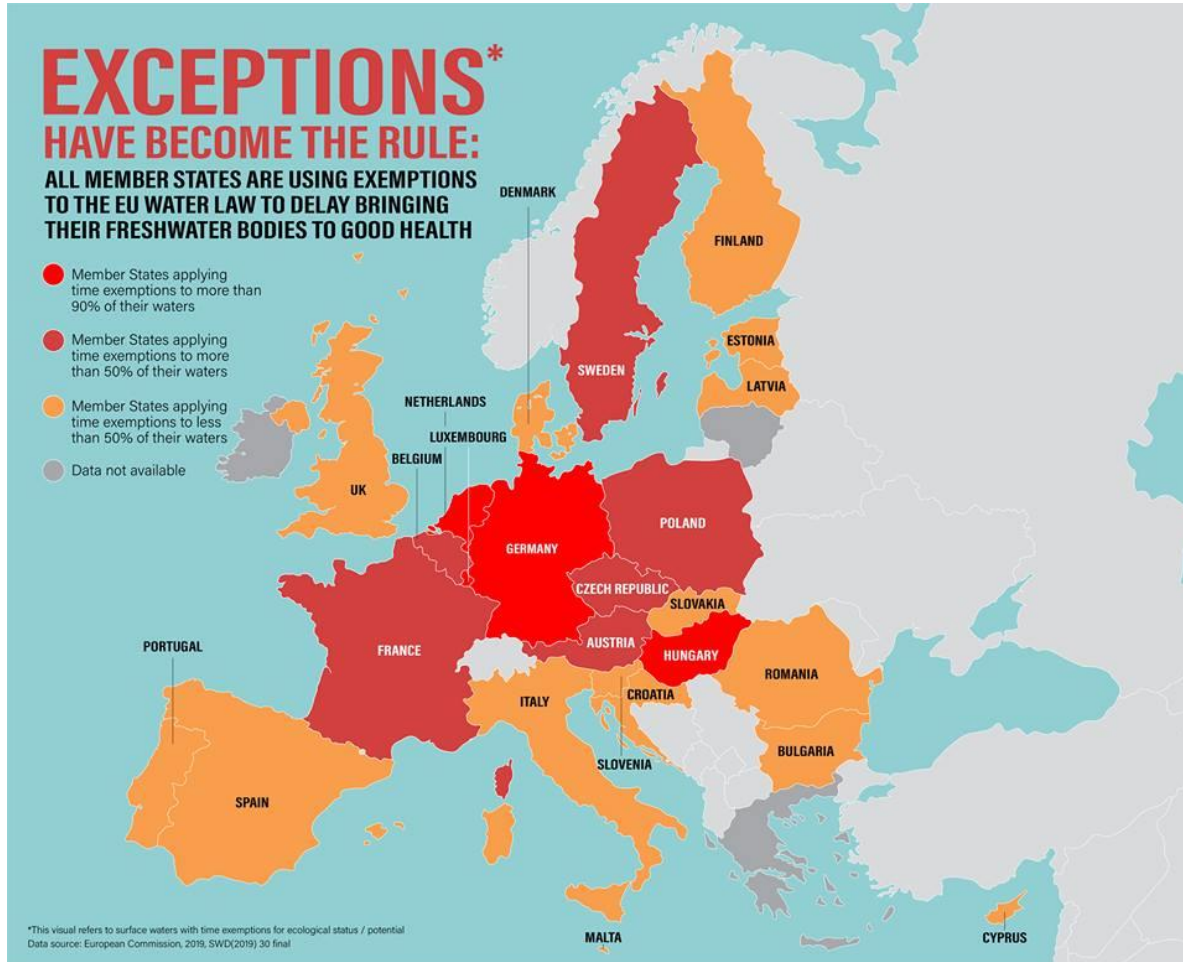
European and Norwegian regulatory approach to water resource management

- 1887: unlike other European countries, Norway institutionalised private property rights for rivers and river systems (watercourse)
- 1906 – the Panic act: realised that foreign capital took ownership to Norwegian watercourses
- 1917; revision of the Panic act
 - Empowered the government to set conditions for any private utilisation of water resources
 - Taxation
 - Public interests
 - River basin management
 - Reversion; after 60 years, private power plants must be handed over to the state
- Main principles continues: owners utilisation of watercourses is subject to public control

