GENTE Energy Community Toolkit

MOTIVATION
Why should I participate in or setup an energy community?

CREATION
How do I setup and/or participate in an energy community?

OPERATION
What technology and tools are available to operate an energy community?

INSPIRATION
What energy communities exist already and how do they operate?

Purpose	Goals & Motivations	Why	People	Use cases	Future of Energy Communities	Process	Options	Simulate	Forecast	Manage	Optimize	GENTE demo sites	Other toolkits
QUESTIONS YOU MIGHT BE ASKING													
What is an energy community?	What are your most important needs as an energy stakeholder either as consumer, prosumer, technology provider or asset owner?	Why are energy communities an important concept?	Who are the relevant stakeholders and what is their role?	What use cases exist for the creation and operation of energy communities?	How many energy communities are there in Europe?	How do we make decisions?	What types of energy community business model are there and how are they defined?	How do the different aspects of a building (materials, type of controllers, outdoor conditions, occupancy) affect building energy performance and indoor conditions?	Can short term solar power (1 day) be forecast (on the edge) reliably?	What can be done to improve the energy production from the PV plants/modules?	How can the energy production and consumption of an energy community be optimized?	What are some examples of conceptual data models for energy communities?	Where can I find information and guidance about other energy community topics?
How are energy communities described in the pertinent literature?	What are your motivations for participating in local energy community projects?	Why choose to join or create an energy community?	How can end users and other stakeholders be involved in the establishment and design of an energy community?	What business model is best suited to you?	How have energy communities developed over time?	How do I find other people to get involved?	What are the guidelines and requirements for implementing a distributed, interoperable, and private energy community?	What are the benefits of simulating building and energy systems during the design process?	How can renewable energy generation (e.g. PV output) be accurately predicted to optimize its integration into the grid?	What is the under-performance level of the PV modules/ plants and why are they under-performing?	What tools exist to optimize energy production?	What are some examples of logical data models for energy communities?	What other toolkits and guidance exist to help me create, join, and operate an energy community?
What are the main characteristics of energy communities?			What are the benefits of installing an energy management system from the end-users, society and aggregator perspective?	How can energy communities help DSOs with grid services?	What factors influence the development of energy communities?	What regulations apply?	How can an energy community handle personal information in a private, secure, trustworthy way?	What value could adding a heat pump system in a building bring?	What is the most reliable way to forecast electricity demand and supply for efficient energy balancing?	How to schedule devices within a building to minimize cost and peak load?	What tools exist to optimize energy consumption?	What are some examples of a data management system applied to real-world energy communities (physical data models)?	
What are the four archetypes of energy communities defined for the GENTE project?				What are the motivations for energy communities participating in grid services?	What are the key factors that create an enabling environment for energy communities?	How can end users and other stakeholders be involved in the establishment and design of an energy community?	What types of technologies are used to develop secure, private, distributed energy management systems?		How can heat load forecasting support efficient operation of district heating systems or heat pumps?	How to handle uncertainties related to PV and load forecasts?	What goals and/or services can energy communities be optimised to fulfil?	What is the potential for energy communities in reducing CO2 emissions?	
				What frameworks are required for energy communities participating in grid services?	What concepts will be important to energy community development in the future?	What are the possibilities and limits of a co-design approach for creating a potential energy community?	What open source tools and services exist to help manage community and personal data in a private, secure, trustworthy way?			How much flexibility can be provided by buildings?		Could an energy community help me increase autarky and self consumption of my PV installation?	
				What are the benefits of installing an energy management system from the end-users, society and aggregator perspective?	How are energy communities predicted to develop in the future?	What are the key learnings derived from the initial phase of the co-design process?	What needs to be considered when designing a data management plan for an energy community?			What open source tools and services exist to help manage community and personal data in a private, secure, trustworthy way?		Can energy communities help to reduce power peaks from the grid?	
					What technologies or solutions can reshape the energy market in the future?	What is the business logic that relates to smart contracting in an energy community?	How do applications of blockchain technology adhere to GDPR requirements?			What is an example of how smart contract technologies can be implemented at energy communities to manage energy consumption, production, and remuneration?		How can energy communities measure and validate their solutions?	
							How does the EU Digital Wallet apply to energy communities?			How can energy communities help DSOs with grid services?		What lessons have been learnt through the GENTE project?	
							What is Zero Knowledge Proof and how does it apply to digital wallets?			What are the benefits of installing an energy management system from the end-users, society and aggregator perspective?		How can the lessons learnt and technologies created be replicated outside the GENTE project?	
							What does a system architecture look like for an energy community?						
							What grid services can energy communities provide and what does a grid services workflow look like / contain?						

