Conference Proceedings

ComForEn 2023

12. Symposium Communications for Energy Systems

„Major challenges on the way to an interoperable energy system“

15. – 17. March 2023
Vienna, Austria and online

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ComForEn 2023
12. Symposium Communications for Energy Systems

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Greetings

The digitalisation of the energy sector needs to take up some more momentum. In the year 2023, we are still discussing to speed up grid connection requests in Europe by an increased level of automation, a.k.a. digitalisation. We should be much further.

Why is the advance so slow, or at least so diverse? One possible answer is: due to complexity. Many actors, many objectives, many processes, many practices, many regulations, many opinions, and many solutions. But how can we escape the complexity trap in which we seem to be caught for a decade or so? Whatever we do, we should at least design interoperable solutions.

Interoperability is the ability of actors, components, and applications to collaborate by exchanging data and information. The next generation of energy systems is expected to integrate many new technologies and applications (demand-response, flexibility services, market participation) across different energy vectors (electricity, heat, gas, mobility, transport) and to guarantee reliability, sustainability, efficiency, and affordability of the system. Thus, Interoperability among those domains, technologies, and applications is a major success factor for ensuring compliance with these requirements.

The AIT Austrian Institute of Technology, TU Wien, and the OVE have invited experts from academia and industry to promote research and development as well as to discuss the major challenges on the way to an interoperable energy system. ComForEn 2023 is aimed at component and system manufacturers, power grid operators, energy suppliers, and research institutions. These proceedings are the testimonial of topics and potential answers to the question: how can we speed up the digitalisation of the energy sector?

We wish you a very enjoyable visit at the symposium, many insights, and many inputs for your own work.

Friederich Kupzog

Mark Stefan

AIT Austrian Institute of Technology GmbH
Center for Energy

Stefan Wilker

Technische Universität Wien
Institute of Computer Technology

We would like to thank the organization team!

Roman Eichinger, Christian Gasser, Yasmin Schlichtinger, OVE

Carina Schöfl, TU Wien

Workshops Day 1

15.03.2023

Interoperability by Design – From Theory to Practice

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Mark Stefan, AIT Austrian Institute of Technology GmbH, mark.stefan@ait.ac.at

Workshop description

Interoperability is a key prerequisite of the digital transformation of energy systems. Some of the major challenges in the way to achieving a seamless integration with a high interoperability maturity level are not following a well-defined methodology. The first part of the workshop presents a methodology – the AIT (Virtual Verification Laboratory) VLab, which is based on the principle of interoperability by design. The principle advocates that interoperability must be considered from the very beginning of the solution design and should be followed through all the life-cycle phases. It works by defining a common view of the system first so that the functional objectives of the solution can be aligned with what needs to be implemented. This methodology is being used in the **Horizon 2020 project SENDER**. In the second part of the workshop, participants are invited to try out the methodology and related toolkit by integrating components into a provided environment. This environment consists of a virtual representation of a simple energy system with several actors (e.g., grid operator, energy supplier, customer) and a predefined use case.

Moderators

Dr. techn. Jawad Kazmi is currently working as a Scientist in the Center for Energy at AIT Austrian Institute of Technology. He received his Ph.D. Degree from Technical University Vienna in 2017. His research interests include requirements engineering, ICT architecture design, and analysis, interoperability, verification, and validation topics. He has been active on these topics and has been contributing to many European and Austrian research projects including InterFlex, LargGo!, SENDER, CLUE, RESili8, DigIPlat, ECOSINT, CLUE, etc. He is also one of the lead developers of AIT Lablink and the AIT VLab framework.

Dr. Mark Stefan studied computer science at the Vienna University of Technology. He started his professional career at Robert Bosch AG in Vienna, where he worked as a software and function developer for 2.5 years. In 2012, he moved to the Institute for Computer-Aided Automation at the Vienna University of Technology, where he worked as a project assistant and did his PhD-studies. He developed an algorithm for the optimization of railroad systems with respect to deadlock detection and avoidance as well as for the minimization of traction energy consumption. Since 2014, he has been working at the Center for Energy at AIT Austrian Institute of Technology GmbH as a Research Engineer and Project Leader. In 2019, he was appointed Senior Research Engineer as well as Thematic Coordinator in the Power System Digitalization research area. His professional focus is on digitalization topics as well as on energy communities.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 957755.

What is interoperability? Views and needs from a stakeholders' perspective

Ludwig Karg, B.A.U.M. Consult GmbH, l.karg@baumgroup.de
Rita Dornmair, B.A.U.M. Consult GmbH, r.dornmair@baumgroup.de
Andreas Corusa, B.A.U.M. Consult GmbH, a.corusa@baumgroup.de

Workshop description

The goal of our workshop is to discuss with different stakeholder groups in the energy system on a possible pathway towards an interoperable energy system.
The workshop will consist of three working streams. In the first part, we will discuss the roles of the different stakeholders and where interoperability is relevant to them, focused on data and which requirement specifications will be needed to establish a seamless exchange. The second working stream will focus on end-users. We will discuss types of users and the importance of interoperability for them – from the viewpoint of users as well as of the other stakeholders in the energy system. And finally, we will define mission statements for **int:net** regarding the involvement of end-customers in the development process of interoperability implementation.

Moderators

Ludwig Karg graduated with a master (Dipl. Inf. univ.) in Computer Sciences at the Technical University of Munich (1981). He gained practical experience in software engineering and held German and international positions in Intel Corp. for multimedia and network products. He is Managing Director of B.A.U.M. Consult GmbH (since 1993) and Chairman of INEM (International Network of Environmental Management). Mr. Karg led various research and development projects on sustainability and renewable energy usage in enterprises, municipalities and regions. Leading an international team of experts, he supports the ERA-Net Smart Grids Plus Initiative in more than 20 European countries.

Rita Dornmair holds a Dr.-Ing. in the field of energy systems/energy economics and a Dipl.-Ing. in Electrical Engineering and Information Technology from the Technical University of Munich. She is researcher and consultant at B.A.U.M. Consult. In international research projects, she works on flexibility in distribution grids, smart energy, energy communities and interoperability in energy systems. In accompanying research on research programs, she develops methods for evaluating project performance as well as impact on entire systems.

Andreas Corusa holds an MSc and BEng degree in Energy and Building Services Engineering and has several years of experience as Co-Founder, Entrepreneur and Consultant in Asia. He is consultant and researcher at B.A.U.M. Consult. In research projects and programs, he works on management and further development of digital collaboration and community platforms. He is involved in customer and citizen engagement processes and analyses in international research projects with focus on energy transition and digitization of energy systems.

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101070086.

Stakeholder Workshop on ICT Architectures for Energy Communities

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Oliver Langthaler, FH Salzburg, oliver.langthaler@fh-salzburg.ac.at
Max Schirl, FH Salzburg, maximilian.schirl@fh-salzburg.ac.at

Workshop description

This workshop is the follow-up to a stakeholder workshop which focused on the requirements imposed by the environment on local energy communities (LECs) and vice versa. These requirements can be broadly categorized as technical (e.g., grid-friendliness, usage of the existing system), ICT related (e.g., interoperability, security, privacy) or socio-economic (e.g., fairness). The intended system, referred to as **ECOSINT** solution, should facilitate the interaction between all relevant parties, specifically the LEC and its members, grid operators as well as external service providers.

Based on the requirements that have been identified as most relevant to the architecture, its creation has started and first results in the form of use case, component and sequence diagrams are available. A selection of these visualizations will be presented in this workshop as the basis for further discussion.

The main aim of the workshop is to receive feedback on the current iteration of the IT architecture and to determine the optimal direction for planned future work. First, it should be discussed if the currently existing system is accurately described. Based on this description, some first options for possible near-term extensions have been modelled. At this stage of the process, various options for further development are possible. Therefore, the workshop should result in input regarding the priority and relevance of these options. The format of the feedback part will include group discussions focusing on the identified topics to encourage and facilitate active involvement of the workshop participants. The workshop is mainly directed towards network operators, external service providers as well as current and prospective LEC members, but input from the general public is of course appreciated as well.

Moderators

FH-Prof. Priv.Doz. MMag. Dr. Günther Eibl holds diploma degrees in mathematics and physics and a habilitation in applied mathematics from the University of Innsbruck in 2021. Since 2013 his work focuses on privacy and security in the energy domain, primarily applying methods from data analysis and cryptography. In September 2022 he became head of the Center for Secure Energy Informatics (CSE) at FH Salzburg. Together with its research and company partners it is working on algorithms and architectures to make the digitalization of energy systems more secure and privacy-preserving.

