Northern Periphery and Arctic Programme
2014–2020

EUROPEAN UNION
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LECo

Local Energy Communities

A comparative analysis: Legal framework – from words to deeds

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A comparative analysis: Legal framework – from words to deeds.

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1 INTRODUCTION AND BACKGROUND

The project LECo – Local Energy Communities - supports small municipalities and communities in the partner regions of Finland, Ireland, Norway and Sweden to benefit from each other's experiences with energy initiatives. LECo also seeks to integrate experiences from Germany. The partner regions of LECo include the following counties, project results are expected to be applicable in the entire NPA-program area:

- Finland: Central Ostrobothnia
- Ireland: Western Region (Donegal, Sligo, Leitrim, Roscommon, Mayo, Galway, Clare) for the Western Development Commission and the Gaeltacht Region for Údarás na Gaeltachta.
- Norway: Finnmark and Troms
- Sweden: Norrbotten

Costs of energy - electricity, heat and transport fuels - are significant expenditures for households and institutions in municipalities and communities, where most of the spent money leaves the community boundaries. LECo aims to contribute to retain a significant share of these outflowing financial resources within a local community, by enabling communities to develop local energy initiatives and to invest in local community and cooperative energy projects.

Part of the planned outcomes of LECo´s work package T2 (WP T2) is an analysis and comparison of existing policies and legal frameworks in the LECo partner regions, which affect municipalities and communities in their decision making on energy projects. Another activity in WP T2 is to interview stakeholders on the effectiveness of policy. This report, including interview summaries, is a delivery to WP T2.

Section 2 presents key energy indicators of the LECo partner countries, Section 3 to 7 provide country specific accounts on legislation, institutions, incentives and other support structures as relevant for cooperative community energy initiatives, but also for municipal energy activities. Interview results and recommendations are included in the country specific sections. A summary section concludes this report.

1.1 Clarification of terms

Energy initiatives in small municipalities, villages and communities are in the focus of LECo and this report. For briefness and clarity in this report, we chose the term "community energy", which intends to include both energy initiatives implemented by the local authority governing the small municipality, the village or the community and initiatives from citizens, corporates and cooperatives.

The term "small municipality" has not been defined, but the majority of municipalities in the LECo region have populations below 10,000. These small municipalities, villages and communities within such municipalities are the main beneficiaries of LECo.

1.2 Community Energy

Community energy has its roots in the vision of small and locally driven generation and distribution of renewable energy and energy efficiency projects, which are economically useful, while contributing to national climate and renewable energy targets. Local ownership and control are preferred and additional advantages include raised awareness, reduced energy consumption and increase in local value creation. The concern for the community and the notion of creating something together are also part of the driving factors behind community energy initiatives (Spear 2000; Warren 2008; Yildiz 2014, Yildiz 2015).

Energy initiatives as presented in Table 1 can include information campaigns and awareness-raising activities, solutions aiming to reduce energy consumption, projects for renewable electricity and heat generation and bioenergy supply.

Table 1: Projects for energy efficiency, renewable electricity and heat generation and bioenergy supply

Renewable electricity	Renewable heating/cooling	Renewable fuels	Energy efficiency
Wind energy (onshore)	Domestic solar thermal heat (hot water and heating)	Biodiesel	Improving building envelopes
Wave and tidal energy	Large solar thermal heat integrated with DH	Bioethanol	Applying advanced building standards
Small (domestic rooftop) solar PV or small ground-mounted.	Solar thermal cooling	Plant oil	Street lighting
Large solar PV (roof- or ground-mounted)	Groundsource heat-pumps and floor heating systems.	Forestry residues; wood-chips; Pellets; waste-wood (returflis)	Public buildings
Small hydropower	Water heat-pumps (lakes, rivers, ocean)	Peat for DH-boilers; peat for residential use.	Commercial buildings
Biogas electricity or CHP.	Air heat-pumps		Apartment buildings
Wood-fired micro CHP.	Wood-fired boilers Peat-fired boilers		Residential buildings
Local district heating CHPs: Biogas-CHP Wood-fired-CHP Peat co-fired-CHP	Biogas, biodiesel-fired boilers	**Transport sector:** Focus on walking, cycling, and public transport. Biogas for busses, etc. Electric vehicles, charging stations, ...	
Micro-grid and electricity storage: Behind the meter On the grid	Local district heating boilers: Biogas Wood-fired Peat co-fired		

Source: Authors.

1.2.1 Organisational models

Community energy in practice applies several models, with varying financial and ownership structures, where the following three are the most common (Oosten 2014, Haggett 2013):

- **The co-operative model**: membership based and democratic.
- **The joint venture**: co-ownership between cooperatives, municipalities and energy companies.
- **The local company**: initiated by a local entrepreneur, supported by the community.
- **The municipal utility**: a municipality owns and operates an energy utility.

Energy undertakings are either municipality owned or are a mix of municipal, community and commercial ownership that treat citizens as active contributors (Roberts 2014). It is important to note that community benefits should not be perceived as goodwill, compensation or "payoffs" (IWEA 2013).

Cooperative models ensure high shares of genuine local ownership, increase citizen involvement and can reduce NIMBY (not in my backyard) effects. Energy cooperatives are largely producer cooperatives, consumer aspects are included in cases when cooperatives offer members discounted rates for energy self-consumption.

Energy cooperative members perceive a membership as low risk investment in case a legal framework exists which supports Renewable Energy and Energy Efficiency Projects (REEEP) and provides for long-term economic security. Individual investments or membership-shares are relatively low and range between EUR 500 and EUR 1000, a maximum share per member may avoid the dominance of a single member (Bohnerth 2015).

1.2.2 Best practices for energy cooperatives

A number of guidelines and handbooks on best practices for energy cooperatives are available, including the Best Practices Reports I+II from REScoop, reports from 100% RES communities, good practice brochures from 100 RE regions in Germany and examples from Ireland (REScoop 2015, 100% RES communities, 100e-Regionen, FoE 2014, Oosten 2014). Best practice principles from these sources include:

Organization and relations with stakeholders:

- Open and democratic membership with clear and unambiguous ethical principles
- Start small and simple to create fast successes, learn from and cooperate with other coops
- Transparent and sound financial plans and control
- Use the social, organizational and technical competencies of members
- Consider members as stakeholders, foster active citizen participation

- Create a knowledge sharing and learning environment, include experts
- Get support of local authorities

Energy conservation and energy efficiency:
- Raise awareness amongst members
- Start with energy conservation and efficiency projects with low investment costs and fast payback (low hanging fruits)
- Cooperate on procurement of renovation, insulation, etc. materials and services
- Consider financing energy efficiency through energy generation revenues

Production, grid connection, sale of electricity and heat:
- Consider different business and ownership models
- Prioritize that members use the energy produced
- Use local resources – wind, solar, hydro, biomass, biogas, etc.
- Combine technologies and optimize the system
- Plan for grid connection (electricity), use smart grids
- Convert fossil fuel heating to biomass heating, consider developing a local district heating system utilizing local agriculture and forestry residues

Community engagement:
- Focus on involving and strengthening the local economy (local value creation)
- Educate the community
- Connect city and rural surrounding
- Connect and cooperate with other communities
- Engage in sustainable development of the municipality, i.e. engage in municipal master and detail planning consultations

A stable legal framework, which reduces economic risks and guarantees long-term security in investments, is crucial for the sustainability of energy cooperatives (citizenergy 2017; Kaphengst 2014).

1.2.3 Common barriers

Barriers in the RES energy field that affect community energy projects include the following (FoE 2014, Oosten 2014, RES-coop 2015):

Societal, cultural, political and/or organizational:
- Lack of historic experience with cooperatives and civic activism
- Low trust in the cooperative model as a viable alternative
- Lack of support from local political representatives

Legal, administrative, bureaucratic:
- Generally, no specific support schemes and incentives for community RES-projects
- Complicated legal framework for RES-projects, high levels of bureaucracy to acquire licenses for electricity producers, micro-grids, permits for grid-connection and feed-in, etc.
- Lack of a national community energy strategy and respective support schemes and institutions

Technical:
- Lack of expertise to design, plan, procure, implement and commission an energy project
- Lack of skilled personnel for operation and maintenance
- Size of energy project can be challenging – wind, hydropower, biogas, district heating, etc.

Financial:
- Financial challenges in the initial stages of project development
- Long payback periods for investments
- Lack of fair and long-term secure payments for energy generated
- Insufficient incentives for renewable heat projects
- Complicated tax rules, no tax exemptions or tax incentives

Challenges in mature cooperatives:
- Expansion – how shall older and new membership shares be valued?
- Re-investment into existing installations

1.3 Local value creation

Community energy efficiency and renewable energy projects create value throughout their respective value chains, including manufacturing of and trading of components and materials used, planning and design of projects, installation, operation and maintenance of installed systems (Mühlenhoff 2010). Municipalities can benefit from such value chains through:

- net profits of the enterprises involved (which are ideally reinvested within the municipality)
- net income of employees involved (which increase local consumption) and
- taxes paid to the municipality (which improve revenue base and allows the municipality to invest and to employ people in other sectors, e.g. schools, kindergarten, elderly care, etc.).

To what extent a municipality directly benefits financially from energy projects depends on the geographical location of the project, the location of the enterprises involved in its delivery and operation and the country's rules on income, business, property tax and other municipal taxes and fees. Municipal value creation increases when more activities on the value chain are located within the municipality. Established enterprises can then also be active with projects in other municipalities, which contribute to an increased value creation at the enterprises' location.

Investigations of German examples of community renewable energy projects show that municipal value creation is highest with wood-fired local district heating systems in combination with solar thermal systems, followed by wood-fired boilers and ground-source heatpumps. Large ground-mounted Solar PV systems are advantageous over small rooftop PV systems and over capital-intensive wind-energy systems (Mühlenhoff 2010).

An online value creation calculator for Germany is available here: *http://www.kommunal-erneuerbar.de/kommunale-wert-schoepfung/rechner.html*

Another tool to determine value creation for building energy efficiency measures is accessible here: https://wertschoepfungsrechner.difu.de/startseite/

The scope of this project does not allow a deeper investigation and comparison of the different tax regimes in the project partner countries and their actual contributions to the municipal revenue base. It is important to note that differences exist and can result in respectively lower or higher interest amongst political leaders to support local energy initiatives.

1.4 Municipal planning

Planning and development for local authorities means to anticipate the future and attempting to shape it for the good of society. Municipal planning aims to keep or improve the quality of living, to ensure sustainable development and efficient use of land, water, air and other natural resources, settlements shall be energy and transport efficient (SPECIAL-EU 2016).

Zoning maps or area regulations can provide more structure for planning, which can address issues such as noise, microclimate, heating methods, land use for energy, flooding and other protection areas such as coastlines, climate change adaptation.

National legal frameworks on the use of natural resources as well as building laws guide spatial and master planning. Typically, land use planning is mandatory on municipal level; other planning, such as economic and local development planning activities, may be mandatory too or is voluntary.

It is important to integrate spatial and municipal master planning with energy and transport planning, which includes land use for energy purposes, such as hydro, wind, solar, biomass, district heating and cooling, waste to energy facilities; and for transport needs. Cooperation and coordination between municipalities and within a region is required at least for bigger infrastructure developments.

Spatial planning – land use planning - Spatial planning has a key role to play in local or regional government's delivery of low-carbon development, infrastructure and renewable energy projects. It also offers an important means of engaging with communities and stakeholders, acknowledging the interconnectedness of issues, which surround the management of space and community.

Master planning - is comprehensive planning for new development – including new settlements and sustainable urban extensions – or for the regeneration of a part of a city.

Energy planning - Energy planning is undertaken by a local authority as part of or complement to master planning, either as a legal obligation or on a voluntary base.

1.5 Approach

For this report, the authors conducted a desk research on legal and policy frameworks, institutional setups, support schemes and incentive programs as deemed relevant for community energy initiatives. Interviews with expert stakeholders on policy effectiveness complement these investigations.

2 COUNTRY ENERGY INDICATORS

The countries of Finland, Ireland, Norway and Sweden are located in the NPA-region and together with Germany they are partner countries in the LECo-project. This section provides an overview of key energy indicators (Table 2) on electricity, heating and RES-shares as relevant for the project.

Table 2: Key energy indicators (2016), electricity consumption and heating demand, RE shares (% 2016), RE target shares (% 2020)

Key energy indicators 2016. 2020 targets	EU28	FI	GE	IE	NO	SE	**Sources**
Final electricity consumption (TWh)	2784	81	517	26	114	128	eurostat, ssb.no
Share of renewable electricity cons.	27%	33%	32%	27%	105%	65%	eurostat
Target share RE-electricity cons. in 2020	20%*	33%	38.6%	42.5%	113.6%	62.9%	**NREAP**
Heating Degree Days, average 2010-2015	3157	5453	3077	2853	5645	5214	eurostat
Building Heating Demand (TWh)	4306	40.8	590	34	41.7	76.4	National statistics
Share of RE in Heating and Cooling (H&C)	19.1%	54%	13%	6.8%	31.7%	68.6%	eurostat
Target share RE-H&C cons. in 2020	20%*	47%	15.5%	12%	43.2%	62.1%	**NREAP**
Population (million)	510.3	5.5	82.2	4.8	5.2	9.9	eurostat
Final electricity cons. per capita (MWh)	5.46	14.69	6.29	5.33	21.83	12.88	calculated
Building heating demand per capita (MWh)	8.44	7.42	7.18	7.08	8.02	7.72	calculated
* EU 2020 target for renewable energy							

Norway and Sweden have the highest RE-electricity shares in the partner countries. Hydropower in Norway and in Sweden, increasing windenergy and high bioenergy-shares in Sweden´s combined heating and power plants (CHP) are the main contributors.

RE-heating shares are highest in Sweden and Finland as a result from biomass use in district and individual heating. Norway´s electricity use in heating results in a relatively high share of RE used in the heating sector. Ireland appears to be significantly behind its 2020 RE-targets for both electricity and heating. Both Ireland´s and Germany´s NREAP-2020-targets for RE-shares in the heating and cooling sector are modest as compared to the Nordic countries.

Climatic conditions in the Nordic countries, as expressed through Heating Degree Days (HDD), and a high share of electricity use for heating, result in much higher per capita electricity consumption in the Nordic countries as compared to Ireland and Germany. Building heating demand per capita in these countries is however only slightly higher as a result from better building insulation standards as compared to Germany and Ireland.

3 FINLAND

Finlands National Energy and Climate Strategy for 2030 targets an 80–95% reduction in greenhouse gas emissions by 2050 (tem.fi 2017). The Strategy promotes decentralised electricity and heat production based on renewable energy. Wood heating in rural areas and urban centres are supported, replacing fossil-based heating and reducing electricity demand for heating. However, there is a discourse about CO_2 impact of wood burning and some researchers regard that increasing wood harvesting and usage of wood reduces forest carbon sink and can actually increase net carbon emissions (bios.fi 2017). Efforts to improve on the efficient use of energy shall continue (tem.fi 2017). The crucial role of municipalities and regions in reaching the emission targets is recognised and the National Strategy shall support these entities in their efforts to implement solutions.

3.1 Legislation

3.1.1 Regional and municipal planning

The Ministry of the Environment (YM) and the 15 Centres for Economic Development, Transport and the Environment under the Ministry of Economic Affairs and Employment (TEM) are the responsible government authorities for planning. The Finnish Environment Institute (SYKE) carries out environmental research and produces national follow-up data on the state of the environment and planning.

TEM is jointly responsible with other ministries and other actors for coordinating, monitoring and evaluating the preparation and implementation of regional strategic programs under the Regional Development and Funding Acts (finlex 7/2014, finlex 8/2014).

Regional councils from 18 + 1 regions (18 regions in Mainland Finland and the Province of Åland) are responsible for overall regional development and regional land use planning in Finland. They cooperate with government authorities, municipalities, universities and other stakeholders in their regions involved in regional development. The mid-term regional strategic program and the regional land use plan implement long-term regional plans (20-30 years).

Municipal councils prepare local master plans, which adhere to regional plans and direct the preparation of local detailed land use plans, as mandated through the Land Use and Building Act and Decree (finlex 132/1999, finlex 895/1999). Land use should promote the ecological, economic, social and cultural sustainability of communities and living environments. The National Building Code, including Energy Efficiency Decrees and Guidelines, complements the legislation in the Land Use and Building Act.

The National Land Use Guidelines as part of Finlands Land Use Planning System include the promotion of energy savings, the use of renewable energy sources and district-heating facilities (Ymparisto 2017). Regional land use plans should indicate sites for wind power plants and waste combustion plants.

> *"Land use should satisfy the national needs for energy supply and promote the possibilities of utilizing renewable energy sources."* - Finland´s National Land Use Guidelines.

The Association of Finnish Local and Regional Authorities (Kuntaliito - Finlands Kommunförbund) organizes municipal climate and environment networks and supports municipalities to develop environmental, climate, energy and energy efficiency strategies and plans (Kuntaliito 2017).

3.1.2 Laws on cooperatives

In 2014, the Finnish Co-operative Act was harmonized with the Limited Liability Companies Act, which has removed the legal requirements of co-operative principles. Such principles are now depending on self-formulated by-laws and rules by the respective cooperatives (finlex 421/2013).

3.2 Institutional overview

3.2.1 Public institutions in the energy sector

Energiavirasto – The Finnish Energy Authority (https://www.energiavirasto.fi/):

- Is responsible for the implementation and administration of programs promoting the production and use of renewable energy.
- Promotes energy efficiency through actions such as energy efficiency agreements, energy surveys, providing energy guidance and communications to consumers, encouraging ecological product design, and granting energy labels.

National energy agencies and institutions, which support municipalities in climate and energy activities:

- VTT – (http://www.vttresearch.com/) - VTT Technical Research Centre of Finland Ltd is one of the leading research and technology organizations in Europe. VTT provides expert services for domestic and international customers and partners.
- MOTIVA – (https://www.motiva.fi/): Motiva promotes the efficient and sustainable use of energy and materials. Motiva provides the public and private sector and consumers with information and services that allow them to make resource-efficient and sustainable choices.

Regional and other local agencies and institutions, which cooperate with municipalities on energy initiatives and are active in the LECo-region:

- Centria UAS – University of Applied Sciences (https://web.centria.fi/)
- Thermopolis Oy – (http://www.thermopolis.fi/) - The South Ostrobothnian Energy Office is an expert in sustainable development and energy provides impartial advice.
- Valonia – (https://www.valonia.fi/) - Valonia is a service centre for sustainable development and energy of Southwest Finland.
- Finnish Forest Centre (https://www.metsakeskus.fi/node/321)

In addition, energy utilities give energy advice. In Central Ostrobothnia they include Kokkolan Energia, Vetelin Energia, Korpelan Voima (Kannus), and Toholammin Energia.

Finnish Energy – (https://energia.fi/) represents companies that produce, acquire, transmit and sell electricity, district heat and district cooling and offer related services.

Business Finland – (https://www.businessfinland.fi/) aims to develop Finland to be the most attractive and competitive innovation environment in which companies are able to grow, change, and succeed.

SITRA – the Finnish Innovation Fund - Finlands fund for the Future (https://media.sitra.fi) works under the supervision of the Finnish Parliament and is entirely self-funded.

