

Zukunft der Schweizer Wasserkraft



Hannes Weigt, 23.01.2019

Swiss Hydro Under Pressure

Wohl und Weh der Wasserkraft

Basler Zeitung

Ist die Wasserkraft wirklich so schlecht wie
ihr Ruf?

Tages-Anzeiger

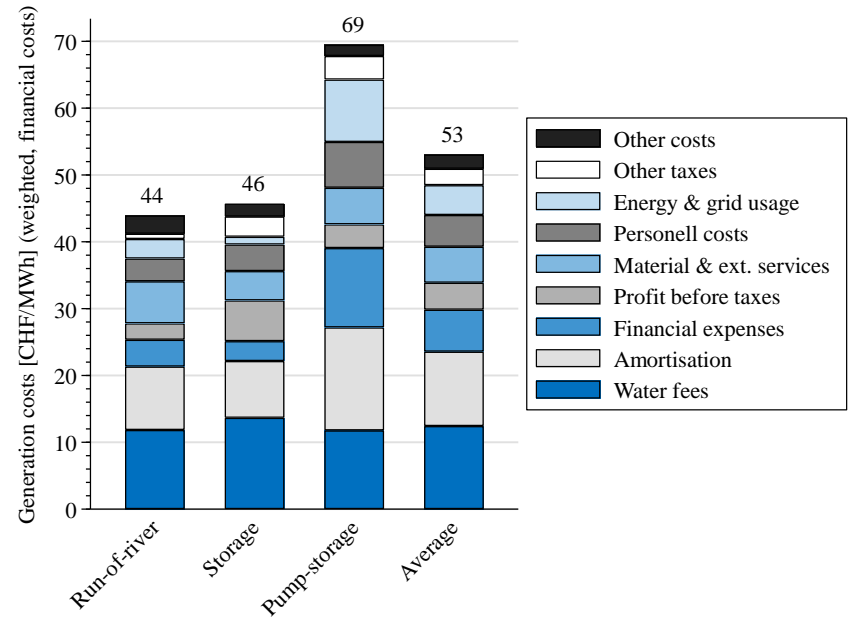
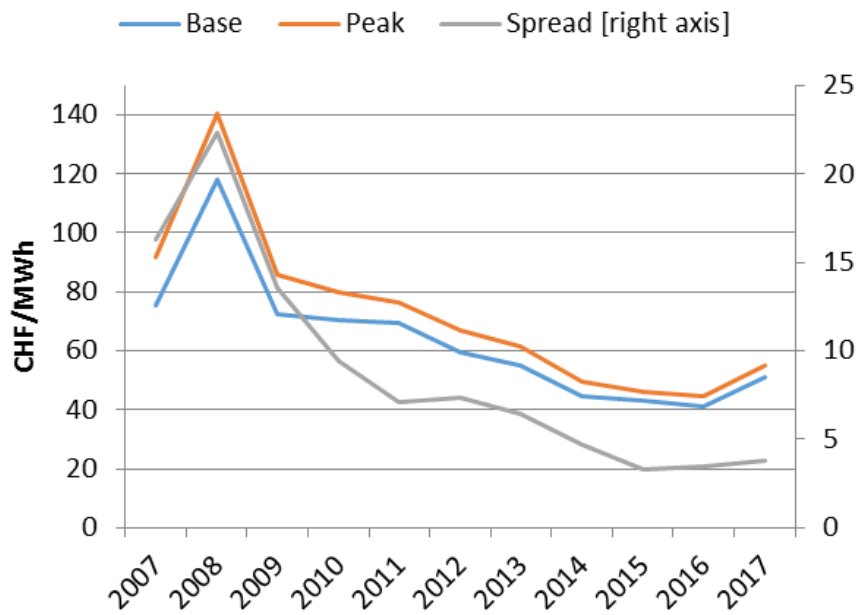
Schwache Wasserkraft

Neue Zürcher Zeitung

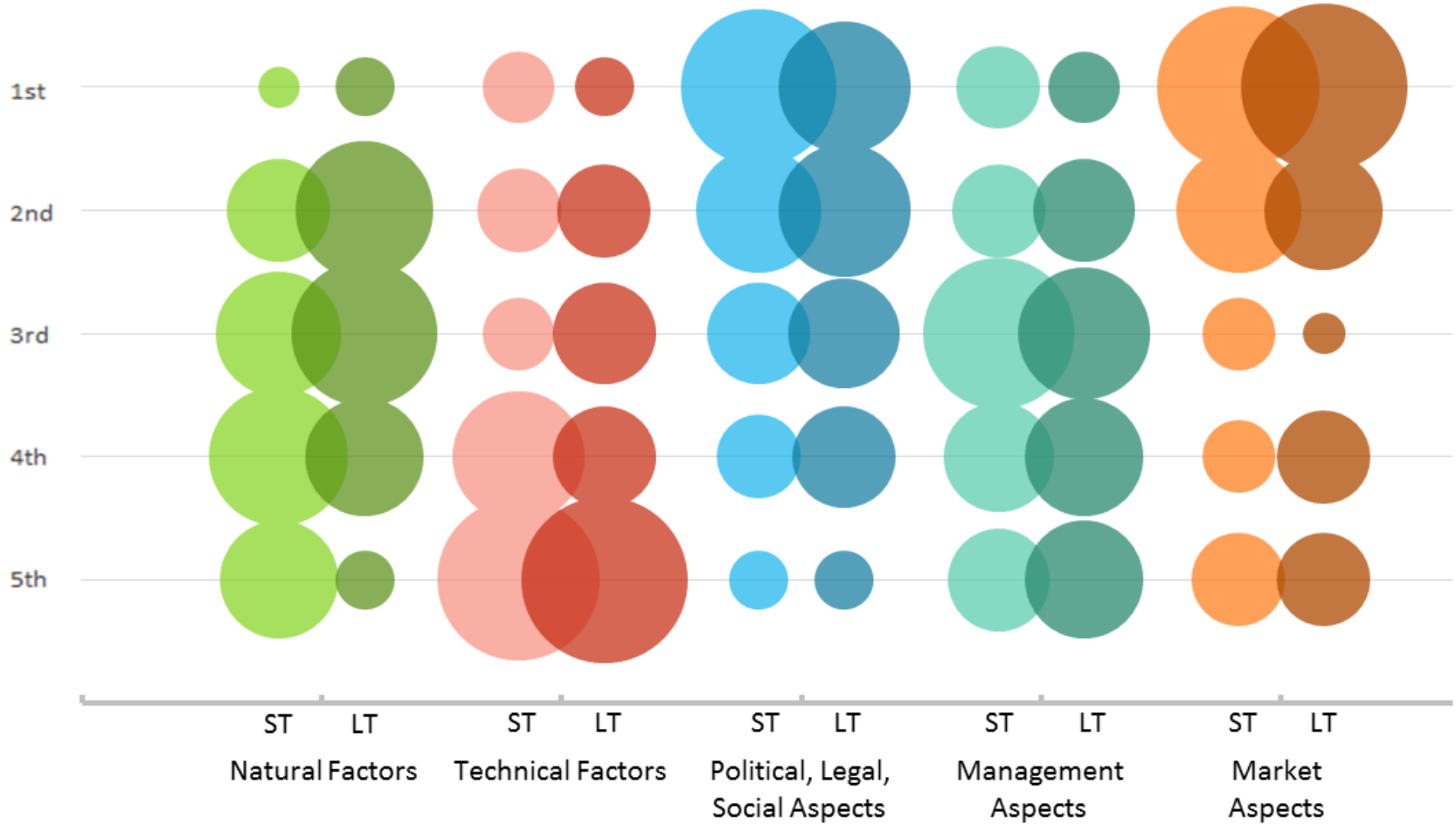
Sorgenkind Wasserkraft

Blick

Last Years Market Prices: Down, Down, Down and a bit Up again

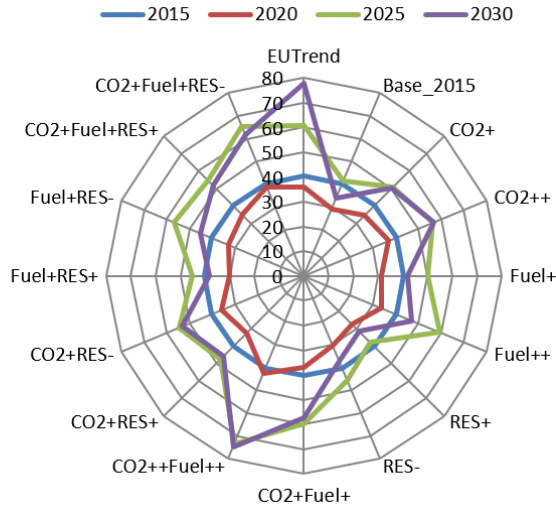


Main Drivers for Swiss Hydro?

