

Swiss Hydro Power: Market Potential

(A Study on behalf of the “*Regierungskonferenz der Gebirgskantone*”)

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Current Market Design & Politics

- **Exchanges & Over-the-Counter Trading Platforms for Power Trading;**
- **Market Areas:** CH with neighboring countries (D/A, F, I) – and others within EU;
- **swisselectric [3]** quantifies «overhead costs» for **sales and trading** with **0.8 Rp/kWh**.

Futures Market: hedge driven **asset backed trading** creates added value;

Spot-Market = Day-Ahead Market + Intraday-Market: commodity “electricity” offers huge volatility (> 150%) for **asset backed trading** in power spot markets.

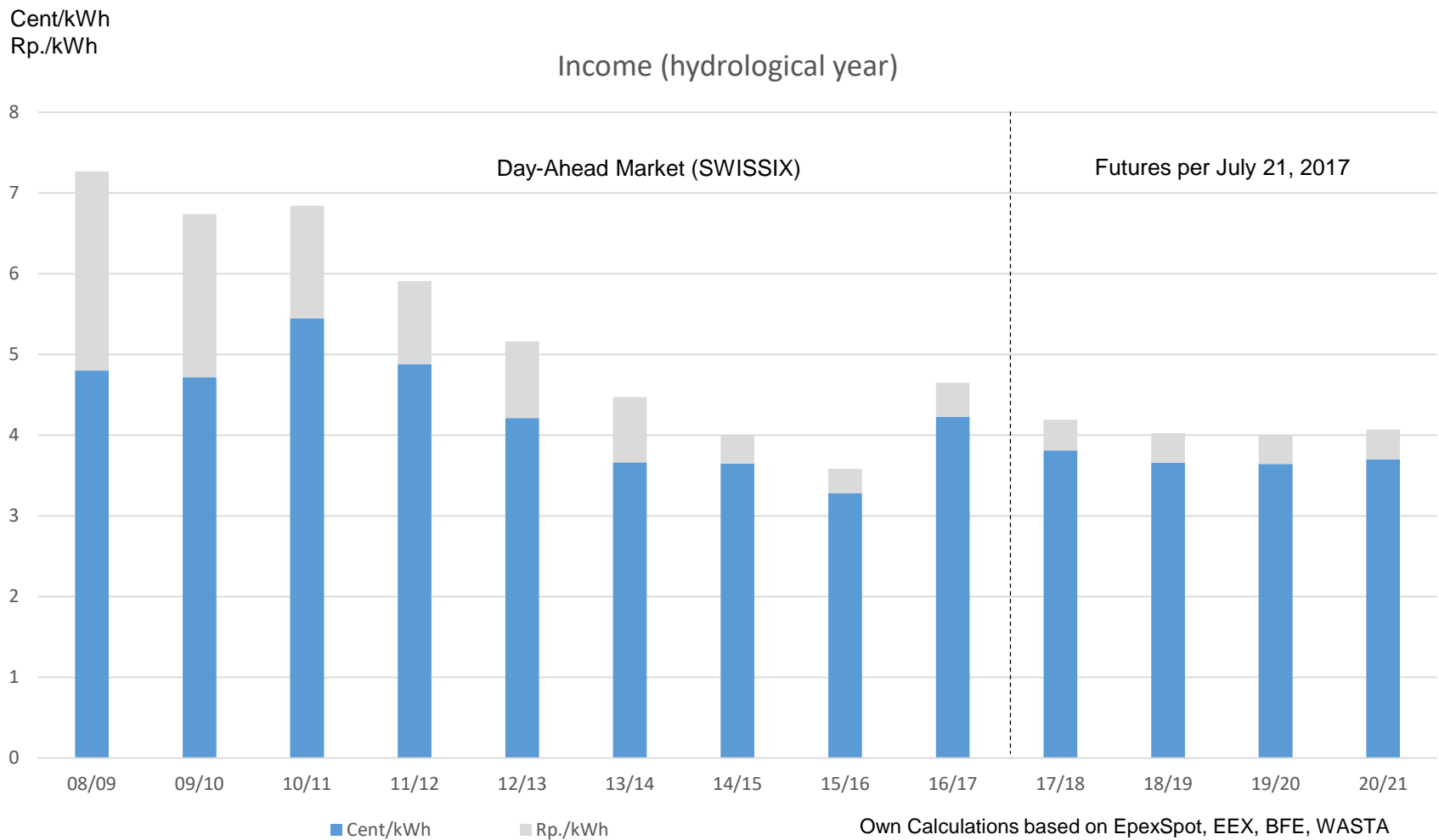
Market for System Services: flexible generation capacities comprise “option rights”;
“**asset backed traders**” offer these “option rights” to the TSO (**in return for a premium**).

