Schweizerische Eidgenossenschaft
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Federal Department of the Environment,
Transport, Energy and Communications DETEC

Swiss Federal Office of Energy SFOE
Energy Research and Cleantech

Research Programme Grids
Call 2023 for Research Proposals

Full proposals accepted for funding

CALL TOPIC 1: GRID PLANNING AND OPERATION

Title:	**DiG-A-Plan – Tool for Distribution Grid Asset Planning under Uncertainties of Load Configuration and Flexibility Provision**
Main applicant:	Haute École d'Ingénierie et de Gestion du Canton de Vaud (HEIG-VD), Yverdon, Prof. Dr. Mokhtar Bozorg
Project duration:	01.09.2023 – 31.12.2025
Abstract:	This project aims to develop and validate a novel risk-based tool for planning the reinforcement, replacement, and expansion of distribution grid assets. To this end, we first quantify both known and unknown uncertainties associated with load configuration, including the deployment of electric vehicles, photovoltaics, and heat pumps, as well as the flexibility provided by prosumers. We then propose a multi-stage distributionally robust optimization model that integrates the quantified temporal and spatial uncertainties into a tractable optimization framework to find cost-effective grid asset planning, preferring known risks to unknown ones. The impacts of uncertainties on grid operation are evaluated by accounting for increased voltage levels, overloading of branches, and the aging of transformers. The effectiveness of the proposed method is tested on three real-world case studies, provided by Groupe E, Yverdon Energies, and Services Industriels Lausanne, using appropriate reliability and resilience metrics in plausible scenarios of energy transition.

Title:	**earlyWARN – A Data-Driven Real-Time Dynamic Security Assessor and Early Warning System for TSOs**
Main applicant:	Zürcher Hochschule für Angewandte Wissenschaften (ZHAW), Winterthur, Prof. Dr. Petr Korba
Project duration:	01.11.2023 – 01.11.2026
Abstract:	The high proliferation of converter-interfaced generation at all voltage levels at the expense of fewer conventional plants at the transmission level will affect the traditional stability boundaries defined by indices such as rate-of-change-of-frequency, frequency nadir, frequency recovery time, etc. Transmission system operator's (TSO) need for a fast dynamic security assessor is imminent in such a habitat where the location and the amount of electricity generation stochastically change daily and seasonally. The project will develop a fast AI/ML-based real-time dynamic security assessor (rtDSA) that can be deployed in the control room of a TSO as part of the SCADA/EMS. The primary role of the rtDSA will be to continuously scan grid's key performance indices (KPIs) and act as an "early warning system" for operators to take preventive actions proactively. The AI/ML-model will be developed using the ENTSO-E dynamic model, while appropriately considering the future scenarios for energy/infrastructure, and modelling resources connected at lower voltage levels. Swissgrid's involvement will ensure the developed solution satisfies practical requirements and is deployable, while Hitachi Energy will provide vendor insights for scalability.

Title:	**Formidable – Community-Microgrid with Grid-Forming Inverters Equipped with Improved Damping and Virtual Inertia: Their Role on Grid Reliability and Resilience**
Main applicant:	Haute École d'Ingénierie et de Gestion du Canton de Vaud (HEIG-VD), Yverdon, Prof. Dr. Mauro Carpita
Project duration:	01.10.2023 – 30.09.2025
Abstract:	The project aims to explore the role of community microgrids in enhancing the reliability and resilience of the grid. A community microgrid coordinates several grid-forming inverters (GFMIs), equipped with improved damping and virtual inertia, within a distribution grid in both standalone and grid-connected operational modes. Through simulations and experimental validation, this study will propose a decentralized control strategy for GFMIs within a community microgrid. The project will investigate the advantages and effectiveness of the proposed community microgrid framework, including improved grid reliability and resilience as well as supporting grid restoration. The project will also examine the technical risks of voltage instability, load imbalance, and short circuits in both operational modes to determine adequate control measures and protection strategies.

Title:	**PLANET – Optimal use of the technical rules in efficient grid planning**
Main applicant:	Berner Fachhochschule (BFH), Biel, Prof. Michael Höckel
Project duration:	01.11.2023 – 28.02.2027
Abstract:	The growing electrification and the integration of renewable energy in-crease the complexity of grid planning. This affects both grid utilization and power quality. Grid connections are therefore assessed by the distribution grid operators in accordance with the technical rules for the assessment of network disturbances DACHCZ. In this context, the assumed simultaneity of certain types of customer installations plays an important role. The lack of knowledge about simultaneity factors can lead to grid bottlenecks or unused reserve capacities. Therefore, the project analyzes the use of the new version 3 of the technical rules in co-operation with the distribution system operators as well as the applied methods and tools. The practice of assessing connection requests is compared with measurements in distribution grids. The project provides complementary recommendations for the assessment according to the technical rules. The results also include an open-source software tool to support connection assessment. In addition, reference values for simultaneity factors and utilization rates for different grid areas and types of installations are given to support a cost-efficient grid planning.