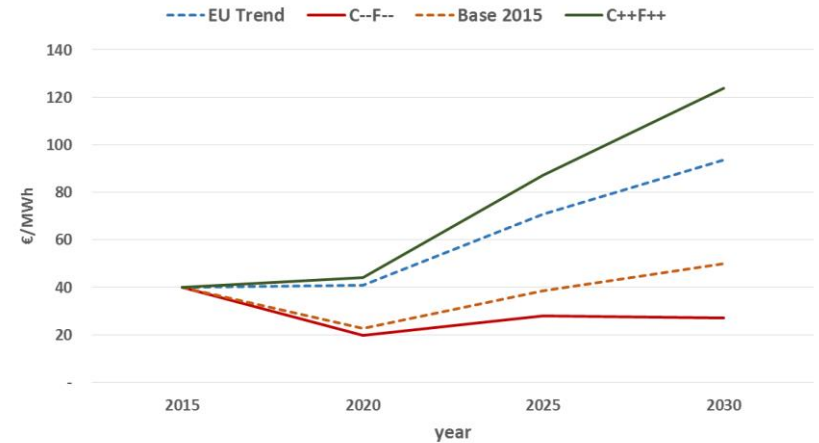


Market Outlook: Uncertain with Strong EU Impact

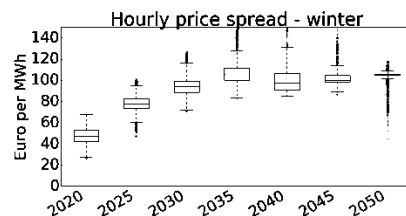
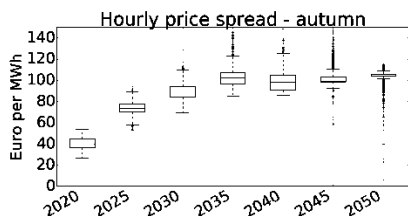
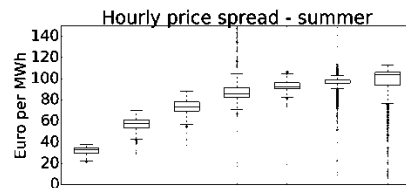
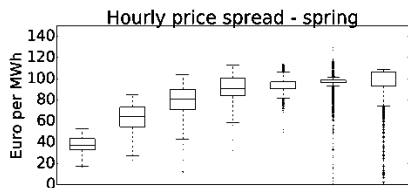
Average Prices (Schillinger et al., 2017)



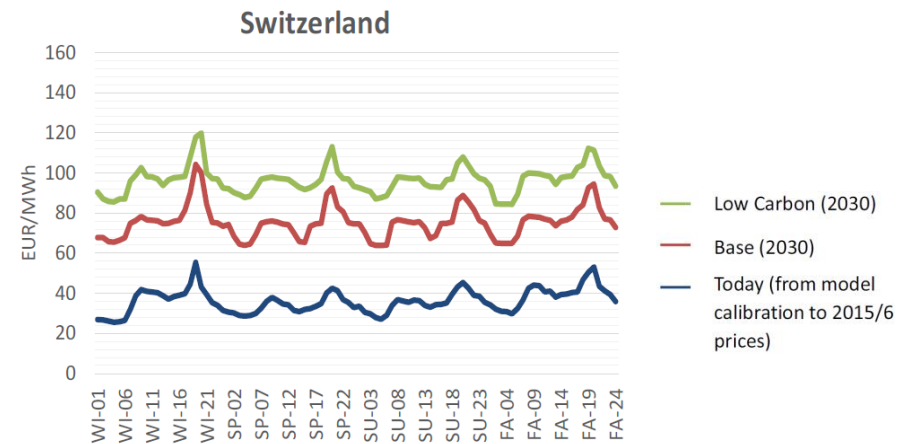
Average Prices (Betz et al., 2018)



Hourly Prices, Base Case, AFEM project



Hourly Prices, Reference Days (Panos and Densing, 2018)



Policy Outlook: Under Negotiation

- Water Fees
- Concession Renewal
- Market Premium for Large Hydro
- EU-CH market agreement
- Full Market Liberalization (+requirement for local, green supply)
- Storage Reserve
- Environmental Regulations

Agenda

Today: Storage Reserve

Tomorrow: Water Fee Reform

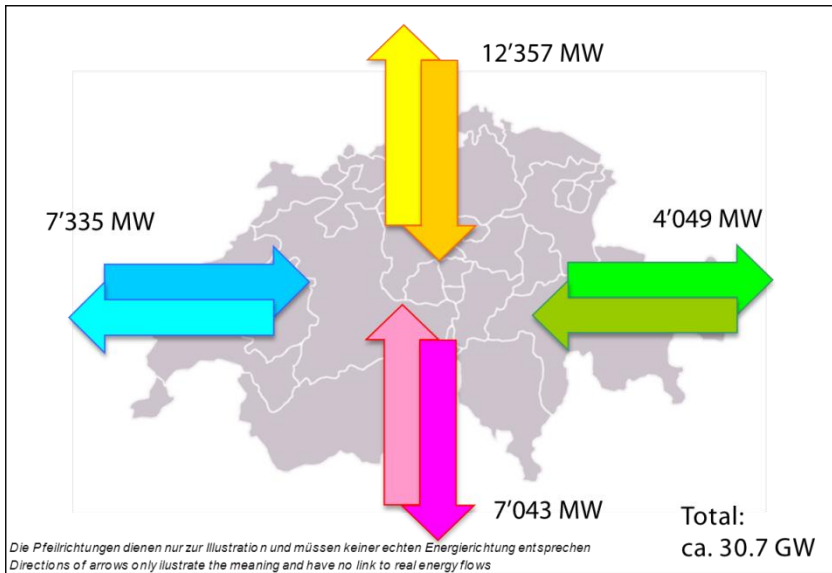
The Day After Tomorrow: Climate Change

'Revision des Stromversorgungsgesetzes'

'Diese aktive Reserve ist als **Ergänzung zum Energy-Only-Markt** ... zu sehen: Primär wird die Versorgung durch reine Marktmechanismen gewährleistet; erst wenn diese Mechanismen versagen, kommt die Reserve zum Einsatz ...dient .. dazu, Energie ausserhalb des Marktes **für ausserordentliche und für Marktakteure nicht absehbare kritische Knappheitssituationen** zurückzuhalten.'

'Reserve soll .. in Form einer .. Speicherreserve ausgestaltet werden, die sicherstellt, dass in den kritischen Zeiten **genügend Energie vorrätig** ist (**und mit der vorhandenen Kapazität tatsächlich produziert werden kann**). Die Kraftwerksleistung wird nicht aus dem Markt genommen, ... kein Anreiz geschaffen, neue Kraftwerksleistung zuzubauen.'

Worst Case?

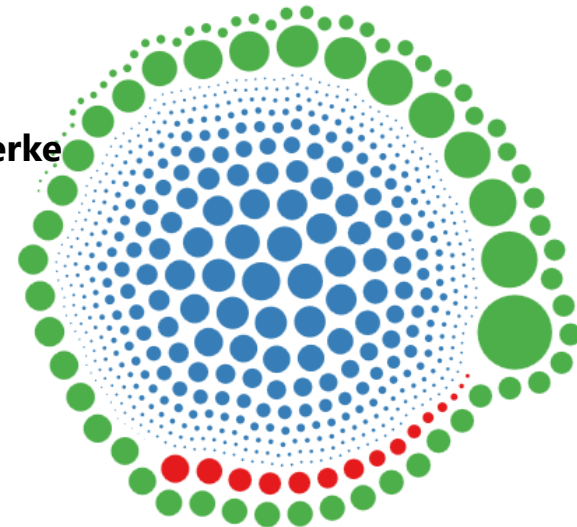


1. No Imports possible:

- Grid likely not the main bottleneck
- Supply from neighbors?

ca. 4.7 GW RoR
ca. 8.7 GW Storage
ca. 0.5 GW Pump
ca. 2.7 GW Umwälzwerke
Total: ca. 15-16GW
PeakLoad: ca. 10GW