DI Oliver Langthaler, BSc received his Master's degree in engineering from the Salzburg University of Applied Sciences in 2014. He then remained at the University as a researcher at the Center for Secure Energy Informatics, where he has been contributing to Smart Grid and energy-related research projects such as OpenNES, VirtueGrid, Future Network Tariffs and ECOSINT. He also founded cappatec, where he develops custom hard- and software solutions, including power metering infrastructure for DSOs. In 2019, he began to focus on LECs as a topic of research and to pursue a PhD at the Paris Lodron University of Salzburg.

DI Max Schirl, BSc studied Information Technology and Systems Management at the Salzburg University of Applied Sciences (SUAS) and finished in 2019. During his studies, he started to work at the SUAS as a Junior Researcher focusing on projects helping small and medium sized companies on their path to digitalization.
Since 2022, he is part of the team behind project ECOSINT and works on integrating privacy and security into the IT architecture of Austria's Local Energy Communities.

This project has received funding from the Österreichische Forschungsförderungsgesellschaft (FFG) under grant agreement No. 881165.

Workshop on Resilience for Cyber-Physical Energy Systems

Filip Pröstl Andrén, AIT Austrian Institute of Technology, filip.proestl-andren@ait.ac.at

Workshop description

Future energy systems will be characterized by a much higher degree of digitalization than today's systems. Digital solutions in the energy system are cornerstones for enabling increased penetration of renewable energies. For energy system operators, system resilience and security will always be of the highest importance. When energy systems are digitalized to a high degree on all levels, resilient and secure future energy systems can only be promised if a cyber-physical view is taken on all aspects.

During this workshop, **RESili8**'s vision on how to tackle this challenge with a resilience solution package will be presented and discussed. The agenda consists of an introduction to the **RESili8** project, followed by three talks highlighting different aspects that are important for resilient cyber-physical energy systems. The workshop is concluded with an open discussion round.

Moderator

Dr. Filip Pröstl Andrén MSc. Filip Pröstl Andrén studied Applied Physics and Electrical Engineering at Linköping University in Sweden where he received a master's degree in 2009. In 2018 he received his PhD in Computer Science at TU Wien on the topic of model-driven engineering for smart grids. Since 2009 he is working as a Scientist at AIT Austrian Institute of Technology, Center for Energy. He is specialised on smart grids and is working with control and information systems, power utility automation, and model-driven engineering.

Smart Energy Systems ERA-Net

This project has received funding in the framework of the joint programming initiative ERA-Net Smart Energy Systems' focus initiative Digital Transformation for the Energy Transition, with support from the European Union's Horizon 2020 research and innovation programme under grant agreement No 883973.

Interoperability Testing of Integration Profile Drafts – IES Showcase

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Reisenbauer Solutions GmbH, Vienna, (requested), https://reisenbauer.solutions/en/

Workshop description

Multi-level interoperability is required for a successful digitalisation of operational processes reaching across systems. Integrating the Energy System (IES) aims to harmonise the use of existing Smart-Energy-System standards and good practice for specific (problematic) use cases. Whereas certification approves conformity to specifications, presuming that conforming systems are interoperable, the interoperability assessment of the IES methodology is centred on peer-to-peer testing. In this side-event, taking place in parallel to the symposium welcoming pass-by visits any time, we showcase exemplarily how peer-to-peer interoperability testing is possible in a ‘garage-setting’, i.e., without the test platform assumed available in the future.

The aim of end-to-end interoperability testing is to support the different developers of interconnected systems that shall cooperate with peer systems. Sunken costs due to misunderstood specifications shall be prevented. Thus, prototype implementations of the integration profiles shall be tested directly among the peer developers from the different system producers and vendors, to enable solving of identified flaws on site and repeating the tests until successful. The feedback from participating peer developers triggers the continuous improvement of the integration profiles (technical specifications) toward maturity. The trial (draft) integration profiles actually tested on-site will be presented in the symposium session dedicated to interoperability testing.

Moderator

Dipl.-Ing. Dr.techn. Gerald Franzl received the academic degree Dr. techn. (eq. PhD) and Dipl.-Ing. (eq. M.Sc.) in Electrical Engineering from TU Wien Austria, in 2015 and 2002, respectively. Since February 2020 he is employed at TU Wien and University for Continuing Education Krems, contributing to the R&D projects SONDER and cFlex respectively, on energy communities and smart energy services. 2008 he achieved certification to Junior Project Manager (IPMA Level_D), 2015 to Process Analyst (PcA), 2016 to EBC*L Certified Manager, and ISTQB(r) Certified Tester (foundation level), 2017 to Digital Transfer Manager (DTM).

Symposium Day 2

16.03.2023

Keynote: The Challenge of Energy Systems Integration and Interoperability

Antonio Kung, Trialog, Antonio.kung@trialog.com

Abstract

As energy systems are increasingly interconnected, including with other domains (such as mobility, transport, cloud, or healthcare), there is a need for the support of dynamic and resilient systems which integrate AI and digital twin capabilities, which address complex cyber-physical systems, and which ensure trustworthiness (e.g. safety, security, privacy).
This talk will cover three challenges:

- The architecture of energy systems: it requires a system of system (SoS) and lifecycle approach to cover the integration of AI systems and digital twins. There is a need for common approaches to construct reference architectures.
- The interoperability of energy systems: it requires a wider view covering technical, structural, syntactic, semantic, organisational, knowledge-base and skills-based interoperability. There is a need for a methodology to construct interoperability, in particular to support data exchange.
- The trustworthiness of energy systems: it requires a wider view covering safety, security, privacy, resilience but societal concerns as well. There is a need for an approach to ensure trustworthiness, including to address the AI act (which calls for a trustworthy AI approach).

The presentation will conclude with considerations on conformity assessment.

Presenter

Antonio Kung is co-founder of Trialog. With more than 30 years of experience in the field of cyber physical systems and the Internet of Things, he brings expertise and know-how particularly on architecture, interoperability or data security and protection. He was the coordinator of numerous national and European collaborative projects in these fields. He is active in standardisation on the Internet of Things, security and data protection, and the editor of many standards (e.g. ISO/IEC 27550, 27556, 27561, 27570, 21823-3, 30149, 31700-2), including ISO/IEC 27568 Security and privacy of digital twins. He became CEO of Trialog in 2018. Antonio has a master degree from Harvard university and an engineering degree from Ecole centrale Paris.

Session 1

Interoperability in specific applications and role interaction

Session Chair: Friederich Kupzog

Stromausgleich Österreich: Plattform Flexibilisierung – Utilization of Decentralized Flexibilities in the Austrian Electricity Grid

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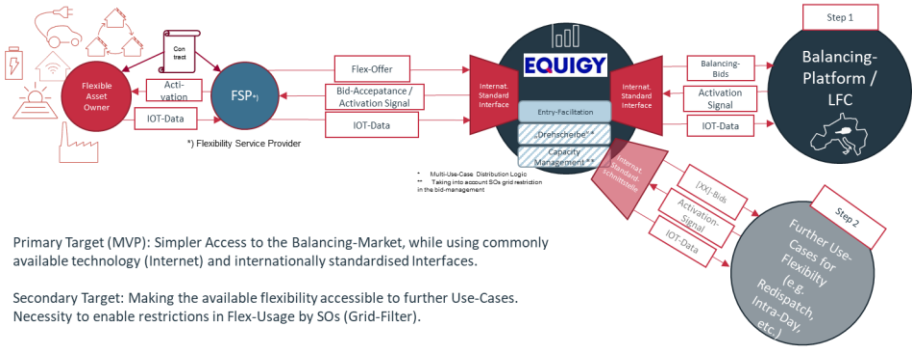
Lukas Obernosterer, Austrian Power Grid AG, lukas.obernosterer@apg.at

Abstract

By 2030, 100% of electricity consumption in Austria is expected to be covered by renewable energy sources. With this structural change, prosumers and small-scale flexibility resources will decentralize the power system and increase volatility. To ensure secure and efficient grid operation, high flexibility in the grid and the possibility to use local flexibility resources are needed. For this reason, APG is developing a new communication platform as part of the project *Stromausgleich Österreich: Plattform Flexibilisierung*, which will enable prosumers to market their flexibility via a uniform interface to different electricity markets. Cooperation between transmission- and distribution system operators is central in this context.



For the implementation of the new communication platform, APG joined the EQUIGY consortium (TenneT, SwissGrid, Terna, Transnet BW) and adopted the Crowd Balancing Platform. The new communication platform minimizes the implementation effort of the necessary

technical interfaces. Currently, a minimal version of the communication platform is being implemented. Project partners are implementing interfaces to the CBP and gain access to the secondary control energy market. For the next project phase, it is planned to both learn from the initial processes and product integration as well as evaluate the integration of other markets and further functionalities to the new communication platform. Close coordination between TSO and DSOs, Austrian energy industry and industry representants will be key to develop the best suited future market facilitation system.