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KEY TERMS

Purpose: Definition; History; Characteristics

Goals & Motivations: Professionalisation; Commercialisation; Key Exploitable Results

Why: Motivations; Surveys

People: Participation; Activation; End users; Stakeholder needs

Use cases: Applications; Grid flexibility; Energy efficiency; Self-consumption optimization; Peak load management; CO2 emissions reduction; Community autarky; Community federation; Community energy costs; Co-design process

Future of Energy Communities: Enabling environment; Predictions; Legislation; Impact; Policies; Scenarios; Future perspectives

Process: Decision making; Collaboration; Stakeholder engagement; Co-design; End user engagement; Replicability; Scalability

Options: Archetypes; Organizational models; Business models; Market; System architecture; Compliance; Conceptual data models; Logical data models; Physical data models; Regulatory Frameworks; EUDI; Business Logic; Digital wallet

Simulate: Digital twin; Building simulation

Forecast: Forecast algorithms; PV forecasting; Load forecasting; Heat demand forecasting; Day-Ahead Forecast; Irradiance Prediction; Weather Forecasting

Manage: Edge devices; Submetering Devices; PV fault detection; Current-Voltage characteristics; Microcontroller; Heat pumps; Grid services; PV module degradation; Building energy management; Energy management system; Interoperability; Modularity; Flexibility; Autarky; GDPR compliance; Zero Knowledge Proof; Self-consumption; Decentralisation; Smart Contracts; Privacy by Design; IoT platform; Distributed Computing; Open Source; Data management; Decentralized Identifiers; Digital Wallet; Ontology; Distributed Ledger Technology; Blockchain technology; Multi-Party Computation; Self Sovereign Identity

Optimize: Production estimates; Heat pump optimization; Artificial intelligence (AI); Privacy-Preserving Learning; Edge intelligence; Optimization; Uncertainty handling; Flexibility; Self-consumption; Autarky

GENTE demo sites: Test cases; Validation; Lessons learned; Replicability; Scalability; Guidelines; KPIs; Potential of Energy Communities; Potential for CO2 reduction; Increase in community autarky; Peak load reduction

Other toolkits: Toolkits; Guidance; Best Practices

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RESOURCES

Energy community definition
- Video - GENTE Project intro
- D4.1 report abstract - "Characteristics of energy communities and motivations, engagement, and socio-economic profiles of end users"
- D4.1 report - "Characteristics of energy communities and motivations, engagement, and socio-economic profiles of end users"
- Am Aawasser Community website
- HSB Living Lab Community website
- Article - "Trouver le juste milieu" ("Finding the middle ground") in bulletin.ch

Stakeholders - needs
- D3.2 report - "Specification of relevant need owners"
- Blog post - survey - "Are you part of an Energy Community? Contribute to GENTE by filling out our survey about your needs."

Energy community definition
- D4.1 report abstract - "Characteristics of energy communities and motivations, engagement, and socio-economic profiles of end users"
- D4.1 report - "Characteristics of energy communities and motivations, engagement, and socio-economic profiles of end users"

Future energy community scenarios
- D3.1 report abstract - "Future energy community scenarios"
- D3.1 report - "Future energy community scenarios"
- Research paper - based on D3.1 - "The Development of Energy Communities in Europe: History, Success Factors, Future Perspectives"

Why energy communities are important
- Video - GENTE Project intro
- Article - "Trouver le juste milieu" ("Finding the middle ground") in bulletin.ch

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Co-design process
- D4.2 - summary of findings - "User engagement in co-design process"

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Use case definition - need owners
- D3.3 report - "Definition of highly applicable use cases"
- D6.3 report - "Optimal LEC operation based on smart BEMS"

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Grid support services
- D6.4 report - "Grid support services from LEC to system operators"

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Business models
- D4.5 report - "Business models for GENTE solutions with replicability and scalability evaluation"

System architecture & Data models
- D8.1 report - "GENTE System Architecture: Conceptional, logical and physical data models for LEC"

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Organisational perspective
- D4.1 report abstract - "Characteristics of energy communities and motivations, engagement, and socio-economic profiles of end users"
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- D3.1 report abstract - "Future energy community scenarios"
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Technical & privacy perspective
- D7.1 report - "Guidelines and requirements, initial set of smart rules and related ontology"
- D7.2 report - "Validation of DLT and GDPR compliance legal rules"
- D7.3 report - "Data privacy and Smart Language ABC"

System architecture & Data models
- D8.1 report - "GENTE System Architecture: Conceptional, logical and physical data models for LEC"

Digital twin
- D5.3 report abstract - "Community digital twin"
- D5.3 report - "Community digital twin"
- Research paper - based on D5.3

Generation forecasting
- D5.2 report - "Edge-based DER forecasting and diagnostic algorithm, including privacy-preserving learning"
- GitHub repo - Forecaster algorithm - forecast PV generation and electricity usage
- GitHub repo - Jupyter notebook of forecasting results
- D6.1 report - "Advanced Load and Generation Forecast"
- Research paper - "Scalable and Lightweight Machine Learning Based Load Forecast: Netload versus Disaggregated Forecast"