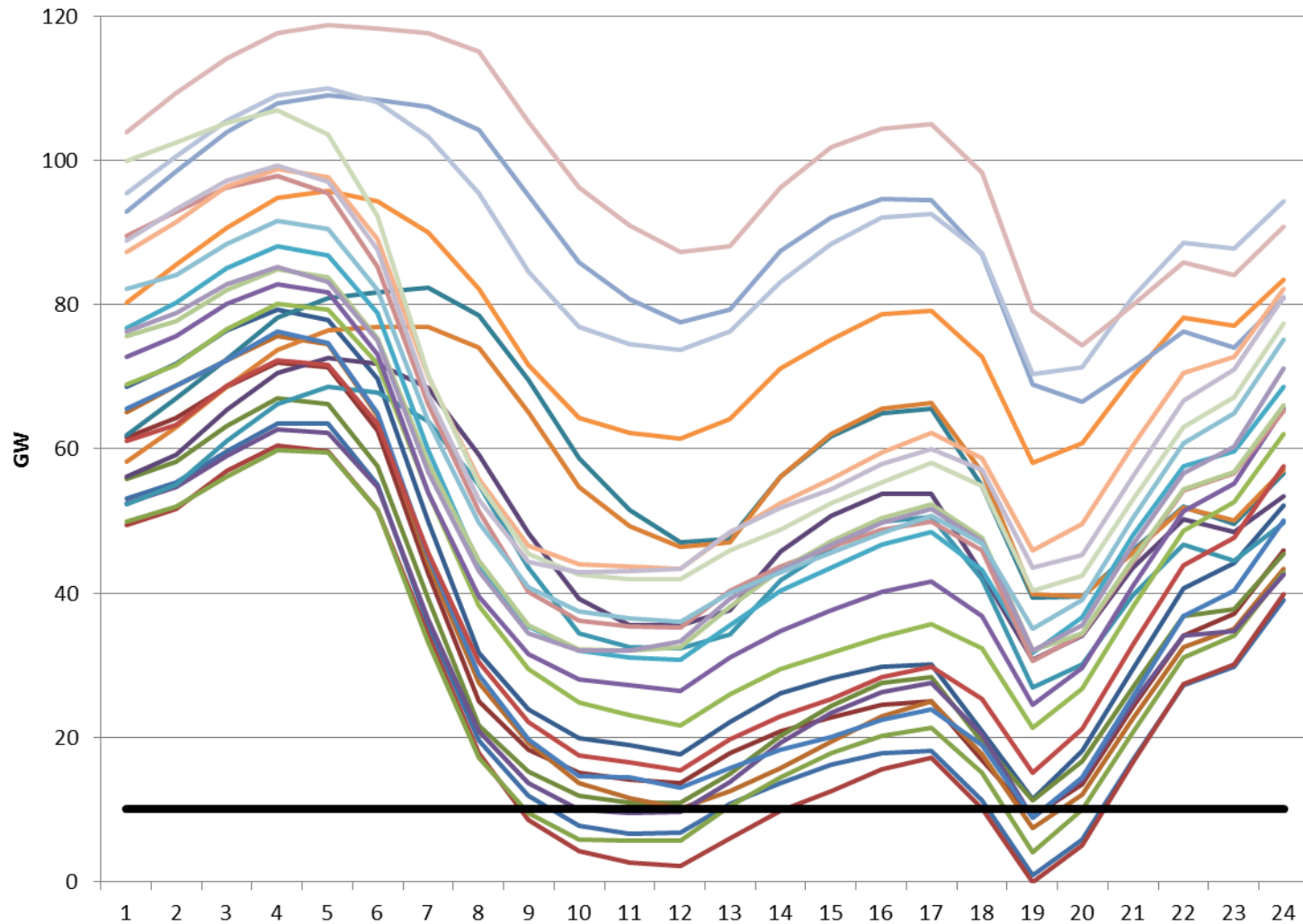
● Laufkraftwerk
● Speicherkraftwerk
● Pumpspeicherkraftwerk



2. Hydro not available:

- 'Overcapacity'
- 'Natural' incentive to provide shortage times

Neighboring Demand Dynamics free up Export Capacity



Preliminary Results:

Worst Case vs. 'some nice energy number'

Our Worst Case	SFOE/Consentec/ Frontiers Example	A bit more 'Full Load'
Full Autarky (12GW) needed for 10 hours	775 GWh (‘2 weeks full load’ ca. 2.3GW)	2TWh (6 GW for 2 weeks)
21.4 €/MWh 214 €/MW	13.6 €/MWh 4'580 €/MW	30.9 €/MWh 10'400 €/MW
2.6 mn € total	10.5 mn € total	62.2 mn € total
System costs: 1.2 mn €	System costs: 3.0 mn €	System costs: 32.6 mn €

Agenda

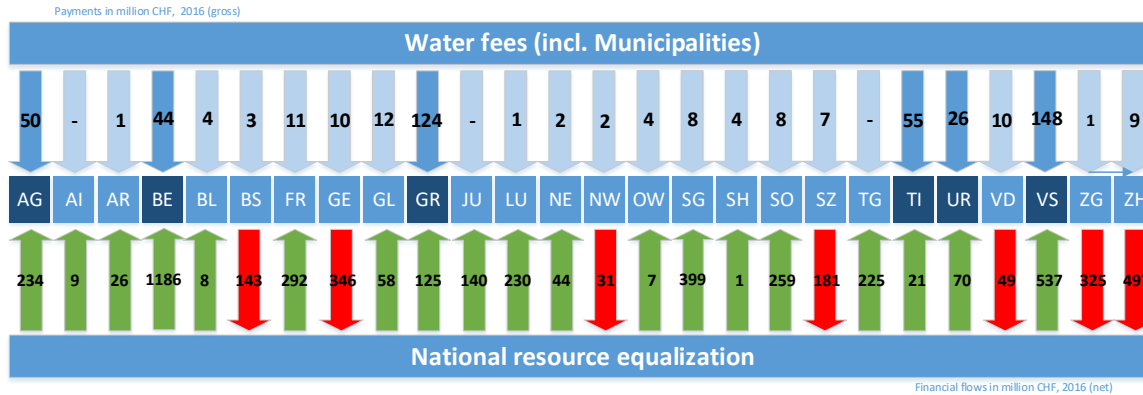
Today: Storage Reserve

Tomorrow: Water Fee Reform

The Day After Tomorrow: Climate Change

It's just a small levy for Switzerland, but a huge cost for Swiss hydro... really?

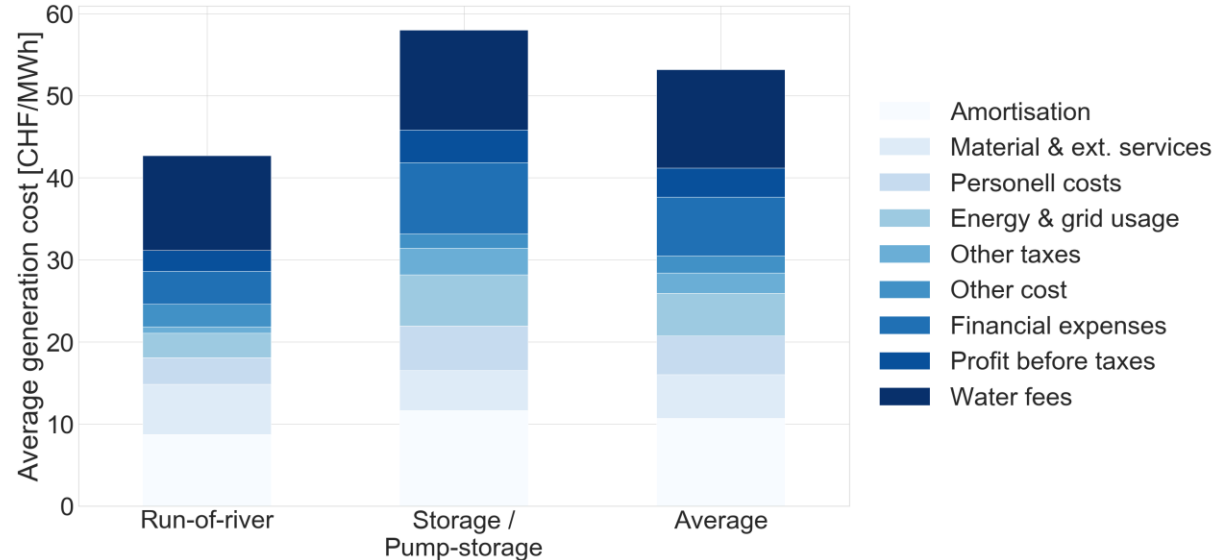
Overview of financial flows (2016)



