Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
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Department of the Environment,
Transport, Energy and Communication DETEC

Swiss Federal Office of Energy SFOE
Energy Research

Annual report from 25. November 2022

IEA ISGAN TCP

Schweizer Beteiligung

Date: 25. November 2022

Place: Bern

Publisher:
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SFOE contract number: SI/502199-01

Contents

1 Introduction

The ISGAN Academy offers the ISGAN community of high-level engineers and decision makers a means of rational and efficient continuous technical skills complement and update in the field of Smart Grids. Through an e-learning platform, experts in the field of Smart Grids presents different webinars on topics of power system fundamentals to more specialised courses on breakthrough smart grids solutions. The information presented includes recent developments, best practices, interesting methodologies, smart grids theory, applications, deployment, events, etc.

2 Goal of Project

According to the Energy Act of January 2018 and the Federal Council decision of August 2019, the general goals for the Swiss energy system is to exit nuclear power and reach zero net greenhouse gas (GHG) emissions by 2050. According to the energy perspectives of the Swiss Federal Office of Energy (SFOE), this will be achieved by increasing the share of renewable energy sources while increasing the energy efficiency.

The implementation of this strategy drives the following (but not limited to) trends: (i) increasing proliferation of variable renewable energy sources (VRES), mainly in a distributed fashion, (ii) increasing electrification of energy demand, i.e. heating and transportation, which leads to a significant increase in both peak and total electricity demand, and (iii) as a result of (i) and (ii), increasing need in techno-economically feasible ways to utilize the available sources of flexibility so that the costs of the energy supply as well as infrastructure investments are minimized.

All these developments put tremendous stress on the energy suppliers and system operators that are responsible for balancing the supply and the demand. As such, they require massive and costly adaptations to the energy infrastructure. The transition also brings along the need for complex new planning, operation, market and ownership models, as well as the need for new regulations to facilitate these models.

FEN, acting as a bridge between academia and the industry, conducts and has been conducting several research activities in this direction. Some of these activities have been performed as an integral part of Swiss participation in the ISGAN activities in the period of 2011-2020. These activities include following:

- In Annex-6, FEN has partly contributed to the TSO-DSO interaction where current interaction between TSOs and DSOs has been investigated for six specified grid operation challenges, and possible future ways of cooperation have been identified.
- Annex-8 activities were more dedicated to offer high-level engineers, decision makers, students and public in general a means of rational and efficient continuous technical skills complement and updates in the field of smart grids.

By exploiting international experiences and insights, the results of this project will continue to provide useful insight to Swiss policymakers and energy stakeholders also for (i) devising future grid investment and operational strategies leveraging the value of flexibility, (ii) decreasing the cost of DER ownership as a result of new potentials of revenue streams by providing flexibility services, and (iii) devising appropriate targets and regulations towards achieving the targets of the Energy Strategy 2050 in the most economic and environmentally friendly manner.

3 Summary of Work Performed in 2022 and Achieved Results

3.1 Annex-VI: Power Transmission and Distribution Systems

3.1.1 Participation and contributions to monthly meetings

The monthly meetings serve as a contact point between the members of Annex-VI, to exchange information on recent projects, inform about ongoing collaborations (like ISGAN surveys/reports) or initiate collaborations beyond ISGAN.

In general ETHZ-FEN contributed to the discussions, collected information for ongoing projects and forwarded ideas, concepts and interesting project reports to other project partners within Switzerland.

The range of topics in these meetings with significant interactions has the following highlights:

- **Sector Coupling:**
  Discussions were held on Sector Coupling as a bridge for seasonal flexibility, decarbonization of heating and as a storage for excess PV. On a local level, Sector coupling serves for diversification of household energy sources. On a global level, Switzerland is developing its own Hydrogen policy and subsidy scheme, a topic that ETHZ-FEN is also involved in. The framework also includes the integration of Switzerland in a future European Hydrogen grid.
- **TSO-DSO interaction:**
  ETHZ-FEN shared the perspective of Swiss TSO-DSO interactions and encouraged the Annex-VI working group, to broaden the topic to include the interaction between larger DSOs (DSO-DSO interaction) and neighboring TSOs, since they face similar challenges. The discussion lead to the contribution to a ISGAN working paper on „Flexibility Harvesting for TSO-DSO interaction“(see the summary in the following section).
- **Local Markets for flexibility:**
  The overall topic of local markets for flexibility cover a broad range of flexibility applications, varying in size, range (local or global objectives) and time (fast and short or slow and long-term). For instance, aggregation of secondary frequency reserve or flexibility for TSO-redispatch serves a global purpose, while flexible reactive power support from converters is a local application. A potential market for dynamic support from converters has both local and global aspects, but is a very fast. ETHZ-FEN encouraged to differentiate between these flexibility applications and also keep the local markets focused on local aspects. Furthermore it was brought up, that flexibility is often seen as complement or alternative to grid upgrade. This can only be done with a reliable regulatory framework, allowing the DSOs to estabish long-term contracts for the access to flexible units.

3.1.2 Contribution to the Report on „Flexibility Harvesting for TSO-DSO interaction“

The activity included participation in monthly meetings to discuss and the design the content with all partners involved, to select the material for contribution, and to harmonize the content of the chapter we were responsible for. The report of the TDFlex project funded by the Swiss Federal Office of Energy, focusing on the services offered by small distributed energy resources to the TSO (excluding the service to the DSO), is used for contributions:

- C.Y. Evrenosoglu, J. Garrison, A. Fuchs and T. Demiray, TDFlex – TSO-DSO Flexibility: towards integrated grid control and coordination in Switzerland, Swiss Federal Office of Energy, Final Report

SI/501735, 2022.[Final report on the SFOE website]

The information extracted from the report is condensed and used in the following sections and chapters:

- Section 3.3 on **Aggregation of the flexibility** in Chapter 3 on **TSO-DSO Stakeholders and Topologies**
- Chapter 4 on **Benefits of flexibility and stakeholder interaction**

FEN acted as the coordinator for Chapter 4, which summarizes the benefits of utilizing the aggregated flexibility within the context of two projects, TDFlex and FlexPlan (H2020), and addresses the topic from the following perspectives: technical, economic, and ICT, regulatory. Following is the summary of how the content from the two projects is integrated:

- transmission system ancillary services (TDFlex): Can aggregated DER flexibility be competitive in ancillary markets day-ahead or intra-day by relying on the flexibility provided by the distributed energy resources so that it is to the benefit of the overall system?
- transmission system operation (TDFlex): Is it technically and economically feasible for aggregated der flexibility at the TSO-DSO substation to help line loading and voltage profiles throughout the transmission grid so that it brings benefit to the overall system operation?
- grid infrastructure planning (FlexPlan): Is it technically and economically feasible to use new storage and flexibility resources in electricity grids as an alternative to building/reinforcing grid elements (lines and transformers)?

3.2 Annex-VIII: ISGAN Academy

As part of our activities in Annex-VIII, three presentations are reviewed and the feedback is provided to the Academy. Following is the list of the webinars and the associated links to the video recording as well as to the dedicated ISGAN website. The feedback for each webinar is attached in the Appendix.

- **5 April 2022** Demonstration of grid forming capabilities and synchronisation services. [Webinar recording] [ISGAN Website]
- **5 July 2022** Recommendations to pave the way for harmonised European flexibilities markets [Webinar recording] [ISGAN Website]
- **29 September 2022** Modeling and control of renewable energy power plants for participation in a Dynamic Virtual Power Plant. [ISGAN Website]

4 Appendix

4.1 Table of content of the ISGAN discussion paper report on ”Flexibility harvesting and its impact on TSO-DSO interaction”

The table of content is provided in this section. The input for the report is being consolidated by the coordinator and the content is being harmonized.

CLEAN ENERGY MINISTERIAL

iea-isgan.org

ISGAN
INTERNATIONAL SMART GRID ACTION NETWORK

Power Transmission & Distribution Systems

Flexibility harvesting and its impact on TSO-DSO interaction

Discussion paper

Author a, Author b, Author c
ISGAN Annex #

December 2022

Table of Content

4.2 Evaluation of ISGAN Academy webinars

The submitted evaluation forms are attached in this section.

