Erfahrungen zur Schwallproblematik aus Österreich

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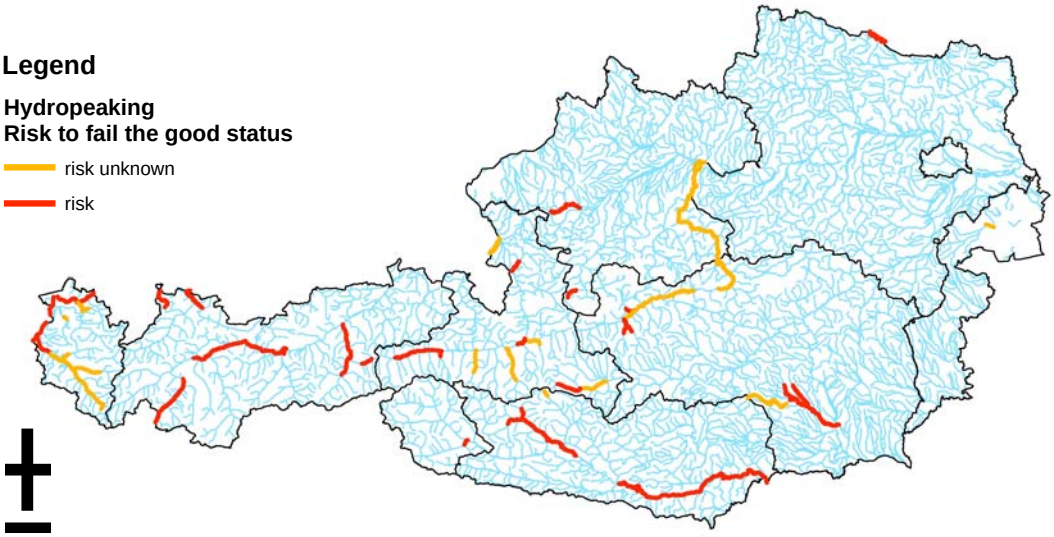
Overview

- **70% of suitable river stretches in Austria are in use of hydroelectric power (Jungwirth et al., 2003).**
- **About 78 river stretches are affected by hydropeaking, mainly at rivers Drau, Möll, Salzach, Enns, Alpenrhein and Bregenzerach (BMLFUW 2005).**
- **Good pre-conditions for hydropeaking in alpine Regions.**
- **Hydropeaking is the most profitably sector for hydro energy.**
- **Only few profound studies available (Moog et al. 1993, Parasiewicz et al. 1998, etc.).**
- **Sufficient knowledge about the ecological effects of hydropeaking is lacking.**
- **Solutions for reduction of impact on the aquatic ecosystem are necessary.**

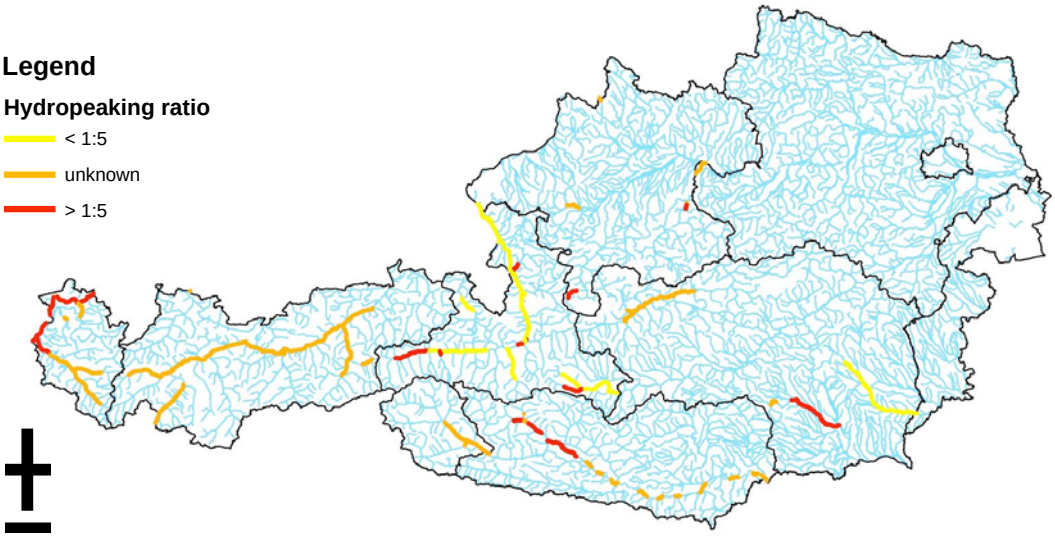
Hydropeaking in Austrian rivers



78 water bodies on a length of 802 km (2,6% of 31.000 km total) are affected by hydropeaking.

Source: „Characterisation of river basins", BMLFUW 2005, (Article 5, WFD).