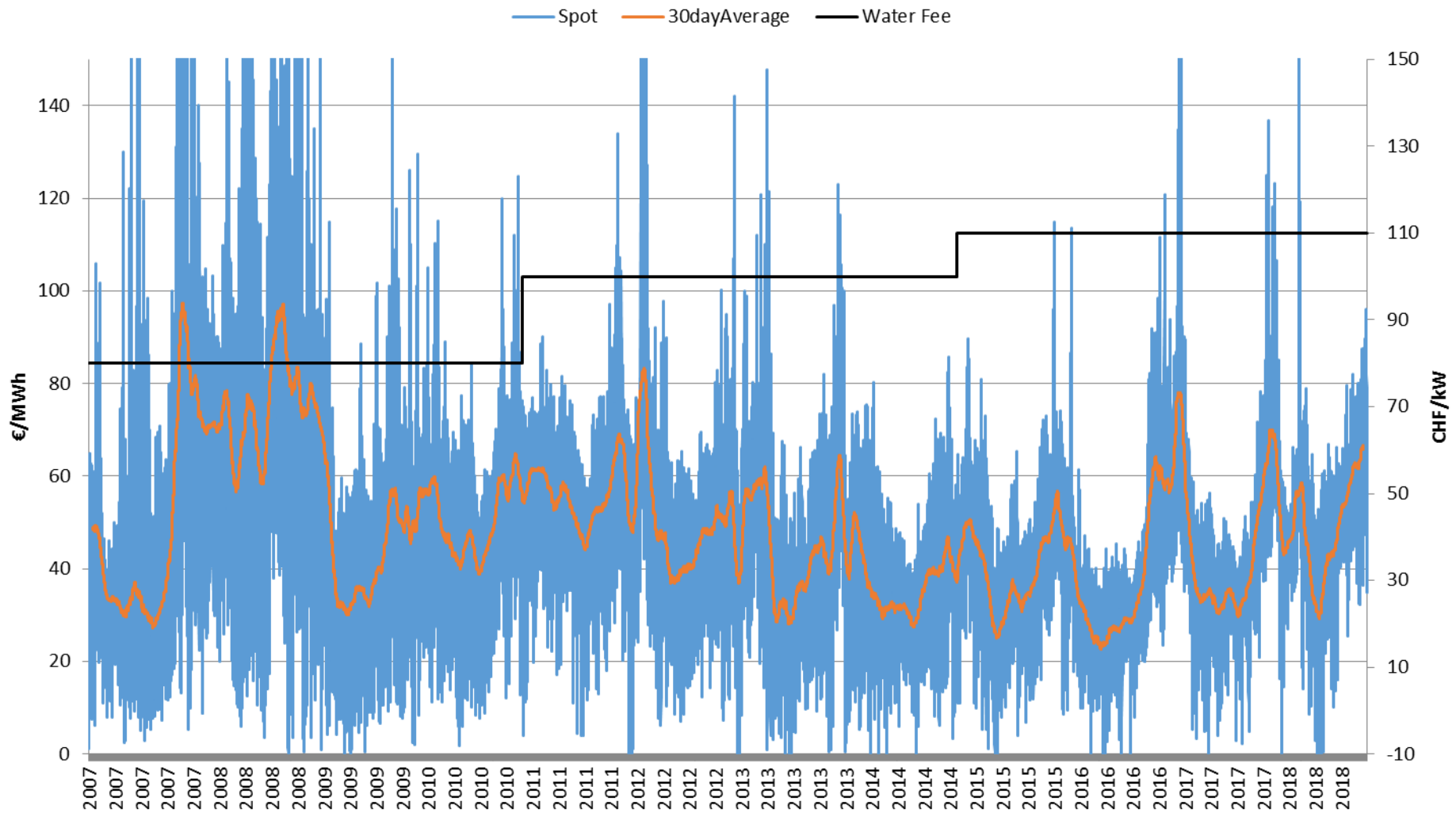
Total income from water fees: ca. **550mn per year**

High relevance for **mountain cantons**

Water Fees represent ca. **1-1.2 Rp/kWh** of company costs (ca. **25%**)



Variable Prices, Fixed Fees

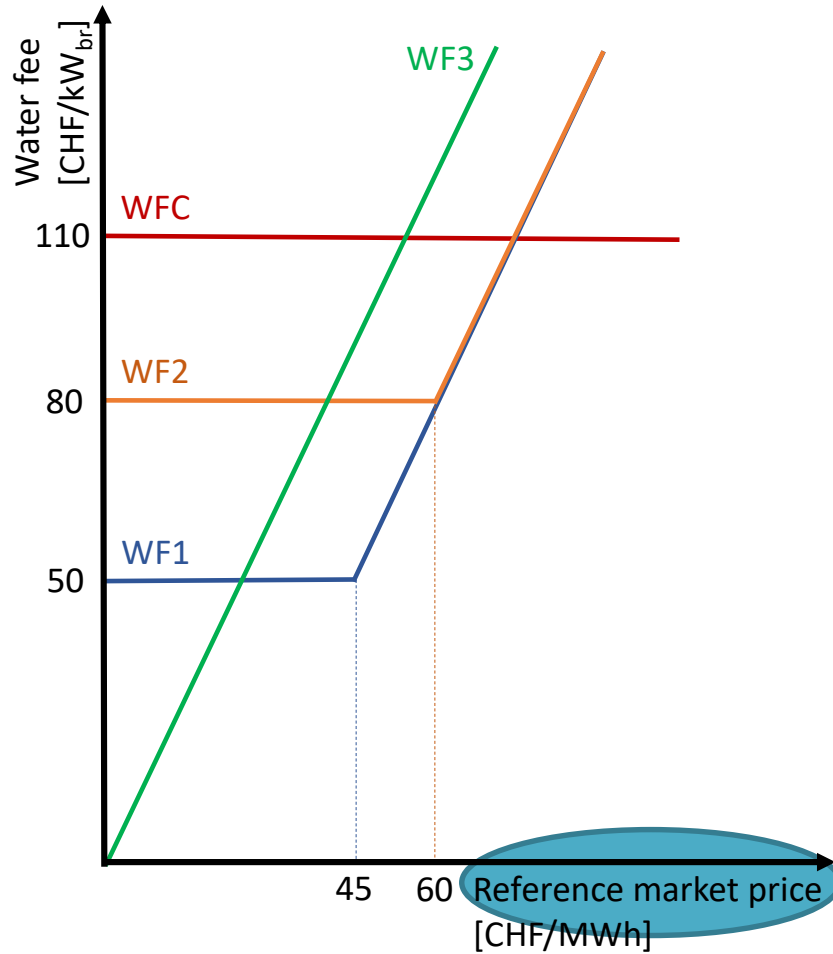


The Bundesrat 2018 proposed six options:

- Flexible water fees (with a fixed and a variable part)
- Fee on the resource rent
- No federal maximum of the water fee, instead qualitative guidance
- Cantonal regulation only, no maximum given by federal level
- Levy on consumers e.g. via network surcharge (instead of holders of the concession)
- Integration in the national fiscal equalization