The communication platform developed with EQUIGY represents a uniform solution to tap flexibility potentials in a low-threshold manner. For this purpose, technological and market-based standards are implemented with a shared, decentralized IT infrastructure. Close coordination and a shared governance structure among the network operators and standardized, non-discriminatory participation in the electricity markets are essential for successful implementation. The existing separation of roles will be maintained.

Presenters

Markus Riegler holds a master's degree of European Energy Economics from University of Applied Sciences, Kufstein. In 2011, he joined Austrian Power Grid AG where he first started working with the Procurement of Balancing Services. He is Senior Team Lead of the Team "System Balance", taking responsibility for the fields of Austrian Electricity Balancing System, Vertical Market Integration, and Development of potential future adequacy mechanisms (e.g.capacity markets). Further, he represents APG in ENTSO-Es Working Group Ancillary Services and Market Committee, as well as in national working groups and is actively involved in various of APG's national and international projects regarding flexibility use.

Lukas Obernosterer, MSc holds a master's degree of Energy Science and Technology from ETH Zurich, with research exchange at the National University of Singapore (NUS). In 2020 he joined Austrian Power Grid AG and is since handling the technical implementation of the CBP and is representing APG in various European working groups on harmonising and coordinating processes regarding the use of decentralised flexibilities in Europe.

Experience of energy consultants and energy provider access roles in the energy data exchange of Austria

Dr. Roland Kuras, PowerSolution Energieberatung GmbH, r.kuras@power-solution.eu

Abstract

In recent years, the energy market in Austria has changed due to digitalisation. Processes have been created in which consumption data can be exchanged between different participants. Consumption data is needed by energy service providers to advise companies on energy consumption, for example: Within an audit according to ISO 50001, to purchase electricity and gas with pool procurement or to carry out billing within energy communities.

Usually, the consumption data is provided in an csv-document containing the data in 15-minute steps. So far, this approach has proven to be the most practical and continues to be used, as few companies implement automatic data exchange. Currently, data can also be transferred via the EDA user portal. EDA stands for Energy Economic Data Exchange

PowerSolution Energieberatung GmbH obtains the consumption data of energy communities from the EDA user portal. As PowerSolution Energieberatung GmbH was one of the first to implement this process with the grid operator in Vienna, there were initial difficulties. On the grid operator's side and ours, the first step was to test how the processes work and what problems can occur, as there was no experience here yet.

Through close cooperation, all problems could be solved and experience gained for similar problems. At the beginning, activating a participant in the EDA user portal took several weeks, but now it can be done within days. Creating a new energy community also took weeks and is now possible within two weeks.

Unfortunately, the availability of data is not always 100% reliable, which means that the smart meter sometimes sends data incompletely and this cannot be transmitted correctly by the network operator. It is expected that these challenges will be solved in 2023 and that a secure data transfer will be in place.

Presenter

DI Dr. Roland Kuras, managing director of the company and former member of the regulatory commission at E-Control, has many years of experience in the field of energy consulting and energy contracting, as well as extensive knowledge of the various energy markets and their mechanisms.

Acknowledgement

The project SONDER has received funding in the framework of the joint programming initiative ERA-Net Smart Energy Systems' focus initiative Integrated, Regional Energy Systems, with support from the European Union's Horizon 2020 research and innovation programme under grant agreement No 775970.

Disclaimer

Realising URRLC for Smart Energy Network Services

Tasos Dagiuklas, London South Bank University (LSBU), UK
Panayiotis Alefragis, University of Peloponnese, Greece and LSBU, UK

Abstract

The growing introduction of DERs (Distributed Energy Resources) to the energy network translates to increased system stochasticity leading to the requirement of introducing new Demand Response schemes with faster response times (low latency) and fast ancillary services, where flexible assets at the edge of the energy grid are used to support network stability. Multi-Access Edge Computing (MEC) is one of the 6G enabling technologies proposed to meet the URRLC. Facilitating automation in the edge plays an important role in ensuring the smooth delivery of time-critical applications such as smart energy network services. This can be realised by orchestrating tasks by taking into account computing and communication dynamics, supporting live migration of Virtual Network Functions to maintain QoS and preventing deadlocks. This talk will present the use of MEC to dynamically map sensory information processing tasks near the physical information source allowing the realization of distributed smart energy services, like distributed Fast Frequency Response to be implemented.

Presenters

Professor Tasos Dagiuklas is a leading researcher and expert in the fields of smart Internet technologies. He is the leader of the Smart Internet Technologies (SuITE) research group at the London South Bank University where he also acts as the Head of Cognitive Systems Research Centre. Tasos received the Engineering Degree from the University of Patras-Greece in 1989, the M.Sc. from the University of Manchester- UK in 1991 and the Ph.D. from the University of Essex-UK in 1995, all in Electrical Engineering. He has been a principal investigator, co-investigator, project and technical manager, coordinator and focal person of more than 30 internationally R&D and Capacity training projects in the areas of Fixed-Mobile Convergence, 4G/5G/6G networking technologies, VoIP and multimedia networking. His research interests lie in the fields of Systems beyond 5G and 6G networking technologies, programmable networks, UAVs, V2X communications and cyber security for smart Internet systems.

Panayiotis Alefragis received the diploma and PhD degrees in electrical & computer engineering from the University of Patras, Patras, Greece, in 1995 and 2000, respectively. He was one of the founders and the managing director of Lyseis Ltd, a specialized software company for optimization software for the airline industry, with clients including, among others, Lufthansa AG, and AIMS. From May 2008, has joined the faculty of the Department of Telecommunication Systems, TEI of Mesolonghi and is currently associate professor with the Electrical and Computer Engineering Department, University of Peloponnese. He has more than 25 years of experience in software engineering and the design of optimization algorithms for very large scale problems in various application areas. His research interests include software engineering, parallel/distributed computing and systems, grid computing, programming languages and compilers, business rules modeling, resource scheduling algorithms, algorithm engineering, integer and combinatorial optimization, wireless / mobile network applications, and embedded design optimization. He was a member of winning teams in many international competitions related to resource scheduling problems, has coauthored more than 60 articles in refereed scientific journals & conference proceedings and he has extensive practical experience by participating in various national and international research projects in the above areas.

EDA energy data exchange – the Austrian way of decentralized data communication

Ing. Mag. Leo Kammerdiener, Energiewirtschaftlicher Datenaustausch GmbH, leo.kammerdiener@eda.at
Ing. Stefan Kienler BSc, Energiewirtschaftlicher Datenaustausch GmbH, stefan.kienler@eda.at

Abstract

What is EDA?
EDA is a secure, future-oriented, stable and cost-effective data exchange method that plays a pioneering role in the European energy market.
Specifically, EDA supports three aspects of the information chain: despatch, distribution and reception of a message in encrypted form in each case, and independent of the data format of the market message itself.
A uniform infrastructure is available to all companies from the Austrian energy sector, through which data or electronic documents can be exchanged in a uniform format and using a uniform communication protocol. This helps to avoid costs arising from individual agreements in the B2B integration of individual communication partners.

The EDA concept:
The secure, standardised and simple energy data exchange is based on the following principles:

- Standardised communication protocols
- Standardised data formats
- Standardised business processes

How does the data exchange work?
Further development of data exchange
Participants: Energy Service Providers, Energy communities, Energy Suppliers, Others
Connection types: User Portal, E-mail connectivity, Communication Endpoint

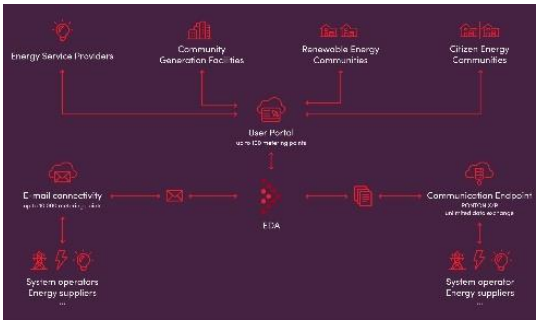


Figure 1. Decentralisation

Presenters

Ing. Mag. Leo Kammerdiener, CEO
Economics studies jn Vienna
1995 - 2006 auditing and tax consulting
2006 - 2002 E-Control Austria
Since 01.01.2021 managing director, EDA Energiewirtschaftlicher Datenaustausch GmbH

Ing. Stefan Kienler, IT project manager
Studies in Information Technology & Business Informatics in Graz
2018-2021 IT Systems Engineer, Energie Graz GmbH & Co KG
Since 01.01.2021 IT Project Manager, EDA Energiewirtschaftlicher Datenaustausch GmbH

Session 2

Interoperability testing & life cycle

Session Chair: Stefan Wilker

Interoperability process for Energy Communities

Dr. Angela Berger, Technology Platform Smart Grids Austria, angela.berger@smartgrids.at

Abstract

Interoperability is a key factor for the successful transition of the energy system. The Technology Platform Smart Grids Austria promotes the initiative IES – Integrating the Energy System, which offers a common understanding and framework to develop interoperable solutions for data exchange.
The European Interoperability Framework for European public services defines four layers of interoperability.