3.2.2 Cooperative institutions and associations

Pellervo – The Confederation of Finnish Cooperatives (https://pellervo.fi/): A service organization for all Finnish cooperatives, founded in 1899:

- By 2015 about 4500 operational cooperatives are registered.
- 103 Renewable energy coops were registered by 2015.
- 7 electricity coops have over 35,000 members and a turnover of 87 MEUR (2015).
- The forestry coop (Metsä Group) has over 124,000 forest owners as members. Services of members include the supply of biomass for heating and operation of district heating systems.
- Triggered by the 1990s economic crisis cooperatives experience a revival and between 100-200 coops are founded every year.
- Source: https://www.slideshare.ne
- t/pellervo/cooperation-in-finland-2012-14261413

Pro-Agria (https://www.proagria.fi/):

- Rural Advisory Services which includes energy advice for farmers and small-scale forest owners.

Ruralia Institute of the University of Helsinki - The Co-op Network Studies (CNS) (https://www.helsinki.fi/en/ruralia-institute):

- CNS is a network established by a group of ten universities and offers multidisciplinary, web-based minor subject courses and modules related to the co-operative sector and social economy. The Ruralia Institute together with the other participating universities develop, produce and coordinate teaching within the network.

Martat (https://www.martat.fi/in-english/):

- Promotes the wellbeing of homes and families and provides energy advice for consumers.

3.3 National incentives for community energy initiatives

Most central support instruments for energy investments in Finland are feed-in tariffs, emission trading, energy taxation, and investment grants ("energy aid").

Investment grants ("Energy aid"):
Municipalities, business and other organizations are eligible for receiving energy aid for energy efficiency and renewable energy projects including sustainable biofuel production. Climate and environmental friendly investments and investigative projects with an emphasis on development of new technologies are also eligible under "energy aid" (finlex 1098/2017 and revisions).

Production support (feed-in-tariff):
A feed-in-tariff for the production of electricity from renewable sources including wind, hydropower, biogas and wood-fuels is enacted (finlex 1396/2010; finlex 1397/2010 and revisions).

Energy Efficiency Agreements 2017-2025 (EEA):
The voluntary EEA promotes practical energy efficiency solutions in various sectors, including industries, municipalities, properties (rental housing and commercial properties) and agriculture. Energiavirasto administrates the EEA and Motiva Oy manages practical execution, communications, reporting and follow-up of the agreements (EEA-web).

Key Elements of the EEA:

- Commitment towards continuous improvement in energy efficiency.
- Energy aid supports efficiency projects and new energy-efficient technology.
- Participants report annually on their energy efficiency improvement measures.

By January 2018 443 businesses, 53 municipalities and 4 joint municipal boards have signed the EEA.

Municipality renewable energy audit:

- Motiva offers municipalities to investigate the possibilities to produce and use renewable energy.
- In Central Ostrobothnia, at least Lestijärvi, Perho, Toholampi and Veteli have conducted this audit.

New government proposal (September 2017) on a technology neutral aid for renewable energy:
This proposal for the period of 2018-2020 would provide a premium scheme based on a tendering process, where power plant investments based on renewable energy would be promoted in a technology neutral manner. At the same time, the feed-in tariff scheme would be closed for biogas and wood-fuel plants. The aim is to increase investment of renewable electricity in a cost-effective way. The objective is to invite tenders for 2 TWh of annual electricity production by 2020 (tem.fi 2017 proposal; tem.fi 2017 proposal (Swedish)).

Table 3: Support mechanisms improve the economic profitability of small-scale energy production

The aid beneficiary	Publicly financed economic incentive for small-scale production (2014)	
Household	Tax credit for domestic projects, 45% of labor costs under certain conditions	Exemption for duty on electricity for systems <50 kW, share ca. 20% of the total price of used electricity (energy, transmission and taxes)
Enterprise or community	Energy aid, e.g. for solar energy 30% 2014	Exemption for duty on electricity for systems <50 kW and under certain conditions 50-2000 kW systems. Importance for non-manufacturing industry ca. 20% of the total price of used electricity
Farm	Agricultural investment aid for heating plants and biogas plants using renewable energy 35%	Exemption for duty on electricity for systems <50 kW and under certain conditions 50-2000 kW systems. Importance ca. 20% of the total price of used electricity
Small company	Rural enterprise support for investments 20-35%	

Source: tem.fi 55/2014.

Promotion of small-scale energy production:
Small-scale production of electricity has been promoted and barriers for it removed during the 2000s (Table 3). A model of electricity market has been created, which makes it possible for electricity users and producers to offer services flexibly. Small-scale electricity production has similar conditions to access the market than other production. The Electricity Market Act regulates access and licensing for distribution business (finlex 588/2013).

INKA – Innovative Cities (2014-2020):
INKA aims to create internationally attractive innovation clusters in Finland. Innovation clusters include companies aiming for growth that are capable of creating brand-new products and services for the international market (INKA-web).

National themes and partner cities include:
- Bioeconomy, implementation responsibility: Joensuu, partners: Jyväskylä, Seinäjoki.
- Cybersecurity: Jyväskylä.
- Future Health: Oulu, Helsinki Metropolitan area, Kuopio, Tampere, Turku.
- Smart City and Renewable Industry: Tampere, Helsinki Metropolitan area, Lahti, Oulu, Turku.
- Sustainable Energy Solutions: Vaasa, Lappeenranta, Pori.

National networks HINKU and FISU:
HINKU - Forum towards carbon neutral municipalities (http://www.hinku-foorumi.fi/). HINKU brings residents, experts and companies together to create and carry out solutions in reducing greenhouse gas emissions. The municipalities involved are committed to reduce greenhouse gas emissions more extensively and rapidly than EU targets and schedules would require. Almost 40 municipalities are committed in the HINKU network, but not any municipalities from Central Ostrobothnia.

FISU - Finnish Sustainable Communities (http://www.fisu-network.fi/). The aim in FISU is carbon neutrality, zero-waste and globally sustainable consumption by 2050. By 2018 11 municipalities participate in the FISU network.

ERA17 - For an Energy-Smart Built Environment 2017 (URL: http://era17.fi/en/)
ERA17 encourages Finland to regain its position as the leader in energy-efficient built environments.

The ambitious plan includes energy efficient buildings and energy efficient land use, which considers factors including dense urban structures, smooth public transport, and availability of nearby local services. Another focus area is distributed and building integrated energy production. ERA17 also promotes to exceed the minimum standards on energy efficiency as required by building regulations.

3.4 Regional and municipal levels

A brief overview on energy strategies from the LECo-regions in Finland, including some examples from municipalities are provided as follows.

3.4.1 Southern Ostrobothnia, Central Ostrobothnia and Ostrobothnia

The common vision of Southern Ostrobothnia, Central Ostrobothnia and Ostrobothnia is to become a European example region for sustainable development. The environmental strategy for their regions for the period of 2014-2020 provides details (NTM 2013, 2015), such as:
- Improved energy efficiency in energy generation, in industrial and municipal sectors.
- Reduced GHG emissions through: substitution of coal and oil with biofuels in energy production, increase of renewable energy shares – wind, solar, biomass (from forestry and agriculture), biogas and the promotion of electric vehicles.
- Higher recycling rates and changes in consumption patterns and lifestyle.
- The municipalities are committed to reduce GHG emissions in all own activities.

Seven regional energy offices support municipalities in their efforts. These are situated in Southern Ostrobothnia, Helsinki, Central Finland, Kokkola area, Satakunta, Tampere, Varsinais-Suomi and Lapland:

- Energy office of Southern Ostrobothnia, c/o Thermopolis Teknologiakeskus (http://www.thermopolis.fi/)
- Central Finland Energy Agency (CFEA) / Keski-Suomen energiatoimisto Kesto (http://www.kesto.fi/)
- Energy consultant in Kokkola area (Central Ostrobothnia) (http://www.muutoksentuulet.fi/).
- In Pori, Satakunta, there is a project "Satahima", offering energy advice to consumers and SMEs. (https://www.pori.fi/ymparistovirasto/hankkeet/satahima/energianeuvonta.html)
- Rane – energy advice for building and living (http://www.neuvoo.fi/) in Pirkanmaa
- Valonia - Service center of sustainable development and energy isssues in Varsinais-Suomi, (https://www.valonia.fi/fi/energia)
- Rovaniemi, energy advice of Lapland (http://www.lapinenergianeuvonta.fi/fi)

3.4.2 Ostrobothnia

The Ostrobothnia climate strategy 2040 presents a vision "Energy Coast 2040" (Österbotten 2015, Energikusten 2040). It contains objectives and concrete actions for the years 2015-2020. The climate strategy builds on Ostrobothnia's landscape strategy 2014-2017 (a draft for 2018-2021 is available) and the Ostrobothnia´s energy strategy 2010-2020 has served as regional starting point (Österbotten-web).

The Energy Coast 2040 vision includes following priorities:

- Energy self-sufficiency of the region.
- A dynamic and flexible energy supply.
- A diverse and local energy generation including energy efficiency in production and consumption.
- Smart energy grids enabling decentralized generation.
- A reduced consumption of fossil fuels in transport, increase of biofuels, focus on walking, cycling and public transport.
- Planning for densification and develop municipal energy plans.
- Improve waste management: reduce, reuse and recycle. Improve coordination of waste transport.
- Promote active and informed experts, decision makers and citizens.
- Implement green procurement for all regional and municipal activities.

The vision recognizes the importance of sustainable community structures, including village centers, cooperation between municipalities and industries and a common information system.

A working group called "Österbottens klimatdelegation" monitors implementation, organizes regular climate seminars and calculates GHG emissions.

The draft for the new Ostrobothnia's landscape strategy 2018-2021 has a strengthened focus on energy, the long-term objectives include:

Ostrobothnia is energy self-sufficient.
Electricity and heat production and transport are carbon neutral.

3.4.2.1 Jakobstad

The climate strategy for the Jakobstad region aims to use energy end resources efficiently and sets a target to reduce carbon dioxide emissions by 20% until 2020 from the 1990 level (Jakobstad 2010).

The district heating CHP-system in Jakobstad is co-fired with biomass, wood-waste, peat and coal (Alholmens Kraft). The company aims to increase biomass and wood-waste firing in the plant.

Jakobstad plans to:

- Increase wind energy within the municipality.
- Sign the municipal Energy Efficiency Agreement and to employ a responsible person.
- The municipality´s own sectors (public buildings) shall lead energy efficiency activities.
- Improve energy efficiency through measures such as information campaigns, advice and the provision of tools to households to manage energy consumption.

3.4.2.2 Vaasa

Vaasa City's Energy and Climate Program foresees Vaasa city to be carbon neutral by 2035 (Vaasa 2016). By 2020 GHG emissions shall be reduced by 30% from 1990 levels by 2020, which is above the required emission reductions of 20% by the Covenant of Mayors network.

Vaasa aims to be the first coal-neutral city in Finland. To achieve the goals, the entire city organization and the actors in the city area should commit themselves to the objectives of the program.

3.4.3 Central Ostrobothnia

Central goals of the province program 2018-2021 include the promotion of new mining activities, bioeconomy and circular economy and the increased production of renewable energy, especially wind power.

The regional plan proposes 17 wind power locations in the province of Central Ostrobothnia and the respective municipal master plans are in the process to include these sites. Areas suitable for more than 10 wind power plants are in Toholampi, Lestijärvi, Kannus and Halsua. Several wind power projects have started in the province.

The usage of wood fuel in energy production is increasing, the total potential of bioenergy is estimated to about 1 TWh/a. Wood was the most significant resource with 0.37 TWh/a in 2016. Annual specific consumption of electrical energy has remained stable and GHG emissions in Central Ostrobothnia have decreased by 10% during the years 2010-2013.

The Climate Strategy of Central Ostrobothnia 2012-2020 includes the following goals:

- Improving energy efficiency continuously.

- Developing new technologies and innovations (e.g. CCU – Carbon Capture and Utilisation).
- Promoting fossil-free production of district heating and electricity generation.
- Increasing energy self-sufficiency.
- Utilization of waste and sewage sludge as energy.
- Boosting bioenergy sectors (agriculture, forestry and biogas).
- Promote the use of geothermal energy (heat pumps).

It has to be noted that small-scale wood burning produces particulate emissions, which are reported to have negative health effects (STM 2016). CO_2 impact and particulate emissions have to be considered when/if wood burning will be increased with aim to prevent global warming. Particulate emissions are especially important in densely populated areas, where exposure to particulates is the highest.

A note on agricultural biomass: Need of fuel and possible additional fertilizing in the collection chain of agricultural biomass (e.g. straw) should be analyzed before utilizing agricultural biomass for energy production. Even in USA, where yield per hectare for cellulose based raw-materials is much higher than in Finland, high net energy yields are not always obtained: E.g. in a study with experimental data (Tao 2013), a MJ of bioethanol required 0,36 MJ fossil fuels, which gives 2,8 for EROI (Energy Return On Investment). To be sustainable, EROEI should be > 3.

3.4.3.1 Kokkola

Kokkola´s action plan for energy efficiency 2008-2016 contains goals and actions for saving energy and for green public procurement and the implementation of energy surveys. The city promotes the increased use of renewable energy sources in the city area and in the city´s own operations.

Important sources of renewable energy at Kokkola region are bioenergy from forests, geothermal energy, wind and solar energy. Four biogas plants utilising animal manure, food waste and sewage are planned to be built by 2020.

3.5 Community energy in Finland – selected success stories

According Pellervo about 103 Renewable energy coops were registered by 2015 and 7 electricity coops had over 35,000 members and a turnover of 87 MEUR (2015).

Pro-Agria (https://www.proagria.fi/) supports farmers and small-scale forest owners in forming cooperatives or wood-fuel clusters to provide forestry and agricultural residues for heating purposes, most of which are operating in rural areas. Services include the ownership and operation of local district heating systems.

3.5.1 Energiakylä

The Energiakylä project supported the development of villages towards energy self-sufficiency in the provinces of Ostrobothnia between 2011 and 2014. Finland's rural development program 2007-2013 funded the project and the Levón Institute at the University of Vaasa coordinated it. The project included 14 case studies, which included increasing energy self-sufficiency using local renewable energy resources and agricultural residues. The project raised lots of interest and succeeded especially in raising awareness about possibilities of renewable energy production and efficient energy use in small rural villages. Village specific analysis and energy plans are available in the final report, which emphasizes the potentials of wind energy and the increased use of bioenergy (Energiakylä 2016). Levón Institute has continued the work after the Energiakylä project with a project Energiaomavarainen seutu ("energy self-sufficient region"), which concentrates on renewable energy strategy in municipalities (University of Vaasa 2016).

3.5.2 Ii – A renewable municipality

Ii municipality is part of HINKU (Towards Carbon Neutral Municipalities) as well as the Finnish Sustainable Communities network (FISU). Municipal decision-making promotes energy efficiency. Ii region generates hydro, geothermal and wind power and produces peat and wood based fuels.

Ii municipality is a winner of RegioStars Awards 2017 Climate Action.

3.5.3 Jeppo Biogas Ab biogas plant

Jeppo Biogas Ab / Jepuan biokaasu Oy in Nykarleby, Ostrobothnia produces biogas from waste of agriculture and food industry for local industry and traffic use (Jeppo Biogas AB). Jeppo Biogas AB was established 2013. The plant is based on wet digestion and total volume of the three reactors is 12 000 m3 and annual production 20 GWh.

3.5.4 Energy self-sufficient Lempäälä

The Energy Self-Sufficient Lempäälä project of Lempäälän Energia Ltd. in Pirkanmaa has been chosen to be one of the eleven Governments' key projects of renewable energy and new technology 2017. It has been granted an investment aid from The Ministry of Economic Affairs and Employment (Lempäälä 2017). Aim of the project is to create an energy self-sufficient business district in the industry area Marjamäki.

3.6 Interview results

Interviewees consider national energy and climate policies as good and ambitious. Much of implementation on regional or municipal levels is however on a voluntary base, where ambitions largely depend on existing political will as well as competences and capacities of officials and financial resources. Community energy projects need to seek financial support from available funding initiatives. Many consider the application procedures as overly bureaucratic, resulting in more projects implemented in larger municipalities, where technical and skilled staff is available on a permanent base. Some municipalities employ consultants on a project base, but understand that competence for larger and long-term energy projects should be built within own staff instead.

Larger projects, which can require a longer implementation time then four years, exceed governing periods between elections, are sometimes avoided, due to political uncertainty. This is also a result of lacking long-term energy strategies and plans going beyond election terms on regional or municipal level. These should be developed with wide public consultation and then be accepted by the community, and continue to be valid after elections and change of political majorities.

Incentives for electricity generation and feed-in are mostly perceived as positive but the strong emphasis on wind energy receives criticism. Uncertainty with the feed-in-tariff policy and other financing incentives are also hindering investment decisions. Solar energy, as system prices drop, is becoming more attractive, especially for commercial users.

Financial incentives for replacing fossil heating systems and developing biogas plants are often considered as insufficient. Farmers and foresters perceive offered advice (e.g. from Pro-Agria) as positive.

The national energy agency sees themselves as positive contributors to the energy transition, while the receivers (regional councils and municipalities) consider the provided information and advice as insufficient. Better-equipped local energy agencies with good understanding of the local and specific circumstances have been requested, especially by smaller municipalities, which lack own resources.

Energy utilities are asked to provide services beyond just energy supply, including energy efficiency advice and technical support for investing into distributed energy generation.

Incentives work well for wind and solar energy, but work less well for biogas and heating energy projects, except in rural areas where farmers receive support in forming energy cooperatives.

Municipalities perceive application procedures for financial support for energy projects as overly bureaucratic. Uncertainty on policy stability can hinder investment decisions.

Municipalities lack resources to participate in national and international networks and consider the procedures as too complicated and cumbersome.

3.7 Finland – summary and recommendations

Finlands energy and climate policies are ambitious. The approach to implementation fits well with the new direction that climate policy received after Paris 2015. Instead of placing compelling targets, it is expected that everyone, including municipalities, companies and civil society, contribute to their will and ability. Local implementation is therefore largely voluntary and depends on political will. Available financial and human resources allow mainly larger municipalities to invest in energy projects. A strong focus in national policies is put on innovation and business development in order to grow successful industrial sectors, providing resource efficient, energy efficient and clean energy solutions.

Finland supports renewable energy projects with feed-in-tariffs (all renewables except solar PV) and with an investment grant scheme - "energy aid", also applicable for energy efficiency projects and in the heating and transport sector. Energy efficiency efforts are mainly promoted through a voluntary Energy Efficiency Agreement scheme where businesses and municipalities commit to contribute to national targets. Residential home owners receive tax deductions on labor costs for energy projects.

The Ostrobothnia regions and municipalities show different levels of ambition and activity in regard to renewable energy and energy efficiency projects. Much of these project activities are on a voluntary base and receive financial support from existing schemes.

Recommendations for policy adaptations:

- Establish local energy agencies and mandate them to provide energy advice and practical support in energy project identification and development.
- Reduce bureaucracy in application procedures for the different support mechanisms.
- Ensure and improve long-term policy and financial security for community energy investments.
- Develop a more holistic and broad approch that ensures that all relevant sectors, including efficiency in buildings and industries, electricity and heating as well as transport sectors are receiving adequate support.
- Biogas development requires more attention.
- Legally enforcing direct and long-term community financial benefits from wind-power developments with Denmark and Germany as examples would increase acceptance (reducing NIMBY effects) of such developments.
- Develop more long-term perspectives, strategies and plans on regional or county level, which are to be adhered to even after changes in political majorities. These shall also guide municipal planning and regional authorities coordinate and monitor.
- Provide more long-term financial support to municipalities to build and retain human resources enabling the development of long-term local strategies and the implementation of energy projects.