swisselectric [3] calculates income for power plants based on day-ahead market:

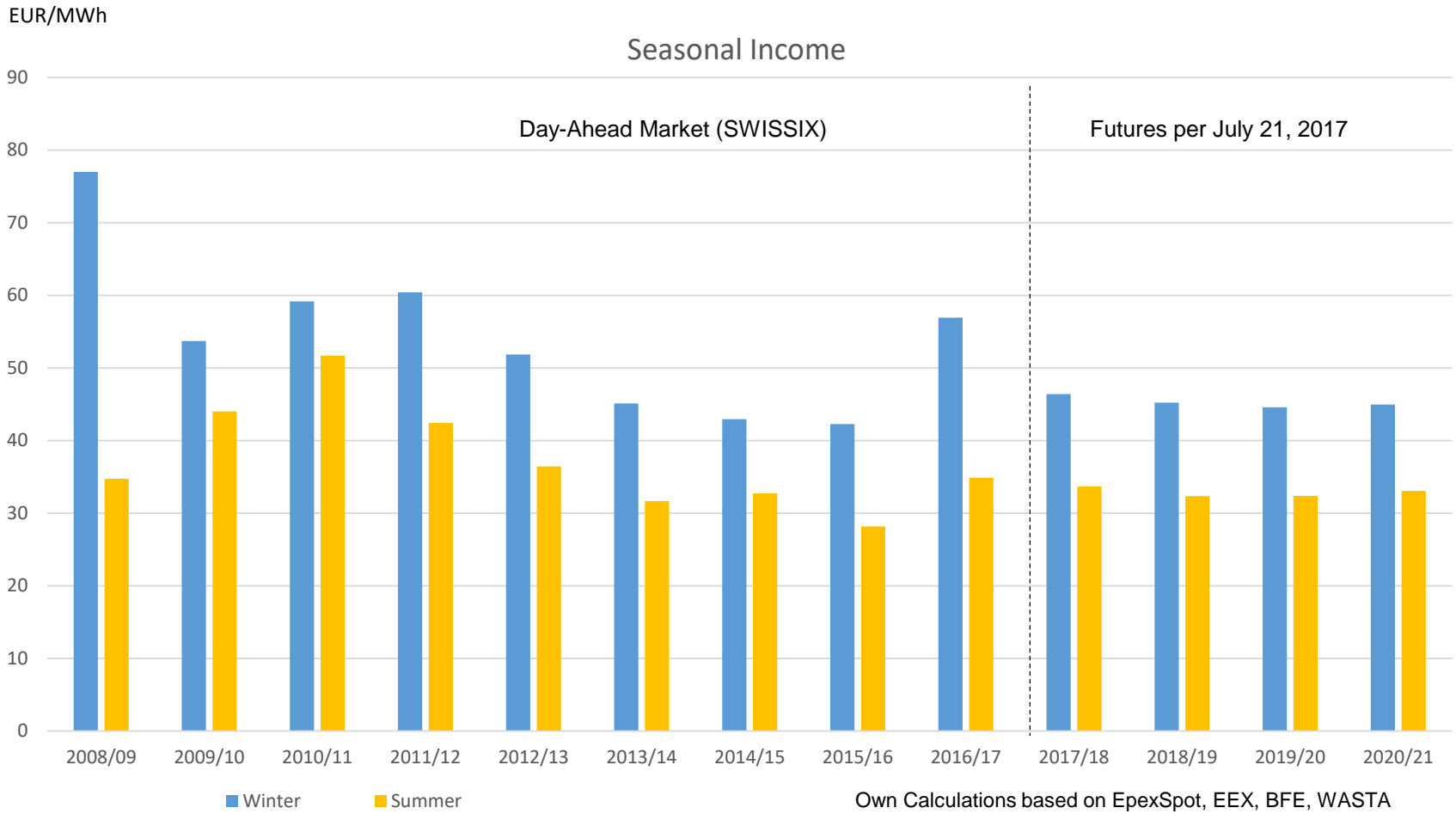
- **sufficient** for **run-of-river plants** (as their flexibility is of “very weak” form);
- **NOT sufficient** for **hydro storage plants**, because **flexibility is ignored; flexibility** comprises “option rights”, which are exploited through **replication** in spot markets.

