



File Bearbeiten Ansicht Chronik Lesezeichen Extras Hilfe

Publikationsdatenbank News — Energy Economics Group IEWT 2021











https://iewt2021.eeg.tuwien.ac.at



# IEWT 2021

## Das Energiesystem nach Corona: Irreversible Strukturänderungen - Wie?

8. - 10. September 2021 | Karlsplatz & Online | TU Wien



[Home](#) [Award-Verleihung](#) [News](#) [Programm](#) [Account Registrierung](#) [Call for Papers](#) [Sponsoren](#) [Themen](#) [Infos](#) [Kontakt](#) [Login](#)


## Das Energiesystem nach Corona: Irreversible Strukturänderungen - Wie?

# IEWT 2021

12. Internationale  
Energiewirtschaftstagung  
an der TU Wien

8. – 10. September 2021  
Wien, Österreich

Tagungsort:  
TU Wien & Virtuell



65%

14°C Sonnig

14:51  
29.10.2021

# Market potentials for new flexibility products for the Continental European power system

Topic: Grid modeling and security of supply

G. Lettner<sup>1</sup>, C. Corinaldesi, C. Loschan, W. Gawlik<sup>(1)</sup>, G. Irsigler, M. Urlesberger<sup>(2)</sup>, A. Stimmer, M. Lenz, M. Froschauer, M. Leonhardt, E. Obererlacher<sup>(3)</sup>,

<sup>(1)</sup>TU Wien - Energy Economics Group, <sup>(2)</sup>Verbund Energy4Business GmbH, <sup>(3)</sup> Austrian Power Grid

## Motivation

Due to the increasing penetration of inverter-based generation and the associated reduction in the number of conventional plants with synchronous generators, the network time constant ( $T_A$ ), which corresponds to the overall inertia in the system, will continue to decrease in the future. As a result, power systems will become increasingly unstable and there is a risk that the currently used primary control reserves (Frequency Containment Reserves, FCR), may not be able to stabilize the frequency in the event of a sudden power imbalance. For this reason, the need for remedial measures is foreseeable. These could include the introduction of new fast control reserves, which have been investigated in this paper.

## Methodology

In order to derive recommendations for the fast control reserves concepts [1]:

- Frequency Containment Reserve „Plus“ (FCR+),
- Enhanced Frequency Response (EFR),
- Synthetic Inertia (SI) and
- Fast Active Power Injection (FAP)

different implementation scenarios were developed and evaluated, taking into account parallel developments [2] [3]. In a first step, analysis were carried out with the help of the electricity market model EDisOn+ [4] to estimate the network time constant that can be expected in the Continental European Power System (CE) in the future. The input data for the market model was used from the TYNDP 2020 scenarios "National Trends" (NT) and "Global Ambition" (GA) [5]. For comparison purposes, additional analysis of the network time constant for the years 2017 to 2019 were carried out using CE generation data from the ENTSO-E Transparency Platform [6]. Based on the fast control reserve concepts FCR+, EFR, SI and FAPI, the market model results and estimated amounts of the fast control reserves, the procurement of fast control reserves via energy markets was assessed with uniform criteria. The qualitative assessment was taken into account on the following criteria:

- Market integration
- Market liquidity
- Market entry
- Price valuation
- Market rules.

Procurement was also analyzed for different scenarios:

- (1) Procurement under the existing FCR tender.
- (2) Tender with symmetrical products
- (3) Tender with asymmetric products (supply | purchase)
- (4) Certificate trading.

## Results

Figure 1 shows a comparison of the annual duration curves of  $T_A$  for the years 2017 to 2019 and the TYNDP 2020 scenarios "National Trends" (NT) and "Global Ambition" (GA). The scenarios show a significantly decreasing and more volatile  $T_A$ . The decrease and greater volatility of  $T_A$  is directly connected to the increasing amounts of inverter-based generation. For about 30 % of the scenario years

---

<sup>1</sup> TU Wien - Energy Economics Group, Gußhausstraße 25-29/E370-3, A-1040 Wien, Tel.: +43-(0)1-58801-376, [lettner@eeg.tuwien.ac.at](mailto:lettner@eeg.tuwien.ac.at), [www.eeg.tuwien.ac.at](http://www.eeg.tuwien.ac.at)

NT2030 and GA2030,  $T_A$  becomes smaller than 6 s, which can potentially lead to critical frequency drops below 49 Hz for reference outages of 3000 MW, if no other frequency supporting measures are active. Accordingly, the share of low network time constants increases up to approx. 40 % in the scenario years NT2040 and GA2040.

