CERA-SG



Cost-efficient data collection and analysis for smart grid and revenue assurance

Cluster

Grid Design

Topics

data collection and analysis, distribution network planning, tariff incentives, consumer behaviour, power flows, prioritizing network investments, peak shaving, detection and reduction of non-technical losses

- T Software for efficient collection and analysis of energy and power flows in the distribution network
- ICT system with non-intrusive sensors, data concentrators and headend
- M Measures for cost savings in network installation
- M Business case for complementary use of harvesting sensors for measuring capacity, technical and non-technical losses
- M Proposals for tariffs and further incentives rewarding loss reduction
- A Visualization of (prevented) losses in a neighbourhood

CERA-SG



https://t1p.de/6bp6













Partners for Further Development

- DSO with non technical power losses and capacity issues
- Developers of software for the management of distributed grids
- Research community around grid data processing
- Research community around incentives for loss reduction
- Producers of energy harvesting sensors











Demand-oriented design of smart energy products and services for local energy grids and markets

Cluster

Grid Design

Topics

residential grids, demand-oriented grid design, users' energy behavior, local energy generation and trading, demand side management, e-mobility, forecasting, renewables, co-evolution of products and services

Results Technology Market Adoption

- Network modeling methodology for AC and DC with EV, demand side management, customer safety and storage
- Tools for sustainability and energy-efficiency rating of smart grid pilots
- Co-simulation framework combining real and simulated elements
- M Specifications and implementation guidelines for the development of products and services
- M Medium and long term scenarios for local smart grids
- A Catalogue of user demands for smart energy products and services
- A Overview on required changes in energy practices and related barriers

TRL 3 —





www.ceseps.eu



















UNIVERSITY OF TWENTE.

Partners for Further Development

- Planners and operators of local microgrids
- Research community around user needs and behaviour
- Research and development community around demand side management
- Developers of AC and DC network models
- Designers of products and services for local grids











Replicability concept for flexible smart grids considering technical, business and social design

Cluster

Grid Design

Topics

community of practice, renewables, replication, local production and consumption, voltage regulation, demand side management, technology, market actor relationships, social networks, user acceptance

- T Simulation tool for comparing grid topologies and scalability
- M Data sets of 10 demo sites and empirical studies including scenarios
- M Collection of replicability tools and good practice examples
- M Replicability framework including grid layout, regulations, (collaborative) business models, actors' relationships, mission, cognitive frames
- M Guidebook for the deployment of flexible, user friendly smart grids with sound market models
- A Methodology for creating a community of practice
- A Catalogue of demands of actors in local smart grids





www.reflex-smartgrid.eu





































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Partners for Further Development

- Planners of smart grids with a high share of renewables
- Designers of business and interaction models for local grids
- Managers of communities of practie in smart energy
- Research community around processing smart grid data
- Research community around collaborative business models









Interactive applications for optimal planning and operation of energy infrastructure in rural areas

Cluster

Grid Design

Topics

rural regions, renewable energy sources, grid planning, infrastructure acceptance, net zero local grids, low voltage AC grids

- Design and control tool for AC microgrids delivering:
 - optimal corridors for MV/LV lines, positions and sizes for DGS, RES, BESS, MV/LV transformers
 - estimation of RES and non-RES generation
 - evaluation of power and heat grid parameters incl. loads and consumption
 - optimization for minimized energy imports/ power loss/ energy generation mix/ operational costs or for maximized profits
- M Financial analysis for power plant and BESS investments considering:
 - energy costs (via Levelized Unit Energy Cost)
 - economic benefits (incl. feed-in incentives & coupled storage)
- A 3D virtual reality tool for visualizing local system configurations, improving communication and enabling acceptance testing with stakeholders





www.rigrid.pl/

















Partners for Further Development

- (Net zero) microgrid operators and planners
- Planners of energy infrastructure
- Researcher community around multi-criterial planning and acceptance of energy infrastructure
- Software designers employing virtual reality
- Software providers for microgrid planning and operation (including Energy Management and Control Systems)
- Local energy communities with active participation of small electric producers, consumers and prosumers
- Experts for mechanisms and regulations for microgrids offering services to ESO/DSO