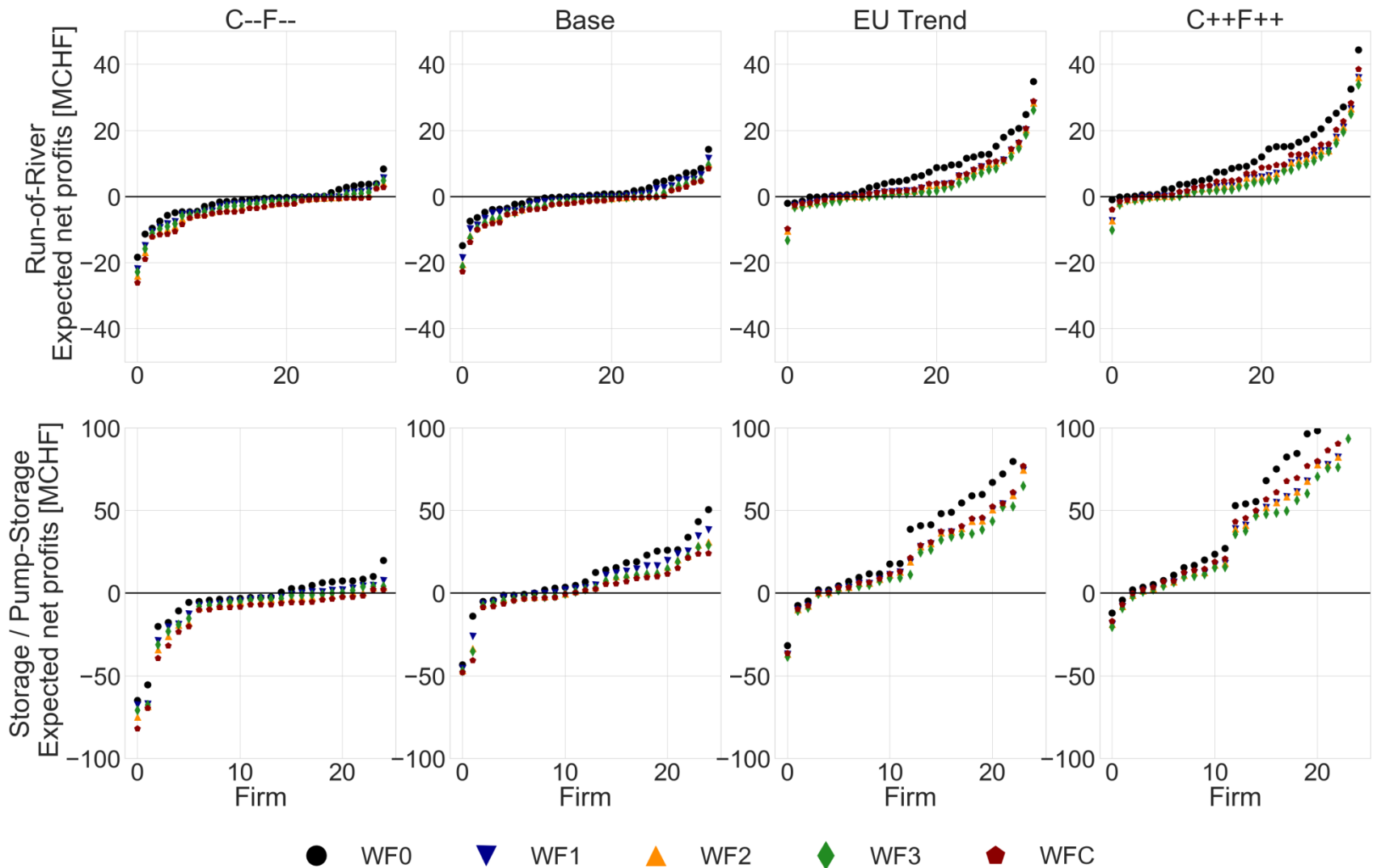
→ Lets examine variable fee design

Variable Fees

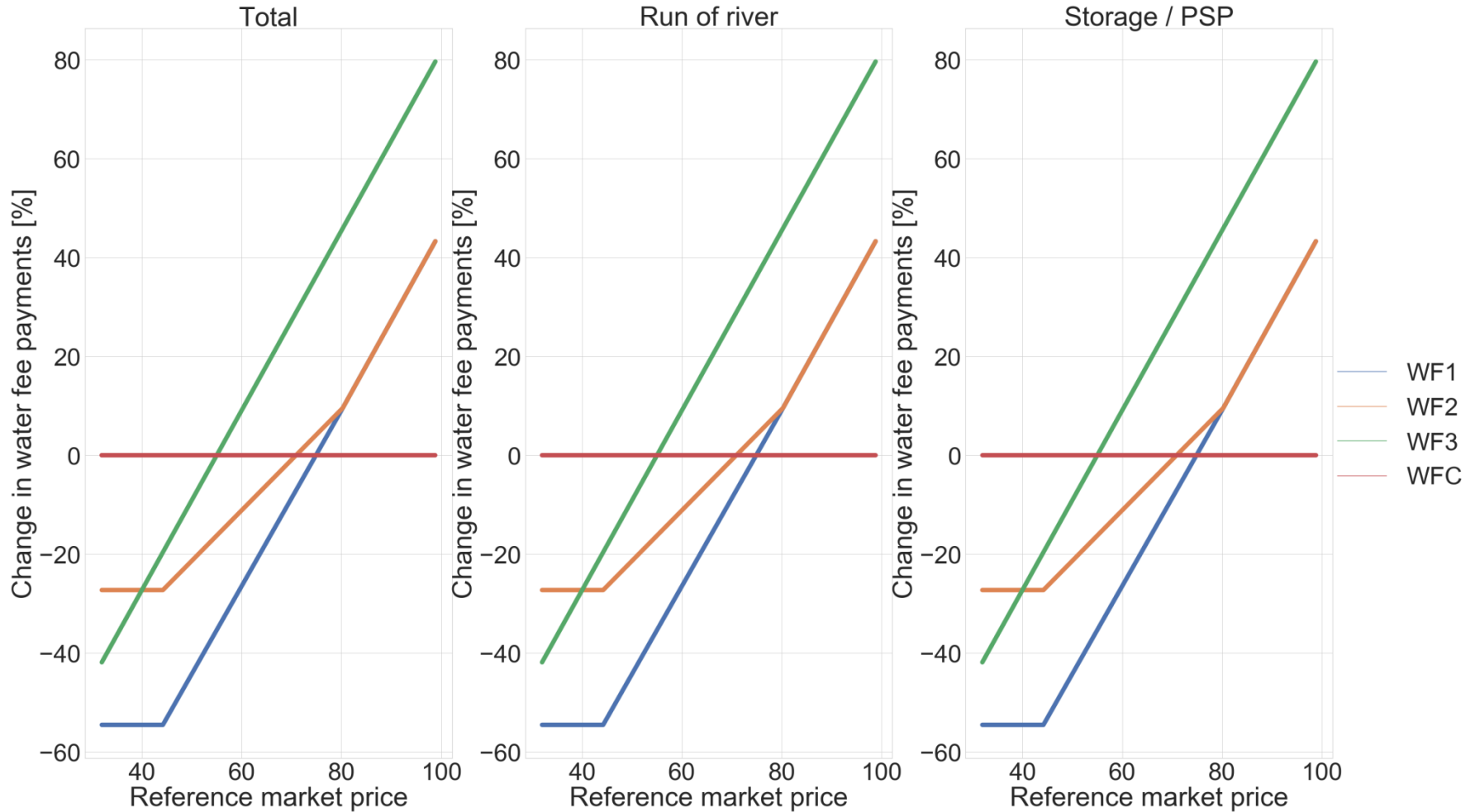


Scenario	Water fee (WF)	
WF0	No water fee	$WF = 0$
WFC	Current water fee level	$WF = 110\text{CHF}/\text{kW}_{\text{Br}}$
WF1	Partly flexible water fee	$WF = 50 + \max(2P-45,0)$
WF2	Partly flexible water fee	$WF = 80 + \max(2P-60,0)$
WF3	Completely flexible water fee	$WF = 2P$

Profit Impact (2025 case)



Payment Impact



Agenda

Today: Storage Reserve

Tomorrow: Water Fee Reform

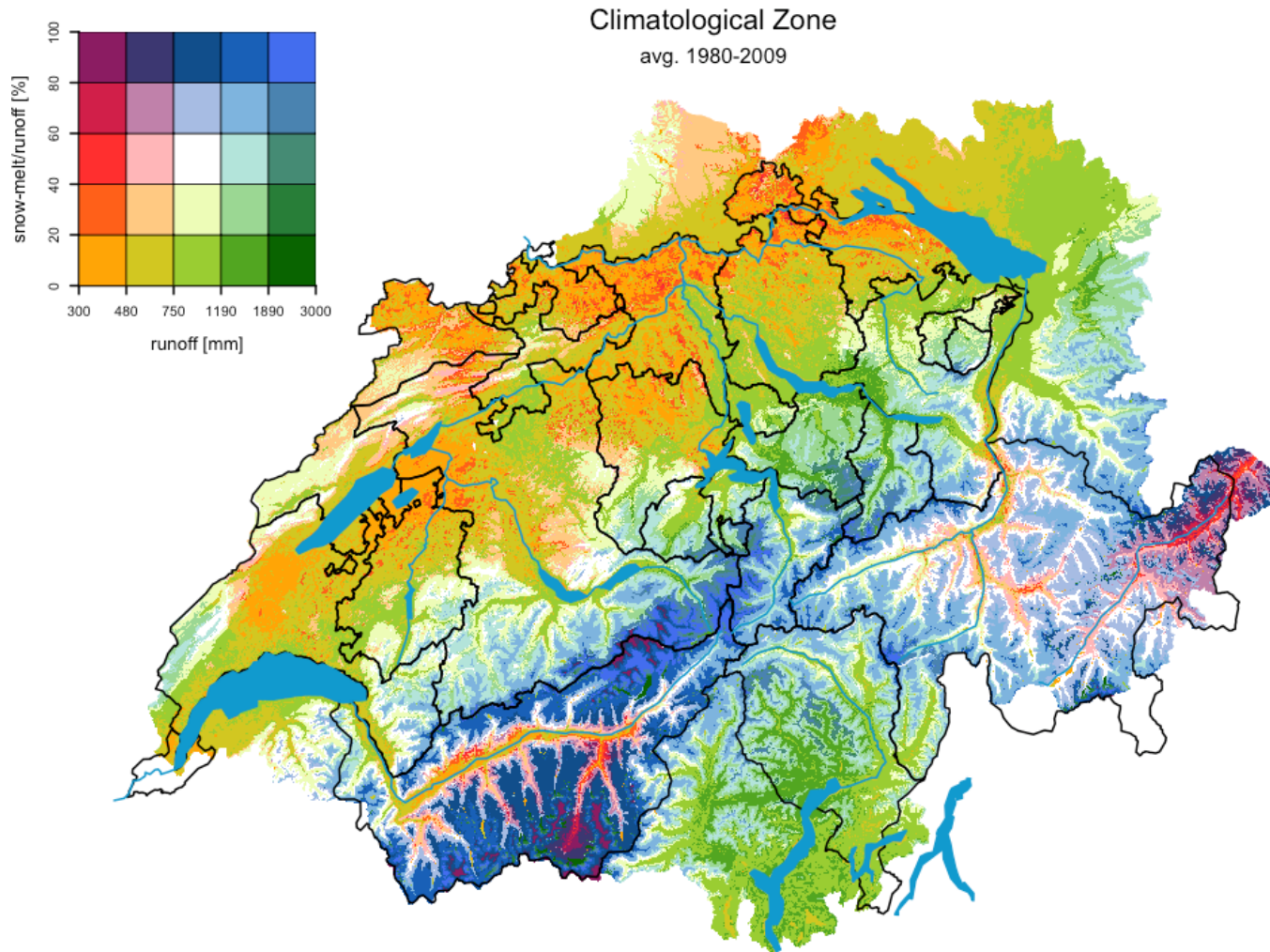
The Day After Tomorrow: Climate Change

How will climate change impact Swiss hydropower's market performance?