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4 IRELAND

The Energy White Paper published in 2015 – titled as "Ireland´s Transition to a Low Carbon Energy Future – 2015-2030" (Ireland 2015) - is a complete energy policy update. The White Paper shall ensure that Ireland achieves its 80-95% GHG emissions reduction goal by 2050 (to 1990 levels). It provides the national policy framework (NPF) to guide Ireland's energy policies until 2030.

The Climate Action and Low Carbon Development Act 2015 provides a statutory basis for the transition of the national objective to a low carbon, climate resilient and environmentally sustainable economy by 2050 as set out in national policy. This Act provides for the preparation of plans covering climate change mitigation. In order to pursue these objectives the Minister for Communications, Climate Action and Environment must submit to the Government a series of successive National Mitigation Plans (NMPs) and National Adaption Framework (NAF).

Section 5 of the Act requires the Minister for Communications, Climate Action and Environment make and submit to Government for approval a "National Adaption Framework" no later than 24 months (i.e 10 December 2017) after enactment and review the Framework every five years. It is clear that climate change and ensuring climate resilience is a priority for all levels of Government.

A Climate Change Advisory Council was established under the Act to assess and advise on this transition. This independent advisory board will analyse on the most effective manner in which to respond to climate change and provide advice on the most effective policies. The Council will also provide reports analysing Ireland's progress regarding national policy goals and greenhouse gas emissions under European targets.

The National Adaption Framework (NAF) was published in January 2018 and sets out the challenges climate change presents for Ireland and envisages an Ireland with a competitive, low-carbon, climate –resilient and environmentally sustainable economy by 2050.

The Framework;

- provides a summary of observed and projected global climate change and the international and European policy drivers for adaptation to climate change. It also contains a summary of observed and projected climate change impacts in Ireland;
- sets out the progress to date on climate change adaptation planning in Ireland, including work undertaken at sectoral and local government level and initiatives involving civil society and the research community;
- provides a number of guiding principles for adaptation at national level. It includes steps for creating an enabling environment for adaptation planning. It sets out the sectors for which adaptation plans under the NAF are to be prepared, along with proposals for local authority or regional level adaptation strategies; and
- outlines how the Framework will be implemented with revised Governance and reporting arrangements as well as actions and supporting objectives that are to be progressed.

The third progress report on the NREAP 2015 states that all sectors require considerable effort to meet the 2020 targets (Table 4, Ireland-NREAP 2015).

Table 4: Ireland´s performance on the NREAP

Measurement	2020 Target	Where Ireland is at end 2018
Renewables in Final Energy Use	16%	10.6%
RES-E (Electricity)	40%	30.1%
RES-H (Heating)	12%	6.9%
RES-T (Transport)	10%	7.4%
Energy Efficiency (Overall)	20% reduction in demand	12%
Energy Efficiency (Public Sector)	33% reduction in demand	24%

Source: Energy in Ireland 2018 Report (SEAI 2018).

In 2012, the Government published a policy statement on energy infrastructure, which recognized the importance of transmission grid expansion to accommodate wind power developments (Ireland 2012a). In the same year the Strategy for Renewable Energy 2012-2020 followed (Ireland 2012b) promoting increasing onshore and offshore wind, building a sustainable bio-energy sector, fostering research and development in renewables, developing sustainable transport and smart energy networks. A draft Bioenergy Plan exists since 2014 (Ireland-Bio 2014), the policy for alternative fuels infrastructure was published in 2017 (Ireland-Fuels 2017).

A 2014 Green Plan Ireland, promotes the transition to a 100% renewable energy supply by 2050 without additional costs as compared to current policies, while creating 100,000 jobs (Connolly 2014).

The 2015 Energy White Paper includes a strong focus on empowering energy citizens and community participation. There is however no national law in place yet in relation to

securing and/or enforcing the provision for financial benefit to a community from renewable energy developments.

4.1 Legislation

Local development planning is legislated in the Planning and Development Act, in the Local Government Reform Act, 2014 and in the Building Regulations.

Local Authority Adaption

A number of local authorities have advanced the development of adaption strategies based on the National Climate Change Adaption Framework (NCCAF, 2012). Clare County Council has an integrated climate change action plan under their current development plan. The four Dublin local authorities have also signaled an intention towards climate strategies with A Strategy Towards Climate Change Action Plans for the Dublin Local Authorities.

The Framework acknowledged that further awareness, training and capacity building is necessary in order to equip decision makers with the capability to respond to the responsibilities that a changing climate presents. Workshops identified some barriers in this area. These include;

- requirement for buy-in all levels of governance and amongst the general public
- the need for better co-ordination between national structures and the local government sector on climate change
- there is a need to identify and promote adaption leadership at all levels of governance.
- Planning for adaption is complex and requires appropriate capacity building within local authorities and across all levels of governance.

4.1.1 Regional and municipal planning

The local planning authorities including the regional assemblies, the counties and the municipalities create and update mandatory development plans, including the county and city development plans and the local area plans (LAPs) every 6 years as prescribed by the Planning and Development Act (Ireland 2000). Where local authorities breach statutory requirements in the development plan process or fail to adopt policies that reflect the overall national policy position, the Minister has powers under section 31 of the Act, which allow him to direct a planning authority to amend a statutory development plan.

The Local Government Reform Act (Ireland 2014) obliges local authorities to make, in accordance with the principles of sustainable development, a 6 year Local Economic and Community Plan (LECP). The Act makes further provision for the establishment of Local Community Development Committees (LCDC) and for planning and oversight of Local and Community Development Programs (LCDP).

In August 2017 the Department of Housing, Planning and Local Government issued a circular PL5/2017 providing guidance on the review of wind energy and renewable policies within the context of the development plans. This circular re-affirms the position of a previous circular letter PL20-13 which advises local authorities to defer amending their existing Development Plan policies in relation to wind energy and renewable energy generally as part of either the normal cyclical six-yearly review or plan variation processes and should instead operate their existing development plan policies and objectives until the completion of the review of the Wind Energy Development Guidelines 2006 (Ireland 2006).

The Department of Housing, Planning and Local Government acknowledged that a review of the Wind Energy Development Guidelines 2006 has taken considerably longer to conclude than envisaged and therefore have issued new Planning Guidelines under section 28 of the Act entitled "Interim Guidelines for Planning Authorities on Statutory Plans, Renewable Energy and Climate Change" (Housing 2017).

For wind energy developments the Irish Wind Energy Association provided a Best Practice guideline (IWEA 2013).

The interim guidelines clearly state that under section 28 of the Act (Planning Development Act 2000) that in making a development plan with policies that relate to wind energy developments the planning authority must;

- Ensure that the national policy on renewable energy is acknowledged and documented (Consideration must be given to the following policies - National Renewable Energy Action Plan, 2010; the Strategy for Renewable Energy 2012-2020, the White Paper on Energy Policy; Ireland's Transition to a Low Carbon Energy Future 2015-2030 and the National Mitigation Plan);
- Indicate how the implementation of the relevant development will contribute to realising overall national targets on renewable energy and climate change mitigation, and in particular wind energy production;
- Demonstrate detailed compliance with the above and complete environmental assessments.

The Interim guidelines are a clear indicator that it is incumbent on Planning Authorities to implement national policies through the development process and the need to address climate change is at the fore in considering planning policies within the County Development Plan. It also reinforces the Departments support for on-shore wind energy as a means of achieving climate change targets.

A development plan shall include objectives for energy facilities and for the integration of the planning and sustainable development with the social, community and cultural requirements of the area and its population. It should reserve land for energy generation and distribution and promote measures such as reduced energy demand and reduced anthropogenic greenhouse gas emissions in the development of sustainable settlements.

The Building Regulations Part L - Conservation of Fuel and Energy – Dwellings – prescribes energy performance requirements (Ireland 2011 – Part L). Part L prescribes minimum levels of energy provision from renewable energy technologies as:

- 10 kWh/m2/annum contributing to energy use for hot water and space heating or cooling; or
- 4 kWh/m2/annum of electrical energy; or
- a combination of these which would have equivalent effect.

4.1.2 Laws on cooperatives

There is a long history of agricultural cooperatives in Ireland since the 1900s. The Irish Co-operative Organisation Society (ICOS) is the unifying force for the Irish co-operative movement. ICOS member co-operatives and their associated companies collectively have over 150,000 individual members, employ >12,000 people in Ireland (a further 24,000 abroad) and have a combined turnover of almost €15 billion.

4.2 Institutional overview

4.2.1 Public institutions in the energy sector

The Department of Communications, Climate Action & Environment (DCCAE) is responsible for mitigation of GHG emissions, energy efficiency and renewable energy.

The Sustainable Energy Authority of Ireland (SEAI) is in charge to implement energy programs, targeting citizens, communities, business and energy suppliers.

Irish Energy Agencies:

- Tipperary Energy Agency: https://tippenergy.ie/
- Three Counties Energy Agency: http://3cea.ie/
- Codema – Dublin´s Energy Agency: http://www.codema.ie/
- LIMERICK CLARE energy agency: http://www.lcea.ie/

Irish Bioenergy Association (IrBEA): http://www.irbea.org/

The Energy Institute (EI - https://www.energyinst.org/) is the professional body for the energy industry, developing and sharing knowledge, skills and good practice towards a safe, secure and sustainable energy system.

- Ireland 2050 (http://ireland2050.ie/) is an Energy Institute initiative to empower and enable everybody to participate in the debate about Ireland's energy future.

The Electricity Supply Board (ESB, https://www.esb.ie/) has the mission to bring sustainable and competitive energy solutions to all customers.

Energy Ireland - Energy Ireland is Ireland's largest energy forum. It consists of a number of events throughout the year, including the main Energy Ireland conference, which takes place each June in Dublin. URL: http://www.energyireland.ie/

4.2.2 Cooperative institutions and associations

Pobal – government supporting communities - is a not-for-profit company that manages programs on behalf of the Irish Government and the EU. Pobal works to engage local communities in the development process and promotes co-ordination between communities, state agencies and other stakeholders (https://www.pobal.ie/).

18 Irish organizations have jointly prepared the Community Energy Policy Position Paper CEPPP in 2014 as a contribution to the public consultation process developing the Energy White Paper published in 2015 (FoE 2014), these organizations are:

- ACE Coop, Atlantic Coast Energy Cooperative Limited, Comharchumann Fuinneamh Oileáin Arainn (Aran Islands Energy Co Op), Cork Environmental Forum, Ecologics Solar Makes Sense , Energy Cooperatives Ireland, Energy Wise Consultants, Oosten, The Foundation for the Economics of Sustainability, Friends of the Earth, Good Energies Alliance of Ireland , LEAF, Collaborating for a Sustainable Future in Laois, MEGA, Micro Electricity Generation Association, MozArt Ltd Architecture Landscape Urban Design, Peoples Energy Charter, Syspro Systems for Progress Ltd, Tipperary Energy Agency, Waterford Energy Bureau, XD Consulting.

Energy Co-operatives Ireland URL: http://www.energy-co-ops.ie/. Promoting community access to the benefits of renewable energy. By 2018 four energy co-ops are registered.

4.3 National incentives for community energy initiatives

Ireland provides a comprehensive support framework for citizen and community energy. SEAI implements a number of programs and initiatives and provides information, capacity building, financial and technical support to homeowners, businesses, communities and public sector to transform the generation and use of energy (SEAI-web).

One of the main barriers to community owned RE projects is the complicated, long and risky process for a community energy project to connect into the National Grid and the difficulty and often impossibility for communities to get paid for electricity they export. However, the details of the proposed Renewable Electricity Support Scheme (RESS) have been announced and the proposed new scheme allows for community participation through an enabling framework. This proposed framework aims to provide pathways and supports for communities in the form of the following;

- Financial supports for community-led projects across early phases of the project development including feasibility and development studies (grants, legal and technical assistance).
- Separate 'community' category in the RESS auction. RESS auctions will be held ar frequent intervals throughout the duration of the scheme. The first RESS auction in 2019 will deliver 'shovel ready' projects.
- Mandatory Community Benefit Fund and register standardised across the sector. It is proposed that this contribution is set at €2/MWh for all RES-E generation supported through RESS auctions.
- Mandatory investment opportunities for communities and citizens in all RESS projects. Projects must fulfil community investment criteria to qualify for RESS actions.

However, micro-generation projects were not included or supported in the RESS given the higher costs identified with micro generation. (Dept. of Communications, Climate Action & Environment, 2018)

SEAI implements Government grant and funding programs (SEAI-grants-web), including:

Homeowners are supported under the **Better Energy Program,** which includes some sub-programs:
- **Better Energy Homes**: grants to upgrade homes with energy efficiency measures.
- **Better Energy Warmer Homes:** free energy efficiency measures to low-income households.
- **Warmth and Wellbeing Scheme.**
- **National Renovation Strategy.**

Communities are supported through initiatives, such as:
- **Sustainable Energy Communities** (SEC and SEC-Network): SEAI supports SECs, which develop sustainable energy projects (energy efficiency, renewable energy, smart energy technology) for the benefit of the community (Table 5).
- The **Better Energy Communities** program (BEC) assists with funding, partnerships and technical support.

Table 5: Critical Success Factors for the Irish SEC model

Critical Success Factor Analysis	Irish SEC Model
Engagement with the local community	**YES**: community defines the parameters, drives the process Addressed throughout the entire process Bottom up approach, grassroots approach SECs are community led, community ran and community focussed 3 year partnership agreements in place
Resource scarcity addressed	**YES**: Technical mentor panel and core competency training Addressed throughout the entire process Financial support: throughout the entire process (look at funding available) and BEC support Mentors available throughout Access to Expertise: technical mentors are available throughout Core competency Skills development
Trusted intermediary in place	**YES**: SEAI have appointed both SEC Community mentors and SEC Technical Mentors RESS Consultation and possible role of a "Trusted Intermediary"
Availability of demonstration sites	**YES**: Better Energy Community program 2012-2017: lot of examples throughout the country Sharing of experiences through the SEC network Can visit PV arrays, wind turbines, heat pumps, biomass boilers, solar hot water systems
Supportive national energy policy context REFITs (microgeneration) Tax relief schemes Priority Grid access Planning assistance Feasibility assistance	 NO YES NO NO YES
Community Ownership and Local Benefit Framework	**NO**: Not yet but a target of 20% community investment is proposed as part of the current RESS consultation within certain distances (possibly 5km) of future renewable installations above agreed sizes (possibly 500 kW). Co-ops are in their infancy in Ireland as there were only four established in 2016. Shared ownership model not widely used although "Energy Citizenship" DCENR 2015 promoted through ownership, participation and debate.

Source: Nic Suibhne, O. Ryan, L. Supporting Sustainable Energy Communities: What is Best Practice? Energy Research & Social Science. 2018 (Under Review).

An example of many **tools provided by SEAI** is: Methodology for Local Authority Renewable Energy Strategies (SEAI 2013). This tool intends to support local authorities in developing their renewable energy strategy.

SEAI reports in the study Irelands Energy Projections on the progress on targets (SEAI 2017):

> "In 2016, grant schemes supported energy efficiency upgrades in 22,000 homes. A further 2,000 homes and 383 community buildings were upgraded via community-based projects, and 667 businesses and 80 public sector entities interacted with SEAI programs."

Pobal manages a number of funding programs addressing community development, including LEADER, which aims to provide rural communities with a method and resources to actively engage and direct the local development of a given area, through a community-led local development approach.

The Electricity Supply Board (ESB) provides community funds for all wind farms across Ireland and the United Kingdom (ESB-funds). Eligible are not-for-profit projects demonstrating direct community benefits located within a radius of up to 10km around a wind farm.

DCCAE Business support programs include ACA – The Accelerated Capital Allowance (a tax incentive), Better Energy Finance and the Energy Efficiency Fund.

DCCAE introduced an **Energy Efficiency Obligations Scheme (EEOS) for energy suppliers**. EEOS places obligations on energy suppliers and distributors to deliver energy savings. The energy credits have a market value (€0.03c/kWh saved for community and €0.14c/kWh saved for domestic) that can indirectly benefit the homeowners and communities if part of the BEC scheme and the coordinator sells them.

4.4 Regional and municipal levels

This section provides highlights from selected county development plans with relevance to community energy. Essentially all viewed plans define local targets aiming to contribute to national goals. Generally, measures such as energy conservation, energy efficiency, sustainable exploitation of local renewable energy resources – often with a focus on wind energy, innovative building design and materials and improved integration between land use planning and transport are included in these local development plans.

4.4.1 Southern Regional Assembly

Since 2014 the Southern Regional Assembly combines three sub-regions (mid-west, south-west and south-east). The Regional Planning Guidelines 2010-2022 for these sub-regions remain valid until the Regional Spatial & Economic Strategies (RSES) are finally put in place. The RSES intends to be a link between the forthcoming National Planning Framework, the City and County Development Plans and the Local Economic and Community Plans.

The Assembly coordinates, promotes and supports strategic planning and sustainable development of the region; it prepares and oversees the implementation of RSES. The assembly also manages, monitors and provides assistance for EU programs.

The section continues with examples of Local Development Plans together with public service/ public sector strategies towards Renewable Energy.

4.4.1.1 Kerry (South)

In addition to the general commitments, Kerry promotes an initiative on the Green Enterprise, which shall facilitate the development of renewable energy in the **Kerry County Development Plan 2015-2021**. Kerry sees significant potential for the development of wind, solar, biomass, geothermal, hydro and wave energy. The Plan targets social housing with energy efficiency provisions.

Another specific initiative is based in the Shannon Estuary where the Shannon Integrated Framework Plan (SIFP) shall facilitate the diversification of the economy, through the promotion of commercial/industrial employment, environmentally friendly aqua culture, maritime, energy, transport, recreation and tourism industries in a sustainable manner.

The Renewable Energy Strategy 2012-2015 (Kerry 2012) seeks to secure the maximum potential for the generation of electricity from wind energy resources, while it is at the same time concerned and cautious on the impacts of such developments within the vicinity of cultural and natural heritage locations. Kerry supports the development of hydro pumped energy storage and encourages the use of small wind turbines and solar panels and charging infrastructure for EVs. It promotes renewable heat (district heating and individual heating-systems) and shall facilitate community groups to develop bioenergy schemes to ensure that district heating schemes use biomass material that is produced from local agriculture and forestry in a sustainable manner.

Transition Kerry

Transition Kerry is a local initiative, which aims to response to three major challenges: Climate change, peak oil and economic decline (http://www.transitionkerry.org).

The initiative has developed a Community Energy Proclamation and a Kerry Sustainable Energy Community Roadmap. This Action Plan for County Kerry's Transition to 100% Renewable Energy Supply by 2030 explores technological pathways for this transition and a 25% reduction in final energy use through energy efficiency by 2030 (Kerry 2014).

4.4.1.2 Cork (South)

The Cork County Development Plan (Cork 2014) strongly focuses on reducing energy demand and developing the potential of all renewable energy resources, but in particular offshore wind and ocean energy. The Plan intends to support R&D of new technologies to harness the potential of marine based renewable energy technologies off the Cork coast.