Integrating smart DC distribution grid technologies

Cluster

Resilience

Topics

DC grids, volatile distributed resources, market clearing algorithms, modular scalable smart grid components, grid operator cooperation

- Modular DC/DC power converter design
- Protection strategies and design topologies for meshed DC grids
- Models and algorithms for congestion management
- T Algorithms for increased system reliability with automatic islanding and reconnection
- M Decentralised real-time market models connected to the physical grid allowing for prosumer participation
- A Proof of concept for selected prosumer integration solutions

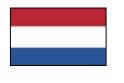




www.DCSMART.eu

















Partners for Further Development

- Planners and operators of distributed grids with high share of renewables and/or congestion issues
- Developers of (DC) grid components
- Research and development community around grid design and resilience
- Developers of algorithms for grid operation
- Developers of models for flexibility markets













Transnational cloud for interconnection of demonstration facilities for smart grid lab research & development

Cluster

Resilience

Topics

smart sockets, grid resilience, ancillary services, risk and benefit analysis, converter interoperability, energy management, validation of grid lab results, grid lab cooperation, renewables, distributed energy resources, AC/DC hybrid grids

Results Technology Market Adoption

- T Transnational cloud platform for smart grid labs with data, methodologies, test results and catalogue of resources
- **T** List of parameters and requirements fo converter interoperability
- Comprehensive map of ancillary services including technical evaluation
- M Method for evaluation of risks and benefits of providing ancillary services by prosumers
- M Market design for many participants on supply and demand side and renewables integration
- A Catalogue of recommended actions for safeguarding grid stability
- A Catalogue of recommended system management strategies

Runtime 2016-2019

TRL





www.eranet-cloudgrid.eu/



















Partners for Further Development

- Operators and users of grid labs
- Research and development community of ancillary services
- (Potential) providers of ancillary services
- Experts in regulatory issues relevant for ancillary services
- Experts in payment schemes and incentives for ancillary services
- Developers of converters
- Grid operators
- Developers and planners of market models











Pattern recognition for optimized grid parameter management

Cluster

Resilience

Topics

Al, pattern recognition, smart meters, grid parameters, grid maintenance & operation, inertia, utilities, renewables, EV, distributed generation, web-based tools

- Control software for automatic asset management enabling streamlined preventive maintenance
- Monitoring and forecasting tool for power, power quality and energy for planning and operating transmission and distribution systems
- T DC microgrid concept with PV, batteries and flexible power conversion for ancillary services to the grid
- Tools for detecting EV charging patterns and multicriteria evaluation of capacity for hosting renewables
- T Catalogue of potentials and risks for curtailing power use by voltage reduction
- T Database of grid parameters, e.g. power quality
- A Approach for user-friendly visualization of grid capacity, consumption and flexibility potentials
- A Characterisation of consumer segments based on consumption and generation patterns





www.europeanpatternrecognition.eu/



















Partners for Further Development

- Grid operators and providers of grid maintenance services
- Research and development community around AI for forecasting energy data
- Research and development community around DC grids and components
- Operators of renewable energy sources
- Developers of innovative, data-driven solutions for grid management
- Ancillary service providers
- Planners of highly independent microgrids











Gamification for energy management in buildings

Cluster

Resilience

Topics

gamification, smart buildings, energy management, demand response, distribution grid support, automated response, end-user activation, energy data processing

- ICT system for meter data collection, storage and analysis
- T Energy monitoring and management application for residential and commercial buildings including algorithms for automated grid services
- T Game-like mechanisms for active participation in demand response
- A Catalogue of incentives for energy efficient behaviour
- A User interface displaying individual performance and ranking, energy education and personalized suggestions





www.gresbas.eu









Partners for Further Development

- Research community around meter data collection and processing
- Developers of building automation and energy management systems
- Research communities around demand response, active participation and end-user education
- Experts for long term user engagement (collaborative and competitive approaches)
- Experts for energy management performance evaluation based on smart meter data
- Developers of energy applications for end-users