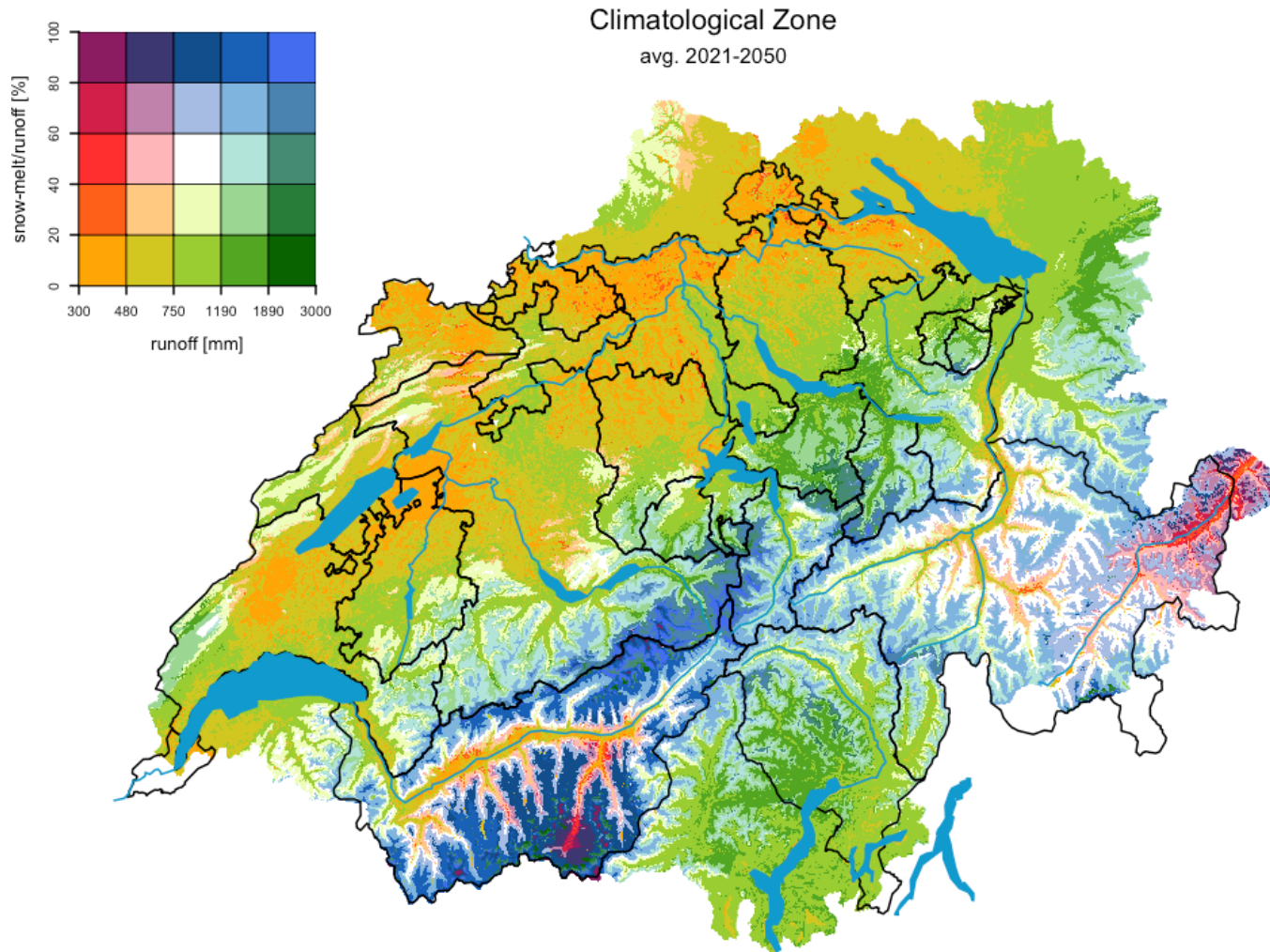
Data and methods:

- Swissmod electricity market model
- Runoff data with high geographical and temporal resolution (by WSL)
- Data for three climate periods
 - Historic (1980-2009)
 - 2021-2050
 - 2070-2099

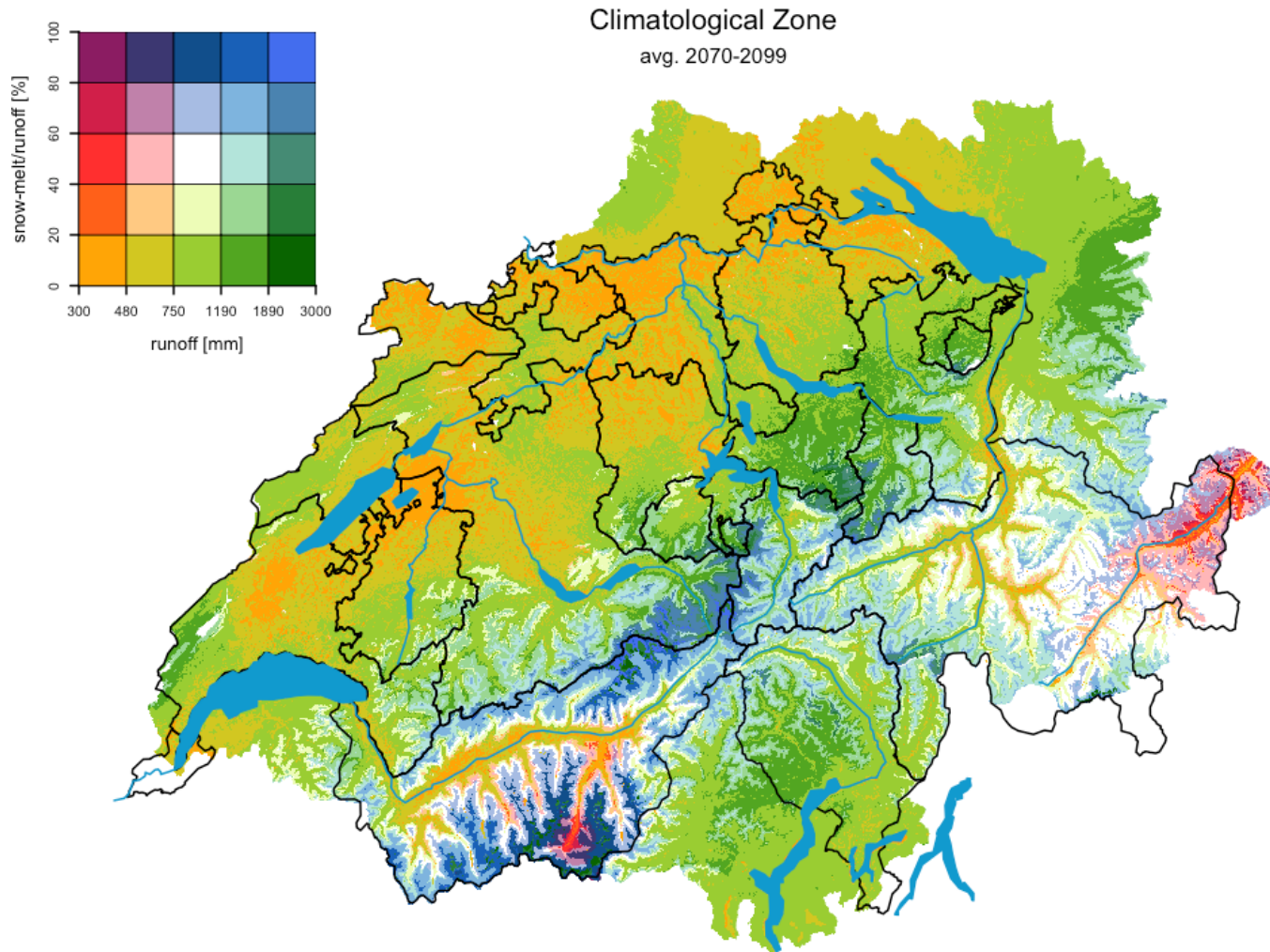
Climate data: Runoff (historic)