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Electric load forecasting
- D6.1 report - "Advanced Load and Generation Forecast"
- Research paper - "Scalable and Lightweight Machine Learning Based Load Forecast: Netload versus Disaggregated Forecast"

Thermal load forecasting
- D6.1 report - "Advanced Load and Generation Forecast"
- Research paper - "Scalable and Lightweight Machine Learning Based Load Forecast: Netload versus Disaggregated Forecast"

Building Energy Management System
- D6.2 report - "Advanced BEMS for "Building control as a service"
- Research paper - "A Novel Energy Management System for Optimal Energy and Flexibility Scheduling of Residential Buildings: A Case Study in HSB Living Lab"
- Research paper - "Flexibility provision from battery storage and PV inverters using IoT platform: Real-life demonstrations at Chalmers campus"
- D6.3 report - "Optimal LEC operation based on smart BEMS"
- Article - EcoCoach at Am Aawasser

Sub-metering device
- D5.1 - Presentation & Documentation - SmartHelio sub-metering devices
- SmartHelio website

Grid support services
- D6.4 report - "Grid support services from LEC to system operators"

Distributed Ledger Technology (DLT)
- D7.1 report - "Guidelines and requirements, initial set of smart rules and related ontology"
- D7.2 report - "Validation of DLT and GDPR compliance legal rules"
- D7.3 report - "Data privacy and Smart Language ABC"

Optimizer
- Video - "Introducing GENTE's Local Energy Community Optimization Algorithm"
- Blog post - "Introducing GENTE's Local Energy Community Optimization Algorithm"
- GitHub repo - Optimizer algorithm - control flexibilities

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Grid support services
- D6.4 report - "Grid support services from LEC to system operators"

Am Aawasser - Switzerland
- Am Aawasser website
- Am Aawasser Factsheet
- Article - EcoCoach at Am Aawasser
- Video - "Introducing GENTE's Local Energy Community Optimization Algorithm"
- Blog post - "Introducing GENTE's Local Energy Community Optimization Algorithm"
- D5.1 - Presentation & Documentation - SmartHelio sub-metering devices
- D8.1 report - "GENTE System Architecture: Conceptional, logical and physical data models for LEC"
- D9.1 report - "Test cases, assessment framework and KPIs"
- Results - D9.2 report - "Summary of demo case requirements, scenarios, solutions and evaluation for each site"
- GitHub repo - Am Aawasser Test Case results
- Results - D9.3 report - "Assessment of demonstration, identification and lessons learned/best practices for replication"

HSB Living Lab - Sweden
- HSB Living Lab website
- HSB Living Lab Factsheet
- D6.2 report - "Advanced BEMS for "Building control as a service"
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- D8.1 report - "GENTE System Architecture: Conceptional, logical and physical data models for LEC"
- D9.1 report - "Test cases, assessment framework and KPIs"
- D5.3 report abstract - "Community digital twin"
- D5.3 report - "Community digital twin"
- Research paper - based on D5.3
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- Results - D9.3 report - "Assessment of demonstration, identification and lessons learned/best practices for replication"

Toolkits from other projects
- Toolbox - REScoop.EU
- Energy Communities Repository - European Commission
- Global Observatory on People-Centred Clean Energy Transitions - IEA
- Community Energy Toolkit: Best practices for broadening the ownership of renewables - IRENA
- Energy Solidarity Toolkit - CEES
- Behavioural Insights Toolkit - UsersTCP
- Resources - Energy Community Platform
- Energy Community Card Game - Reschool Project
- COOLKIT: The knowledge repository to help you build your energy community - Compile Project
- Community Climate Action Toolkit - Schumacher Institute
- Energy Futures Toolkit - Carbon Coop

Energy community definition
- Research paper - "Terminologies and concepts of energy cooperations in Europe: A systematic review of characteristics, potentials, and challenges"

Co-design process
- QUBE Project: Accommodation-related energy cooperation in Wesemlin, Switzerland - HSLU project page
- QUBE Project: Accommodation-related energy cooperation in Wesemlin, Switzerland - Article
- QUBE Project: Accommodation-related energy cooperation in Wesemlin, Switzerland - Dialog Luzern

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- Link to a code and data repository
- Link to a video
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- Research paper - published
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How to use this toolkit

Visit the how-to guide for a walkthrough and tips on how to use the toolkit.

If you have problems accessing any of the resources in the toolkit, have a look in the GENTE public deliverables folder - all resources are available there.

How-to guide | Public deliverables folder

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Contact us

Get in touch with the team on hello@genteproject.com or via the details on the HSLU GENTE Project page.

HSLU GENTE Project page | GENTE website

Partners

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