Title:	**PROPER-Grids – Probabilistic Risk-informed Operational Scheduling for Power Grids**
Main applicant:	Scuola universitaria professionale della Svizzera italiana (SUPSI), Mendrisio, Dr. Roberto Rocchetta
Project duration:	01.12.2023 – 31.05.2026
Abstract:	Achieving sustainability and decarbonization goals requires efficient planning and scheduling of power grid operations while managing risks and uncertainties. Well-established industrial practices often overlook rare event risks and rely on deterministic N-1 methods. However, these methods neglect vital information on disturbance frequencies and uncertainties in operational and weather conditions, leading to inadequate and costly responses to varying risks. Inspired by probabilistic machine learning advancements, this project introduces an innovative approach for efficient Probabilistic Risk Assessment (PRA) and risk-informed operational planning. A specialized sampler will estimate the probability of rare events, assessing operational-environmental risks and low-probability cascading incidents. The framework integrates a cascading failure simulator and forecasting module, forming the backbone for risk-informed grid planning and scheduling under uncertainty. By comparing the risk-informed approach with deterministic methods, this project aims to achieve more profitable operational schedules and contribute to resilient, sustainable, and economically viable power grids.

Title:	**RESILIENT – Security-informed power system expansion planning for a net-zero Swiss energy transition**
Main applicant:	ETH Zürich, Dr. Christian Schaffner
Project duration:	01.01.2024 – 31.01.2026
Abstract:	The objective of this project is to investigate the impacts of security-informed generation and transmission expansion planning of the Swiss net-zero energy transition within a European context. The analysis includes evaluating a range of uncertain future transition pathways, assessing the uses of flexibility and proposing alternative planning procedures. The main scientific novelties are: 1) identification of candidate transmission system branches using a systematic procedure, 2) coordinating the planning of generation and transmission expansion by considering both a cost and a risk-based perspective and 3) computational tractability which allows investigating the Swiss power system in full detail. Through our partnership with Swissgrid, this work aims to provide methods and planning tools that will be implementable additions to the existing Swissgrid ‘Strategic Grid’ evaluation. Furthermore, we aim to make the developed tool open-source and thus reach a wider community of researchers and practitioners.

Title:	**RESTART – Novel Restoration Approaches for Grids with a high share of Renewables and Converter Technologies**
Main applicant:	ETH Zürich, Dr. Turhan Demiray
Project duration:	01.10.2023 – 31.03.2026
Abstract:	This project focuses on the future restoration process after partial or complete blackouts of the Swiss electricity supply system. Based on a thorough review of established Swiss restoration procedures with industry experts, representative case studies are defined to capture restoration challenges, in particular involving converterbased active grid components (RES, BeV-charging, BESS). Each case study characterizes a potential development of the restoration process under varying grid conditions. A hierarchical assessment of the procedural sequence, load flow security, and dynamic/electromagnetic transient stability are performed using established tools of the project partners. The goal is to quantify the security characteristics and to recommend an evolution of the current procedures. The roadmap will account for the risks (uncertain behavior, transients) but also potential restoration support (e.g., from microgrids) from the new power grid structure. The project is carried out in close collaboration with the project partners, involving Swissgrid, DSOs and industry associations, to ensure maximal relevance of the investigations.

CALL TOPIC 2: PLUG & PLAY PHOTOVOLTAICS

Title:	**Plug & Play PV – Plug & Play Photovoltaic Systems**
Main applicant:	Berner Fachhochschule (BFH), Burgdorf, Prof. Dr. Christof Bucher
Project duration:	01.09.2023 – 31.08.2025
Abstract:	Plug & Play photovoltaic systems are becoming increasingly popular. Because they are not installed systems but consumer products, their regulatory treatment is challenging. The "Plug & Play PV Systems" project aims to address the most important issues relevant to Switzerland. Because this requires many different stakeholders, the project group consists of Meteotest (calculating the potential for Plug & Play PV systems), VSE and BKW (assessing the systems from the grid operator's point of view), ESTI, electrosuisse and VSEK (assessing the safety of Plug & Play systems), as well as the BFH, which is leading the project and answering normatively unresolved safety questions in laboratory tests. The PV industry will be represented in the project by three partners with many years of experience with Plug & Play PV (Energie Genossenschaft Schweiz, hassler energia, Solarblitz). The aim of this project is, on the one hand, to propose pre-normative rules and, on the other hand, to draw up proposals for the regulation of installations from the point of view of VSE, electrosuisse and ESTI, well consulted in the consortium.