Underlying study estimates market potential for hydro plants based on reference market EpexSpot (CH, D/A) using Black Scholes dynamics as benchmark model.

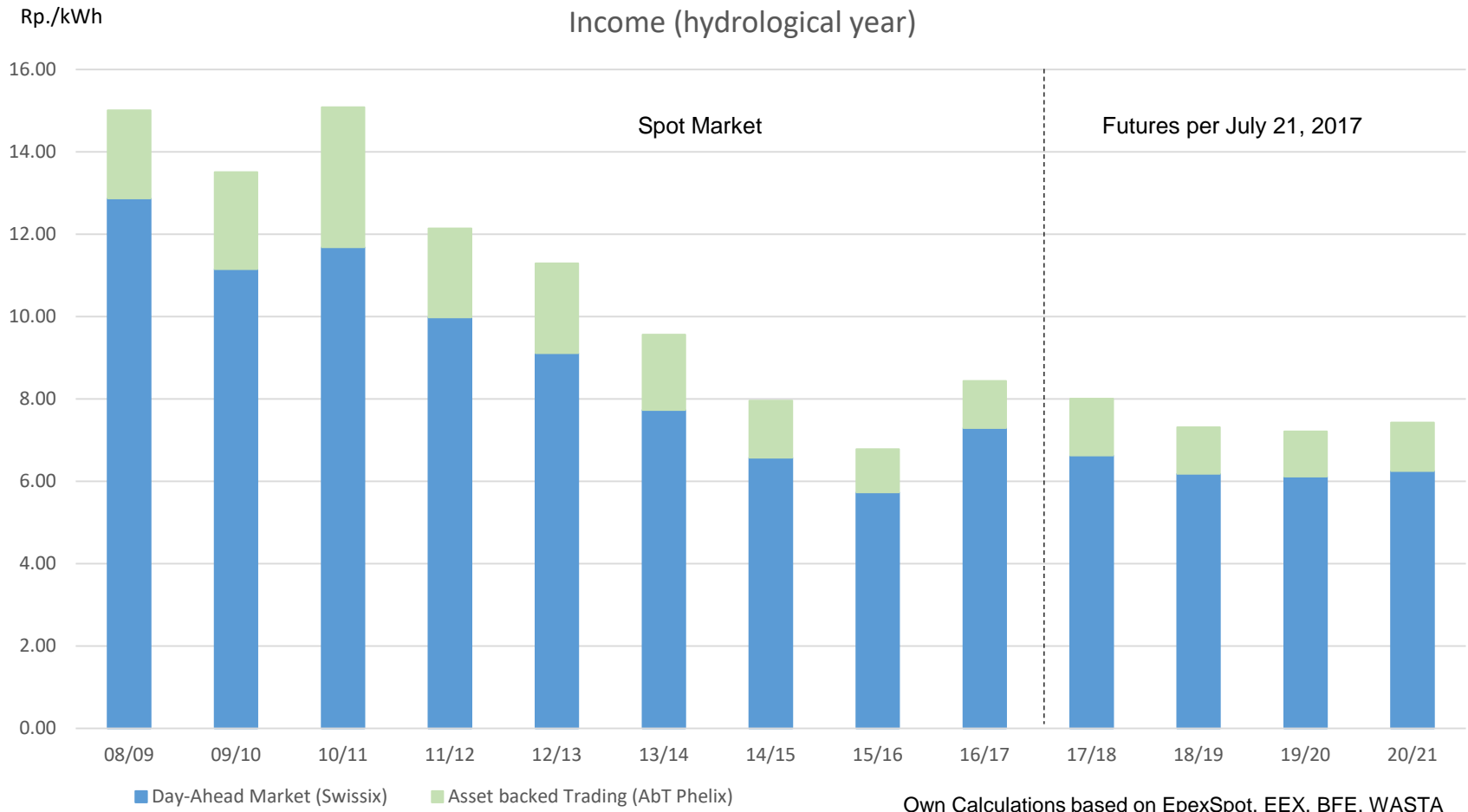
Run-of-River Plants (I)