Multi-input intelligent distribution automation system

Cluster

Grid Management

Topics

automated distribution grid management, remote sensing, forecasting

- Volt/VAR management system for generating maximum capacity
- T Central automated control software for the distribution grid including monitoring, prediction and optimization
- Algorithms processing sensor and forecast data for load management and voltage regulation
- T Designs for low-cost, smart devices and remote sensors with SCADA communication standards





www.project-midas.com/

















Partners for Further Development

- Distribution grid planners and operators
- Research community around sensor data collection and processing (via algorithms)
- Developers of control software for distribution networks
- Developers of real-time monitoring and forecasting tools
- Developers of smart devices and remote sensors
- Research communities around interoperability of smart devices and remote sensing











Flexibility market platform for regional load shaping

Cluster

Grid Management

Topics

flexibility, market platform, tariff design, dynamic market & grid signals, stakeholder needs, grid capacity, simulation, peak shaving, load shaping

- T Hard- and software platform for efficient management of grid capacity based on market signals
- Aggregation of peak shaving flexibility for gridoptimized regional load shaping
- T Catalogue of grid support options and simulation models for flexible loads
- M Pilot business model with defined processes and stakeholder incentives
- M Pricing model sensitive to demanded security of supply
- A Simulation platform for visualizing complex systems
- A Catalogue of stakeholder preferences for use and provision of flexible loads (incl. industry and commerce)





www.t1p.de/8ul4



Lucerne University of Applied Sciences and Arts

HOCHSCHULE LUZERN









Fachhochschule Nordwestschweiz









Partners for Further Development

- Distribution grid planners and operators
- Developers of market platforms for flexibility
- Designers of business models for flexibility
- Developers of software and solutions for peak shaving
- Providers of flexibility
- Developers of solutions for complex systems
- Research and development community around grid capacity











Configurable energy management system for renewable power plants and smart grids

Cluster

Grid Management

Topics

storage, grid codes, monitoring and control, configurable ICT system, high voltage, grid stability, plant management

- **T** Electronic equipment for real-time control of (re)active power for grid stability (HESS)
- T High power density module requiring 35% less space
- Power plant management system for power balancing and peak shaving
- T Hot-swapping feature for system reliability
- Modular multilevel converter incl. storage modules for integrating renewables in the high voltage grid
- M Catalogue of converter use cases and performance rating
- M Power rate system for reduction of CAPEX by 50%





www.t1p.de/n87y











Partners for Further Development

- Grid code development community
- Transmission system operators
- Research community around (re)active power management
- Operators of power plants
- Research community around high voltage grid resilience
- Developers of energy management systems











Planning and operation principles for cost-efficient distribution grid management

Cluster

Grid Management

Topics

guidelines, grid planning, flexibility, distribution grid, smart technology, regulatory and market barriers

Results Technology Market Adoption

- Simulation tools for automated grid planning (low voltage) and curtailment prediction for distributed resources
- Method for network expansion planning
- T Tools and methods for approximating the operational impact of flexibility (medium voltage grids)
- M Catalogue of country-specific conditions (incl. legal) for smart grid technology and market applications
- M Estimates for network reinforcement savings by implementation of smart technology
- M Characterisations of new market roles around mobility and flexibility
- A List of policy recommendations for reduced barriers
- A Demand and generation profiles on household level with varied incorporated smart technology
- A Best practice guidelines for smart grid planning and operation

Runtime 2016–2019

TRL





www.smartguide.uni-wuppertal.de/en



















Partners for Further Development

- Experts for flexibility in distribution networks
- Planners of (distributed) low voltage grids
- Developers and adopters of innovative technology for grid planning and operation
- Operators of low and medium voltage grids
- Designers of business models around flexibility
- Research community around demand and generation profiles
- Research community around differences in European regulation











Direct and automated cooperative market for grid operators on national and transnational level for integration of local flexibility

TSO/DSO Interface

Topics

automated markets, inter-DSO, DSO/TSO, system architecture, grid management, flexibility, storage systems, business models, stakeholders