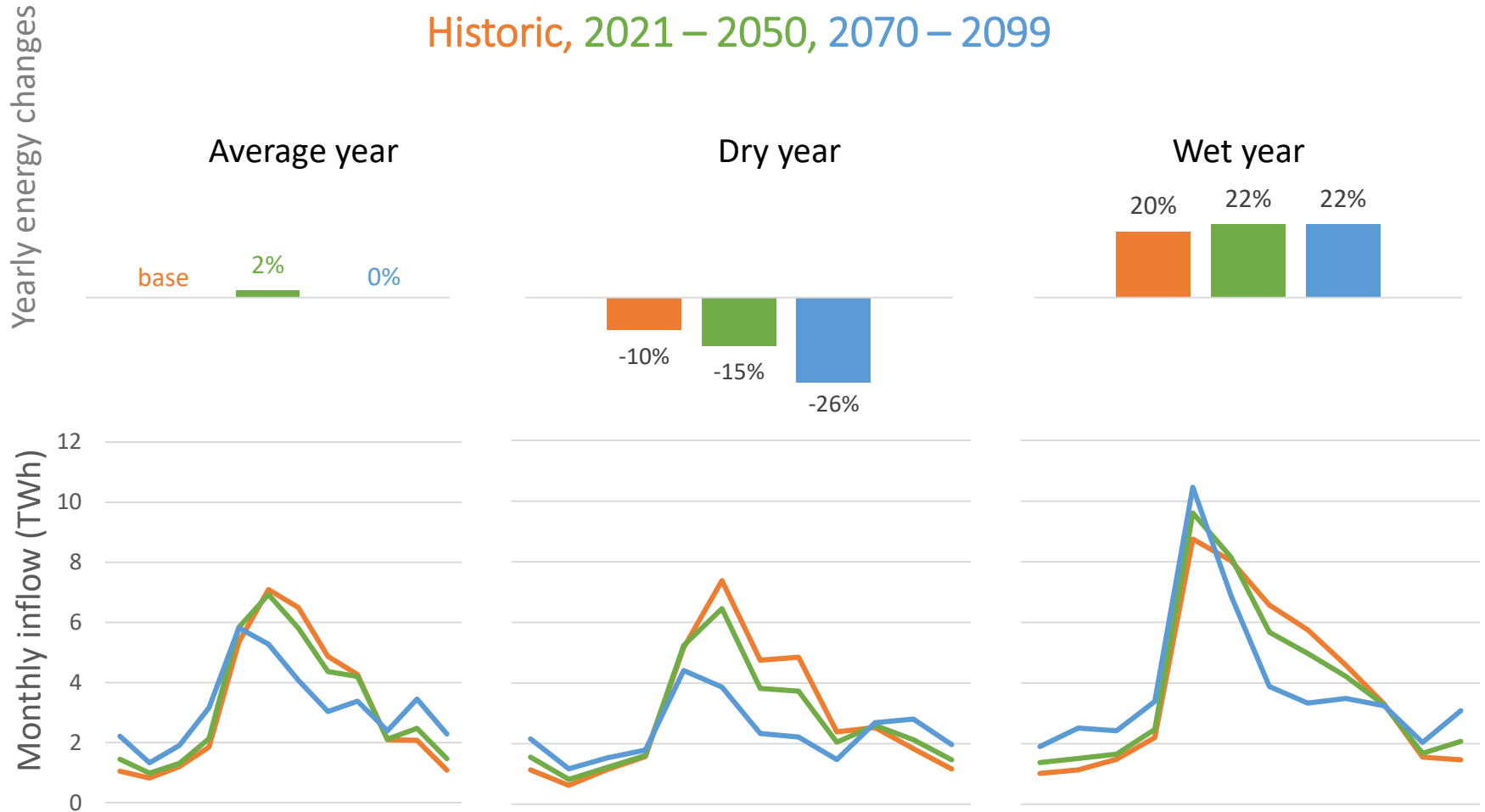
Climate data: Runoff (2021-2050)



Climate data: Runoff (2070-2099)

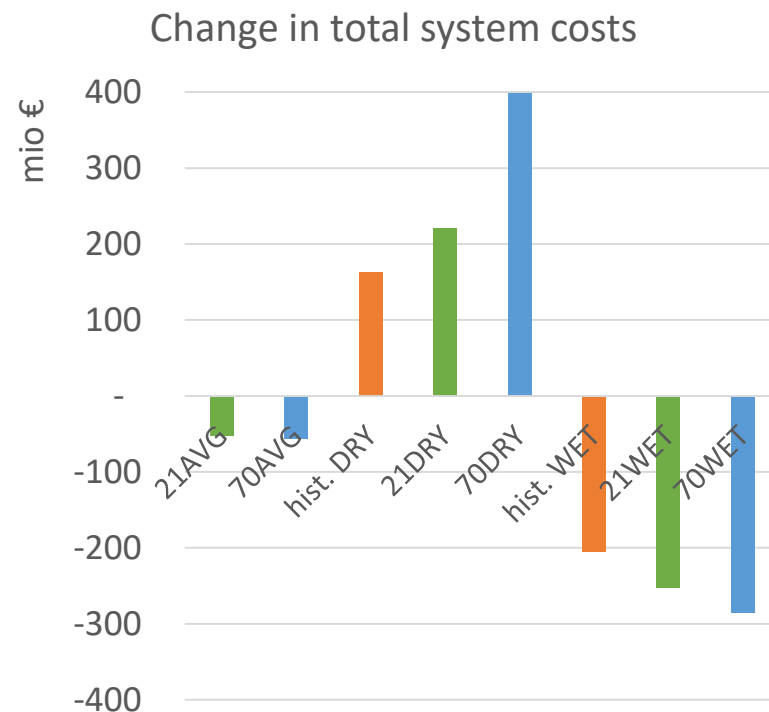
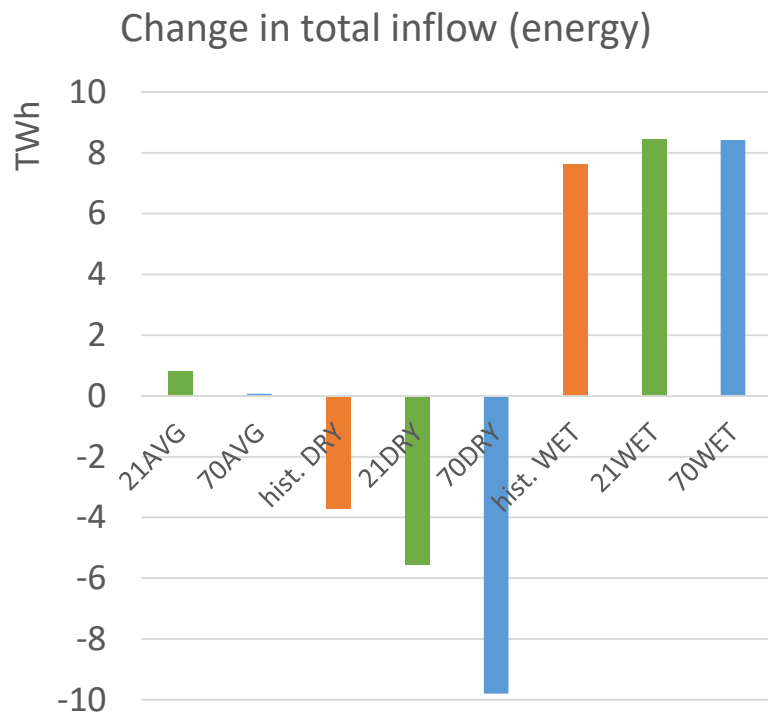


Inflow Change by Climate



System Impact

Absolute difference in Total System Cost relative to historic base year

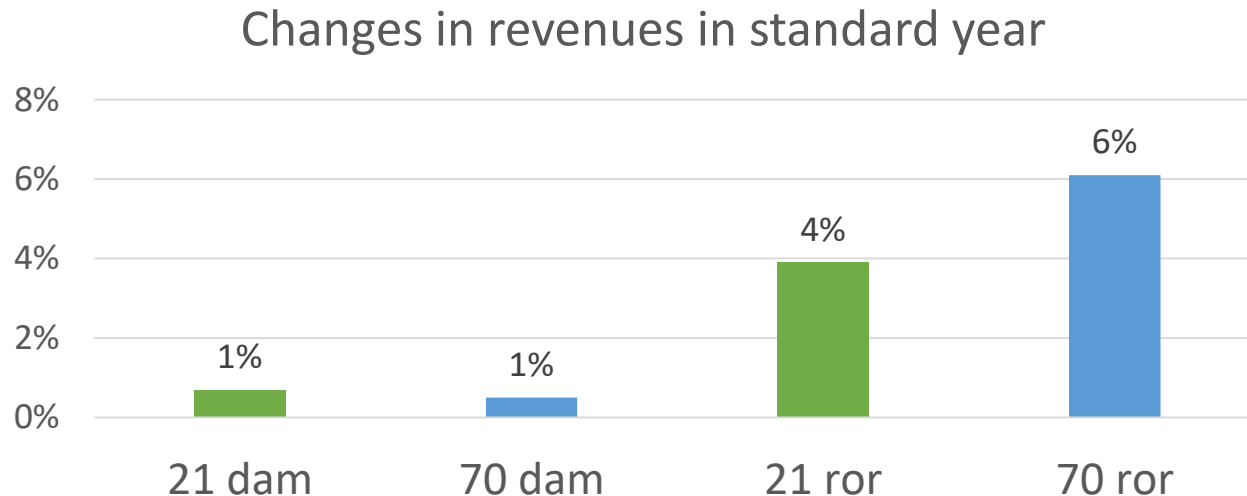


Historic, 2021 – 2050, 2070 – 2099

Revenue Impacts (2015 Market Conditions)