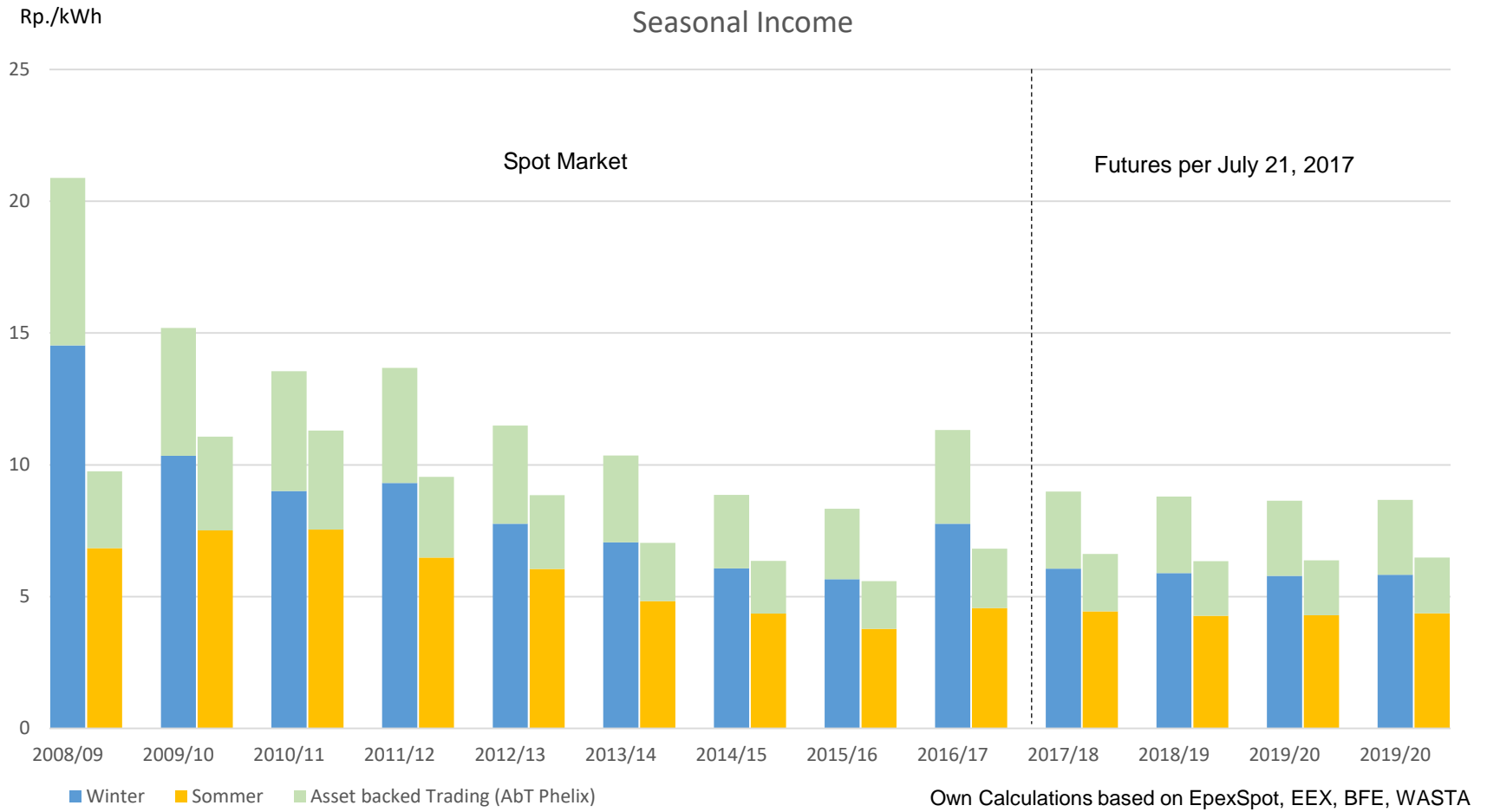
Run-of-River Plants (II)