Hydropeaking in Austrian rivers



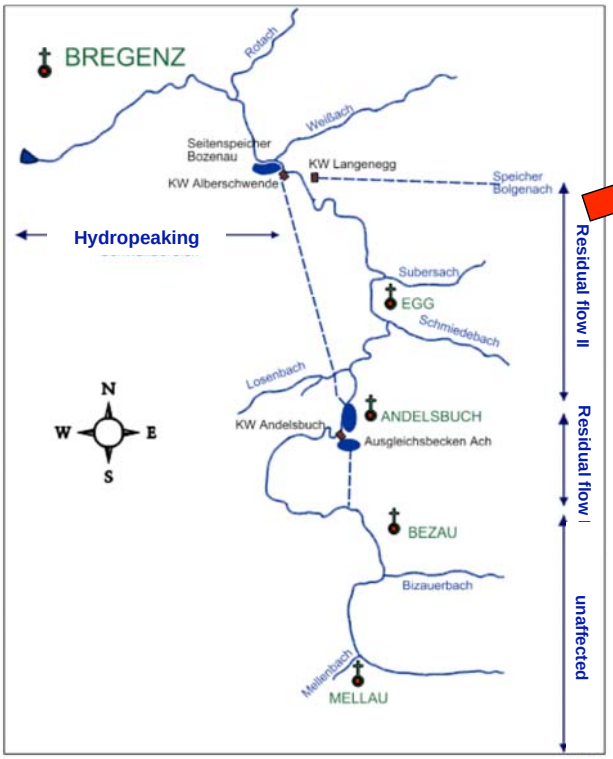
Criteria:

Ratio low flow to peak flow > 1 : 5 of daily discharge curve for small and medium sized rivers.

Large rivers > 100 km^2.

802 km (2,6 % of total) are in risk to fail the good status according to WFD.

Case-study Bregenzerach

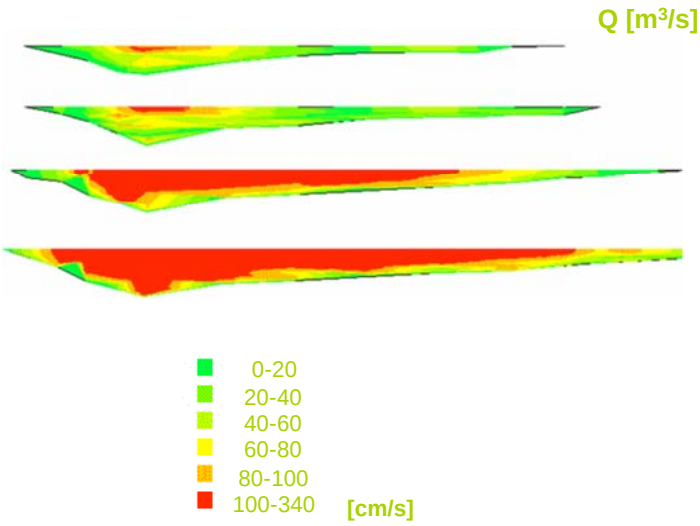


FACTS:

- **River in Western Austria - affected by heavy hydropeaking discharges (up to 60m³/sec).**
- **Mitigation measures developed for reduction of adverse effects of hydropeaking.**
- **In conjunction with construction of a new power plant.**

Case-study Bregenzerach

Flow velocity change



Case-study Bregenzerach

Ecological integrity of Bregenzerach 1986, 1994 and 1996/1997

Site		Ecological integrity							
		MZB		Fish			Total		
		1986	1997	1986	1994	1996	1986	1994	1996
Reference site	1,1a,1b	1-2	1-2	2	2	2	2	2	2
Hydropeaking site	7	4	3	3-4	3-4	3-4	4	3-4	3-4
	8	4	2	3-4	3-4	3-4	4	3-4	3-4
	9, 10	3	2	3-4	3-4	3-4	3-4	3-4	3-4

1	no impact, ecological integrity guaranteed
1-2	slight impact
2	medium impact
2-3	fundamental impact
3	strong impact
3-4	very strong impact
4	ecological integrity no more possible

Before mitigation:

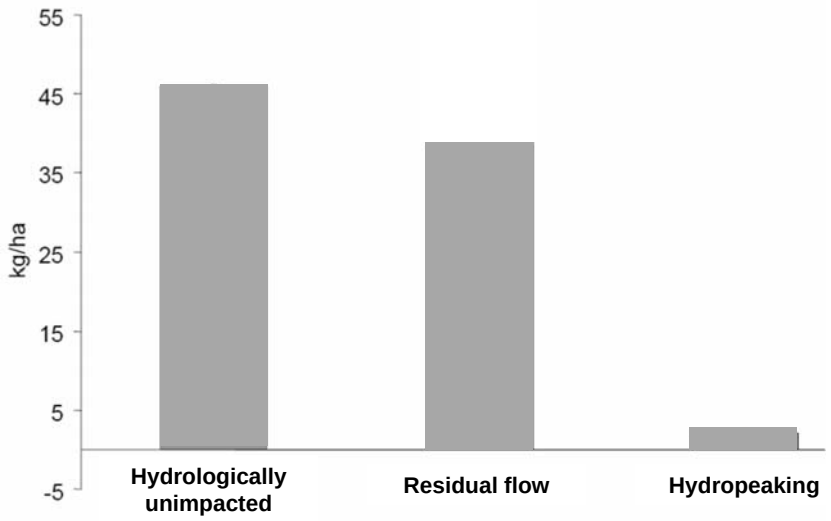
- Low flow peaking flow relation: 3:60m³/s
- No pre-peaking