Results Technology Market Adoption

- System architecture for using flexibility close to the origin (respecting grid requirements)
- T Design for lean interface between DSO and TSO
- T Hardware and software agents for automated local market clearing algorithms, flexibility clustering and load control
- T PLC communication technology and cascade for automated grid operation from market to energy asset
- M Catalogue of roles of actors in local balancing and trading
- M Proposal for a regulatory framework and market enabling congestion management and local balancing
- M Multi-actor business models for flexibility and balancing incl. incentives and constraints of stakeholders
- M Market framework for regional trading integrating flexibility providers and catering to stakeholder needs
- A Simulation tool for scenario evaluation

Runtime

2016-201<u>9</u>

TRL

3 —





www.callia.info/en/



























Partners for Further Development

- Operators and experts of local markets
- Research and development community around reactive power procurement scenarios
- Aggregators and grid planners and operators
- Designers and providers of energy market places
- Experts for flexibility in transmission grids
- Developers and adopters of innovative technology for grid planning and operation
- Research community around (automated) cascaded flexibility management and communication
- Research community around energy market stakeholders











Virtual power plant for renewables-based ancillary services

Cluster

TSO/DSO Interface

Topics

ancillary services, renewables, stability, virtual power plant (VPP), frequency reserve, simulations, forecasting

Results Technology Market Adoption

- VPP control system aggregating distributed renewable energy resources for frequency containment and frequency restoration & replacement reserve as required by TSO
- VPP model incl. hardware, forecast tools for power generation and flexibility, reserve simulation and dispatch control algorithm considering plant & system inertia
- T Evaluation methodology for renewables solutions based on forecast of weather events (EU-wide)
- M Estimates for revenue increase for renewables power plants and cost savings of reserve for grid operators
- A Stochastic and operational bidding tool for the VPP for bringing flexibilities to the market accounting for user behaviour

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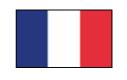




www.restable-project.eu/























Partners for Further Development

- Research and development community around VPP and forecast tools
- Research and development community around inertia, frequency management and reserve simulation
- Operators and designers of renewables power plants
- Designers of market models integrating flexibility
- Grid planners and operators
- Developers and actors of reserve markets













Voltage control on the transmission grid using wind power at other voltage levels

Cluster

TSO/DSO Interface

Topics

wind, reactive power, DSO/TSO interface, voltage control, coordination

Results Technology Market Adoption

2016-2018

- T System for controlling voltage in the transmission grid by adapting voltage in wind turbines at lower voltage levels
- T Voltage control strategies for medium voltage grids with distributed generation
- Voltage control algorithms, component and communication design for controllers in wind turbines, static VAR compensators and transformer tap-changers
- T Analytical model for estimates of potential for reactive power provision by distribution grids
- M List of requirements for response to reactive power requests from superior grids
- M Method for assessing the stability of distribution grids with distributed wind power with varied scenarios

TRL





www.volatile-project.com/





VATTENFALL







Partners for Further Development

- Research and development community around interoperability, grid code implementation and TSO/DSO interfaces
- Designers of (remuneration models for) ancillary services and providers, especially reactive power support/ voltage control
- Operators of medium voltage grids with distributed generation
- Operators of reactive power markets











Technology and market integration for coordinated ancillary services covering different voltage levels

Cluster

TSO/DSO Interface

Topics

ancillary services, flexibility, reactive power, energy management, converter interoperability, cross-voltage levels, TSO/DSO, virtual and topological power plants, grid codes

- T Simulation platform for cross-voltage-level scenarios with varied distributed energy resources
- Control and monitoring system for the coordination of ancillary services (AS) across voltage levels
- T Catalogue of requirements for AS at DSO/TSO level
- M Set of market mechanisms, business models and roles for AS by prosumers and responsive consumers
- M Catalogue of trading options for topological and virtual power plants
- M Evaluation sheet of grid codes and list of recommendations for improvements
- M Assessment sheet of impact of European market frameworks on VPP participation
- A Catalogue of best practices for engaging prosumers





www.decas-project.eu/







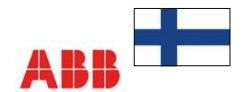














Partners for Further Development

- Developers and providers of ancillary services
- Providers of flexibility
- Experts in user-centered interface design
- Providers of short-term forecasts for active and reactive DER power
- Research and development community around grid codes, interfaces and interoperability
- Managers of grids (all voltage levels)
- Operators of virtual and topological power plants