Hydro Storage Plants (I)

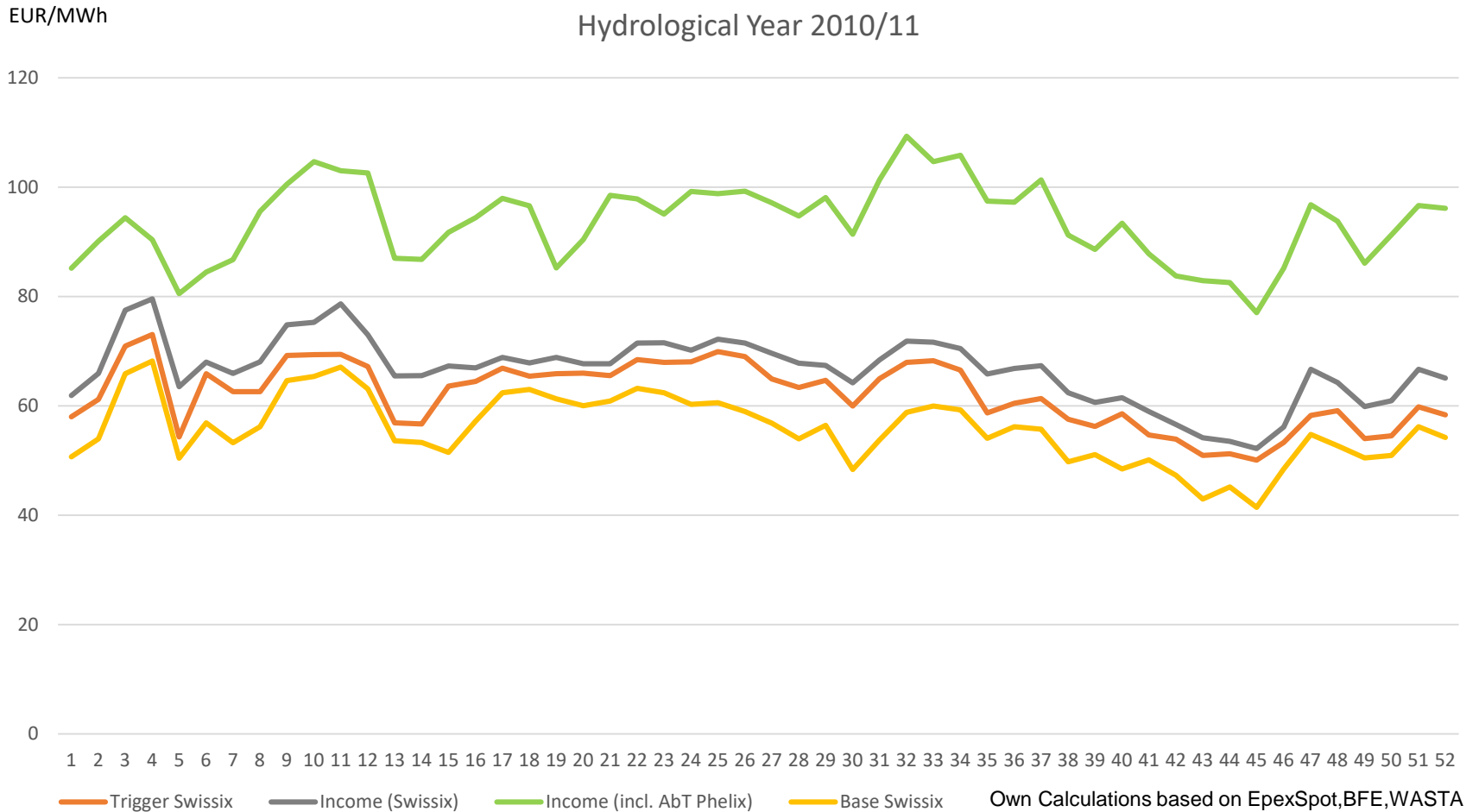


Hydro Storage Plants (II)