After mitigation:

- Relation: 3:20:60m³/s
- Installation of pre-peaking
- Reduction of peaking intensity for pre-peaking to 17%
- Reduction of peaking intensity for main peaking to 79%

Case-study Bregenzerach

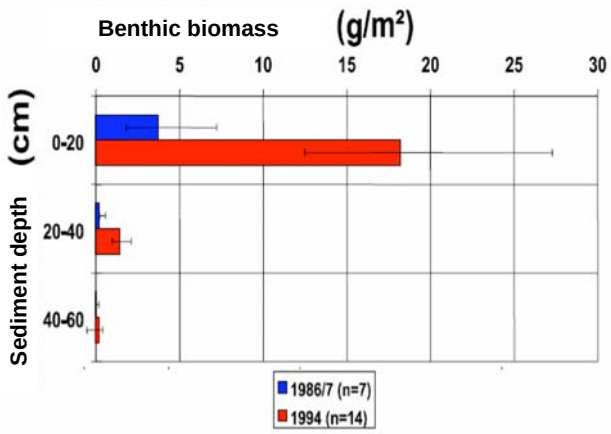
Fish biomass at the study site



- **Prior to mitigation, fish and invertebrate fauna were heavily affected by the peaking.**

Case-study Bregenzerach

Estimated benthic biomass at the study site



- **Benthic biomass was less than 15%, after mitigation it recovered to about 60% of reference value.**
- **No post-mitigation improvement was found with respect to fish biomass.**

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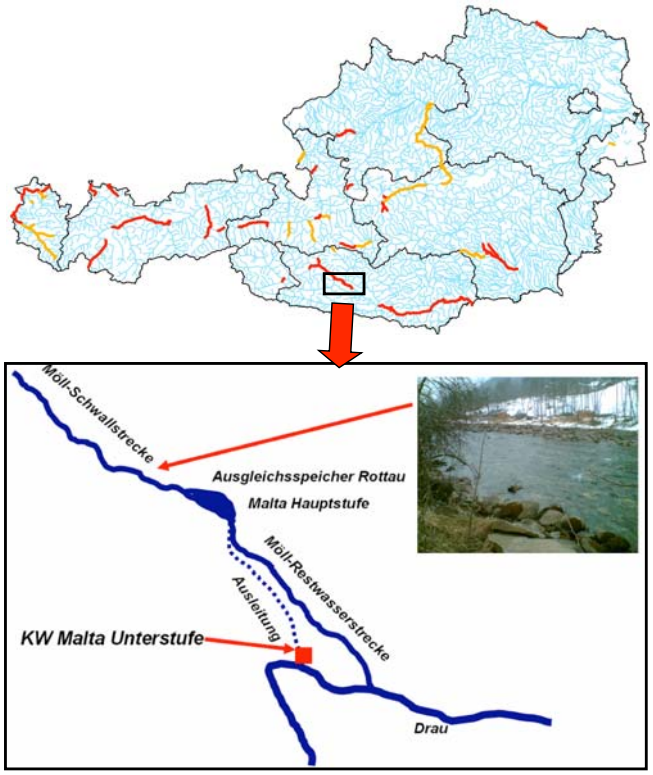
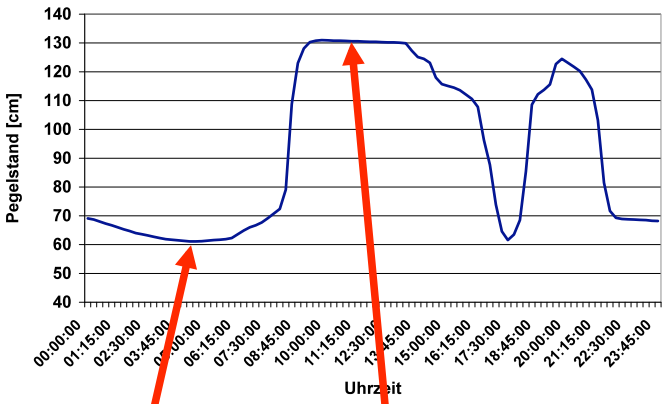
Example Drau