Webinar Evaluation Form

The presented document is aimed to make easy the evaluation of the presentations proposed for the ISGAN Academy Webinar series. By analysing the corresponding slide deck, please consider the mentioned aspects and, possibly, explain your position. The listed questions represent the minimum appraisal set; please, feel free to include any comment you may have on the presentation. Thanks for your support.

The feedback provided to the Webinar Speakers is anonymised as produced by the ISGAN Academy Committee.

Title: Demonstration of grid forming capabilities and synchronisation services.
Does the slide deck fit with the webinar title?
Yes
Is the image quality sufficiently high?
Yes
Does each slide deliver a clear message?
Is the presentation easy to understand/self-consistent?
Yes
Is the presentation too long/short?
Ok
What do you like about the presentation?
Demonstrations
What do you dislike about the presentation?
Audience would benefit from a discussion on how to scale up, cost and the ownership of BESS. Discussion on the cost of equipping BESS with grid-forming converters.
Please, list the errors, improvements that you suggest to specific slides.
Slide 41: I guess “MWA” should be either “MW” or “MVA” Slide 46: “UE” → “EU”
Please, provide here any other comment you may have on the presentation

Webinar Evaluation Form

The presented document is aimed to make easy the evaluation of the presentations proposed for the ISGAN Academy Webinar series. By analysing the corresponding slide deck, please consider the mentioned aspects and, possibly, explain your position. The listed questions represent the minimum appraisal set; please, feel free to include any comment you may have on the presentation. Thanks for your support.

The feedback provided to the Webinar Speakers is anonymised as produced by the ISGAN Academy Committee.

Title: Recommendations to pave the way for harmonised European flexibilities markets
Does the slide deck fit with the webinar title?
Yes
Is the image quality sufficiently high?
Yes
Does each slide deliver a clear message?
Yes
Is the presentation easy to understand/self-consistent?
ok
Is the presentation too long/short?
Ok
What do you like about the presentation?
What do you dislike about the presentation?
Please, list the errors, improvements that you suggest to specific slides.
The 7 aspects on Slide 9 are revisited throughout the presentation. Maybe it would be easier for the audience to follow if the authors find a way to remind the audience that they are actually referring to the items in that list when they progress in the presentation. This can be done by using the enumeration in the relevant slides. Example 1: Slide 17 refers to Item #1 on Slide 9 Example 2: Slide 19 refers to Item #2 on Slide 9 Example 3: Slide 22 refers to Item #3 on Slide 9 ...

Please, provide here any other comment you may have on the presentation

Webinar Evaluation Form

The presented document is aimed to make easy the evaluation of the presentations proposed for the ISGAN Academy Webinar series. By analysing the corresponding slide deck, please consider the mentioned aspects and, possibly, explain your position. The listed questions represent the minimum appraisal set; please, feel free to include any comment you may have on the presentation. Thanks for your support.

The feedback provided to the Webinar Speakers is anonymised as produced by the ISGAN Academy Committee.

Title: Modeling and control of renewableenergy power plants for participation in a Dynamic Virtual Power Plant
Does the slide deck fit with the webinar title?
- Yes
Is the image quality sufficiently high?
- Except for the one-line diagram in “Appendix”.
Does each slide deliver a clear message?
- Not necessarily. Refer to the box below.
Is the presentation easy to understand/self-consistent?
- Not necessarily. Sudden jumps without appropriate connections.
Is the presentation too long/short?
- Long
What do you like about the presentation?
What do you dislike about the presentation?
Please, list the errors, improvements that you suggest to specific slides.
- It would be helpful if take-away messages or emphasis on Slides 41 – 44 are provided - Using s-functions: good for prototyping but not suitable for implementation. Since the proposed method is for time-critical applications, it would be nice if they elaborate on how this method can be deployed in industrial applications. - The content of Slide 45 and the title of the slide do not match, at least not clear to this reviewer.

- Slide 38: IT would be nice to elaborate on the following statement: “TS controller shows a much better performance”. Why? Was it expected or not? [for a nonlinear system, isn’t it expected that the LTI model will perform worse, inherently, than the exact TS model?
Please, provide here any other comment you may have on the presentation