- Legal interoperability: legal frame for cooperation
- Organisational interoperability: business processes for collaboration
- Semantic Interoperability: the meaning and value of information
- Technical Interoperability: the required technologies and standards

The IES-Process offers a transparent and collaborative approach that covers these layers and leads to a use case-based specification of the required interfaces.

In the ERA Net project SONDER the so-called Technical Frameworks for Energy Communities were developed to specify the interfaces between the community and other actors. Here the description is about the exchange of the network operator and the energy community to receive the meter data according to the prescribed ebUtilities processes. The work showed the added value of the initiated process to the existing efforts to harmonize the data exchange between different actors in the energy sector.
This session will explain the approach, shows the result of the process and gives an outlook on the possible anchoring in existing activities.

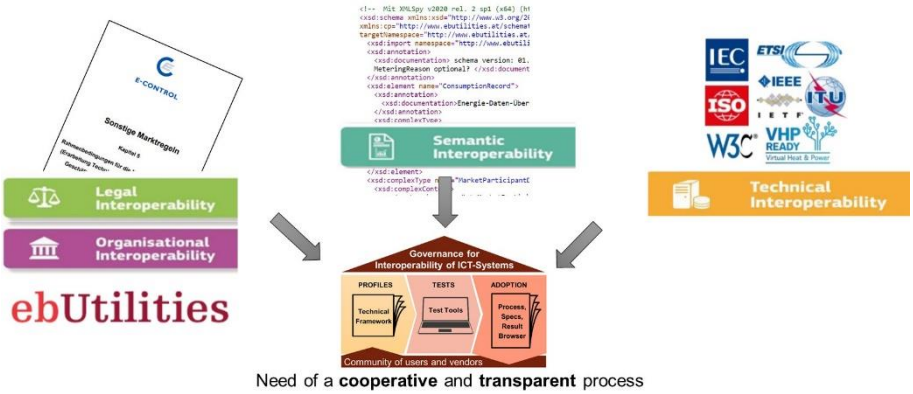


Figure 1. Interoperability Process covering the four layers of interoperability.

Presenter

Angela Berger studied electrical engineering at the TU Wien. She then worked at Siemens in various business areas. Since 2008, Ms. Berger has been involved in the field development and in the Technology Platform Smart Grids, where she has been Managing Director since 2013. Ms. Berger oversees the Austrian initiative IES-Integrating the energy system, which was launched as a result of the IES-Austria project. Since 2018, Ms. Berger has also been the managing director of the Association Verband der Bahnindustrie, where, in addition to the actual task of representing interests, she also promotes the topic of interoperability.

Acknowledgement

This research was funded by the European Union's Horizon 2020 research and innovation programme under grant agreement no. 775970 (RegSys) in the framework of the joint programming initiative ERA-Net Smart Energy Systems.

Interoperability as a Key Factor for Digitalization – a Success Story for Cross-Sector Knowledge Transfer

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Abstract

Interoperability is a key enabler for the digitalization of processes that involve systems from various vendors. Specifications on how information is exchanged among systems need to be available equally to all developers of the communicating components. The methodology applied to achieve interoperability is based on the transparent development of integration profiles. The here sketched trial profiles result from R&D projects and await improvement and adoption now. Lessons learned and recommendations are mentioned throughout and summarized in the conclusions.

Authors

Gerald Franzl received the academic degree Dr. techn. (PhD) and Dipl.-Ing. (MSc) in Electrical Engineering from TU Wien, Vienna, Austria, in 2015 and 2002, respectively. Since February 2020 he is employed at TU Wien and University for Continuing Education Krems, contributing to the R&D projects SONDER, cFlex, eAlloc, and EnergyDec, designing and evaluating techniques to best realise and operate smart energy solutions. In 2008 he achieved IPMA Level_D Project Manager, 2015 Process Analyst (PcA), 2016 EBC*L Certified Manager, and ISTQB ® Certified Tester, and in 2017 Digital Transfer Manager (DTM) certification.

Christoph Wanzenböck, MA, MBA holds a master's degree in environmental and Sustainable Management and a master's degree in business administration. He has experience in the health care sector as well as in the business sector. Currently he is the managing director of the Technology Platform Smart Grids Austria (TP SGA).

Angela Berger studied electrical engineering at the Vienna University of Technology. She then worked at Siemens in various business areas as a software developer and in project and quality management. Since 2008, Ms. Berger has been involved in the field of Smart Grids development and in the Smart Grids Technology Platform, where she has been Managing Director since 2013. Ms. Berger oversees the Austrian initiative IES-Integrating the energy system, which was launched as a result of the IES-Austria project. Since 2018, Ms. Berger has also been the managing director of the Association Verband der Bahnindustrie, where, in addition to the actual task of representing interests, she also promotes the topic of interoperability.

Towards an Interoperability Roadmap for the Energy Transition

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Abstract

Smart grid interoperability is the means to achieve the twin green and digital transition but remains heterogeneous and fragmented to date. This work presents the first ideas and cornerstones of an *Interoperability Roadmap for the Energy Transition* that is being developed by the Horizon Europe int:net project. This roadmap builds on four cornerstones that address open interoperability issues. These are a knowledge base to address the lack of convergence among existing initiatives, a maturity model and a network of testing and certification facilities to address the lack of practical tools for the industry, and a governance process to address the gap between standards-related approaches of *Standards Development Organisations* and *Research and Innovation projects*. A community of practice will be set up to ensure the continuity of the ongoing activities related to smart grid interoperability. To outlive the duration of the int:net project, the aim is to formalise the community of practice as a legal entity.

Authors

Valerie Reif is a research associate in electricity regulation at the Florence School of Regulation, European University Institute in Italy. She conducts research in European Horizon projects on interoperability and on TSO-DSO-consumer coordination. She teaches on electricity markets, the EU network codes, and the EU Green Deal. Valerie holds an MSc and a BSc degree in Renewable Energy Engineering and a BA in European Studies. She is a substitute member of the regulatory commission of the Austrian energy regulatory authority E-Control.

Thomas I. Strasser received a master's and a PhD degree from the Technische Universität Wien (TU Wien) and he was awarded the Venia Docendi (habilitation) in the field of automation from the same university. For several years, he has been a senior scientist in the Center for Energy of the AIT Austrian Institute of Technology. His main responsibilities involve the strategic development of smart grid automation and validation research projects as well as the mentoring/supervising of junior scientists.

Joseba Jimeno is B. Sc. in Industrial Engineering and M. Sc. in Electric Engineering (University of the Basque Country, 2001). He is working in Smart Grid related research projects as research engineer and project manager in TECNALIA. His main research activities are related to energy management in microgrids, demand response and the operation of distribution grids. He has been also involved in the development of communication architectures and information models for Smart Grid applications.

Marjolaine Farre holds a Diploma Engineer degree from Supélec and a Master's degree in Environmental Systems Engineering from University College London (UCL). In 2017, she worked as a consultant for Enedis, the main Distribution System Operator (DSO) in France, to improve their modelling tools for real-time operation of the MV and LV grids. In 2020, she joined Trialog to consolidate the Energy team and is now involved in several H2020 European projects related to smart grid, energy management, flexibility and interoperability.

Oliver Genest has 14-year experience in ICT for smart energy systems, focusing on system architecture and digital transformation of energy systems (interoperability, standards, IoT, data management, data spaces). At European level, he is the Chairperson of the BRIDGE working group on Data Management. Within Trialog, he leads the energy-related business and projects, and coordinates research and innovation activities. He holds an engineering degree from Ecole des Mines de Nancy, France, and a General Management certificate from ESCP Europe.

Amélie Gyrard is a R&I European project consultant at Trialog, Paris, France. She has 10-year experience in IoT Semantic Interoperability and experienced in working with H2020 European projects such as StandICT.eu 2023, AI4EU, Interconnect, and FIESTA-IoT etc. She co-authored white papers targeting developers and engineers where standardization activities

are collaborating (W3C Web of Things, ISO/IEC JTC1, ETSI, ONEM2M, and AIOTI). She is involved in standardizations (e.g., IEC SyC Smart Energy, ISO/IEC SC41 IoT and Digital Twin, ISO/IEC SC42 AI). She co-authored more than 40 scientific articles (>1900 citations, h-index=29); and is a reviewer for communities such as IoT, WWW, and AI.