Power plant Malta-Unterstufe

21. March 2003



25 m³/s

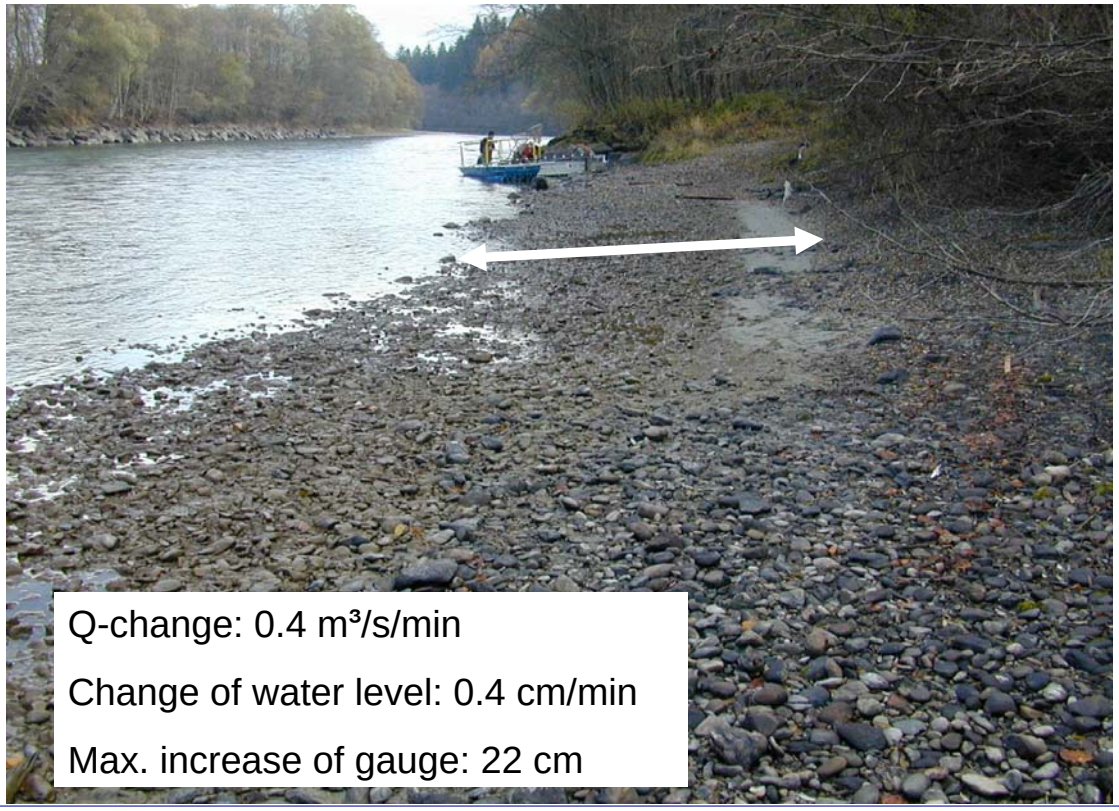
110 m³/s

Q-change: 2.2 m³/s/min

Change of water level: 1.9 cm/min

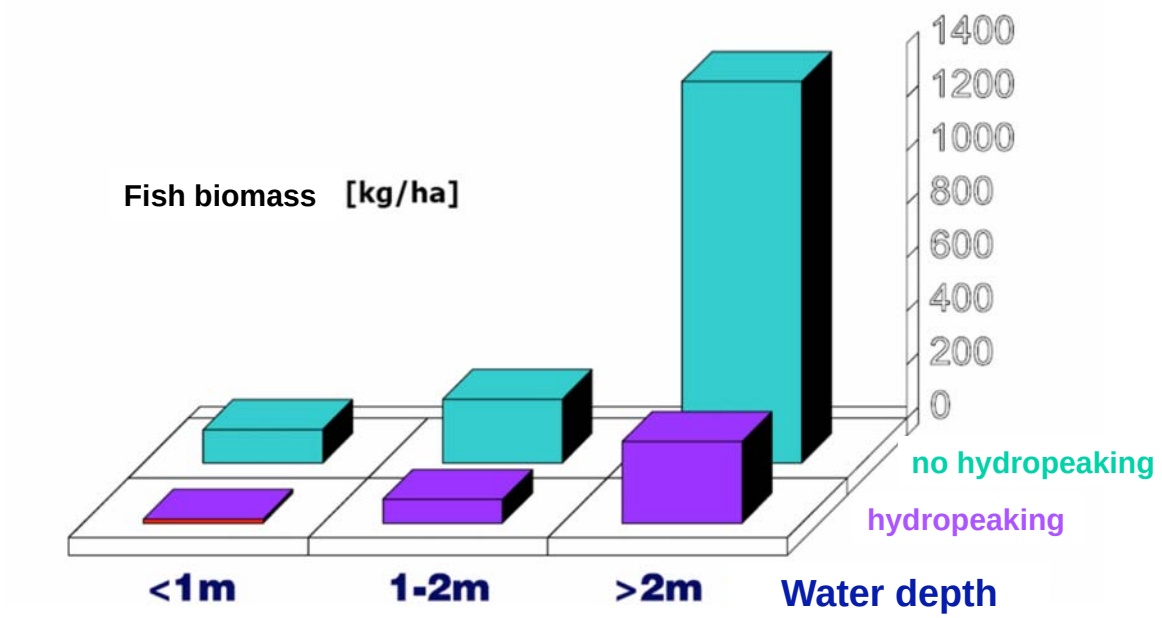
~ 70cm fluctuation of water level

Hydropeaking – Strassen Amlach