The Plan highlights the importance of integrated waste management, waste to energy, forestry and bioenergy. It also includes hydropower, geothermal energy (heat pumps), CHP and district heating.

A 2012 Energy Background paper to the County Development Plan Review (Cork 2012) suggests supporting the development of micro-renewables subject to normal planning considerations (chapter 10) and states on Community Benefits (chapter 9): Where appropriate, the provision of community gain initiatives should be incorporated into wind farm developments.

The high-level goals of the **Cork County Local Economic and Community Plan** (Cork 2016) include the provision for harnessing County Cork´s energy potential and the creation of a local circular economy model of sustainability.

The LECP proposes to draft a **Strategic Energy Plan**, which shall identify a range of actions to achieve energy efficiency and renewable energy targets from local sources. Cork intends to draft a scoping report on the development of an Energy Research Plan, in collaboration with Cork's research institutions, by 2018.

In reference to the **South West Action Plan for Jobs**

2015–2017 the Cork County LECP recognizes the employment growth potential of the energy sector, and also that sustainable energy plays a critical role in underpinning society.

Energy Cork - Energy Cork is an industry-driven cluster pursuing coordinated actions to strengthen enterprise and employment within the energy sector in the Cork region. Supported by Cork City Council and Cork County Council: http://www.energycork.ie/

4.4.1.3 Limerick (South)

The **Mid-West Regional Planning Guidelines 2010-2022, Limerick County Development Plan 2010-2016** and the **Limerick City Development Plan 2010-2016** reference renewable energy specifically in several chapters. The update of the LCDP for the next 6-year period is in progress. A renewable energy strategy shall be prepared and implemented to meet national climate change targets and provide guidance in relation to renewable technologies.

The Limerick Local Economic and Community Plan 2016-2021 (Limerick 2016) and the the Local Community Development Committee (LCDC) promote actions in low energy / low carbon community initiatives, waste reduction and reuse and supporting the establishment of renewable energy consumer co-ops to create local energy supply from indigenous resources with low environmental impact.

The Limerick Regeneration Framework Implementation Plan (Limerick-RFIP) dovetails with the Limerick 2030 Economic Plan (Limerick-EP) and targets the communities in the city that are most disadvantaged. Actions include energy efficiency, energy retrofitting, energy security and renewable energy.

4.4.1.4 Clare (West and South)

The **Clare County Development Plan (CCDP) for the period 2017-2023** (Clare 2017) supports energy efficiency and conservation and strives for decarbonisation of lifestyles and economy. It recognizes the abundance of renewable energy resources including: onshore and offshore wind, wave, tidal, solar energy, geo-thermal (heat-pumps), bio-energy including biomass from forestry and agriculture as well as biogas production and waste heat recovery. The available options for storage in hydro pumped energy storage plants contribute to an envisioned 100% local and renewable energy supply of Clare County.

The Clare Wind Energy Strategy as part of the CCDP (Volume 5) includes the promotion of community involvement in its general objectives for wind energy developments and points out that there is no national law enforcing the provision for financial benefit to a community from renewable energy developments. It however mentions that in accordance with the Planning and Development (Strategic Infrastructure) Act 2006, An Bord Pleanála may attach financial conditions to a facility that would constitute a substantial gain to the community.

Volume 6 of the CCDP comprises a comprehensive Renewable Energy Strategy. A main objective of Clare County Council is to meet the County's energy needs from 100% indigenous renewable energy sources.

The Clare County Local Economic and Community Plan 2016 – 2021 (Clare 2016) considers that reducing fossil-fuel use could be achieved by increasing local renewable energy production and increasing the efficiency of energy use. Bioenergy crops could be cultivated in some parts of the county and converted in biomass boilers.

The 2005 County Clare Rural House Design Guide (Clare 2005) promotes energy efficient construction techniques, including utilization of local materials, the integration of solar energy, biomass and heat-pump heating systems and small-scale hydropower and wind-energy.

4.4.2 Western Region

The Western Development Commission (WDC) envisions being the hub for the strategic economic and social development of the seven counties in the Western Region (Donegal, Sligo, Leitrim, Roscommon, Mayo, Galway and Clare). **The WDC Strategic Plan 2015-2018** (WDC 2015) recognizes that the renewable energy sector in the western region is gaining momentum. It sees the region being recognized as a center of expertise and it includes a significant focus on the large-scale growth and use of the bioenergy resources of the region.

WDC provides support to community energy initiatives. It is or was active in ongoing and concluded energy related projects (http://www.wdc.ie/publications/renewable-energy-reports/), including:

- GREBE - http://www.grebeproject.eu/ ... helps develop renewable energy (RE) business opportunities.
- RASLRES - http://www.raslres.eu/ ... aims to increase the use and uptake of locally produced renewable bio-energy solutions in rural areas.
- BioPAD – http://www.biopad.eu/ ... aims to ensure that bioenergy becomes more widely used.

4.4.2.1 Galway County (West)

The Galway County Development Plan 2015-2021 (Galway County 2015) includes a **Housing Strategy (Appendix II) and Wind Energy Strategy (Appendix IV)**.

Galway County strongly emphasizes the need for balancing the provision of renewable energy resources against the protection of the environment. Integrated development is a recognized strategic aim where it seeks to ensure a more sustainable and integrated concept of development with regard to land use, transportation, water services, energy supply and waste management over the lifetime of the plan.

Improving gas supply and gas networks have high priority in Galway´s Plan. Harnessing renewable energy resources, including wind, solar, biomass, geothermal, hydro and wave energy and improving energy efficiency in buildings shall reduce County Galway's dependency on imported fossil fuels.

The Wind Energy Strategy (Appendix IV) seeks to promote community consultation and requires community involvement and benefit where possible in proposed wind farm developments.

Galway County has a number of Local Area Plans supporting the development of areas with socio-economic challenges. **The Galway County Local Economic and Community Plan**

2016-2022 (Galway County 2016) recognizes the capacity for the production of wind-based renewable energy. Actions to address the objective of energy efficient buildings and renewable energy include:

- supporting the transfer to renewable energy based heating systems;
- harnessing the LEADER sub-program on Development of Renewable Energy to increase use of renewable energy sources among community organizations;
- adopting the principles of the guidelines for Local Authority Renewable Energy Strategies (LARES, SEAI 2013) when reviewing their County Development Plans and
- collectively examine the potential for Regional Renewable Energy strategies.

Galway County Council seeks to assist community and voluntary groups in the region in implementing energy efficiency programs. It will support participation of communities in the SEAI Better Energy Communities scheme and will develop and promote the Sustainable Energy Communities (SEC) model in the region.

Oileáin Árann is an example of an Energy Transition Community in Galway county, where they have established an energy co-op and intend to generate community owned energy on the island (www.aranislandsenergycoop.ie).

4.4.2.2 Galway City (West)

The Galway City Development Plan 2017-2023 (Galway City 2017) emphasizes the creation of sustainable neighborhoods where energy efficiency and use of renewable energy sources shall be integrated into the design and layout of development. In recognition of the need to reduce the City Council's carbon footprint, the Council has prepared a draft **Corporate Energy Management Strategy (2015),** which will be followed by an **Energy Action Plan** for implementation.

The Vision for Galway City as provided in the **Galway City Local Economic and Community Plan 2015-2021** (Galway City 2015) recognizes the importance of sustainable development in general terms but does not provide any specific actions in the action plan related to energy efficiency, renewable energy use or community energy.

4.4.3 Údarás na Gaeltachta

Údarás na Gaeltachta is responsible for the economic, social and cultural development of the Gaeltacht (Irish speaking regions) in Ireland. In partnership with the SEAI Údarás na Gaeltachta has implemented a programme of energy conservation in the Gaeltacht. The funding was granted under the BEC programme throughout the Gaeltacht and included making building occupied by its client companies, community projects, and Údarás buildings and industrial estates more energy efficient. Údarás na Gaeltachta's commitment to become a Sustainable Energy Community (SEC) aims to provide continuing solutions to reduce energy consumption costs in the Gaeltacht areas and to increase energy efficiency and use energy renewable technologies in the area.

Údarás na Gaeltachta participated in a number of EU funded projects including ECOLAND, MITKE, ANCOIRM and the GREAT (Growing Renewable energy Applications and Technologies) project which focused on providing data on developing technological solutions in relation to the smart grid, renewable energy and distributive generation. The project allowed small to medium sized enterprises and communities to develop technological solutions in relation to the Smart Grid, renewable energy and distributive generation, stimulating innovation and employment.

Údarás na Gaeltachta have also taken significant steps in the planning and development of Páirc na Mara, anew low cardon marine innovation park which is to be developed in the Conemara Gaeltacht. Údarás na Gaeltacht is also committed to transforming its current business parks into 'Green Business Parks'.

4.5 Community energy in Ireland – selected success stories

Templederry Community Wind Farm is the first and only community owned wind farm in operation in Ireland (Templederry-web).

Oileáin Árann **is an example of an Energy Transition Community** (Aran Islands Energy Cooperative). The island community aims to be energy independent by 2022 - becoming Ireland's first energy transition community.

SEAI's Better Energy Community (BEC) Programme was initiated in 2012 as a pilot project with a budget of €3m; in 2017, the Programme provided €25m in direct funding to a total investment in energy efficiency of almost €100m (Table 6).

Table 6: Status of the Better Energy Community Program (Source: BEC Overview 2012-2016, SEAI)

	2016	2012-2016
No of successful projects	37	298
Applications received	63	493
Homes	2050	12400
Non-Domestic	405	1300
GWh of energy saved	67	306
SEAI grants	18 MEUR	85 MEUR
Estimated project costs	45 MEUR	170 MEUR
Average grant support	41%	50%

4.6 Interview results

Policies set out in the Energy White Paper and reflected in local development plans provide general principles and direction. The detail of the Renewable Electricity Support Scheme (RESS) and Support Scheme for Renewable Heat (SSRH) are still to be released, but will hopefully clarify some matters in terms of incentivizing renewable electricity (RE) and especially the transition from fossil fuel heating (oil, gas, peat and coal) to renewable heat (RH). Interviewees consider lack of political will for implementing policies since Ireland is one of only four EU-member states that will not meet their 2020 targets as set out in the NREAP.

The Ireland 2040 Plan has a focus on urban centers and disfavors rural development.

Wind energy receives too much focus and support, a long-term view and long-term regulatory certainty for all sectors RES-E, RES-H, RES-T are required.

Support programs, both national and EU (e.g. INTERREG, HORIZON2020), exist and are useful, but have overly bureaucratic processes, challenging especially smaller municipalities where human and financial resources are limited. BEC and SEC are practical and address issues on community level.

The Citizen's Assembly approach to public consultation provides an element of trust, but interviewees request greater transparency and dissemination of the consultations.

Ireland needs a functioning Energy Agency network, covering the whole island. This would lead to greater coordination, information sharing and activity in the green economy. Where active Energy Agencies exist, they work well in building a trust relationship with Local Authorities and agencies, as well as the private and residential sectors. Interviewees suggested that such agencies could adapt a more holistic approach and include water, waste, resource and energy management.

Participation in networks (e.g. SEAI SEC) builds relationships and provides a common vision toward sustainable transition.

4.7 Ireland – summary and recommendations

Ireland´s Energy White Paper "Ireland´s Transition to a Low Carbon Energy Future – 2015-2030" (Ireland 2015) - is a complete energy policy update. Regional, county, city and local economic and community development plans are updated every 6 years in a participative public consultation process. All reviewed plans commit to contribute to national energy and climate policies and targets in harnessing potentials for energy efficiency and abundant renewable energy resources.

Ireland is one of only four EU-member states that will not meet their 2020 targets as set out in the NREAP (Ireland-NREAP 2015).

Ireland has the potential to supply the countries energy demand with 100% renewable energy from local renewable energy resources by 2050, including onshore and offshore wind, ocean energy, solar, biomass and waste, hydro power and hydro pumped storage (Connolly 2014). Development plans strongly focus on utilizing more of Ireland´s significant wind potentials, including necessary grid development. Ireland puts considerable efforts in improving energy efficiency of the existing building stock, especially supporting low-income households. It at the same time neglects the utilization of biomass potentials from agriculture, forestry and waste streams, which could contribute to sustainable economic development of rural areas. The potential for hydropower is recognized but no project could be found being in the pipeline.

Support programs to citizens and communities include Better Energy Communities (BEC) and Sustainable Energy Communities (SEC) and result in a growing number of implemented projects.

Recommendations for policy adaptations:
Ireland has comprehensive and resource demanding mandatory planning activities in place. Regional assemblies develop regional strategies and plans, counties and cities make comprehensive county, city and local development, economic and community development plans. Additional wind energy plans and renewable energy plans, amongst others, also exist or are considered to be developed. These procedures appear to be

ineffective, plans are not well synchronized, are inconsistent and due to a 6-year review cycle and sometimes significant delays in updates they are often outdated. This could be compared to the Swedish planning model, where only municipal comprehensive master plans are mandatory and detail plans are legally binding. Planning on county level exists also in Sweden but has mainly consulting, monitoring and coordinating function. Master plans have to be reviewed once during an election period.

- Considerable more effort is needed to establish local energy agencies, which shall provide advice and support to municipalities and community energy initiatives.
- The NAF and NCCAF identified a number of key barriers to effective planning. One of these was the fragmentation of roles and responsibilities across government departments, agencies, local authorities and other bodies. Responsibility in a number of areas are spread across a number of departments, agencies, bodies and local authorities. It has been problematic moving adaption forward in some sectors. The National adaption Steering Committee is addressing some of these problems. However, further integration and coordination is required.
- Introduce legal enforcement of community ownership in and long-term financial benefits from renewable energy developments. When implemented similar as e.g. in Denmark for windpower, this will increase the number of community owned renewable energy projects.
- Develop a long-term view and long-term regulatory certainty for all sectors: RES-E, RES-H, RES-T.
- Create less bureaucratic procedures for support programs, grid connection and permitting: It is extremely complicated, costly and long for a community energy project to connect to the National Electricity Grid and once connected it is extremely difficult for communities, micro generators or auto generators to get paid for the electricity they export. Communities cannot generate electricity locally and use it locally by more than one user.
- Develop and implement hydropower and hydro-pumped storage projects. Potentials exist and the balancing capacities of hydropower are required for a continued wind power development.

A review of the Wind Energy Development Guidelines concludes with following recommendations:

- The application of a more stringent noise limit, consistent with World Health Organisation noise standards, in tandem with a new robust noise monitoring regime, to ensure compliance with noise standards;
- A visual amenity setback of 4 times the turbine height between a wind turbine and the nearest residential property, subject to a mandatory minimum distance of 500 metres between a wind turbine and the nearest residential property;
- The elimination of shadow flicker; and
- The introduction of new obligations in relation to engagement with local communities by wind farm developers along with the provision of community benefit measures.

Notes on rural housing:

A National Renovation Strategy (Department of Communications, Energy and Natural Resources – Better Buildings - A National Renovation Strategy for Ireland) has been prepared to fulfil Article 4 of the 2012 Energy Efficiency Directive, which requires Member States to set out long-term strategies for mobilising investment in the renovation of buildings.

However, article 4 of the Directive states that the long-term strategy shall encompass cost-effective approaches to renovations relevant to the building type and policies and measures to stimulate cost-effective deep renovations of buildings, including staged deep renovation.

The most common dwelling in Ireland is a detached house with more than 42% of the total housing stock falling into this category. These detached houses are typically located in rural areas (72%) and are larger than the average European house. This dispersion means that many of these dwellings are not connected to the gas grid and thus reliant on solid fuels or oil-based heating systems. As a consequence, the emissions from these houses are high but so is the potential for major efficiencies gains with renovation works. However, the issue of rural housing has not being addressed as it is not as cost effective (Ahern 2013).

Notes on Bioenergy:

The utilization of local biomass resources, with its significant potential for sustainable economic development of rural areas, needs more attention:

- Biomass potentials from forestry and agriculture are significant. Demand could be quickly increased by a faster deployment of biomass heating-systems in residential and commercial buildings and the development of district heating systems in the larger cities, where some initiatives are ongoing. Analysis of smaller district heating systems in Finland, Sweden and Norway show that, depending on local circumstances, including distances between buildings, available biomass from agriculture or forestry, available larger heat off-takers such as hotels, schools or other larger facilities, such systems can be economically feasible from around 100 households.
- According a SEAI 2017 assessment of Biogas and Biomethane in Ireland between 3% and 22% natural gas could be replaced by biomethane, depending on the scenario selected - from waste only to utilizing agricultural land for additional feed stock, such as grass silage, etc. (SEAI-Bio 2017).

4.8 References Ireland

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5 NORWAY

Norway adopted a new energy policy in 2015 with a time-frame up to the year 2030 under the premises of strengthened security of supply considering future transformations of the international energy and especially the electricity markets. This policy, presented in the whitepaper "Power for change", envisions more efficient energy consumption and further expansion of renewable energy production, from hydro, wind, solar, biomass and waste, and significant emission reductions from the transport sector. The target for improvements in energy intensity (energy use/BNP) is set to 25% from 2016 to 2030, the GHG-emission reduction target is 40% by 2030 with 1990 as base-year (Norway 2016, IEA-Norway 2017). A target for overall renewable energy share was not specifically defined in this policy, but it had already reached 69% in 2014 - above the 67.5% target for 2020 as set in the NREAP published under the EU-Directive 2009/28/EC in June 2012 (Norway 2012). Despite the country's high profile in environmental issues, Norway remains a large exporter of oil and gas, and is still opening new areas for oil and gas exploration.

The Norwegian government administration system is divided into three levels: the Government (*Regjeringen*) at the national level, county councils (*fylkeskommune*) at the regional level, and municipalities (*kommune*), each with an elected government. Norway is currently undergoing a county reform, which was initiated by the current government, whereby today's 19 counties will be reduced to 11 by 2020. Similarly, the number of municipalities will be reduced from 426 to 358.

Both the counties and the municipalities are independent authoritative bodies, but the responsibilities and tasks are to a large extent set by national legislation. Of relevance to local energy communities, the counties are responsible for e.g. public transport, roads, power production and business development. The responsibilities of municipalities include local roads, water supply and sewage, local administration and planning and local environmental protection.

5.1 Renewable energy status

The following sections gives an overview of the status of renewable energy sources in Norway, with focus on small-scale installations, which would be relevant for local energy communities.

5.1.1 Hydropower

Hydropower is Norway's primary source of electricity, and covers almost all of the domestic electricity demand. In 2017, the Norwegian hydropower plants generated 143 TWh, accounting for 96% of the Norwegian electricity production (NVE 2018a).

The term "small-scale hydropower" encompasses power plants up to 10 MW, and can be divided into micro power plants (up to 100 kW), mini power plants (100-1000 kW) and small power plants (1-10 MW). It is not primarily the size of a hydropower plant that determines if it is subject to concession, but rather the possible damage or disadvantages for the public interest in the water resource. For power plants above 1 MW, the licensing authority is the Norwegian Energy and Water Resources Directorate (NVE), while the municipality is responsible for smaller plants (NVE 2018b).

According to the The Organization for Small-Scale Hydropower (*Småkraftforeninga*), there are at least 400 small-scale hydropower plants in Norway. In addition, 400 power plants, with a potential production of 3.2 TWh per year, have been licenced but not yet built.