Mark McGranaghan is a Fellow at EPRI, located at the EPRI Europe office in Dublin, Ireland. He received his BS and MS degrees in Electrical Engineering from the University of Toledo (Ohio) in 1977 and 1978, respectively. He has authored more than 70 technical papers and articles on topics ranging from power quality to insulation coordination. He has been a leader in the development of smart grids for the last 20 years. He is an IEEE Fellow and in 2014 received the Charles Proteus Steinmetz Award for his expertise and dedication to power engineering standards development.

Gianluca Lipari received his Ph.D. degree in electronic engineering from the University of Reggio Calabria, Italy, in 2016. In 2015, he joined the Institute for Automation of Complex Power Systems of RWTH Aachen University in Germany and, in November 2020, the Fraunhofer FIT Center for Digital Energy in Aachen. Since October 2022 he is Technical Leader and European Project Manager at EPRI Europe. His research activities focus on digitalization of the energy system, including cloud applications for cyber-physical systems monitoring and automation.

Johann Schütz is a researcher in the field of Energy Informatics at OFFIS. He received his Bachelor and Masters Degree in Business Informatics at the University of Applied Sciences of Osnabrück in 2014 and the University of Oldenburg in 2017, respectively. After his graduation he worked at the OFFIS Institute for Information Technology in the group "Standardized Systems Engineering and Assessment" and is currently doing his Ph.D. with a focus on the digital sustainability of the energy system as a (net-centric) system-of-systems.

Mathias Uslar is member for the German NC in the IEC SyC Smart Energy WG 5 as well as in the various national German mirrors. He is senior principal scientist as well as Group Manager at the OFFIS – Institute for Information Technology in Oldenburg, Germany. His work focuses on the topic of Systems Engineering and Assessment, mainly focusing on the aspects of System-of-systems interoperability as well as IT security.

Sebastian Vogel represents E.DSO for Smart Grids in several EU-funded initiatives revolving around the digitalisation of distribution grids and cross-sector integration. He graduated from Fudan University, China, with an M.Sc in International Public Policy and from Gothenburg University, Sweden, with an M.Sc in International Administration and Global Governance. Sebastian connects technological innovation and European policymaking. He advocates for empowering stakeholders and collaborative outcomes to support the green transition and the digitalisation of power systems.

Arsim Bytyqi received his B.E. and M.Sc. degrees from University of Pristina, Pristina, Kosovo, in 2005 and 2009, respectively. He received his Ph.D. degree in Nanotechnology from Jozef Stefan International Postgraduate School, Ljubljana, Slovenia, in 2013. He is currently working as Advisor in ENTSO-E. He is a member of IEC TC57 WG13. His research interests include modelling of power grid in CIM/CGMES format, advancing standardization and interoperability activities in TSOs, and contributing on development and implementation of EU H2020 projects.

Rita Dornmair is researcher and consultant at B.A.U.M. Consult. In international research projects, she works on flexibility in distribution grids, smart energy, energy communities and interoperability in energy systems. In accompanying research on research programs, she develops methods for evaluating project performance as well as impact on entire systems. Rita Dornmair holds a Dr.-Ing. in the field of energy systems/energy economics and a Dipl.-Ing. in Electrical Engineering and Information Technology from the Technical University of Munich.

Andreas Corusa is consultant and researcher at B.A.U.M. Consult. In research projects and programs, he works on management and further development of digital collaboration and community platforms. He is involved in customer and citizen engagement processes and analyses in international research projects with focus on energy transition and digitization of energy systems. Andreas Corusa holds an MSc and BEng degree in Energy and Building Services Engineering and has several years of experience as Co-Founder, Entrepreneur and Consultant in Asia.

Gaurav Roy received the B.Tech. Degree from SRM University, Chennai, India, and the M.Sc. Degree in power engineering from RWTH Aachen University, Aachen, Germany, where he is pursuing a PhD degree with the Institute for Automation of Complex Power Systems (ACS).
He joined the Institute for Automation of Complex Power Systems (ACS), RWTH Aachen University, as a Research Assistant. His research topic is the automation of multi-terminal dc grids and the interoperability of devices in automation systems.

Ferdinanda Ponci received her Ph.D. degree in electrical engineering from the Politecnico di Milano, Italy, in 2002. She was with the Department of Electrical Engineering, University of South Carolina, Columbia, SC, USA, until 2008 and from 2009 with the Institute for Automation of Complex Power Systems, E.ON Research Center, RWTH Aachen University, Aachen, Germany, where she is currently a Professor for Monitoring and Distributed Control for Power Systems. Her research interests include advanced measurement, monitoring and automation of active distribution systems.

Alberto Dognini received his M.Sc. degree in electrical engineering from the Politecnico di Milano, Italy, in 2014. In 2015 he joined ABB - Medium Voltage Products Division as Engi-

neering Project Manager. Since 2017 he has been a Research Associate with the Institute for Automation of Complex Power Systems, E.ON Energy Research Center at RWTH Aachen University, Germany and, since 2022, also with the Center for Digital Energy, Fraunhofer Institute for Applied Information Technology (FIT), Germany.

Antonello Monti received his Ph.D. in electrical engineering from the Politecnico di Milano, Italy, in 1994. He started his career in Ansaldo Industria and then moved to the Politecnico di Milano, as an Assistant Professor. In 2000, he joined the Department of Electrical Engineering of the University of South Carolina (USA), as Associate and then Full Professor. Since 2008, he is the Director of the Institute for Automation of Complex Power System at the E.ON Energy Research Center, RWTH Aachen University. Since 2019, he holds a double appointment with Fraunhofer FIT, developing the new Center for Digital Energy, Aachen.

Symposium Day 3

17.03.2023

Keynote: Distribution Grid Model standards development and interoperability testing

Sean Crimmins, Electric Power Research Institute (EPRI), scrimmins@epri.com

Abstract

Today's growing number of distributed energy resources (DER) – including solar photovoltaic, battery storage, and wind generation – are making our grid more capable and decarbonized, they are also making distribution grid behavior more unpredictable. For energy providers, creating and sharing an accurate model of the current and future electrical grid is critical to operating and planning decision making. EPRI is building on 25 years of standards development with the IEC and the UCA CIM User Group to create a new eco-system of utilities, vendors and partner organizations to develop and test profiles that meet the needs of the evolving energy grid.

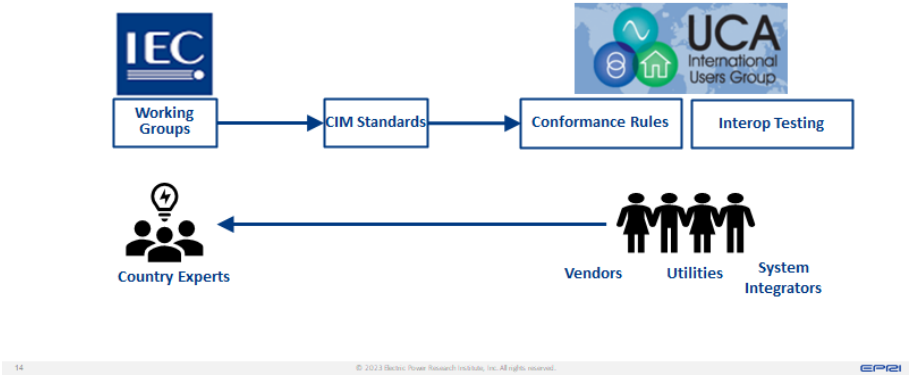

Figure 1. CIM Standards Development Eco-System

Presenter

Sean Crimmins, Principal Manager, Enterprise Architecture and Systems Integration, Electric Power Research Institute (EPRI)

Sean is a certified Enterprise Architect with 26 years of experience in Information technology and 22 in the electric power industry. At EPRI Sean leads the research into Enterprise Architecture and Systems Integration in the electric power industry. The team focuses on achieving the industry objectives of Strategic Alignment, Information Availability, Application Portfolio Optimization and Enterprise Architecture maturity.

Prior to joining EPRI, Sean was a Data Architect and Enterprise Architect at California ISO where he optimized a portfolio of 30 business critical applications and lead the implementation of energy market enhancements and a new outage scheduling application.

Session 3

Applied Interoperability in Energy Systems

Session Chair: Mark Stefan

Solutions for Intelligent Industrial Energy Communities

Matteo Gerola, MAPS SpA, Solutions for Intelligent Industrial Energy Communities

Abstract

Renewable Energy Communities (RECs) could include industrial sites with power generation sources of both renewable and non-renewable type. Energy efficiency needs of such sites are then considered along with energy sharing and/or flexibility goals or commitments of the whole REC. To our knowledge, there does not exist in the market any solution to address the issue of combining this kind of competing goals.