- Holistic river basin management plans, with regular revisions



Water resource management: conflicting interests



- The EU Water Framework Directive adopted in 2000
- Implementation lagging behind
 - Complicated processes
 - Major conflicts are not resolved
 - The directive does not solve the conflicts, it defines processes to create solutions
- Key conflict areas not so much related to energy as to pollution vs. wildlife and recreational use

Illustration: WWF

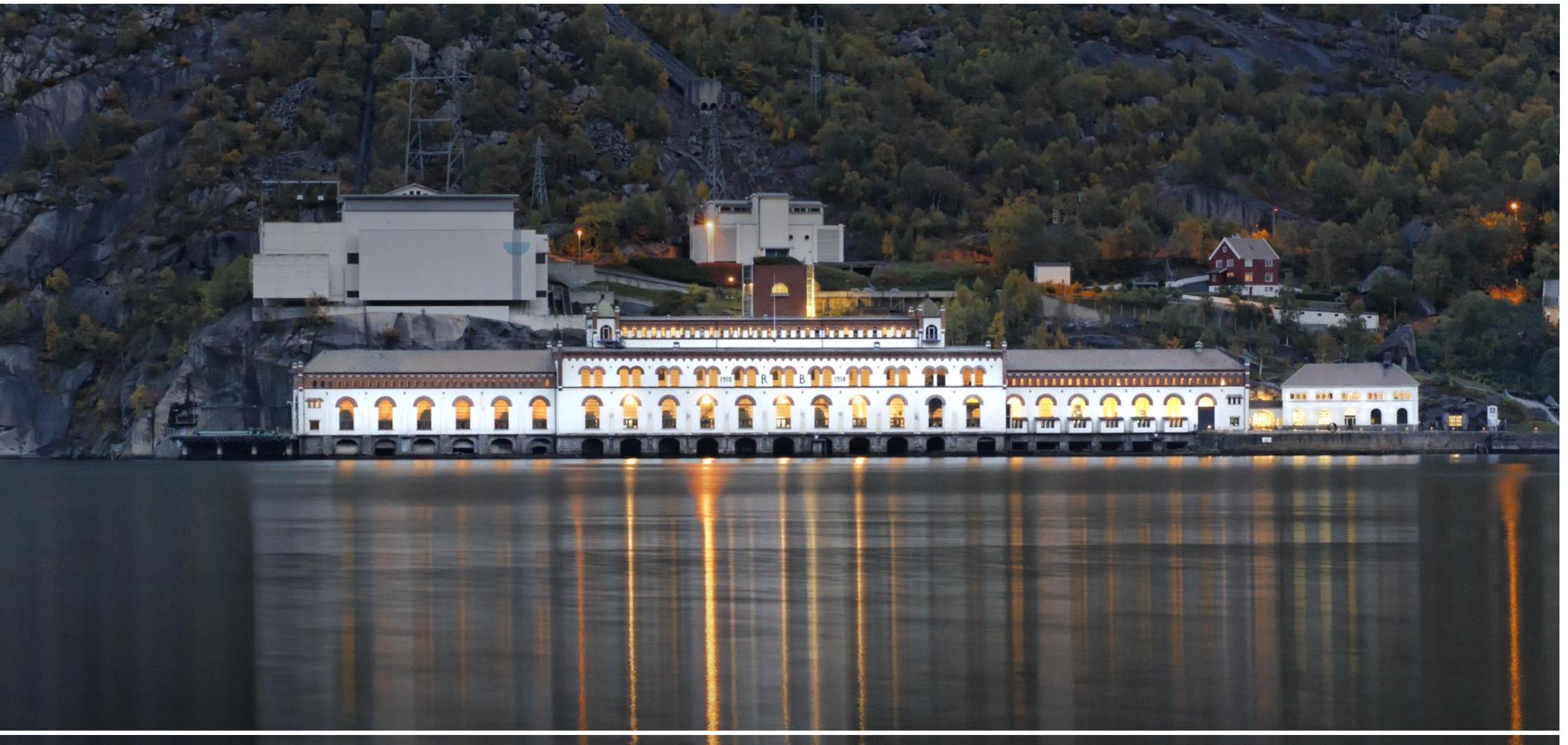


Photo: Statkraft

Thank you!

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