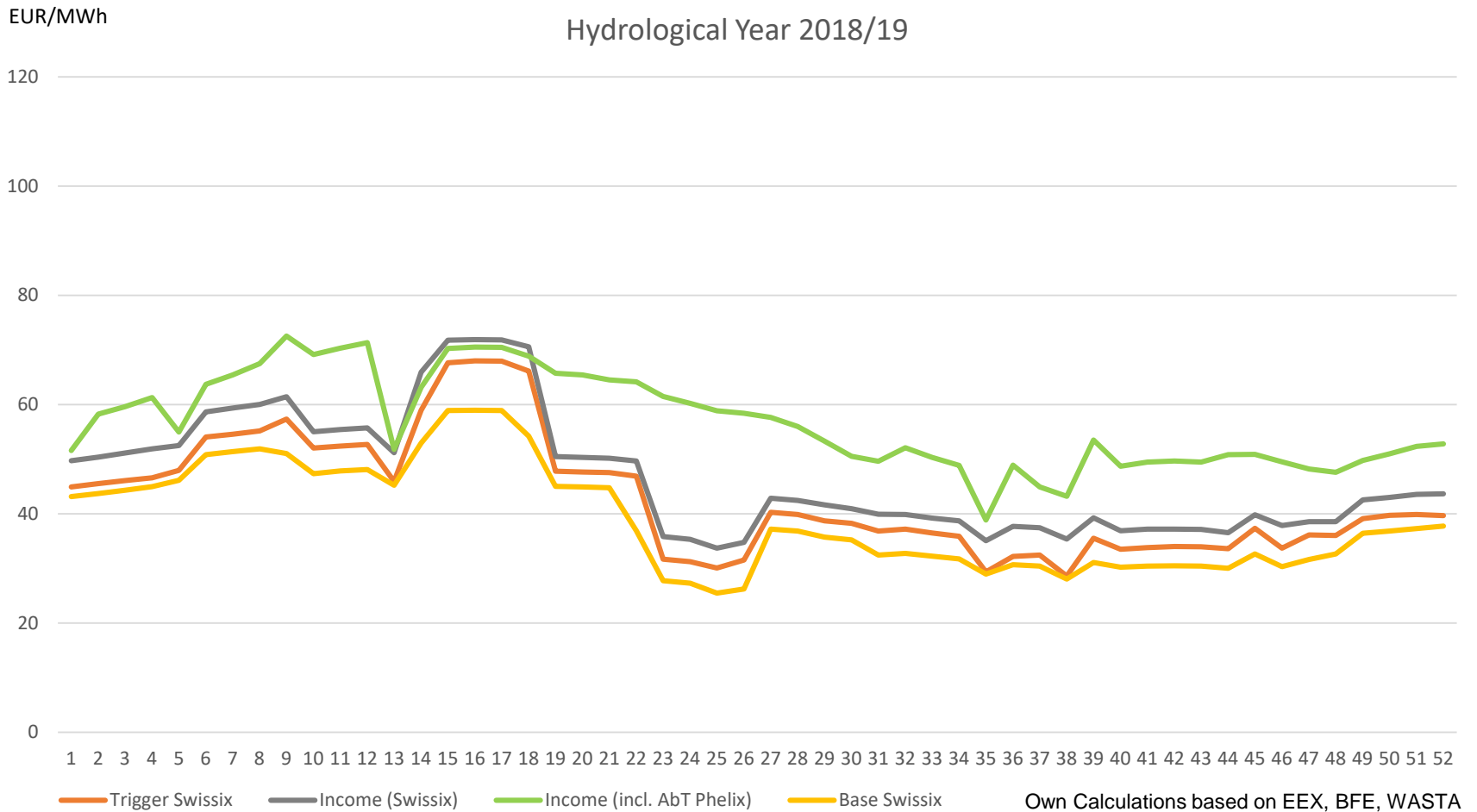
Weekly Levels: Base – Trigger – Income (2010/11)