5.1.2 Biomass

According to the Norwegian government, increased production and use of Norwegian biomass is a high priority. The way forward was outlined in the *Strategy for increased bioenergy* in 2008, where the goal was set to increase the bioenergy development by 14 TWh until 2020, which was at that time approximately a doubling of the current use (Norway 2008). The government estimates that the bioenergy potential from Norwegian commercial forests is 29 TWh, including 6 TWh from tops and branches which today are viewed as logging debris (Norway 2014).

However, according to a recent report from the Office of the Auditor General of Norway, the increase in the years 2008-2016 was only 1.6 TWh (Norway 2018b). This was the result of specific regulations for biofuels in the transport sector, in combination with taxes. According to the same source, the increase was only in liquid biofuels for road transport, and the increase was mainly in imported biofuels. The increase was estimated to reduce the Norwegian greenhouse gas emissions by 1%. The report from the Auditor General further states that the involved ministries have failed to coordinate and evaluate different measures against each other, and advices the government to establish a common and baselined strategy, including taxation policies (Norway 2018b)

A majority of Norwegian buildings have heating systems based on electricity, and it is common to have a wood stove as a secondary heat source. However, 12% of the households and around 50% of farm houses have fuel wood as their main heat source (Bøeng 2014).

5.1.3 District heating

The use of district heating is low in Norway compared to other Nordic countries but is increasing, particularly in cities. In 2017, the increase in energy consumption from district heating was 4.4%, giving a total of 5.5 TWh according to Statistics Norway (Aanensen 2018). Most of this was consumed by the service industry, 32% by households. About 50% of the energy came from waste incineration, and wood waste was the second largest energy source.

In Norway, district heating is often separated into large-scale systems (*fjernvarme*) and small-scale systems (*nærvarme*). Small-scale systems can often supply heating to e.g. a school, nursing home or a group of houses.

District heating plants with a total capacity over 10 MW are covered by the Energy Law (Norway 2010), and are subject to concession, which are managed by (NVE 2016). The concessionary gets permission to operate district heating within a specified area, and can apply to the local municipality to get

mandatory district heating connection for new and renovated buildings.

There is no central strategy for the development in district heating in Norway, but the development is to some extent covered in building regulations (Jensen 2015). These include the ban of fossil fuel based heating and flexible heating systems, while stricter energy regulations are assumed to have a negative effect. Increased urbanisation is also expected to have a positive effect on the use of district heating in Norway (Jensen 2015).

One example of small-scale district heating system is Østre Hageby in Stavanger, where a low temperature network with boreholes provide heating to 66 dwellings (Hasenmüller 2018).

5.1.4 Wind power

In 2017, there was around 1 GW wind power installed in Norway, generating 2.85 TWh wind energy. This accounted for 1.9% of the Norwegian energy power production (NVE 2017). The Norwegian parliament whitepaper on energy policy from 2016 states that the Government should develop a national framework for concessions on onshore wind power, and the ambition for a similar framework for offshore wind power (Norway 2016). The commission went to The Norwegian Energy and Water Resources Directorate (NVE), who are currently working on mapping the most suitable areas for land based wind power. A proposal for a national framework is expected during before March 2019 (NVE 2018c).

Offshore wind power is seen as an important future opportunity for Norwegian industry, in particular due on the long coastline and experience of offshore oil and gas activities. A strategy for floating offshore wind power is given in the national budget 2018 (Norway 2018a). At the moment, the government is still working on opening up to two areas for off-shore renewable energy production as well as applications for pilot projects.

A legal amendment from 2013 simplified the process for establishing small-scale wind power plants, so that plants below 500 kW are exempt from the concession requirement. Applications for building small wind turbines can therefore be handled by the municipalities according to the Planning and Building Act, which is a much faster process (Nilsen 2014). So far, the simplified process does not appear to have led to a large increase in the market for small-scale wind power, although it is difficult to find any data on installations.

5.1.5 Solar energy

The number of solar cell installations in Norway has increased rapidly from around 2014, but from a very low level. Before this time, the largest market was for very small-scale systems on off-grid mountain cabins. In 2017, the installed capacity increased by 18 MW_p, or 59%, and Norway now has around 45 MW_p installed (Multiconsult 2018). The largest increase has been in large-scale systems for office and industrial buildings, but there has been an increase in installations also in the residential market.

There are not very strong financial incentives for solar energy in Norway, but clarifications regarding the regulations regarding electricity certificated and prosumers are expected to have contributed to the increase during last year (Multiconsult 2018).

5.2 Legislation

5.2.1 The Climate Act

In 2017, the Climate Act (*Lov om klimamål, klimaloven*) (Norway 2017) was established . The purpose of the act is to assure that the Norwegian climate goals are met on the way to a low emission society in 2050, in accordance with the Paris agreement. Specifically, the law states that the Norwegian greenhouse emissions shall be reduced by at least 40% in 2030, and with 80-90% in 2050, compared to 1990.

5.2.2 Planning and Development

Land use and administration in Norway is governed by the Planning and Building Act[1] (*Plan- og bygningsloven, PBL*, LOV-2008-06-27-71) (Norway 2010b). The first paragraph (§1-1 Objectives) states that the objective of the law is to "secure a sustainable development for the benefit of the individual, society and future generations". The law applies to all sectors and is valid for all land area, including waterways, and out to one nautical mile from the shoreline. Some activities are exempt from the law, including public roads, hydropower plants and other electric power production plants.

Plans for land use exist on several levels. The County Council shall develop and adopt regional planning strategies, regional master plans and regional planning provisions (BPL §3-4). The Municipal Council shall develop and adopt a municipal planning strategy, municipal master plan and a zoning plan (PBL § 3-3). The management of building applications and permits is also the responsibility of the municipalities. The counties are responsible for auditing the plans of the municipalities.

While the planning regulations are managed at the regional and municipal level, it is the responsibility of the Ministry of Local Government and Modernisation to issue "National expectations regarding regional and municipal planning" every fourth year (PBL § 6-1). This document should guide regional and municipal planning strategies and plans, and be at the basis for the involvement of the central government. The latest issue from 2015 (Norway 2015) highlights the importance of efficient land use and to coordinating land use and transport systems, and the exploitation of "opportunities for use of waste heat, geothermal energy and ocean thermal energy conversion" in new development areas. The importance of climate change adaptation is also highlighted.

5.2.3 Local Government

The functions and responsibilities of municipalities and coun-

1 A general Norwegian-English term list for The Planning and Building Act is available at the Government website: https://www.regjeringen.no/no/tema/plan-bygg-og-eiendom/plan--og-bygningsloven/plan/veiledning-om-planlegging/Bokmal-nynorsk-ordliste/ordliste-norsk-engelsk--plan--og-bygning/id462717/

ties are goverened by the Municipal Act (*Lov om kommuner og fylkeskommuner, kommuneloven*) (Norway 1992).

5.2.4 Building Regulations

The Planning and Building Act is complemented by the Regulations relating to building applications (*Byggesaksforskriften, SAK*, FOR-2010-03-26-488) (Norway 2010c) and the Regulations on technical requirements for construction works (*Byggteknisk forskrift, TEK*, FOR-2017-06-19-840) (Norway 2017b). Both are is issued by the Ministry of Local Government and Modernization and managed by the Norwegian Building Authority (*Direktoratet for byggekvalitet, DiBK*).

The current version of the Regulations relating to building applications is SAK10, which is valid from 1 July 2010. Among the objectives are to ensure well-prepared building applications and efficient procedures.

The current version of the Regulations on technical requirements for construction works is TEK17, which is valid from 1 July 2017. The energy requirements (§ 14) were, however, changed already in 1 January 2016 in the preceding version TEK10, and left unchanged in TEK17. The building regulations open up for two different ways to address energy efficiency demands (§142): energy limits (*energiramme*) or energy measures (*energitiltak*). The former sets limitations for a building based on its type and heated floor area, while the latter sets limitations on individual building parts or functions, e.g. U-values and air leakage number. In both cases, there are minimum requirements on certain building parts that need to be met (§143).

In addition, buildings with local renewable energy production of at least 20 kWh/m² heated floor area can get an increased energy limitation or 10 kWh/m² heated floor area (§ 145). Furthermore, it is not permitted to install heating systems based on fossil fuels, and buildings above 1000 m² need to be equipped with so-called energy flexible heating solutions, and be adapted for low-temperature heating (§ 144). Flexible heating solutions does not mean that several sources need to be used, but that it should be a real possibility to change heat source. Low-temperature heating systems ensures flexibility in the heat source, where for example solar heating or different types of heat pumps can be used. Low-temperature heating systems normally mean use of water-based heating systems.

5.2.5 Renewable energy trading

Renewable energy in Norway and Sweden is also covered by the green electricity certificates scheme. It was put in place by Sweden in 2003 and Norway joined in 2012 with the objective to increase the renewable energy generation in the two countries by 28.4 TWh before 2020 (NVE 2018d). The scheme is regulated by the Electricity Certificates Act (*Lov om elsertifikat*, LOV-2011-06-24-39) and is technology neutral. A green certificate is awarded for each produced MWh of renewable energy. The Norwegian part of the scheme will be discontinued after 2021, while the Swedish part will continue until 2030.

Renewable energy can also get extra income by selling Guarantees of Origin (GO) on the European power market. GOs were introduced in the first EU directive on renewable energy in 2001 (Directive 2001/77EC) (NVE 2018e). One GO is equivalent to 1 MWh of produced renewable electricity. However, the high cost of joining the scheme in Norway in effect excludes small-scale plants such as private solar installations.

5.2.6 Local/distributed energy sources

Local power generation, for example from a solar photovoltaic (PV) system on a building, is covered by the so-called plus-customer scheme (*Plusskundeordningen*) (NVE 2017b). A plus-customer is defined as an end-user with use and production of power behind the point-of-connection to the power grid, where the power injected to the grid at no point exceeds 100 kW. Since 1 January 2017, the grid owner is obliged to accept surplus power from local power sources, although they are not obliged to pay for it. A plus customer does not need to pay the network tariff for power injected to the grid, and can select a power provider that is willing to pay for the injected power. From 2019, power injection above 100 kW will also be accepted, although the plus customer will have to pay an input tariff (*innmatningstariff*) for power above the threshold.

A prerequisite for distributed power generation is the introduction of so-called smart meters (*avanserte måle- og styresystemer, AMS*). These meters measure electricity both to and from the grid with at least hourly resolution, and makes it easier to monitor and control the grid. All electricity customers in Norway will get smart meters before 1 January 2019 (NVE 2018f)

The Planning and Building Act (§ 20-1 f.) states that a solar energy installation (PV or solar thermal) is to be considered a technical installation and it is therefore necessary to apply for building permit. However, installations, alterations or repairs on existing building units may be exempt from this requirement.

5.2.7 Electric vehicles

Since the 1990s, Norway has implemented a very progressive policy regarding electric vehicles (EVs). Most importantly, EVs are exempt from the purchase/import tax and the 25% VAT on the purchase. In addition, EV owners have had a low annual road tax, no charges on toll roads and free municipal parking. Although some of the non-economic incentives are now removed, the policy has led to that a 40% share of the new cars sales in Norway is now either battery electric vehicles (BEV) or plug-in hybrid vehicles (PHEV), and the share of EVs in the total personal vehicle fleet is around 6%.

Electric vehicles are an important part of Norwegian climate regulation, and have been a driver for the increased uptake of local PV systems. EV owners are interested in new energy technology, and a survey by the Norwegian EV Association showed that at least 34% of EV owners were considering installing solar cells on their house.

5.2.8 Laws on cooperatives

Cooperatives are governed by the Co-operatives Act (*Lov om samvirkeforetak*, LOV-2007-06-29-81), which was established

in 2007 (Norway 2007). Among the objectives of the law are to make it easier to establish and run co-operatives, secure co-operatives distinctive qualities, help put co-operatives and "social economy" on the agenda, change attitudes towards co-operatives (Norway 2007b). Among other things, the law does put minimum requirements on the co-operatives capital assets. Social economy is described as activities or operations for which the benefit to the members or society – and not profit – is the major driving force.

For local energy communities, the Co-operative Building Societies Act (*Lov om bustadbyggjelag*, LOV-2003-06-06-38) may also be relevant (Norway 2003). A co-operative building society can work with building or acquiring housing for its members and housing management. A co-operative building society can for example manage several housing co-operatives.

5.2.9 Tax regime, relevant for municipality revenue creation

The municipal income consists of one part that the municipalities are free to dispose as they wish, and one smaller, tied-up part. Around 40% of the income comes from municipal taxes and 34% from so-called block grants (*rammetilskudd*), or tax equalization scheme, which compensates for the different costs and incomes in different municipalities. The block grants also include regional grants that target specific regional political goals (Norway 2018c).

5.2.10 Implementing EU legislation in Norway

Norway is not part of the European Union, but committed to many of the EU legislations through the European Economic Area (EEA) agreement between EU and European Free Trade Association (EFTA). In addition to trade, the agreement also encompasses legislation on environment, research and education, culture and social issues. Each new EU regulation or directive needs to be negotiated separately between EU and the countries in EFTA (Norway, Iceland, Switzerland and Lichtenstein).

The result is that the incorporation of EU legislation in the Norway legislation is a lengthy process. For example, the Energy Performance of Buildings Directive (EPBD) from 2010, which among other things states that all new buildings in the European countries should be "nearly zero energy buildings" by 2021, is still incorporated in the EEA agreement (Norway 2018d). At the same time, EU has issued several amendments to the EBPD as a part of the package "Clean Energy for All Europeans" (also known as the "Winter Package"). However, many of principles of the EBPD are incorporated in Norwegian legislation and white papers, for example mandatory energy certification of buildings and a plan for increasing the energy efficiency requirements in the building regulations to nearly zero energy in 2020 (Isachsen 2016).

5.3 Institutional overview

5.3.1 Responsible governmental department(s) and public institutions

On a national level, the planning system in Norway is governed by ministries and other authorities. The following *ministries* are relevant to the planning system:

The Ministry of Local Government and Modernization (*Kommunal- og moderniseringsdepartementet, KMD*) "is responsible for housing policy, the Planning and Building Act, local government finances and local administration, ICT Policy and Public Sector Reform, rural and regional policy, the conduct of elections, government employer policy, Sami and minority affairs and national mapping and geodata policy."

The Ministry of Climate and Environment (*Klima- og miljødepartementet, KLD*) has the overarching responsibility for the Norwegian policy regarding climate and environmental issues and for the coordination of the Government's climate and environmental goals. The areas of responsibility are biodiversity, cultural heritage, outdoor life, pollution, climate, and the Polar areas.

The Ministry of Petroleum and Energy (*Olje- og energidepartementet, OED*) has the responsibility to achieve a coordinated and integrated Norwegian energy policy. A primary objective of OED is to "ensure high value creation through efficient and environmentally friendly management of Norway's energy resources". The energy sector in Norway encompasses oil and gas, renewable energy and carbon capture and storage (CCS).

The Norwegian *directorates* are administrative bodies placed under the ministries, with well-determined tasks or areas of responsibilities. The following directorates are relevant in the planning process:

Norwegian Building Authority (*Direktoratet for byggekvalitet, DiBK*) is a directorate under the Ministry of Local Government and Modernisation. DiBK is a national competence centre on buildings, and communicated with the municipalities, participants in the building industry and the market for building materials. An important function is to increase the knowledge of building regulations, building quality and building permit process, and the directorate is an agent in the process of carrying out national building policy.

The Norwegian Water Resources and Energy Directorate (*Norges Vassdrags og Energidirektorat, NVE*) is a directorate under the Ministry of Petroleum and Energy. The mandate is "to ensure that the development of Norwegian hydropower is both environmentally friendly, as well as beneficial to the Norwegian society at large". NVE is responsible for managing Norway's water and energy resources, and for risk assessment and mapping of e.g. flooding, landslides and avalances. NVE also participates in national and international R&D projects.

The following *funding bodies* are of relevance for local energy communities:

Enova (www.enova.no) is a state-owned agency, established in 2001, that supports initiatives furthering the transition to a low-emission society. It is owned by the Ministry of Climate and Environment. Enova gives financial support to

both companies and private persons, and the focus areas are reduced greenhouse gas emissions, innovation and technology development. Companies can get financial support for e.g. introduction of new low-emission technologies, pilot projects and the added cost of choosing climate friendly solutions. Private persons can get support for several energy measures in their homes, such as replacing fossil fuel-based heating systems, installing solar energy systems or energy-efficient renovation. Enova has a budget of 2.5 billion NOK in 2017.

The Norwegian State Housing Bank (*Husbanken*) (www.husbanken.no) has the main task of implementing Norway's housing policy "secure and adequate housing for all". The support schemes and loans are primarily aimed at less advantaged groups, either directly or through different municipal grants for e.g. social housing and nursing homes. The bank also provides advantageous loans for private persons who wants to upgrade existing buildings or build new housing with high environmental standards or design for universal accessibility. The bank also supports R&D projects.

The research council of Norway (*Norges forskningsråd, NFR*) (www.forskningsradet.no) is the primary supports funding body for R&D projects.

Nysnø Climate Investments (www.nysnoinvest.no) is a sovereign wealth fund that is administered by the Ministry of Trade, Industry and Fisheries. The fund, which was established in December 2017, will make long-term investments in companies that are both profitable and provide solutions for reducing greenhouse gas emissions.

5.3.2 Non-governmental organisations (civil society)

Energy Norway (*Energi Norge*) (www.energinorge.no) is an industry organisation representing companies within production, distribution and trading of electricity, and its members produce 99% of the power in Norway. The organisation provides a large number of courses as well as manages and develops research projects for the industry, and is promoting the vision of a renewable, fully electric Norway.

Norwegian Green Building Council (*Grønn byggallianse*) (www.byggalliansen.no) is a member organisation with actors from the building and property sectors. The objective is to develop the sectors towards increased sustainability and consideration for the environment. The organisation also manages environmental certifications schemes for the building industry, primarily BREEAM.

FutureBuilt (www.futurebuilt.no) is a ten year program (2010-2020) with the objective to showcase 50 "role model projects" within sustainable buildings and communities. The partners are Oslo, Bærum, Asker and Drammen municipalities in Southern Norway, Enova, the Ministry of Local Government and Modernisation, the State Housing Bank, the Norwegian Building Authority, Norwegian Green Building Council and the National Association of Norwegian Architects.

The Research Centre on Zero Emission Neighbourhoods (ZEN) (www.fmezen.no) is funded for eight years through the Research Council of Norway program "Research centres for renewable energy" (*FME, forskningssenter for fornybar energi*). The centre's participants come from the whole value chain, including municipalities and counties, the building industry, architects, energy companies and academia. The objective is to develop solutions for buildings and neighbourhoods with zero greenhouse gas emissions.

The Norwegian Smart Grid Centre (www.smartgrids.no) is a membership organisation with the objective to be a competence centre for smart grids in Norway. The members are R&D institutes, universities and companies, organisations and representatives from the public sector.

Norwegian Organization for Hydroelectricity Producing Municipalities (*Landssammanslutninga av Vasskraftkommunar, LVK*) (www.lvk.no) organizes municipalities with hydropower plants. LVK assists its members in questions regarding e.g. energy policy, and provides technical and legal expertise that may not be available in the municipalities. The organization has 174 members, that is, more than a third of the municipalities in Norway.