Revenue increases in average years for both dam and RoR

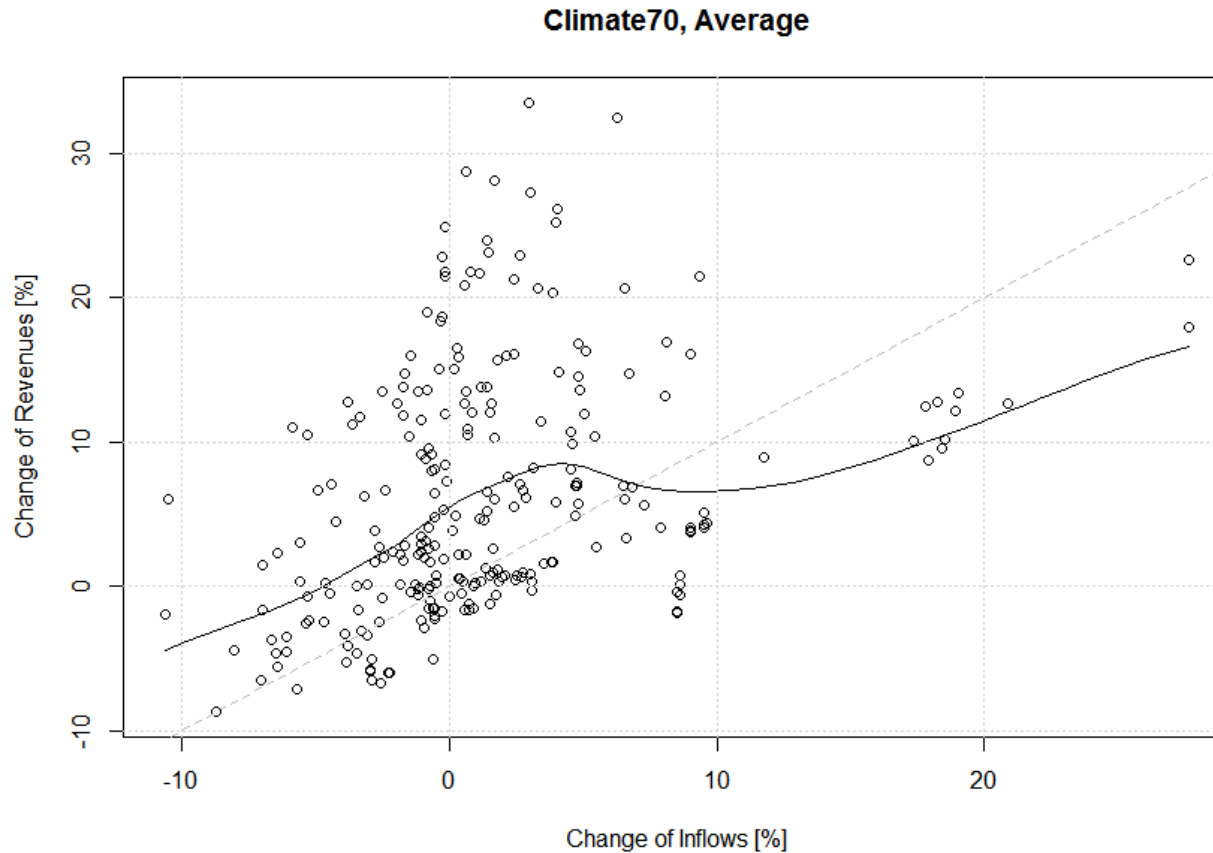
RoR benefits from better seasonality



For other weather conditions:

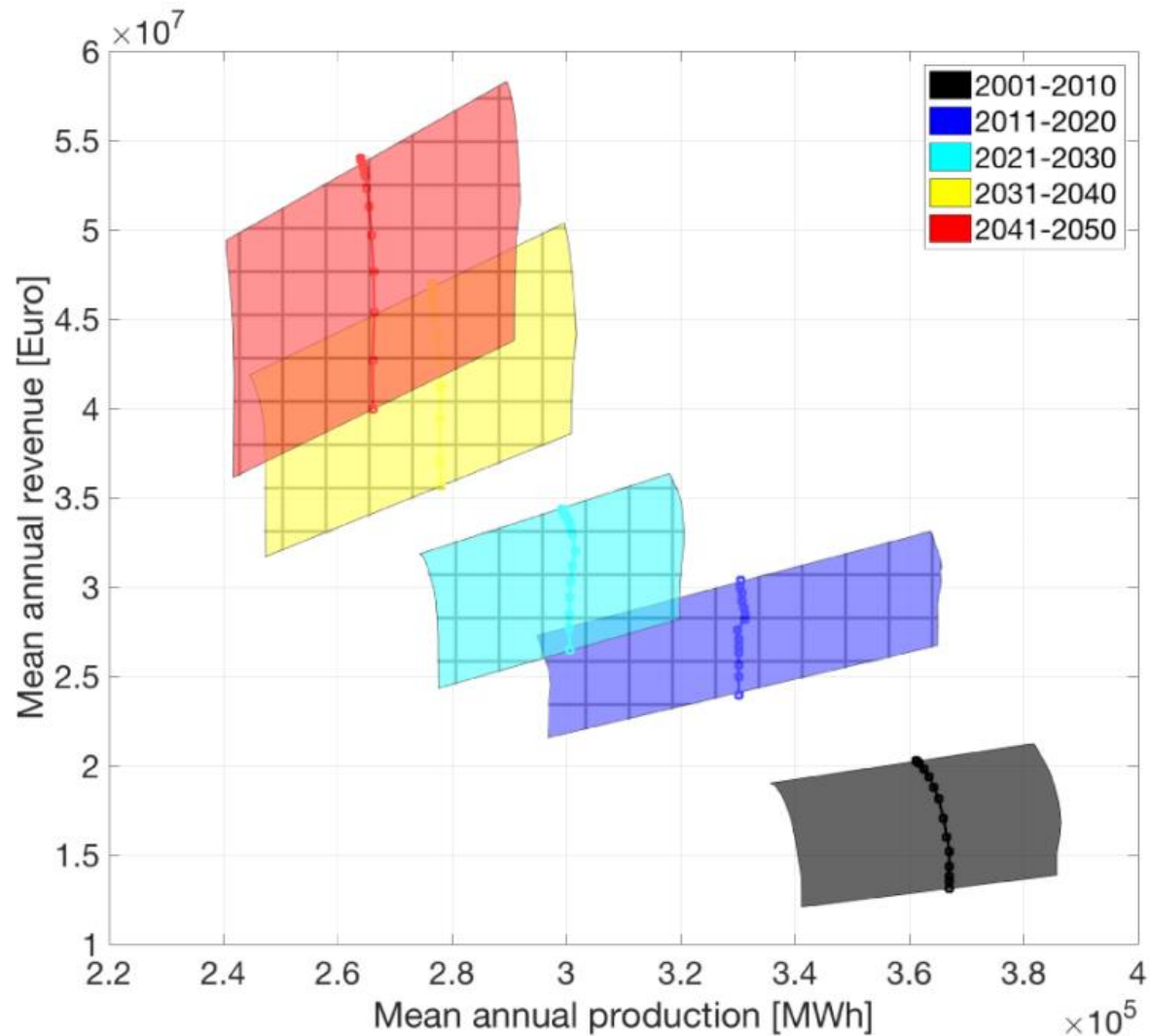
- Dry years get worse
- Wet years get better

BUT!



Large **Heterogeneity** of Swiss Hydro Plants

And Who Knows What the Market Brings...



Conclusions

- The only certainty is the **uncertainty**
- Its the **economy**, stupid!
- Swiss **choices** do matter, for Switzerland
- BUT: in the long run, hydro is likely not dead!

3rd Workshop: The Future of Swiss Hydropower

29.03.2019, 9:15-12:30

Welle 7, Schanzenstrasse 5, Bern

Program

8:45 *Registration and Coffee and Gipfeli*

9:15 Welcome, Introduction and Project Overview

9:30 Market Realities

- Ups and downs in coming years
- Little money for flexibility
- Uncertainty will become the norm

10:15 *Break*

10:30 Regulatory and Policy Challenges

- Drivers and institutional issues
- More than just energy
- Water fees: company and canton perspectives

11:30 Discussion:

- Where can and where can't Swiss Hydro act?
- Flexible water fees: compromise possible?
- Electricity market design and hydropower
- What needs to be done until 2024?

12:15 Summary, Open Points and Needed Next Steps

12:30 *Lunch buffet*

Backup

Hydropower in Swissmod