(based on EpexSpot)



Weekly Levels: Base – Trigger – Income (2018/19)

(based on <https://www.iorcf.eu/dynamics/Public/Dokumentation.aspx> [6])



Status Quo: Sensitive Facts & Conclusion

(The Political Call for Transparency - Intro)

Swisslectric [3] quantifies «Overhead Cost» of 0.8 Rp/kWh for «Sales and Trading»

«Power Trading» comprises «Asset backed Trading» and «Proprietary Trading»:

- «Proprietary Trading» requires allocations of «risk capital» depending on «exposures»;
- «Risk Ability for Proprietary Trading» dropped significantly due to «missing equity»;
- Lessons learned from former «Atel Trading» and «EGL».

- «Asset backed Trading» requires no risk capital;
- Assets «water» and «plants» represent «risk capital in physical form»;
- Income through «asset backed trading» requires no risk adjustments;
- (Out-)Performances may be assessed by benchmark models;

- OWNERS OF «ASSETS» PROVIDE POWER TRADERS WITH «RISK CAPITAL IN PHYSICAL FORM».

Status Quo: Sensitive Facts & Conclusion

(The Political Call for Transparency - **Costs**)

Total costs in 2015 (excl. dividends): ~ 1'180 Mio. CHF

(Hydro Storage Plants generate ca. 20 TWh, p.a.)

Swisselectric [3] reports for hydro storage plants:

Generation costs for 2015 (excl. dividends) of 5.1 Rp/kWh (= 1'020 Mio. CHF);

these costs include «**Wasserzins**» in the amount of **1.55 Rp/kWh (= 310 Mio. CHF).**

The «**overhead**» for «**sales and trading**» of **0.8 Rp/kWh (= 160 Mio. CHF)** cover

- access to international markets (exchanges and OTC-trading platforms)
- trading in spot products, futures and system services

Status Quo: Sensitive Facts & Conclusion

(The Political Call for Transparency - **Income**)

Hydro Storage Plants generate ca. 20 TWh (p.a.); **Est. Income 2017/18 ~ 1'528 Mio. CHF**

Based on the **Future Market (per July 21, 2017) for the hydrological year 2017/18** and on an estimated production of 20 TWh (hydro storage plants):