Our software platform combines efficiency goals with energy sharing goals, possibly considering flexibility constraints, while realizing the optimal trade-off among these goals, leveraging on AI and operational research based software algorithms for the optimization of aggregates of energy producers and consumers with multiple, and possibly competing, goals.

Using the capabilities of our platform we can aggregate Industrial Energy Community (IEC) data in a virtual energy community whose daily operations will be simulated by recurring to statistical data regarding households' consumptions, photovoltaic efficiency, and energy storage efficiency. Through AI-based algorithms that ingest energy needs, external conditions, such as weather forecasts and gas and electricity prices, our platform can define the best operating mode of the industrial site to fulfil its energy needs while also inducing benefits to the community and minimizing its energy bill.

Presenter

Matteo Gerola holds a M.Sc. degree in Telecommunication Engineering from University of Trento. In 200, he joined Fondazione Bruno Kessler (FBK), Italy, as software architect, software developer and project manager. In the past decade, he contributed to several EU and commercial projects as WP and task leader, in the field of software-defined networking and optical networks. Since 2017, he has been a founding partner of Energenius Srl, a company of the Maps SpA Group, as R&D manager and software architect. Energenius develops proprietary AI-based energy analysis solutions for industrial and tertiary customers.

Unlocking Customer Flexibilities through Standardized Communication Interfaces

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Abstract

The need for a more sustainable energy system is leading to more electric energy generation being connected to low voltage (LV) distribution grids. At the same time, due to accelerated growth in electric mobility and heat pumps, more and more energy consumed by end customers is supplied via LV distribution grids.
These developments cause distribution networks to become less predictable and make them subject to much higher changes in supply and demand. Therefore, additional flexibility will be needed to keep such systems operating with a high quality of service. The required flexibility could be provided by distributed generators as well as flexible loads. This leads to the question of how these flexibilities can be activated by distribution system operators, when needed. A digital interface between distribution system operator and device operator could be implemented to communicate flexibility requirements. In this work, three possible deployment scenarios for such a digital interface are presented. A market review of available standards and commonly implemented communication protocols was conducted, to identify potential candidates for the standardization of such an interface.

Authors

David Reihs received a bachelor's degree from the Technical University of Munich in Technical Physics and went on to study Physical Energy and Measurement Engineering at the TU Wien. With the diploma thesis titled „Framework for Evaluation of Home Energy Management System Approaches", he finished his studies with distinction. In 2017, he started working at the AIT Austrian Institute of Technology, Center for Energy, as a Research Engineer, focusing on Power System Digitalization. His early work at AIT was focused on the effective integration of electric vehicle charging infrastructure into power grids.
In recent years his research interest shifted to energy communities and their role in increasing energy system resilience and sustainability. He is pursuing a PhD degree at the University of Passau focused on the investigation of effects of large-scale deployment of innovative energy solutions in the scope of energy communities.

Fabian Bouda studied Electrical Engineering at the TU Wien. He received a master's degree in the field of power systems engineering in 2020 and graduated with distinction. During his master studies and afterwards, he worked in the development department of a manufacturer of power hardware-in-the-loop test systems. Since 2021 he works at TU Wien at the department for Energy Systems and Networks as a project assistant. His research focuses on the fields of grid protection as well as grid friendly operation of loads and distributed generation.

Fabian Leimgruber is Research Engineer at the Energy Department of the AIT Austrian Institute of Technology. He has experience as research assistant and lecturer at University of applied sciences Technikum Wien, including the topics modeling, simulation and statistical data analysis. He finished his studies at the University of Applied Science Vienna in 2011 and holds a master´s degree in "Renewable Urban Energy Systems ". He joined the Erasmus Programme at Cyprus, where he worked on his master thesis "Study of thin film photovoltaic module degradation and its assessment using outdoor data". His work experience includes numerical simulation, optimization, software development and statistics & data analysis.

Katharina Machtinger graduated from the FH Technikum Wien with a bachelor's degree in electronics, focusing on embedded systems. She then went on to study electronics and computer technology at the FH Joanneum in Styria. In 2021, she completed her master's degree with distinction for the thesis "A Wide Bandgap Based High-Power Battery Charger for Ultra-Fast EV Charging applications". Already during her master's degree, she began working part-time at the AIT Austrian Institute of Technology, Center for Energy as a Junior Research Engineer in the team for electrical energy systems, where she still works today.

Thomas I. Strasser received a master's and a PhD degree from the Technische Universität Wien (TU Wien) and he was awarded the Venia Docendi (habilitation) in the field of automation from the same university. For several years, he has been a senior scientist in the Center for Energy of the AIT Austrian Institute of Technology. His main responsibilities involve the strategic development of smart grid automation and validation research projects as well as the mentoring/supervising of junior scientists.

Mark Stefan studied computer science at the TU Wien. He started his professional career at Robert Bosch AG in Vienna, where he worked as a software and function developer for 2.5 years. In 2012, he moved to the Institute for Computer-Aided Automation at the Vienna University of Technology, where he worked as a project assistant and did his PhD-studies. Since 2014, he has been working at the Center for Energy at AIT Austrian Institute of Technology GmbH as a Research Engineer and Project Leader. In 2019, he was appointed Senior Research Engineer as well as Thematic Coordinator in the Power System Digitalization research area. His professional focus is mainly on digitalization topics as well as the planning and implementation of applications for energy communities.

Alfred Einfalt During his master and PhD studies in electrical engineering at the Vienna University of Technology, he gained experience in the field of research. On the one hand through several internships at one of the leading non-university research institutions, the AIT Austrian Institute of Technology and on the other hand as a university assistant at the Institute of Electrical Power Systems and Energy Economics. Since 2011 he has worked as research scientist and project manager for national and international R&D projects in the field of Smart Grid with Corporate Technology at Siemens AG Austria. As one of the current working priorities, he is leading the technology related R&D activities for Siemens AG Austria as part of the research program of the joint venture Aspern Smart City Research. Since March 2019 he is driving the application of industrial IoT to support the development of distributed energy systems in his role as Principal Key Expert.

Lukas Schober has received his bachelor's degree in electrical engineering at DHBW Friedrichshafen. Afterwards he completed a master's degree in Energy Technology and Energy Management at the University of Applied Sciences Vorarlberg. In addition, he received the MBA in International Business Management from the University of Applied Sciences Weingarten. In his final theses, he investigated the technical and economic impact of electromobility on power grids. Since 2015, he has been working for the distribution grid operator Vorarlberger Energienetze GmbH in the grid development and planning department. He leads an expert group for the development of regulatory frameworks for distribution grids for Austria (TOR) and manages projects for load management of electric cars.

IEEE 2030.5 in practice

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Abstract

Distributed energy resources, such as solar inverters and windmills, have significant impact on electrical grids. As seen at the end of last year in Australia, a heavy thunderstorm created a disruptive event, so that utilities were forced to turn off approx. 400MW of photovoltaic production to prevent a blackout. The IEEE 2030.5 standard provides a solution to mitigate the risk of blackouts in such events. It allows sustainable growth of renewable DER installations, without having a negative impact on the grid stability. A major challenge for utilities integrating DERs into the power grid, stems from the non-trivial predictability of a DERs' grid feed-in. Adopting the IEEE 2030.5 standard, allows utilities to optimize their grid-balancing mechanisms and to coordinate and control DERs in critical situations. Australia is the first country to widely adopt the IEEE 2030.5 standard. In this presentation we discuss the utilization of the IEEE 2030.5 in Australia, and we provide recommendations for application of the IEEE 2030.5 in Europe.

Presenters

Thomas Hüttner studied computer sciences at the Johannes Kepler University in Linz. In his early career he worked as a software engineer for Fabasoft, then Utimaco, and took over responsibilities as software architect, 1999 as product manager. During his time at Utimaco (acquired by Sophos in 2008) he was primary contact to the TCG, contributed to PKCS#15 and was member of TeleTrusT working groups. In 2012 he joined Dynatrace and became responsible for cloud technologies and security. Since 2018 he is working as project manager and product owner at Fronius with the focus on Remote Control topics.

Raffael Rehberger studied Software Design at the University of applied Sciences Joanneum, in Kapfenberg, Styria. In his early days at Fronius, Raffael worked on embedded firmware development for photovoltaic inverters. In the more recent years of his career, his focus shifted towards realizing an IEEE 2030.5 compliant platform, that enables sustainable and safe growth of renewable energy resources - aiming to combine the Internet of Things, IT-Security, and electrical engineering. Currently, he is leading a team of 8 members working on Remote Control solutions for smart grids, such as the realization of the IEEE 2030.5 in Australia.