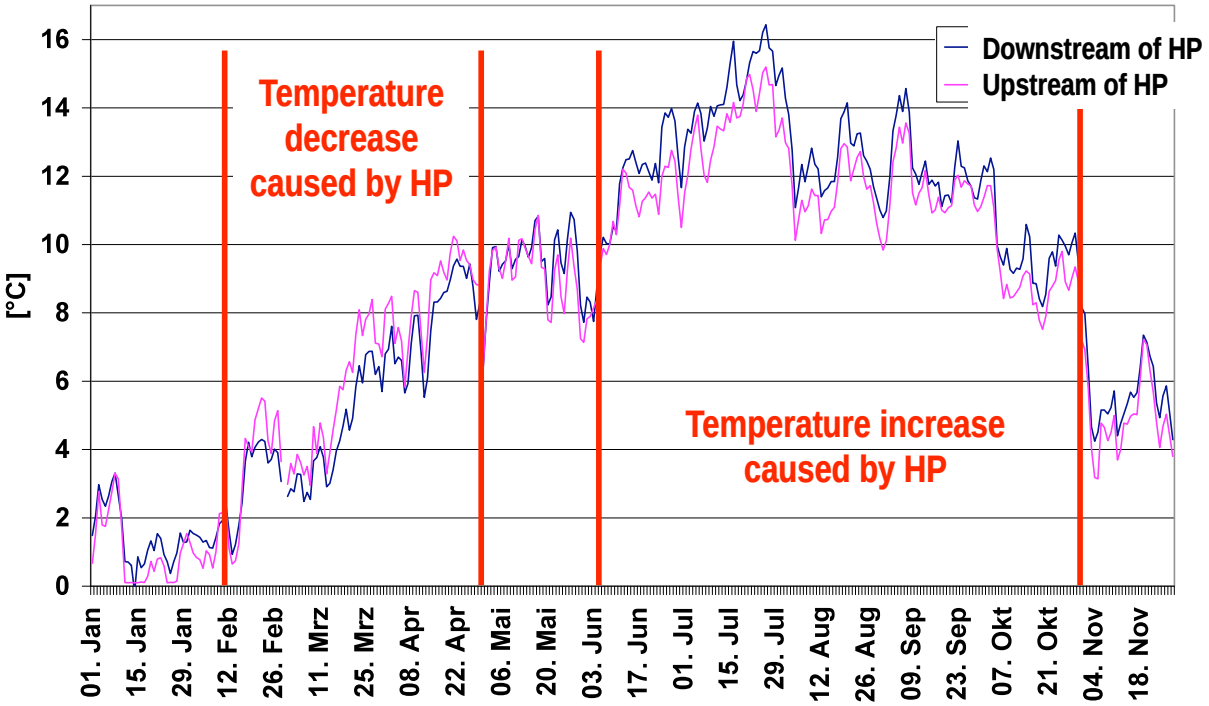


Hydropeaking – Drau

Influence of hydropeaking on fish

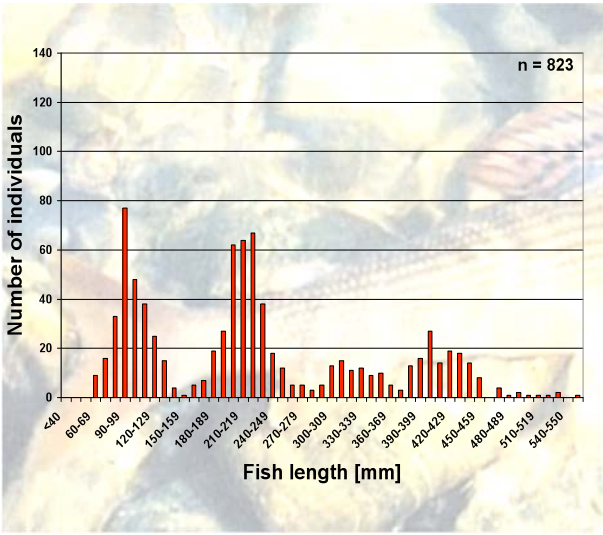


Water temperature modification



Length-frequencies of grayling

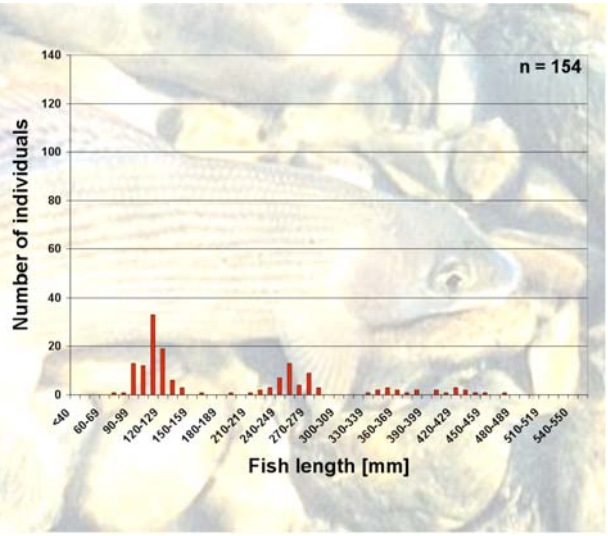
Low intensity of hydropeaking



upstream Sachsenburg