Utilizing batteries in electric vehicles to store solar electricity

Cluster

Local Energy Communities and Microgrids

Topics

photovoltaic power production, renewable energy sources, batteries, electric vehicles, charging stations, CO2 emissions, virtual networks, big data, low voltage, peer-to-peer (p2p)

Results Technology Market Adoption

- Supervisory control and data software for production and consumption in a distribution grid with high EV and PV load
- T Strategies for efficient power storage and consumption reducing grid strain based on smart meter data, e.g. by adapting power consumption at EV charging stations to production
- M Scalable business model for a virtual network for realtime p2p trading of solar power
- M Mechanism for issuing and trading guarantees of origin
- A Toolkit for municipalities and companies investing in EV charging infrastructure and PV

Runtime 2016-

TRL

7 —





www.solarcharge2020.org/

















Partners for Further Development

- Municipalities and companies planning/operating PV and/or EV installations
- Designers and operators of distribution grids seeking to integrate RES and/or small producers
- Researcher community investigating EV storage solutions
- Developers of virtual networks
- Providers of software for load balancing and marketplaces for p2p trading









MATCH



Markets, actors, technologies: A comparative study of smart grid solutions

Cluster

Local Energy Communities and Microgrids

Topics

stakeholder requirements, socio-technical networks, local anchoring, DC grids

- T DC hardware, system architecture and communication protocols for grid balancing with PV and storage, renewable powered company fleets and comprehensive energy concepts
- T Test bed for emulating DC grids (configurable topology, grounding systems etc.)
- M Implementation guidelines for workable smart solutions considering technology, market and stakeholders requirements
- A Characterisation of user roles with requirements for microgrid solutions
- A Catalogue of strategies and conditions for active involvement of small con-/prosumers in electricity generation and grid balancing incl. the potentials and limitations of economic incentives

MATCH



www.match-project.eu/

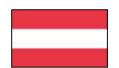




















Partners for Further Development

- Experts in long-term user involvement for smart energy
- Experts for social acceptance of smart technology
- Intermediaries between energy system planners and consumers
- Research and development community around business and market models relying on active user participation
- Designers of smart grid solutions
- Planners or smart energy system











Distribution level microgrid concept integrating distributed generation sources and consumer participation

Cluster

Local Energy Communities and Microgrids

Topics

flexibility, microgrids, hierarchical control, simulation scenarios, optimized control, energy management systems, distribution level

- T Framework for microgrid scheduling incl. uncertainty management
- T Communication protocols for operation of microgrid components and interface to local energy markets
- M Decision support tool for DSOs and aggregators guiding daily, real-time allocation of resources and interaction at whole-sale & ancillary service markets
- M Operation mechanism and structure of local market for microgrid management
- M Economic assessment for microgrid business cases





www.ugrip.eu/













Partners for Further Development

- Planners and operators of microgrids and aggregators
- Operators of distribution grids connected to microgrids
- Developers of communication protocols for grids
- Providers of solutions for interfaces between microgrids and distribution grids
- Providers of energy management systems for microgrids
- Research community around uncertainty in grid operation
- Designers of energy market models













Energy management system with demand response for grid-friendly quasi-autarkic energy cooperatives

Cluster

Local Energy Communities and Microgrids

Topics

demand response, forecasting algorithms, cooperative models, decentralized coordination, energy management system, renewables, user preferences

- T Control algorithms for energy services with distributed storage units (batteries, heat buffer, EV)
- T Licensable software for distributed sector-coupled energy management system and community management system
- T Forecasting algorithms for PV generation, load and heat demand
- M Cooperative business models for microgrids
- M Characterisation of the market actor "microgrid manager"
- A Decision model for eliciting user preferences





www.grid-friends.com















Partners for Further Development

- Research and development community around forecasting algorithms; multi-sector, multi-vendor energy management systems; distributed flexibility aggregation and exchange; user preferences for energy products
- Providers of solutions for microgrids eager to test interoperability
- Developers of energy management systems
- Distribution and micro-grid operators
- Energy community pilots
- Established and emerging energy cooperatives