Income (production): 5.24 Rp/kWh (see [7]) **~ 1'048 Mio. CHF**

Asset backed Trading generates an income of **~ 480 Mio. CHF**

- **in Spot Markets** (see [7]) **~1.38 Rp/kWh (= ~ 276 Mio. CHF)**

- **in Future Markets** (volatility ~50%) **~0.40 Rp/kWh (= ~ 80 Mio. CHF).**

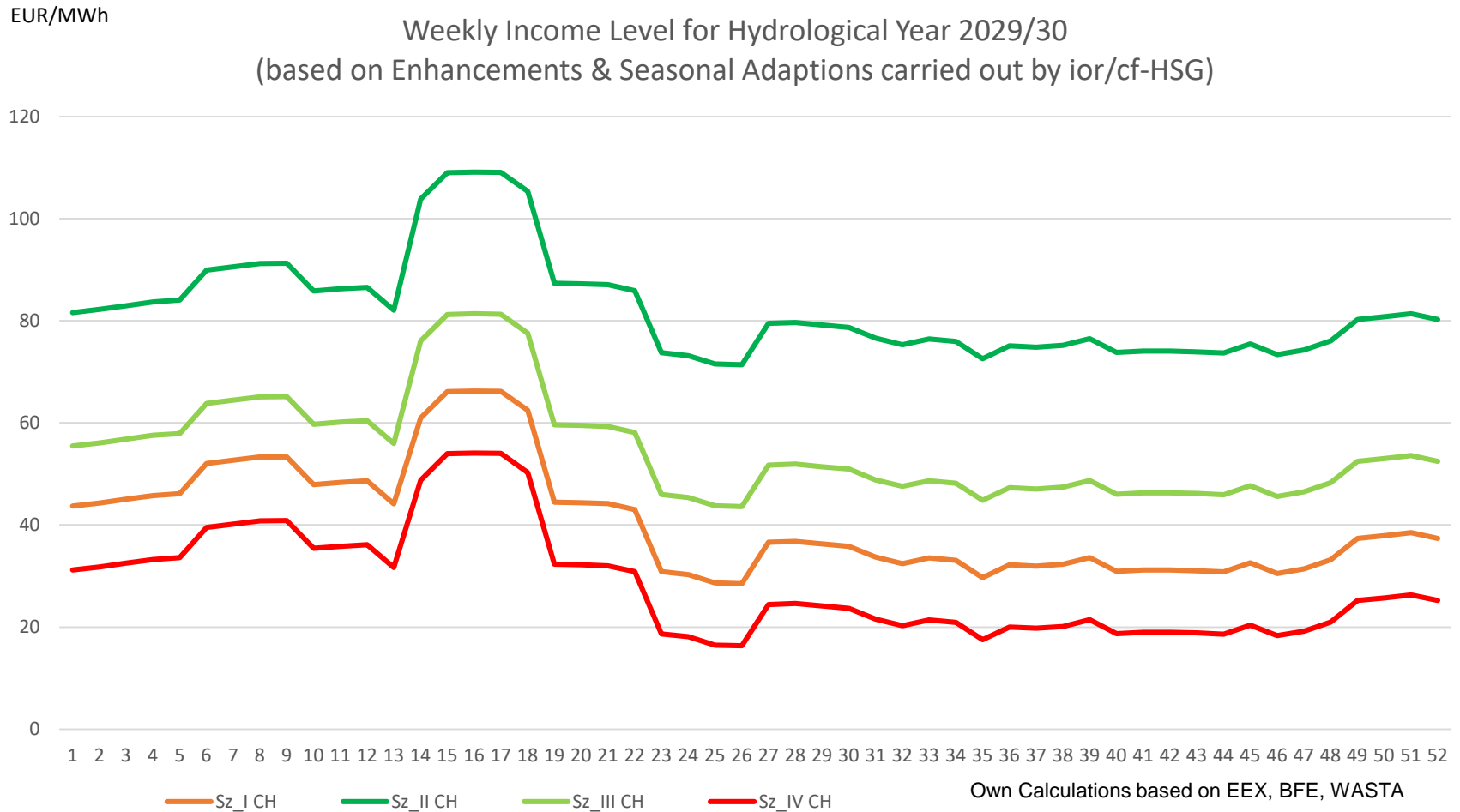
Asset backed Trading «System Services» amounts to **~180 Mio. CHF (p.a.)** (see [5]);

(Estimated 20% of storage capacities meet the demand for system services)

Remark: According to the annual report of Swissgrid for the year 2009, «system services» were remunerated with an amount of 540 Mio. CHF in 2009.

Open Issue : The Future Market Design

(price szenarios based on *Schillinger et al. (2017) [4]*)



References

- [1] BFE (2017): *Schweizer Elektrizitätsstatistik 2008-2015*.
- [2] BFE (2016): *Statistik der Wasserkraftanlagen der Schweiz (2008-2016)*.
- [3] Piot M. (2017): *Wirtschaftlichkeit der Wasserkraft in der Schweiz*, in Wasserwirtschaft 1/2017.
- [4] Schillinger M., Weigt H., Schumann R., Barry M. (2017): *Hydropower operation in a changing environment*. SCCER-CREST WP3 Working Papers.
- [5] Swissgrid: Geschäftsberichte (2009-2016)

- [6] <https://www.iorcf.eu> (2017): *Daily Forecasts of Power Spot Prices and Hourly Price Forward Curves for Market Areas Switzerland, France, Germany/Austria, Germany, Austria*; ior/cf-HSG, University of St.Gallen.

- [7] Frauendorfer K., Schürle M. (2017): *Das Erlöspotenzial der Schweizer Grosswasserkraft*, Studie im Auftrag der Regierungskonferenz der Gebirgskantone; ior/cf-HSG, Universität St.Gallen ([Link](#)).

Thank you
for your attention.