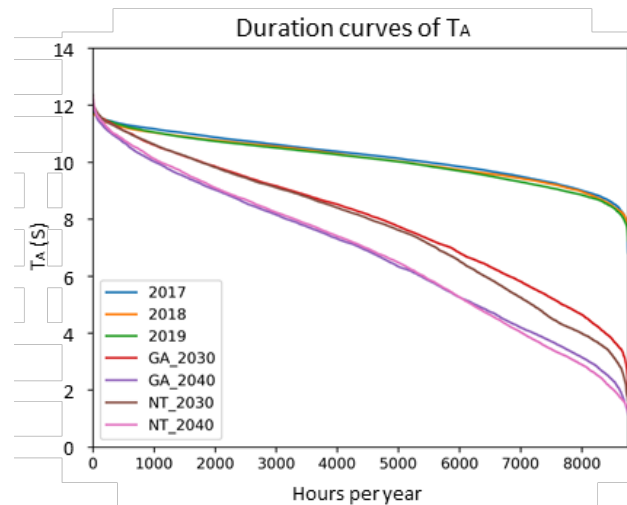


Figure 1: Annual duration curves of the current and future network time constant

From the conducted qualitative assessment, an evaluation of the market suitability of the different types of fast reserve concepts was derived.

FCR+ could be procured as a subset in the existing FCR tenders, opening up synergies regarding market integration and market rules.

EFR could be particularly suitable for suppliers that have difficulties to participate in the currently existing primary control reserve markets. In the case of an asymmetric product design, even controllable loads could participate in such a market.

Due to the complexity of the concept of SI, certificate trading appears to be more advantageous than a tender concept via a symmetrical product design.

A combined evaluation of market aspects, operational aspects and the underlying concept (activation based on a static frequency trigger) shows that FAPI is the least favorable option for a market implementation.

Acknowledgements: The project "ABS4TSO" [7] is funded by the Climate and Energy Fund and carried out within the framework of the Energy Research Programme 2017.

## Literature

- [1] Alacs et al., "MÖGLICHE UMSETZUNG VON SCHNELLEN REGELRESERVEN IM KONTINENTALEUROPÄISCHEN VERBUNDSYSTEM", [https://www.tugraz.at/fileadmin/user\\_upload/tugrazExternal/4778f047-2e50-4e9e-b72d-e5af373f95a4/files/kf/Session\\_C6/363\\_KF\\_Alacs.pdf](https://www.tugraz.at/fileadmin/user_upload/tugrazExternal/4778f047-2e50-4e9e-b72d-e5af373f95a4/files/kf/Session_C6/363_KF_Alacs.pdf)
- [2] ENTSO-E, "Fast Frequency Reserve – Solution to the Nordic inertia challenge", 2019, <<https://www.epressi.com/media/userfiles/107305/1576157646/fast-frequency-reserve-solution-to-the-nordic-inertia-challenge-1.pdf>>.
- [3] National Grid, "Dynamic Containment – Industry Information", 2020, <<https://www.nationalgrideso.com/industry-information/balancing-services/frequency-response-services/dynamic-containment>>.
- [4] B. Dallinger, "Model-based Analysis and Design of an improved European Electricity Market with high shares of Renewable Generation Technologies", Dissertation, Technical University Vienna, 2018, <<http://repositum.tuwien.ac.at/obvutwhs/download/pdf/3381277>>.
- [5] ENTSO-E, "TYNDP 2020 Scenario Report", 2020, <[https://www.entsos-tyndp2020-scenarios.eu/wp-content/uploads/2020/06/TYNDP\\_2020\\_Joint\\_ScenarioReport\\_final.pdf](https://www.entsos-tyndp2020-scenarios.eu/wp-content/uploads/2020/06/TYNDP_2020_Joint_ScenarioReport_final.pdf)>.
- [6] ENTSO-E, "Transparency Platform", 2020, <<https://transparency.entsoe.eu>>.
- [7] <https://www.apg.at/de/projekte/abs4tso>