The Norwegian Solar Energy Society (*Norsk solenergiforening*) (www.solenergi.no) is a member organisation with around 500 members from industry, the R&D sector in addition to private persons. The objective of the organisation is to promote knowledge and use of solar energy in Norway.

The Organization for Small-Scale Hydropower (*Småkraftforeninga*) (www.småkraftforeninga.no) is a member organisation with around 500 members representing owners of small-scale hydropower plants and other concerned parties. The organization represents small-scale hydropower interests towards politics, society and media.

Norwea (www.norwea.no) is an interest and business organisation working to establish and maintain a wind power market in Norway. The organisation works with onshore and offshore wind power, as well as with other renewable offshore energy sources. The organisation was established in 2006 and has around 130 members.

Norwegian district heating (*Norsk fjernvarme*) (www.fjernvarme.no) is the interest organisation for the district heating industry, and represents 47 companies. The organisation works to promote the development of district heating, primarily based on renewable or recycled material.

5.4 National incentives for community energy projects

5.4.1 National funding through Enova

Enova supports business in development, testing and implementation of innovative energy and climate solutions for buildings, transport, industry and services. Building projects can get funding for testing new technologies, or the added cost of using the best available technologies. Enova also funds large-scale pilot projects. Some of the support schemes are also available for housing co-operatives.

For private persons, Enova supports the installation of renewable energy in buildings and energy efficiency measures. Some examples are shown in Table 7.

Table 7. Examples of Enova's financial support for private persons.

Measure	Funding
Energy guidance	Up to 7500 NOK
Energy renovation	Up to 150 000 NOK for renovation to passive house level
Installation of renewable energy production	10 000 NOK + 1500 NOK/kW up to 15 kW (in total up to 28 750 NOK)
Installation of solar thermal systems	10 000 NOK + 200 NOK/m² up to 25 m² (in total up to 15 000 NOK)
Installation of heat pumps	From 10 000 NOK for an air-to-water heat pump to 30 000 NOK for ground source, geothermal or sea water heat pump

5.4.2 Support for municipalities

Municipalities can apply for funding through the *Klimasats* support scheme, which has the objective to support projects that lead to reduction of greenhouse gas emissions. Financial support is given under the thematic areas land and transport planning, transport, emissions reduction measures in other sectors, preparatory projects, and inter-municipal competence networks. Funding is given every year, and the total budget in 2018 was 150 million NOK. Klimasats is administered via the website *Miljøkommune* (www.miljokommune.no), which also provides guidance and support for municipalities on environmental issues.

5.5. Regional level

5.5.1 Troms County

The County Master Plan for Troms County (2014-2025) (Troms 2014) states that objective of land use management is to facilitate good and sustainable development for business and society. The plan highlights the importance of balancing development and consideration for the environment, including the coastlines and sea. The plan points to the importance of co-ordinating the land use and transport planning, in order to reduce the need for transport, and that the increased transport demand due to growing cities should be by walking, biking and public transport. In addition, the plan points to the need for climate adaptation, and that the county has developed two tools for climate adaption for use in regional and municipal planning: The Climate Helper (*Klimahjelperen*) and Climate Profile Troms (*Klimaprofil Troms*).

In 2015, Troms County (*Troms fylkeskommune*) developed the Regional Climate and Energy Strategy 2015-2025 (Troms 2015), which lays out the strategies and priorities regarding energy and climate in the region. The overarching goal is increased energy-efficiency, sustainable power production, and increased use of renewable energy. Additionally, the report includes a strategy for climate adaptation. According to the data presented in the report, transport accounts for over half of the greenhouse gas emissions in the county, and much of the strategy plan is dedicated to climate efficiency land and transport planning and low or zero emission vehicles. This is to be achieved for example through better co-ordination of housing, land and transport plans, efforts to increase the share of walking and biking, a goal of zero emission public transport, and facilitation for the use of electric vehicles to a regional charging strategy. The strategy also states that the county should support the development of smart grids. The strategy is to be updated in 2019.

Troms County is part of the regional network *Klimapartnere* (Climate Partners) (https://www.klimapartnere.no/troms/), together with among others the university, regional businesses and non-governmental organizations. The purpose of the network, which has several chapters in different parts of Norway, is to "reduce greenhouse gas emissions and to stimulate green community and business development". The network works by spreading knowledge, developing green business ideas, creating meeting places, and through co-operation at several levels.

5.6 Municipal level

5.6.1 Tromsø Municipality

Tromsø Municipality has an Environment, Climate and Energy Plan from 2008-2018 (Tromsø 2008), which is currently being updated (a proposal was sent out for circulation in August 2018 (Tromsø 2018)). The plans set high ambitions for the reduction of greenhouse gas emissions in Tromsø, and states that municipality should have a high environmental profile that lies ahead of national ambitions. The current plan aims for a reduction in greenhouse gas emissions of 50% in 2030 compared to 1990s level, and a low emission society in 2050. The municipality predicts that the Planning and Building Act will be among the most important tools in this work.

The plan outlines the responsibilities of the municipality, for example as regulatory authority, building owner, purchase agent, facilitator, and information source. The plan states that the municipality should set high demands on local building developers and use its power as regulatory authority to minimise the number of deviations.

The plan highlights existing local projects such as *Tenk Tromsø* (Think Tromsø), which is a collaboration project with

among others Troms County, aiming to reduce the emissions from transport.

Tromsø is a tourist town, and another important project is *Bærekraftig reiseliv* (Sustainable tourism). The project is a cooperation between the among others the municipality and Visit Tromsø, and measures in this project include promoting less polluting means of transport, choosing operators with environmental certification and sustainable use of the wilderness areas.

Among the concrete actions in the draft plan with relevance to local energy communities are:

- Strengthen the municipal master plan with concrete measures to achieve a low emission society.
- Revise the standard demand specifications for buildings with regard to energy, climate and environment.
- Stimulated the use of massive wood for building projects.
- Complete BREEAM certification of at least two projects within five years.
- Realise a nearly zero energy building (nZEB) within five years.
- Organize a dialogue conference on the topic PV systems.
- Introduce a requirement that the cost of PV systems are evaluated in all municipal building projects at an early stage.
- Stimulate the use of PV systems through economic incentives and information spreading.

5.7 Barriers, challenges, recommendations

A barrier for energy efficiency measures as well as installation of local new renewable energy systems in Norway is the low price on electricity from the grid, both historically and today. This means that the pay-back time for any measure is long. A Norwegian survey from 2016 showed that around 40% of the population do not know how much electricity they use in their homes, which is probably due to the low price on electricity.

The complex nature of the power system, both technically and economically, may also be a barrier for people to engage in community energy projects. In addition, the Norwegian power system generally works well and has a low rate of power failures, and the necessity of local projects may not be evident.

Many Norwegian buildings use direct electric heating combined with wood heating. This makes it more complex and costly to change to a heating system based on thermal energy sources, since water-borne heating systems have not been common.

For small-scale renewable energy installations, mainly PV, the lack of incentives and regulations have been a barrier. Before the prosumer scheme became operational, the grid companies were not required to accept electricity from local installations. They are still not obliged to pay for the electricity, although the customer is free to choose a power company that will.

A study of the drivers and barriers for installing small scale renewable energy system, PV in particular, in Norway was recently published by the research institute CICERO (Westskog 2018). Some of the conclusions were that PV installations were considered a relatively expensive installation, and that the knowledge about solar energy was low. Of the people who had installed PV systems, none mentioned reducing their energy demand as a driving factor, but rather an interest in environmental issues or in new technology. The authors pointed out that generous, reliable and simple incentive schemes are needed to significantly increase the number of PV installations in Norway, and recommended feed-in-tariffs (FiTs) as such a scheme.

A general barrier in Norway is probably that the concept of local energy communities is little known. There are not many examples of successful projects, and those are not known to the general population.

However, many Norwegians have experience with small-scale energy systems since there is a large number of private mountain cabins (*hytte*), of which many are not connected to the grid. It has been fairly common to install a small scale PV system and battery bank, and there are many solutions available for this. In fact, off-grid PV accounted for most of the installed PV power in Norway until just a few years ago.

In addition, the general notion among Norwegians appears to be that the grid electricity in Norway is more or less fully renewable. The electricity production in Norway is 98% renewable (96% hydropower and 2% wind power). However, if trade with Guarantees of Origin (GO) for renewable electricity is accounted for, most of this is actually sold to other European countries. Only 19% of the power in Norway was bought with GOs, which means that the grid power mix in Norway is actually only 31% renewable. The trade with GOs is not well known among the general public, and the concept sometimes met with scepticism.

5.8 Community energy in Norway – success stories

5.8.1 Smart Energy Hvaler

Smart Energy Hvaler (www.smartenergihvaler.no) was one of the demo projects of the Norwegian Smart Grid Centre and the activities have been part of national and international research projects. The primary partners are Hvaler Municipality, power company Fredrikstad Energi and Smart Innovation Norway, which works with business oriented R&D. Hvaler Municipality consists of a group of islands located in the southern part of Norway, and is used as a full-scale demo arena in the smart grids. The demo area consists of 86 km^2 with 4000 cabins, 2700 dwellings a smaller number of industrial properties. Smart energy meters are installed in 6700 households are included on the demo arena.

One of the projects in Hvaler is Sandbakken waste recycling plant (Figure 1), which together with some of the municipality's surrounding buildings are called Hvaler Energy Park (Buckholm 2017). It is presented as Norway's first full-scale microgrid. It has the possibility to run in island mode (disconnected from the national power grid) by aid of a so-called Microgrid Power Router (MPR) which was developed in the H2020 project EMPOWER (www.empowerh2020.eu). The recycling plant is equipped with a 1200 m^2 PV system with an expected production of 156 000 kWh per year, a 3 kW

roof-mounted wind turbine (two others are to be installed), and a battery with a storage capacity of 220 kWh (Granås 2017). According to the project partners, the micro grid can manage without electricity from the national grid for six months, from spring to fall.

Figure 1: Solar cells and a grid turbine at Sandbakken waste recycling plant in Hvaler. Photo: Fredrik Aspheim/Tekniske nyheter (Granås 2017).

Solar energy installations has been an important part of the project. Hvaler Municipality provides information and a pre-designed package deal for a photovoltaic (PV) system. There is also an additional support scheme for photovoltaic (PV) installations as a complement to the one from Enova. While Enova supports the installation, the municipality supports additional costs such as advisory services and system solutions for monitoring and control with up to 3500 NOK.

Involvement of user flexibility and facilitation for electric vehicle (EV) charging are also focus areas. A small-scale test with 25 users showed that the electricity demand was reduced by introducing differentiated power tariffs (Lie 2014).

5.8.2 Hurdal Ecovillage

While the initiative for Smart Energy Hvaler came from the municipality and local power company, Hurdal Ecovillage (*Hurdal* Økolandsby) (www.hurdalecovillage.no) was the result of many years of work from a group of private persons. According to one of the founders, the group wanted to build an ecovillage based on a farm and visited around 40 potential sites before the current location in Hurdal was found (Torp 2018).

Hurdal Municipality is located around 80 km North of Oslo in Southern Norway, and the ecovillage now consists of The ecovillage was developed and built by the company Filago, as a pilot project for green property development. Filago currently has other similar projects under development. The construction started in 2013 and by the end of 2016 around 160 people were living in the ecovillage (Torp 2018). The plan is to house 400-500 people within the coming years in single family houses and housing co-operatives (Hurdal 2018).

According to (Westskog 2018b), Hurdal Ecovillage developed over time from cooperative ownership, self-built houses and a wish to be self-sufficient to move closer to mainstream society with houses designed and built by professional actors and privately owned. The authors state that the primary motives for moving to the ecovillage today are to become part of a community and to lead a more sustainable life.

Today, the ecovillage is based on three "pillars": Active houses, a farm, and an ecological business centre. Active houses is a building concept using naturally ventilated buildings with sustainable materials (mainly wood). The heating and electricity comes from bioenergy and solar power, but the houses are grid-connected (not autonomous). The available farmland is both rented to professional actors, and managed through co-operative farming. The business centre includes a bakery and café, gym, general store and offices (Hurdal 2018).

5.8.3 Vulkan

The Vulkan district in Oslo is an example of urban local energy (https://www.vulkanoslo.no/miljo-og-byutvikling/). The district, which includes among other things a hotel, a food hall and the office building of environmental organisation Bellona, is connected to a local district heating and cooling system. The system is managed through a joint energy central (Joelson 2015). Information is also available online (www.energisentralen.no). The sources are geothermal heating/cooling, solar thermal from the Bellona building, and excess heating from the buildings. The 300 m deep geothermal boreholes are used both for heating and cooling, and for storing energy during summer (Figure 2).

Figure 2. Part of the Vulkan quarter, with the solar thermal collectors on the Bellona building to the right in the photo. The collectors are located on the tilted surfaces on the façade, and also act as solar shading. Photo: Finn Ståle Felberg, www.vulkanoslo.no.

During summer 2014 it was found that the cooling system was under-dimensioned, and the chosen solution was to install an ice storage under the food hall (Garathun 2015). The ice storage is "charged" during the night, and keeps the buildings cool during the day.

5.9. Norway summary

Norway has high ambitions regarding the reduction of greenhouse gas emissions. In 2017, the Climate Act put the goals of the Paris Agreement into Norwegian legislation, stating that the national greenhouse gas emissions shall be reduced by 40% in 2030, and that Norway should be a low emission society in 2050. However, despite the high ambitions, Norway remains a large exporter of oil and gas and still opens new areas for oil exploration.

The government administration system of Norway is divided into three levels: state, county and municipality. They are relatively independent of each other and have different areas of responsibility, and plans for land use exist on all three levels. The national government is responsible for the overall planning strategy and setting guidelines, the counties for developing regional master plans, and the municipalities for the local zoning plans and building permit procedures.

In this context, among the most important pieces of legislation is the Planning and Building Act, which outlines the land use and administration, and the Regulations on technical requirements for construction works (*TEK*), which sets the requirements on e.g. energy consumption in buildings.

Norway is not part of the European Union, but still follow EU regulations on a number of areas, including environment, research and social issues, due to the membership in the European Economic Area (EEA). However, the timeframe for implementing EU legislation may be long. For example, the Energy Performance of Buildings Directive (EPBD) has not yet been incorporated into Norwegian legislation, although some of the contents is included in regulations and white papers.

There are not many examples of local energy communities in Norway. One barrier for both introduction of local renewable energy projects and energy efficiency measures is the low price of electricity, historically and today. In addition, if the trade with Guarantees of Origin (GOs) is not accounted for, the Norwegian power mix is 98% renewable, which means that many do not see the need for reducing energy demand or introducing more renewable energy. One driver for increased installations of renewable energy, solar energy in particular, has been Norway's progressive legislation on electric vehicles (EVs). EVs now make up around 5% of the personal vehicle fleet, and many EV owners are interested in renewable energy technology.

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6 SWEDEN

The newly adopted climate policy framework for Sweden sets following GHG emission targets: By 2030 GHG emissions of the non-ETS sectors shall be reduced by 63%, 75% by 2040. Emissions from all activities on swedish territory shall be reduced by at least 85% by 2045, all from 1990 levels (Sweden 2017). The 2020 Swedish targets to reduce GHG-emissions by 17% and to increase the renewable energy share to 49% had already been achieved. One of the main drivers for the Swedish energy transition is the worlds highest CO2-tax of US$126/tCO2eq (WBG 2017). Sweden´s energy commission proposed a 100% renewable energy (electricity) target for 2040 in its final report in January 2017. This is complemented with an increased end-use efficiency target of 50% by 2030 as compared to 2005 levels (SOU 2017:2).

The 2017 Swedish climate policy framework states that the work necessary to achieve the enacted targets will be carried out in close cooperation with authorities, municipalities, industry, and civil society. Sweden intends to be a leading country in the global effort to realize the Paris Agreement's ambitious goals.

6.1 Legislation

The three levels of planning responsibility that exist in Sweden are: the state - county council - municipality.

6.1.1 National legislation on building and planning

The central supervisory body is the National Board of Housing, Building and Planning (Boverket). It is responsible for monitoring developments in the field of physical planning, issuing building regulations and additional provisions in the Planning and Building Act (PBL) which constitutes a general framework (SFS 2010:900). The stated purpose of the PBL is to promote societal progress, ensure equal and proper living conditions, clean and sustainable habitats for todays and future generations. The PBL is complemented with the National Building Code including construction regulations (EKS) and building regulations (BBR). The single government authority in charge for PBL, EKS and BBR is Boverket. The Swedish Energy Agency is consulting in energy related questions.

The PBL, EKS and BBR already include the national implementation of EUs directive on near-zero energy buildings (NZEB): New public buildings shall be near-zero energy buildings by 1st January 2019 and all new buildings shall be near zero-energy buildings by 1st January 2021.

6.1.2 Regional and municipal planning

Each county has a County Council *(Sw = landsting)* alongside the County Administrative Board (CAB, *Sw = länsstyrelse*) with responsibility for the county's development. The CAB and the County Council provide consultations, monitoring and coordination of municipal planning and ensure that inter-municipal issues and matters of national interest are considered. The CAB reviews and may suspend detailed municipal plans and area regulations adopted by the municipality.

A legally required planning on county level does not exist in Sweden hence regional strategies or county development plans are not binding on the municipalities but serve as guides in deciding whether comprehensive and detailed plans as well as area rules comply with overarching interests.

The PBL puts the responsibility for planning on the municipal council *(Sw = kommunfullmäktige, kommunstyrelse)* including the appointed executive board and the building committee. The municipal comprehensive plan (*Sw* = översiktsplan) shows how the municipality intends to take into account national interests and regional objectives, plans and programs as well as areas for rural development in coastal areas, ensuring the appropriate use of areas according to the Environmental Code (Miljöbalken SFS 1998:808 and SFS 1998:811).

The Environmental Code provides that land and water areas that are particularly suitable for industrial production, energy production, energy distribution, communications, water supply or waste management facilities shall, to the extent possible, be protected against measures that may significantly complicate the acquisition or exploitation of such facilities.

The Municipal Act provides further legal requirements for comprehensive planning (Kommunallag – SFS 2017:725). Comprehensive planning has two main purposes: partly to form a political program for important development issues in the long term, and to provide support for detailed planning and review of cases under different laws. At least once during its term of office, the municipal council must review the comprehensive plan in a democratic consultation process.

Detailed regulation of land use and housing is carried out through a detailed development plan (DDP), which is also assumed and adopted by the municipal council. A DDP shall have an implementation period of 5-15 years, has legal effect and is directly governing land use.

6.1.3 Energy in municipal planning

Concerning energy planning the Act and ordinance on municipal energy planning legislate these affairs and state that the municipality shall promote efficient energy use and ensure a safe and sufficient energy supply (SFS 1977:439, SFS 1977:440). Each municipality shall have an up-to-date plan for supply, distribution and use of energy within the municipality. The Act requests the municipality to investigate in the potential of cooperation with other municipalities or important energy stakeholders including industry and power utilities in order to address efficient energy use and supply. If such potentials exist, the municipality shall consider this in its planning.

A 2009 ordinance on energy efficiency measures for authorities requires the implementation of efficiency measures in public administrative buildings (SFS 2009:893). This ordinance is accompanied with state-aid for energy efficiency measures in municipalities and county councils (SFS 2009:1533). The state-aid requires and supports the preparation of an energy efficiency strategy and action plan and the actual implementation of such measures.