fish biomass 46,4 kg/ha

High intensity of hydropeaking



downstream Sachsenburg

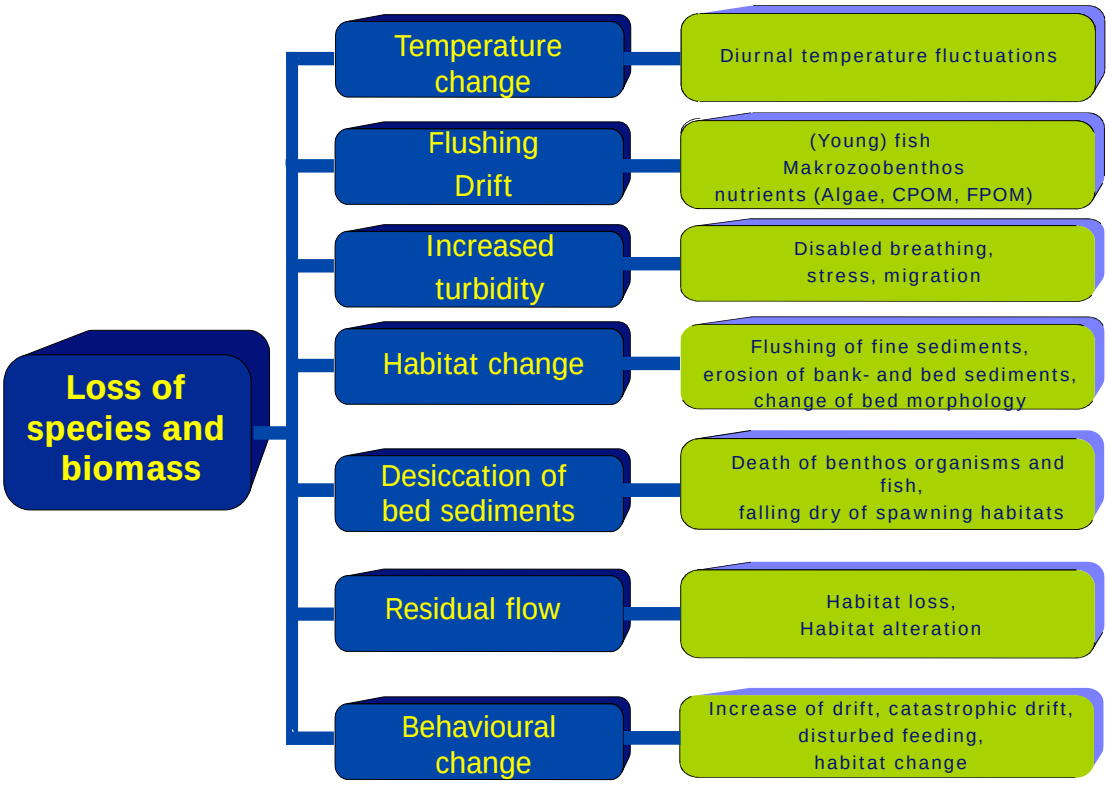
fish biomass 3,3 kg/ha

Example Drau

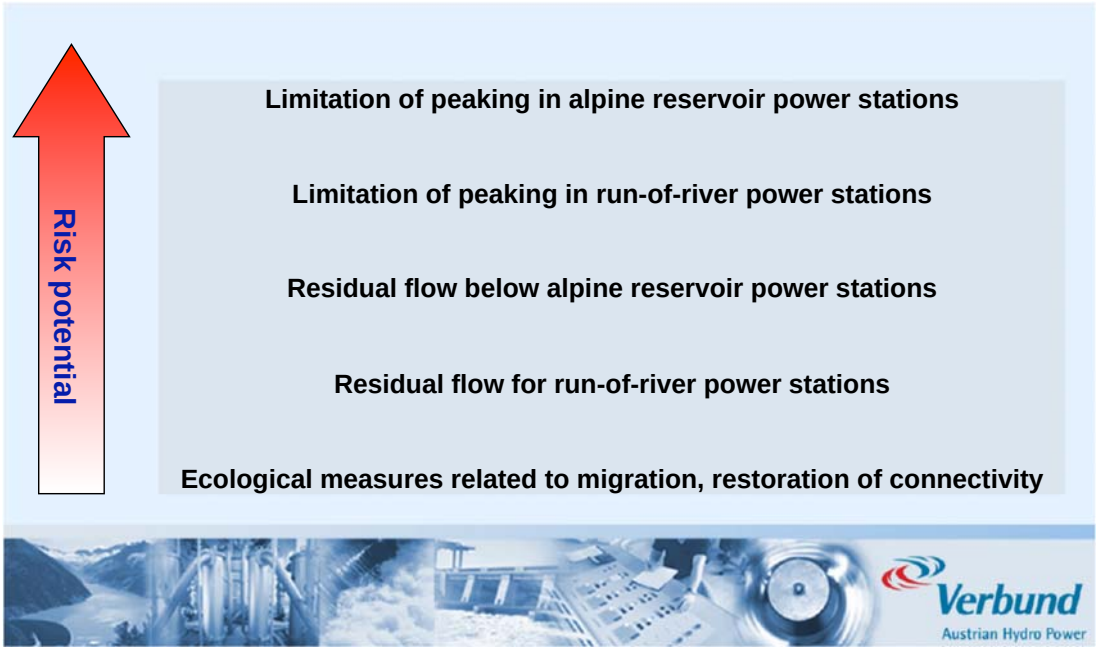
LIFE project: **"Restoration of the wetland and riparian area at the Upper Drau river"**