Use cases also exist for attackers – how to foster the concept of misuse cases

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Abstract

As a cross-cutting issue, interoperability typically seems to be impacted by security and vice versa. In this paper, we propose an integrated approach (on a conceptual level) for testing the interoperability among the interfaces of various heterogeneous systems by combining multiple, but yet separated, state-of-the-art approaches. Including a dedicated test tool management system (IHE Gazelle) along with a mapping of the incidents identified in the Misuse Case Template (MUC) to the MITRE ATT&CK Framework and the serialization of the result into the STIX2 format with the objective of eliminating or minimizing the impacts that may cyber incidents cause. We assume that our output can significantly assist in improving the safety, quality, and ways of vulnerability detection. The main purpose of the proposed model is to achieve a high level of confidence in the system's performance for both use cases and misuse cases.

Authors

Mana Azamat holds a B.Sc. degree in Computer Engineering (Hardware Engineering) from Shiraz University, Iran, and a Master's degree (MSc) in Media-Informatics from University of RWTH-Aachen, Germany. She joined the OFFIS – Institute for Information Technology in Oldenburg, Germany in 2018 as a researcher in the security analysis of smart grids, and currently she is contributing to smart grid and energy-related research projects as a consultant/ internal project manager.

Johann Schütz is a researcher in the field of Energy Informatics at OFFIS – Institute for Information Technology in Oldenburg, Germany. He received his Bachelor and Masters Degree in Business Informatics at the University of Applied Sciences of Osnabrück in 2014 and the University of Oldenburg in 2017, respectively. Since graduation, he has been working at OFFIS with a focus on energy systems as systems-of-systems.

Mathias Uslar is member for the German NC in the IEC SyC Smart Energy WG 5 as well as in the various national German mirrors. He is senior principal scientist as well as Group Manager at the OFFIS – Institute for Information Technology in Oldenburg, Germany. His work focuses on the topic of Systems Engineering and Assessment, mainly focusing on the aspects of System-of-systems interoperability as well as IT security.

RENergetic: Creation and Replication of Urban Energy Islands

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Abstract

Creation and replication of urban energy islands as geographically confined systems of distributed energy resources and multiple energy vectors with a high level of energetic self-sufficiency is a key strategy to fight climate crisis. To successfully implement that concept, trans-disciplinary research defining promising transformation paths towards reaching this vision is needed. The RENergetic project approaches the development of energy islands by technical optimization across all energy vectors, socio-technical optimization of the usage of energy demand flexibility, socio-psychological interventions, and a replication strategy that considers all these different aspects. Interoperability between the RENergetic solutions and pilot energy islands is a key design requirement in the project, that is addressed by working with a multi-energy SGAM framework.

The goal of the RENergetic project is to demonstrate the improvement of efficiency and energy autarky, the community involvement in and the socio-economic viability of three urban energy islands: The New Docks in Ghent (BE), the Warta Campus in Poznan (PL) and the Hospital and Research campus in Segrate-Milan (Italy).
RENergetic empowers Renewable Energy Communities to inhabit Energy Islands based on an Economy of Quality (quality attributed to the value of living and working in a clean energy society), fueling their involvement in processes traditionally hidden for local communities such as heat supply.

www.renergetic.eu

Presenters

Dr. Sonja Klingert has been a post-doctoral researcher and project manager at the University of Stuttgart since May 2022. Prior to that she was at the University of Mannheim (2010-2022) and worked as a re-searcher for the Wuppertal Institute for Climate, Environment and Energy. Amongst others, she had the local leads for EU re-search projects as DC4Cities, ELECTRIFIC, RENergetic, or DE-CIDE. Her interest is in demand side flexibility from a trans-disciplinary point of view, in green business models, eco-aware contracts as well as impact analysis and social issues of the energy turnaround. Sonja Klingert holds a M.S. degree ("Diplom") in Economics from the University of Karlsruhe.

Prof. Hermann de Meer received his Ph.D. from University of Erlangen-Nuremberg, Germany, in 1992. He had been an Assistant Professor at Hamburg University, Germany, a Visiting Professor at Columbia University in New York City, USA, and a Reader at University College London, UK. Professor de Meer has been ap-pointed as Full Professor at the University of Passau, Germany, and as Honorary Professor at University College London, UK, since 2003. His research interests include cloud computing, energy sys-tems, network virtualization, IT security, smart grid, smart city, industry 4.0, digitalization of energy systems, computer networks and comunications, and distributed systems.

DI Michael Niederkofler holds a degree of applied physics from Technische Universität Graz. He managed large international green-field pro-jects in the steel and raw materials industry and has worked and lived in Venezuela, Kazakhstan and China. After his international career he worked as an independent consultant for project management and inter-nationalization. Since 2018 is the head of the Innovation Lab act4.energy, a living lab initiative with the goal of developing regional, renewable energy systems. He is working on solutions for the energy transition with a focus on demonstration and pilot projects and the replicability of results.

Session 4

Improving Interoperability

Session Chair: Stefan Wilker

Towards Interoperable Local Energy Communities in Austria

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Abstract

To ensure continued reliable operation of the energy grid in the face of a rising number of local energy communities (LECs), they need to be integrated in a way that ensures that they do not negatively impact, but rather support the overall system, e.g., by providing flexibility. Project ECOSINT aims at intelligent, digital integration of LECs to achieve this goal. Along with several other tasks, this includes the development of a suitable software architecture, which is currently in progress and has yielded a conceptual model as a first result. Among the numerous requirements regarding LECs and their software architecture which have been collected in the initial phase of the project, interoperability has been identified as a crucial factor for success. This is addressed by incorporating the VLab framework, which is presented and demonstrated for a simple EV charging scenario.

Authors

FH-Prof. Priv.Doz. MMag. Dr. Günther Eibl holds diploma degrees in mathematics and physics and a habilitation in applied mathematics from the University of Innsbruck in 2021. Since 2013 his work focuses on privacy and security in the energy domain, primarily applying methods from data analysis and cryptography. In September 2022 he became head of the Center for Secure Energy Informatics (CSE) at FH Salzburg. Together with its research and company partners it is working on algorithms and architectures to make the digitalization of energy systems more secure and privacy-preserving.

Dr.techn. Jawad Kazmi is currently working as a Scientist in the Center for Energy at AIT Austrian Institute of Technology. He received his Ph.D. Degree from Technical University Vienna in 2017. His research interests include requirements engineering, ICT architecture design, and analysis, interoperability, verification, and validation topics. He has been active on these topics and has been contributing to many European and Austrian research projects including InterFlex, LargGo!, SENDER, CLUE, RESili8, DigIPlat, ECOSINT, CLUE, etc. He is also one of the lead developers of AIT Lablink and the AIT VLab framework.

DI Oliver Langthaler, BSc received his Master's degree in engineering from the Salzburg University of Applied Sciences in 2014. He then remained at the University as a researcher at the Center for Secure Energy Informatics, where he has been contributing to Smart Grid and energy-related research projects such as OpenNES, VirtueGrid, Future Network Tariffs and ECOSINT. He also founded cappatec, where he develops custom hard- and software solutions, including power metering infrastructure for DSOs. In 2019, he began to focus on LECs as a topic of research and to pursue a PhD at the Paris Lodron University of Salzburg.

DI Max Schirl, BSc studied Information Technology and System's Management at the Salzburg University of Applied Sciences (SUAS) and finished in 2019. During his studies, he started to work at the SUAS as a Junior Researcher focusing on projects helping small and medium sized companies on their path to digitalization.
Since 2022, he is part of the team behind project ECOSINT and works on integrating privacy and security into the IT architecture of Austria's Local Energy Communities.

Dipl.-Ing. Stefan Wilker B.Eng. holds a Diploma Engineer degree of Media and Human-Centered Computing from TU Wien. He is working as Assistant Professor at the Institute of Computer Technology at TU Wien. Since 2019 he is the group manager of the Energy&IT Group and is responsible for teaching, project and group coordination. The Energy&IT Group focuses on the research fields of smart grids, energy communities, interoperability, forecasting and creates intelligent middleware IT solutions. He acts as the project coordinator for the international ERA-Net project SONDER as well as for several other projects of the group.

Improving energy community interoperability by utilizing Web of Things

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Abstract

The novel energy communities (ECs) concept introduces communal incentives for citizens to monitor and control energy usage. This circumstance brings up the need for digitalized solutions that support EC members in optimizing energy usage. While research and industry already came up with concepts to tackle this problem, interoperability aspects of Information and Communication Technology (ICT) infrastructures are rarely investigated. As a result, the diverse protocol landscape of energy-related devices slows down technological penetration and consequently hinders the modernization of ECs. For this reason, the following paper proposes an architecture design that addresses interoperability problems in ECs by bundling communication concerns into services that utilize the Web of Things (WoT) standard. Furthermore, the architecture design is demonstrated in a testbed environment where a WoT compatible Electric Vehicle (EV) charging station and a legacy inverter are integrated.