6.1.4 Laws on cooperatives

In Sweden most energy associations or membership based energy enterprises, which may or may not include the name "kooperativ" in the organization's name, are listed as economic associations (*Sw = ekonomisk förening*) in the Swedish Companies Registration Office (*Sw = Bolagsverket*), but cooperatives can operate in any corporate form. An economic association is regulated by the Act for economic associations (SFS 1987:667).

An economic association has at least three members who want to run a business together and shall promote members' financial interests. This means that members will receive a financial exchange of participation in the association. For example, the exchange could be an employment, a better price or a lower cost. There is nothing that prevents the association from promoting interests other than purely economic, as long as the economic interest dominates. Both legal and natural persons may be members. An important principle is open membership. Members pay membership (from 1 SEK and unlimited) and decide on basic rules that will apply to the association. Members are not personally responsible for the association's obligations. The economic risk is, in principle, restricted to the membership.

6.1.5 Tax regime, relevant for municipality revenue creation

Municipal and county tax revenue is created from income tax and property fees on housing properties. Corporate taxes and property taxes on commercial and energy facilities are state taxes, which is unique in Europe. A national tax equalization and distribution system (*Sw = skatteutjämningssystem*) shall enable all municipalities and county councils / regions to offer its inhabitants equal services regardless of the municipality´s or county´s own revenue base.

6.2 Institutional overview

6.2.1 Public institutions in the energy sector

There are several ministries with responsibility in the fields of energy, environment and climate.

The Swedish Energy Agency (*Sw = Energimyndigheten*) is subordinate to the Ministry of the Environment and Energy and works for a sustainable energy system, combining ecological sustainability, competitiveness and security of supply. The Agency supports the development and dissemination of knowledge targeted at households, industry, and the public sector. (http://www.energimyndigheten.se/en/about-us/).

The National Board of Housing, Building and Planning (SW=Boverket) is responsible for monitoring developments in the field of physical planning, issuing building regulations and additional provisions in the Planning and Building Act (PBL) which constitutes a general framework (SFS 2010:900).

Swedish Environmental Protection Agency The Agency carries out assignments on behalf of the Swedish Government relating to the environment in Sweden, the EU and internationally.

Energy Agencies of Sweden (*Sw = Energikontoren Sverige*, http://energikontorensverige.se/) is an intergovernmental body for the 15 Swedish Regional Energy Offices and works for more efficient energy use and increased share of renewable energy through projects in collaboration with public and private actors.

Energy agencies also coordinate Sweden's municipal energy and climate advisers – **Energirådgivningen** (https://energiradgivningen.se/), which is an impartial and free service to residents and companies.

6.2.2 Cooperative institutions and associations

Verksamt.se is a collaborative website of authorities including the Swedish Employment Agency, the Swedish Companies Registration Office, the Swedish Tax Agency and the Swedish Agency for Growth, providing information and e-services for starting or running a business (https://www.verksamt.se/fundera/starta-kooperativ).

Coompanion works for entrepreneurship where people realize ideas together, democratic and beneficial to themselves and the world (https://coompanion.se/).

Sveriges Ekokommuner - http://www.sekom.se/ - Sekom encourages development towards a more sustainable society, where we have a sound environment while at the same time; people have a high quality of life.

Hydropower -
Föreningen Sveriges Vattenkraftskommuner och – regioner (FSV) – URL: http://fsv.nu/

Svensk Vattenkraftförening - The main purpose of the association is to promote the development of small-scale hydropower (<10 MW) and promote sound conditions for energy recovery from small-scale hydropower, taking into account its environmental contribution to ecologically sustainable electricity generation. - http://svenskvattenkraft.se/om/

Solar -
Svensk Solenergi (a solar industry association) - http://www.svensksolenergi.se/

ETC EL – A company investing in solar parks, supporting interested citizens and initiatives in setting up solar energy cooperatives. - https://www.etcel.se/

Wind –
Svensk Vindenergi (a wind industry association) - http://svenskvindenergi.org/

Svensk Vindkraft förening – Swedish Wind Energy Association - https://www.svensk-vindkraft.org/

Nätverket för vindbruk - https://www.natverketforvindbruk.se/. The wind power network spreads knowledge and information about wind power and supports regional initiatives of national importance. The network was founded in 2008 on behalf of the government and is part of the Energy Agency's work to promote the expansion of wind power.

Bioenergy –
SVEBIO – Svebio's vision is to be the leading representative

and an international example for developing bioenergy in a sustainable society. - https://www.svebio.se/

Pelletsförbundet - PF works to support, strengthen and stimulate the pellets industry. - http://pelletsforbundet.se/

Biofuel Region - We contribute to a fossil-free vehicle fleet and a developed bioeconomy by initiating, coordinating and collaborating in projects. - http://biofuelregion.se/

6.3 National incentives for community energy initiatives

There are officially no national energy incentives targeted at community energy initiatives directly. However, there are subsidies for which communities can apply. The so-called "Klimatklivet" programme is one of them, and so is the Solar PV investment subsidy. These initiatives have been successful until 2018, when the governmental budget changes for 2019 put these initiatives on hold (Klimatklivet) or proposed to cut substantially (Solar PV subsidy).

Föreningen för Samhällsplanering (FFS) has participated in SPECIAL-EU as the Swedish partner and produced a summary report in Swedish: Energismart Samhällsplanering (FFS 2016).

SPECIAL-EU – www.special-eu.org – Spatial Planning & Energy for Communities in All Landscapes. The project aimed to bridge the gap between energy action planning and spatial and urban planning. Useful outcomes include a practical guide for planners and a series of expert papers on integrating energy, transport into urban planning (SPECIAL-EU 2015, 2016).

6.4 Regional level - Norrbotten

Since 2017 the **Region Norrbotten** (formally: County Council of Norrbotten, *Sw = Norrbotten läns landsting*) assumes the regional development responsibility and together with the county administrative board (CAB), municipalities, companies and organizations, the county council contributes to creating enabling conditions for regional development.

Another relevant administrative body in the region of Norrbotten is the association of all 14 municipalities in Norrbotten (**Norrbottens kommuner** - https://www.norrbottenskommuner.se/). The members aim for an increased municipal cooperation and sustainable regional development. In cooperation with the Region Norrbotten a revision of the regional development strategy (*Sw = regionala utvecklingsstrategin, RUS*) is on the way (current: Norrbotten 2012).

The four most northern municipalities in the county of Norrbotten – Jokkmokk, Gällivare, Kiruna and Pajala – have founded the **Lappland municipality association** (*Sw = Lapplands kommunalförbund, LKF*) in 1989. The activity areas include high schools, adult education, and coordination of procurement, energy and climate advice and special support for people with long-term mental illness (http://www.lapplands.se/).

A regional plan in the sense of a comprehensive plan does not exist for the Region Norrbotten.

The Climate and Energy strategy for the county of Norrbotten from 2016 has the perspective up to 2050 (Norrbotten 2016). It defines following targets for 2020, based on 2005 levels:

- 25% reduced GHG emissions.
- Double the regional BNP per emission unit (carbon efficiency target).
- The share of renewable energy has increased by 40% and absolute energy use has reduced by 10%.
- Renewable fuels in the transport sector is higher than 20%.
- The targets for 2050, based on 2005 levels, are:
- 85% reduced GHG emissions.
- Norrbotten shall contribute towards Sweden´s vision to be a fossil-free nation.
- Energy consumption shall be at least 40% less as compared to 2005.

It is the intention of the climate and energy strategy to act as support for authorities, municipalities, enterprises and organisations in their decision-making. The strategy promotes an increased energy perspective in the planning processes, including the comprehensive planning of the municipalities.

The North Sweden Energy Agency (*Sw = Energikontor Norr, EKN*) is an impartial resource for competency on energy issues and coordinates regional activities. EKNs task is to increase the share of renewable energy and to support companies and public sector in Norrbotten to conserve energy and natural resource.

Region Norrbotten supports the membership of municipalities in the **Covenant of Mayors**, where the county of Norrbotten is the regional coordinator with technical support of the Energikontor Norr. Through this, the municipalities commit to work in a strategic and structured way with energy and climate issues and receive support for their own energy end climate activities.

6.4.1 Jokkmokk municipality

Jokkmokks comprehensive plan from 2011 recognizes existing interests in developing mining, hydropower and windpower. It also considers that favorable areas for windpower developments are often in conflict with military and other interests - national defense forces actually objects ten out of eleven areas for wind development as proposed in the current comprehensive plan. Jokkmokk has no landareas which are demarcated as national interest areas for windpower development, but local wind-conditions are favorable in many areas, which are not demarcated for national interest. It also states that the municipality promotes renewable energy sources, including windpower and biofuels, as well as efficient use of energy through physical planning and building structures (Jokkmokk 2011). The Jokkmokk comprehensive plan is under revision.

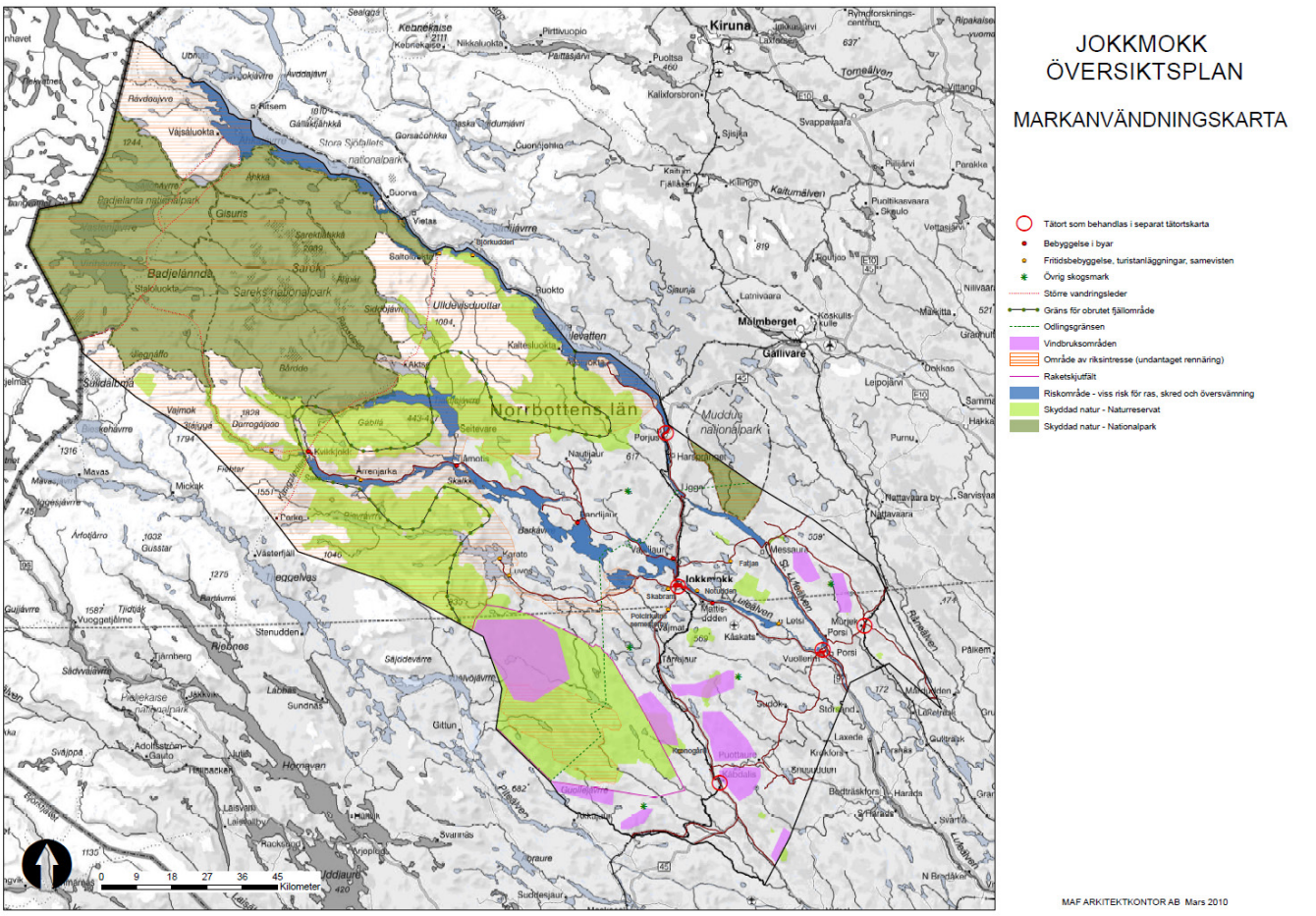

Figure 3: Jokkmokk Land use plan. Source: Jokkmokk comprehensive plan 2011

In order to work towards reduced climate impact Jokkmokk has developed an Energy and Climate Strategy and Plan, which also serves as the SEAP for the Covenant of Mayors, which Jokkmokk joined in 2010 (Jokkmokk 2009). The municipality´s energy supply shall be secure, economic, health and environmental friendly. Jokkmokk shall actively promote efficient use of energy and prioritize the use of local and renewable energy sources including solar, wind and small-scale hydropower.

The 2013 SEAP implementation report presents successful implementation of the municipal GHG emissions inventory, of energy efficiency measures in municipal buildings, in the district heating system and within municipal transport. Jokkmokk has started a dialogue with wind power developers for establishing a wind park within the municipal area in which the municipality is having a share (Jokkmokk 2013).

Other community energy initiatives:

- Jokkmokk municipality is a member of the Swedish Ecomunicipalities
- Jokkmokk municipality has been partner in the RECENT NPA project in which several energy related pilot projects have been defined and feasibility studies have been done
- Jokkmokk municipality has implemented a comprehensive EPC project
- Jokkmokk has entrepreneurs in wind power and solar business
- Jokkmokk has a 100% municipally owned DH-utility with 98% biomass-energy production
- Jokkmokk has a unique hydropower training lab
- Jokkmokk has several adult training programs (Yh-utbildninar) which relates to energy and electricity http://lapplands.se/sv/Lapplands-lararcentra/Yh/
- Jokkmokk provides municipal energy consultancy to SME, organisations and households and has a special program in place for energy coaching for small businesses below 300 MWh/yr – both funded by Swedish Energy Agency and administrated under Lapplands Kommunalförbund.

6.5 Barriers, challenges, recommendations

Table 8: Barriers, challenges and recommendations

Type of barrier or challenge	Description / definition of barrier or challenge	Problem summary in detail
Target conflicts, e.g. public owned district heating plant is expected to deliver profit	Public owned energy companies don´t benefit from EE measures at customer's buildings	Lack of "white certificate system" for Energy Companies in Sweden Energy companies have not yet developed new business models of delivering energy services instead of energy only
	New renewable production as wind mills, hydro plants are in conflict with e.g. biodiversity, nature protection (National Parks) or military targets (wind)	Land and natural resources are limited and target conflicts not avoidable
	Mobility in a remote, long-distances, cold region vs. higher share of renewable fuel in transport	Electric cars still not enough developed Biogas production from waste limited due to small communities
Lack of awareness in the region	Large scale hydro production – "no need to safe energy here" Population decline is the main priority Politicians prioritize growth based on industrial production and mining Low energy prices, especially for electricity and district heating	Lack of know-how about RES business opportunities and EE benefits Lack of staff capacities for strategic energy work to implement RES business and EE projects
Small Northern communities don´t explore smart energy solutions for own facilities Lack of knowledge and staff resources	Small units, small numbers of employed, lack of experts Long distances make it even harder to attract experts coming to the region Challenge to hire experts Difficult to get funding for experts	Lack of knowledge on fundraising and EU project money Funding process too complicated for smaller communities Lack of easy solutions to get funding for staff and funding for investments
No or weak (binding) targets	Weak targets for buildings, both new construction and renovation	High building cost in Sweden make decision makers hesitant towards new regulations High share of RES makes need for EE less urgent
	(Almost) no regional (binding) targets for sustainable transport	Long distances which are difficult to tackle in other ways than individual and fossil based transport Lots of heavy transport from industry which are difficult to tackle in a regional context only
	No ambitious regional overall energy and climate targets	Regional level has little real power in Sweden High share of heavy industry in Norrbotten which stands for a high share of emissions and falls under ETS = regional level policy less important
Common uncertainty due to e.g. population development, economic factors	Population decline vs. new investments Conflict between old industrial and service-orientated (turism etc.) community High rate of elderly people Downshifting of public budgets	

Source: Based on interviews and analyses carried out within EU projects RECENT - Renewable Community Empowerment in Northern Territories - http://recent.interreg-npa.eu/ and and COOPEnergy - Cooperating in sustainable energy planning - http://www.coopenergy.eu/

6.6. Community energy in Sweden – success stories

Wind energy - A brief review of existing energy-cooperatives in Sweden gives the impression that the interest of building and continuing cooperatives in wind energy has dropped in the recent years. Many of the visited websites include information on selling of assets. Reasons are not provided but may include lack of profitability due to very low electricity spot prices, the drop in prices of the green electricity certificates and high maintenance costs for a single wind-turbine or a small windpark with older models. Many cooperatives started in the pioneering period of the 1990s and early 2000s with turbines in the several 100 kW classes, which were less capital intensive compared to today´s technology (Waldo 2013). Some examples:

- **Nätverket för vindbruk** – Andelsägd vindkraft - https://www.natverketforvindbruk.se/sv/Naringsliv/Vem-ager-vindkraften/Kooperativ-och-andelsagande/
- **Sveriges Vindkraftkooperativ** - http://svef.nu/
- **Trärike Vindkraft** - http://www.trarikevindkraft.se/
- **Storumans Vind kooperativ** - http://www.storumanvind.se/
- **Utellus** - https://www.utellus.se/vindkraft/
- **VästanVind** - http://www.vastanvind.se/

Solar PV experiences an upward trend in the recent years due to reduced costs, high investment grant subsidies (up to 30% since 2018), increasing number of skilled installers, other improvements in tax-exemptions (zero energy tax for systems less than 255 kW) and relaxed permission procedures. Newly founded cooperatives with an interest in Solar PV make use of these improvements.

> **ETC EL - Solar PV parks**: https://www.etcel.se/vara-solparker
>
> **Solelkommissionen** - is a network consisting of HSB, JM, Telge Energi, Solkompaniet and Vasakronan. The network was formed in March 2015, and since then it is working on better conditions for own solar PV production. - http://www.solelkommissionen.se

Solar thermal systems on residential buildings (single-family homes or multi-family homes) are only growing slowly as they receive financial support through a tax reduction on labor costs. A few district heating systems have integrated solar thermal supply. Solar thermal systems integrated in apartment buildings can supply overcapacities into the DH-grid. Research on seasonal storage points in the direction of economic feasibility of such solutions (Dalenbäck 2013). Some links to solar thermal information in Sweden:

- https://www.svensksolenergi.se/fakta-om-solenergi/solvaerme/naervaermesystem-och-mindre-fjaerrvaermesystem
- http://www.energimyndigheten.se/snabblankar/lattlast/hur-varmer-du-upp-ditt-hus/solvarme/
- https://energikontornorr.se/wp-content/uploads/2017/11/Energikontor-Norr-tittar-på-solenergi_171107_EKN.pdf
- http://www.energikontornorr.se/se-filmen-som-visar-hur-vi-kan-fa-solvarme-aret-runt/
- Solar District Heating - http://solar-district-heating.se/: SDHp2m – Solar District Heating Policy to market is an ongoing EU-funded project.