Revitalisation measures in Natura2000 area, enlarged to a total of 977 ha along a river section of 70 km **(http://www.life-drau.at).**

Potential impacts of hydropeaking

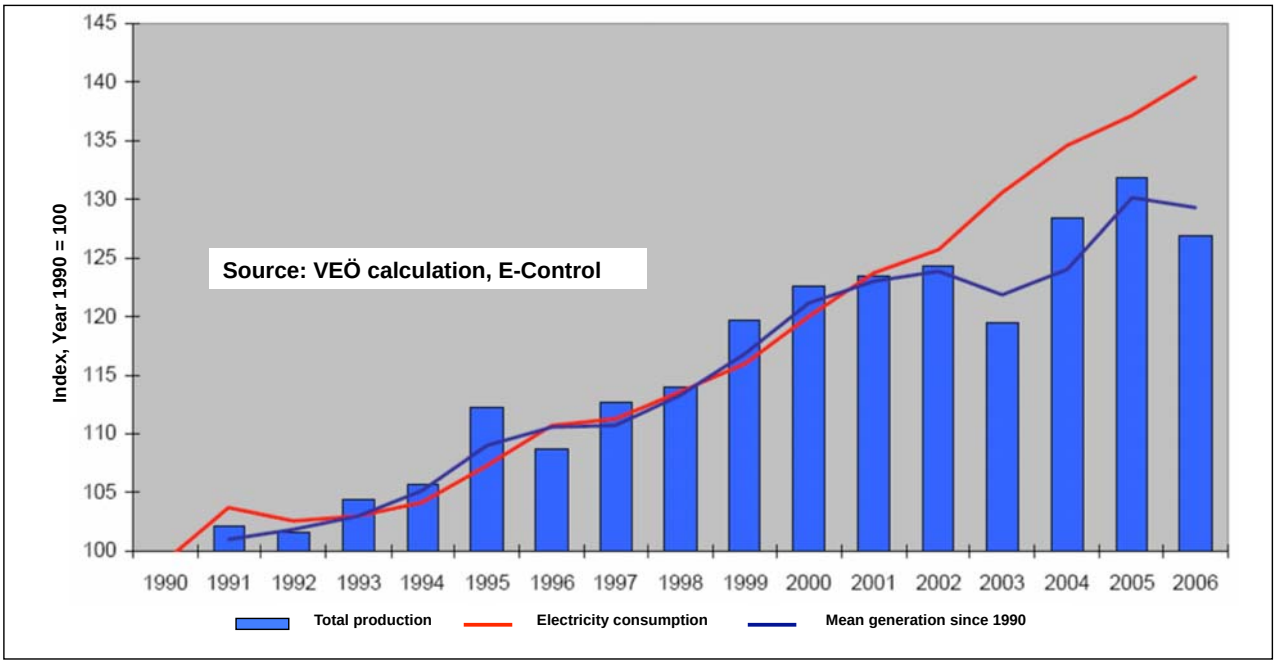


Risk potentials for hydro-power



Source: Verbund, Austrian Hydro power

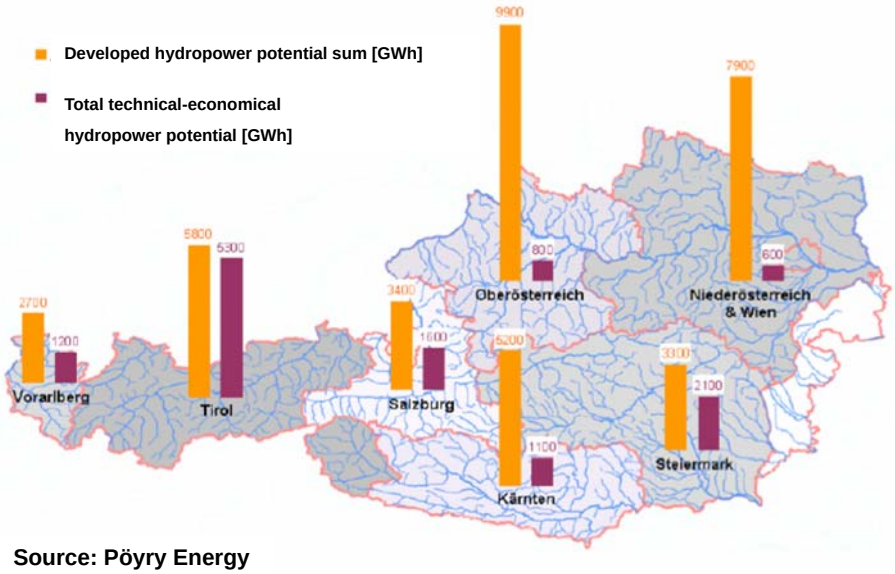
Increase of electricity consumption



Increase of electricity consumption in Austria: 39% (1990-2006)