Authors

Dipl.-Ing. Leonhard Esterbauer joined the Institute of Computer Engineering at TU Wien in 2021, where he completed his master's thesis in 2022. Since then, he has been working as a research assistant at the Automation Systems Group. His research interests include the Internet of Things and related software architectures. With these interests in mind, he currently aims to reduce interoperability problems and accelerate technology penetration in the context of energy communities.

DDipl.-Ing. Dr. Gernot Steindl is working as a postdoc university assistant at the Institute of Computer Engineering, TU Wien. He holds a master's degree in Electrical Engineering (2013) and Building Technology (2016). He received his PhD in Computer Science from TU Wien (2021). His main research interest is focused on information modeling and knowledge representation in the domain of industrial & building automation as well as smart energy systems, to utilize machine-readable semantics for explainability in Cyber-Physical Systems (CPS).

Univ.Prof. Dipl.-Ing. Dr.techn. Wolfgang Kastner is full professor (Industrial Internet of Things) and head of the research unit Automation Systems part of the Faculty of Informatics at TU Wien. His research addresses distributed automation and (industrial) communication systems in various application domains, such as including factory automation, building automation and smart grids. Cur-rent research topics tackle the safe while secure IT/OT convergence and approaches for the Industrial Internet based on information modeling and knowledge representation.

Is blockchain helping to establish open energy data spaces?

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Abstract

The blockchain technology has the potential to revolutionize the energy sector by creating open energy data spaces. Since the introduction of the Ethereum network with its Turing complete programmability, start-ups have been working to deliver scalable solutions for this purpose. However, progress has been hindered by scalability issues in blockchain networks and the lack of developed tools for creating smart contracts. Additionally, data privacy concerns have been a constant topic of debate, and ensuring simple access to these networks is essential to ensure broad applicability.

In recent years, significant progress has been made in addressing these issues. Advancements such as layer 2 scaling solutions like Optimistic Rollup and ZK-Rollup, InterPlanetary File System (IPFS) for data storage, and zero-knowledge proofs for data privacy have greatly improved the scalability and privacy of blockchain networks. Furthermore, developments in tooling and infrastructure have made it easier to develop and deploy smart contracts on these networks.

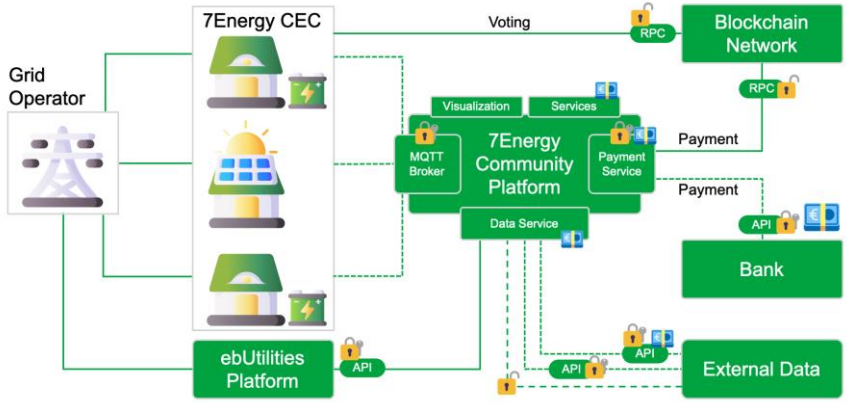

Figure 1. Example: Simplified data space for the 7Energy Citizen Energy Community platform

These advancements have enabled the creation of decentralized energy marketplaces, where individuals and organizations can buy and sell energy directly with each other, without intermediaries, leading to more efficient energy. This presentation will provide insights into the technologies and the potential challenges towards the successful use of open energy data spaces.

Presenter

Dipl.-Ing. Thomas Zeinzinger holds a Diploma Engineer degree of material science from Mining University Leoben. After a brief stop at the Department for Automation in Leoben, he worked 4 years for ThyssenKrupp in Munich, Germany, 4 years for Magna in Preding, Austria and 5 years for Siemens in Weiz, Austria, before he started his own consulting business in 2013. His interest in optimizing processes and working on innovation accompanied his entire career until he stumbled 2016 over the Ethereum blockchain system.
Since 2017 he is head of the board in the lab10 collective eG, a non-profit cooperative working on cutting edge blockchain development, which ranges from the ARTIS blockchain network to the award-winning projects Minerva Wallet and 7Energy – Energy Communities without Banks.

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Disclaimer

EDDIE – European Distributed Data Infrastructure for Energy

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Abstract

EDDIE establishes a unified European interface to Electricity metering data. Considering the shortfalls experienced through the deployment of centralised, inter-dependent and inflexible platforms, the EDDIE consortium proposes a completely decentralised, distributed, open-source Data Space solution, aligned with directions of the work on the Implementing Acts on Interoperability as mandated by Article 24 of Directive (EU) 2019/944, the European Data Strategy and accommodated with the European Data Spaces Initiative.

Main objective is to create a dependable, scalable, and extensible European Distributed Data Infrastructure for Energy Framework to streamline (1) data accessible through data-sharing infrastructure (e.g., grid operators, connection point registries, etc.) (2) in-house citizen data and (3) market data.

Instead of interfering in MS data management scenarios, the solution encapsulates European and regional diversity, and allows for services to act on a unified European interface. Near real-time in-house data is seamlessly integrated in the proposed architecture through the use of open prosumer data interfaces transformed to a common format, and transferred efficiently utilising Apache Kafka data streaming technology.

Active European customers get an efficient, trusted and unique user experience for participatory smart grid services, and for data-driven solutions data integration efforts are minimised. New market actors can develop their solutions once, and deploy it anywhere across all supported regions.

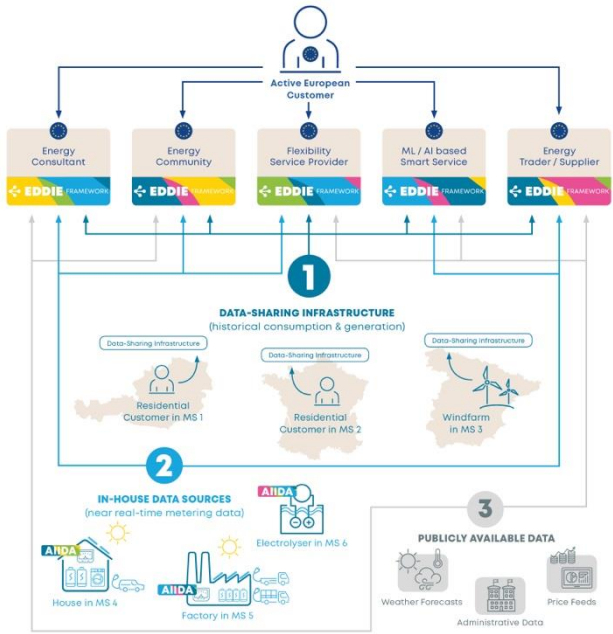

Figure 1. EDDIE – European Distributed Data Infrastructure for Energy

Presenters

Dipl.-Ing. Georg Hartner. Georg is working for *Austrian Energy Association* and *GEODE – The voice of local energy distributors in Europe* in the EU Smart Grids Task Force and is a key contributor to its advice for the ongoing initiative to establish European energy service interoperability legislation. He is also a member of *EU DSO Entity*'s expert groups for Data Interoperability and Distributed Flexibility. Accompanying these work streams, Georg co-initiated Horizon Europe - funded *'Project EDDIE - European Distributed Data Infrastructure for Energy'*, which will make available European retail energy data easily available through a de-centralised uniform interface. Based on this foundation, Georg contributed to the design of INSIEME - an initiative to establish a holistic and standardized data exchange infrastructure for individual consumer activation and energy communities.

Dipl.-Ing. Dr. Oliver Hödl has two decades of professional experience with informatics/computer science in academia, industry and art. He is an interdisciplinary HCI researcher with a doctorate in computer science awarded with distinction by the Vienna University of Technology. He has gained broad interdisciplinary experience from a dozen of third-party funded projects for technological advance in areas such as smart city and mobility, disaster relief and critical infrastructures, music and art, education and didactics as well as healthcare and therapy. Currently, he is the project coordinator and co-initiator of the Horizon Europe project EDDIE (European Distributed Data Infrastructure for Energy) at the AIT Austrian Institute of Technology. He is also affiliated with the University of Vienna working as a lecturer and theses supervisor.

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