Since 2006, 10% of the total consumption has to be covered by netto-imports (tends upwards)

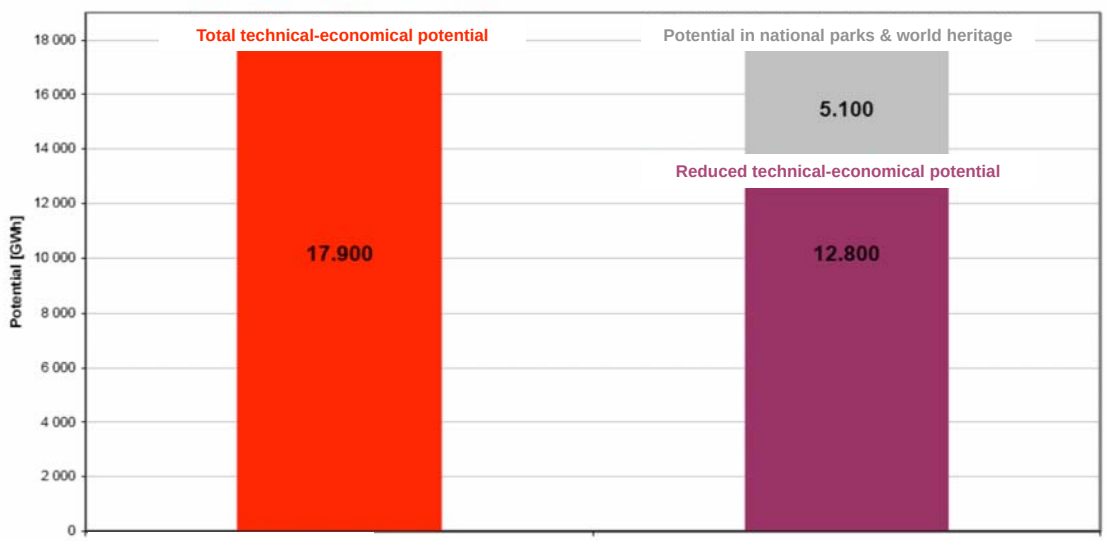
„Masterplan Wasserkraft“



Source: Pöyry Energy

Remaining hydropower potential in Austria according to Pöyry Energy (VERBUND): 13TWH (total technical-economical hydropower potential)

„Masterplan Wasserkraft“



Source: Pöyry Energy

Reduction of the total technical-economical hydropower potential, considering national parks and world heritage Wachau from ~ 18 TWH to ~ 12 TWH.

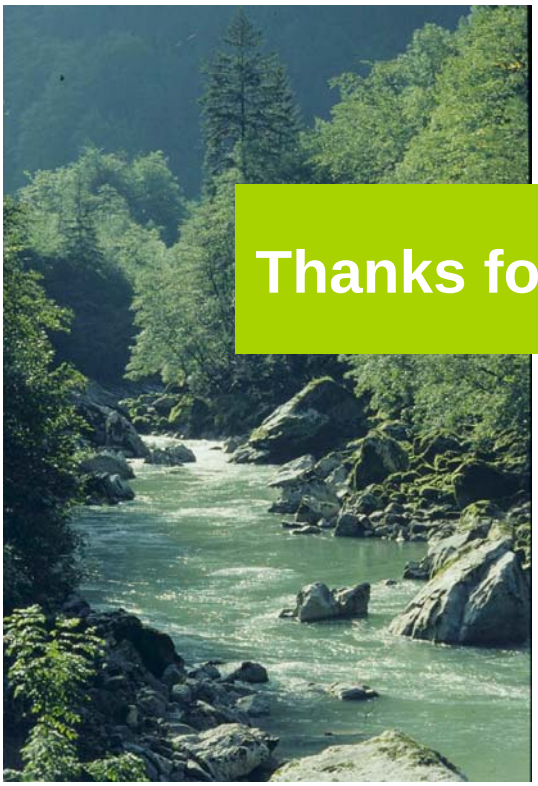
Hydropeaking in Europe

Source: EFI+ project **(http://efi-plus.boku.ac.at)**

Required actions

- ***Complete identification of hydropeaking sites in Austria following a consistent methodology.***
- ***Determination of effects on the aquatic system caused by hydropeaking - need for new methods and experiments.***
- ***Research on ecological hydropeaking criteria and related thresholds.***
- ***Knowledge on interactions with other pressures (morphology, continuum, water quality).***
- ***Development of mitigation measures: Compensation reservoirs, damping of ramping rate, reduction of peaks, etc.***

Source: „Positionspapier der Arbeitsgruppe Schwall“, **ÖWAV**



Thanks for your attention!