A large number of **small hydropower** (<10 MW) is owned by individuals, enterprises or a cooperative (http://svenskvattenkraft.se/).

> **Svensk Vattenkraft Förening** - http://svenskvattenkraft.se/: Promotes the development of small-scale hydropower (<10 MW), taking into consideration its environmental contribution to ecologically sustainable electricity generation.
>
> **Vattenkraftens vänner** - https://vattenkraftensvanner.wordpress.com/: Works to highlight the importance of hydropower for Sweden´s ability to achieve the set environmental goals.

Bioenergy in the form of residues from forestry and forestry industries, in its either solid raw form or converted into wood-chips or pellets, is an important renewable resource for heating homes and apartment buildings and as fuel in small and large-scale district heating systems. It is common that small-scale DH systems (*Sw = närvärme*), are operated as economic associations or cooperatives.

> **Bioenergiportalen – Närvärme** - http://bioenergiportalen.se/?p=6829&m=1733&page=narvarme
>
> **Energirådgivningen** - https://energiradgivningen.se/sma-hus/fjarrvarme-narvarme

6.7 Interview results

National energy and climate policies got a renewed momentum through the new climate policy framework (Sweden 2017), which states that ambitious targets shall be achieved in close cooperation with authorities, municipalities, industry, and civil society. Interviewees expressed hope that this will lead to financial resources made available to local actors enabling them to work with a more long-term perspective in energy activities.

The successful program on energy efficiency in municipalities, which ended in 2014, allowed long-term thinking in municipal energy development. Since then, energy activities on municipal level, especially in smaller, but also in some larger municipalities, is perceived as patchwork – from one project to the other, without long-term perspective. People say that they are "project-damaged".

The legislation on energy planning requiring municipalities to develop and update energy plans is not followed up and is also not supported with sufficient financial resources. Municipalities participate in national and international environment, energy and climate networks, which provide ideas and partners for co-applications for projects from national and

international funders. Networks, such as the Covenant of Mayors forces the participants to think and plan strategically, but often there are no resources for action - to implement the ambitious measures as laid out in the Sustainable Energy and Climate Action Plans (SECAP).

The energy advisory program is working, enterprises and others show interest, but then often lack resources or interest to apply for funds from the different programs, pointing towards too complicated and bureaucratic procedures. Another reason for lack of interest are the expected low returns of investment, due to still low energy prices.

The regional energy agency EKN and the advisory and capacity building services from the CAB receive positive feedback from municipal officials. But also here smaller municipalities then often lack human resources to go ahead with project applications.

Co-ownership of e.g. windparks with affected stakeholders is not legally required resulting in exploitation of land areas, without direct and long-term financial benefits to community members.

A crucial combination for success in smaller municipalities is: a visionary (and permanently employed) municipal official responsible for energy issues paired with a political leader, who share the enthusiasm to make things happen.

6.8 Sweden – summary and recommendations

Sweden is the only LECo partner country where municipalities are legally obliged to develop and maintain energy plans. Energy efficiency in buildings is legislated through the building regulations, implementing the respective EU-directives.

Smaller municipalities cannot afford a permanently employed official who takes responsibility for energy activities, which often require long-term perspective. Support programs are many and require human resources to take initiative, develop projects and apply for support, some examples:

The Swedish Energy Agency, the Swedish EPA and the Swedish Growth Agency (*Sw = tillväxtverket*) administrate several support programs, including Klimatklivet, Klimatsynk, Energisteget, Energilyftet, Industriklivet, Elfordonspremie, Solcellsstöd, Vindkraftspremie, Stöd för energikartläggning i små och medelstora företag, Gröna fonden, Regional investeringsstöd, Landsbyggdsprogrammet, Stöd samlingslokaler, EIBs InnovFin Energy Demo Projects, ...

Wind energy cooperatives seem to shut down due to high investment and maintenance costs paired with low returns. Solar PV cooperatives are on the rise, due to significant investment aid and decreasing system costs. Municipalities, bioenergy cooperatives and local entrepreneurs own and operate small district heating systems, where the integration of solar thermal systems can be economically feasible. Small-scale hydropower operators face economic challenges due to low electricity prices and environmental constraints.

Small municipalities in Norrbotten cooperate on the energy advisory program and receive support from the regional energy agency EKN as well as from the CAB for energy activities.

Recommendations for policy adaptations:
Consider a change in the property tax regime. Currently such taxes on energy generating facilities are state taxes, which is relatively unique in Europe, resulting in zero direct financial benefit to the exploited municipalities. In addition, work towards legislating mandatory co-ownership models for e.g. windparks and solarparks resulting in direct and long-term financial benefits for affected communities and consider applying such legislation on existing hydropower stations.

National policies are ambitious, regions, counties and municipalities are committed to contribute towards national targets. CABs and energy agencies are well established and provide information, capacity building and networking opportunities to municipalities and companies.

- Energy offices and energy advisors should provide more support for small municipalities and SMEs towards project identification, proposal writing for financing, project development and implementation.
- Provide long-term funding, which is independent from national and local political majorities, for permanently employed energy and climate officers at each municipality.
- Offer advisory support in organizational development for the establishment of energy cooperatives.
- Review and simplify complicated administrative and bureaucratic procedures for support programs.
- Design a broader and more technology neutral financial support for small-scale energy production and energy efficiency measures for households and SMEs.

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7 GERMANY

With its widely known reputation as a forerunner in the promotion of renewable energy, Germany pursues the target to cover at least 60% of its primary energy consumption and at least 80 per cent of the electricity consumption with renewable energy by 2050. At the same time, the primary energy consumption is set to cut in half compared to 2008. Thereby, Germany seeks to reduce its greenhouse gas emissions by 80-95% compared to 1990. This long-term strategy to transform Germany's energy supply from fossil and nuclear energy to a system largely based on renewables has been passed by the federal government in 2010 (Germany 2010) and is popularly referred to as the "Energiewende (English: Energy Turnaround)".

With the renewable energy share in electricity steadily growing and closing in to 40 per cent of the power consumption (2018: 38.2% (AG Energiebilanzen 2018)), renewables in Germany have passed the stage of mere growth in quantity and are now tackling novel challenges, particularly regarding the system integration of large volumes of the variable renewable electricity sources wind and solar PV. This includes, among others, grid-related developments and storage technology as well as adaptations of the electricity and energy markets, and the flexibilization of remaining conventional capacities (Fischedick 2014). Further, stronger interconnections between the power, heat and transport sectors (sector coupling) in order to decarbonise the latter two are under development.

The governmental "Climate Action Plan 2050" (BMUB 2016) acknowledges the key role of municipalities in climate action and recognizes local communities as important actors for contributing to the great energy transition called the Energiewende through community energy initiatives. Sustainable urban development, climate-friendly smart city and smart community concepts should be supported and funded.

In the past, the growth of renewable electricity in Germany was largely carried out by decentralized actors, such as citizens, farmers, municipalities and small- to middle-scaled companies. The "Big Four" utilities RWE/Innogy, E.On/Uniper, Vattenfall and EnBW, who (partly with their predecessor companies) formally dominated the German power sector own only a small fraction of the installed renewable power generation capacity in Germany (see Figure 4). Due to this decentralized nature (and thanks to the tax regime) renewable energy in Germany generates a value added on the local level in the order of 11 billion Euro per year (IÖW 2013). Thus, promoting local energy initiatives has become a major factor in local development policy.

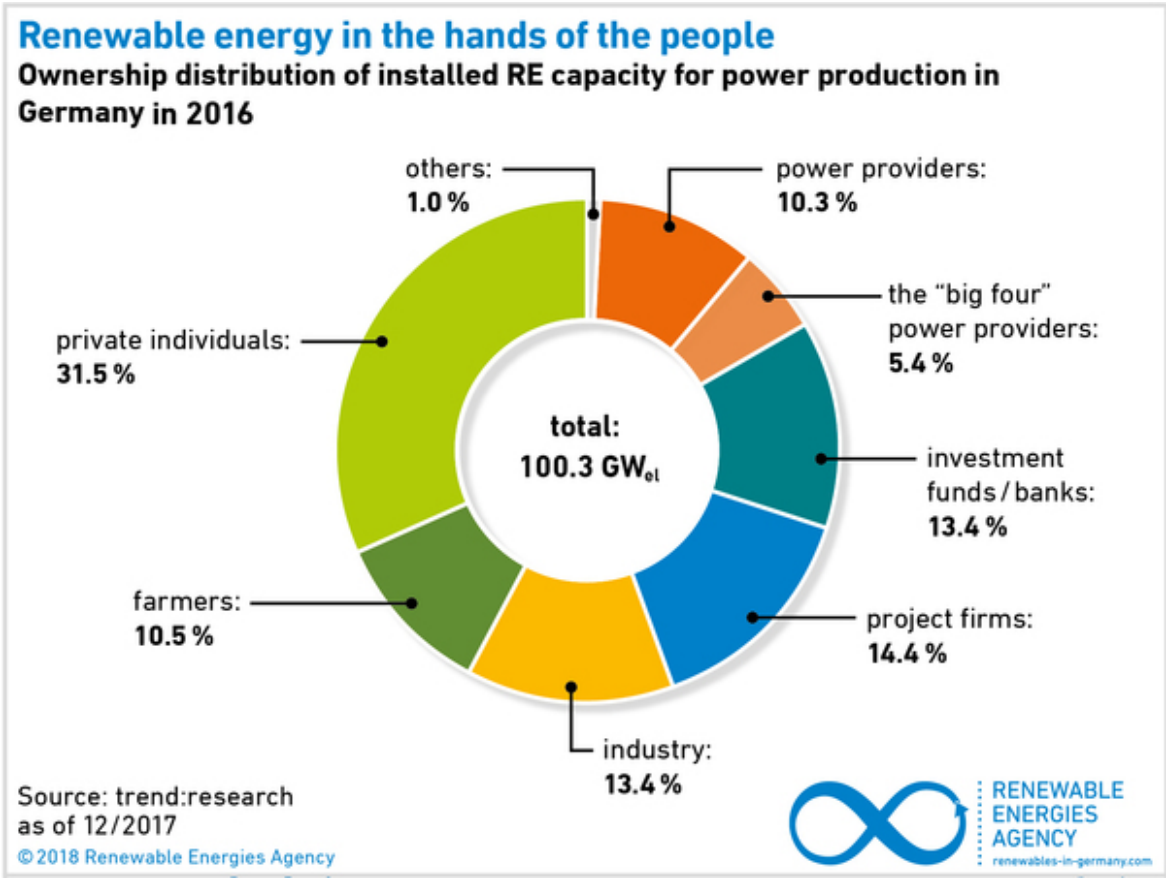

Figure 4: Ownership distribution of the installed renewable power generation capacities in Germany (2016), not including offshore wind power.

However, newer legislation regarding support schemes has prompted concerns that especially citizen and community driven renewable energy projects might suffer disadvantages regarding the implementation of their projects. Innovative business models for community energy such as regional power tariffs or landlord-to tenant electricity also suffer from legal and economic uncertainties. Thus, despite its promising past, the future of German community energy remains somewhat unclear.

7.1 Current status of renewable energy in Germany

7.1.1 Electricity sector

Since the introduction of the Feed-in-Tariff for renewable electricity in 2000, the share of renewables has steeply increased from 3.4% to 38.2% of the annual electricity consumption in 2018 (preliminary estimation). Among the renewables, wind power delivers the largest share, followed by biomass and photovoltaics. Due to lacking geographic potential and ecologic constraints, hydropower amounts for only a relatively small fraction.

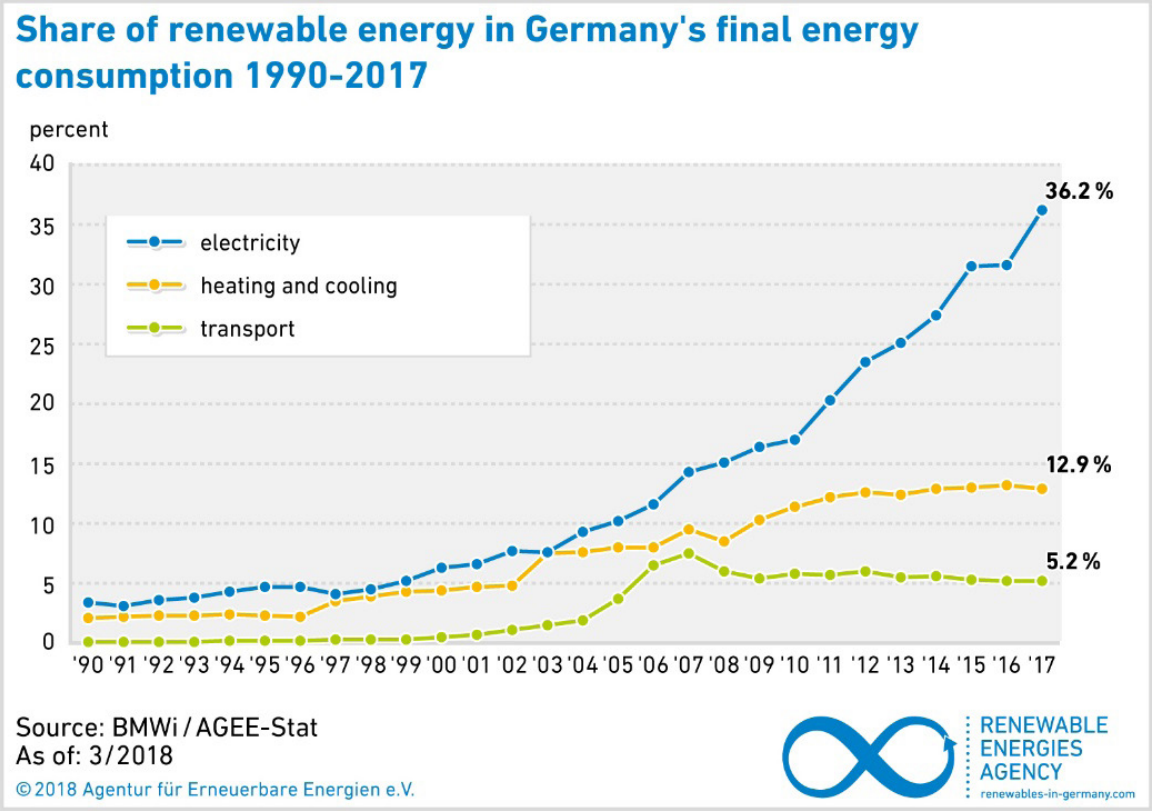

Figure 5: Share of renewable energy in the German annual final energy consumption by sector.

Table 9: Renewable power generation in Germany (preliminary estimation for 2018, AG Energiebilanzen 2018)

Power source	Power generation [TWh]	Share in total power consumption [%]
Wind onshore	93.9	15.7
Wind offshore	19.4	3.2
Photovoltaics	46.3	7.7
Biomass (incl. biowaste)	52.0	8.7
Hydropower	16.9	2.8
Total	228.7	35.2

In its coalition agreement, the current federal government aims to foster the expansion of renewable electricity in order to reach a renewable share of about 65% by 2030 (CDU/CSU, SPD 2018), however without any further specification of the composition of power sources. In the long term of 2050 and beyond, most scenarios agree that wind energy and photovoltaics will carry the main burden in the power mix, due to availability and cost advantages. Hydropower and deep geothermal energy will, lacking the geographic preconditions, not grow significantly. Regarding biomass, most scenarios assume roughly the same amount of power generation. However, the installed capacity of biomass plants is assumed to increase manyfold, because the power generation will flexibly complement the weather-dependent sources wind and solar PV (AEE 2015).

7.1.2 Heat and cooling sector

The German heat and cooling sector accounts for roughly half of the country's final energy consumption (seeFigure 5). Within this decisive sector, the share of renewable energy is stagnating in recent years and amounted for 12.9% in 2017 (seeFigure 6, not including renewable electricity used for heating and cooling).

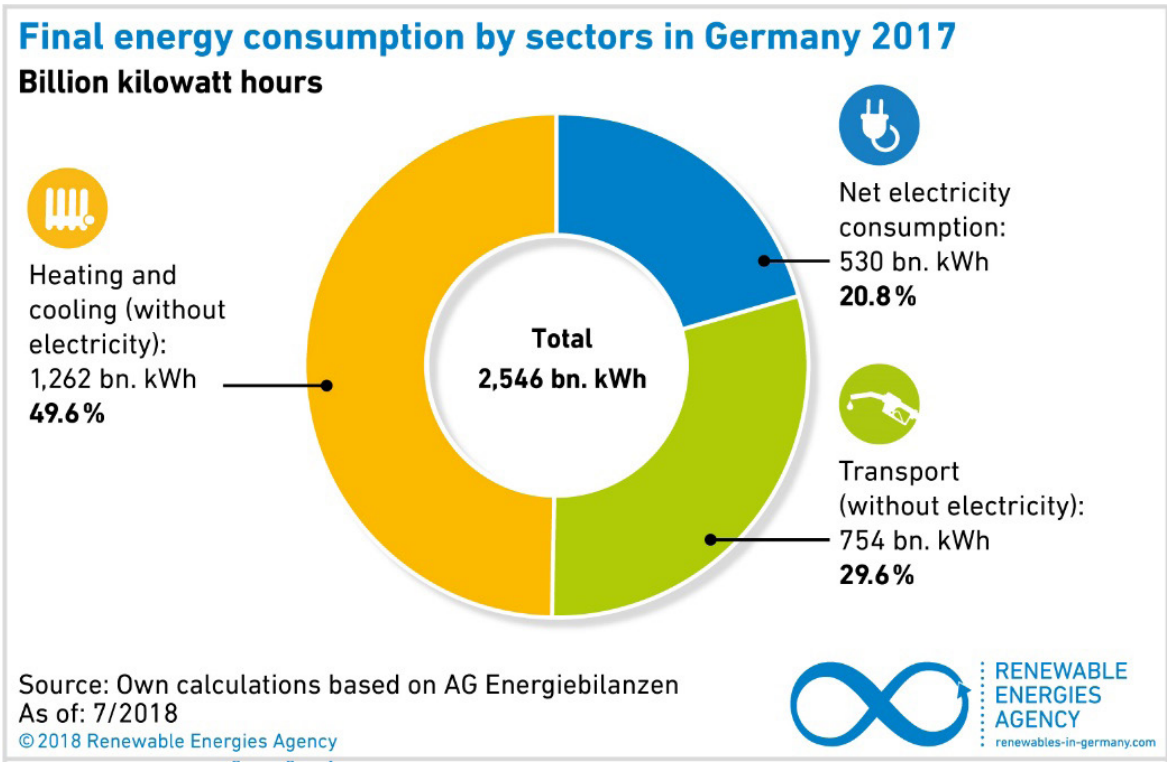

Figure 6: Final energy consumption in the German electricity, heat/cold and transport sectors 2017.

In 2017, 86.8% of renewables in heat originated from biomass, predominantly solid biomass like wood and biowaste (73.4%), complemented by near surface geothermal and ambient heat (7.6%) as well as solar thermal energy (4.9%). Deep geothermal only plays a marginal role (0.7%), being limited to a few regions with commercially exploitable potential.

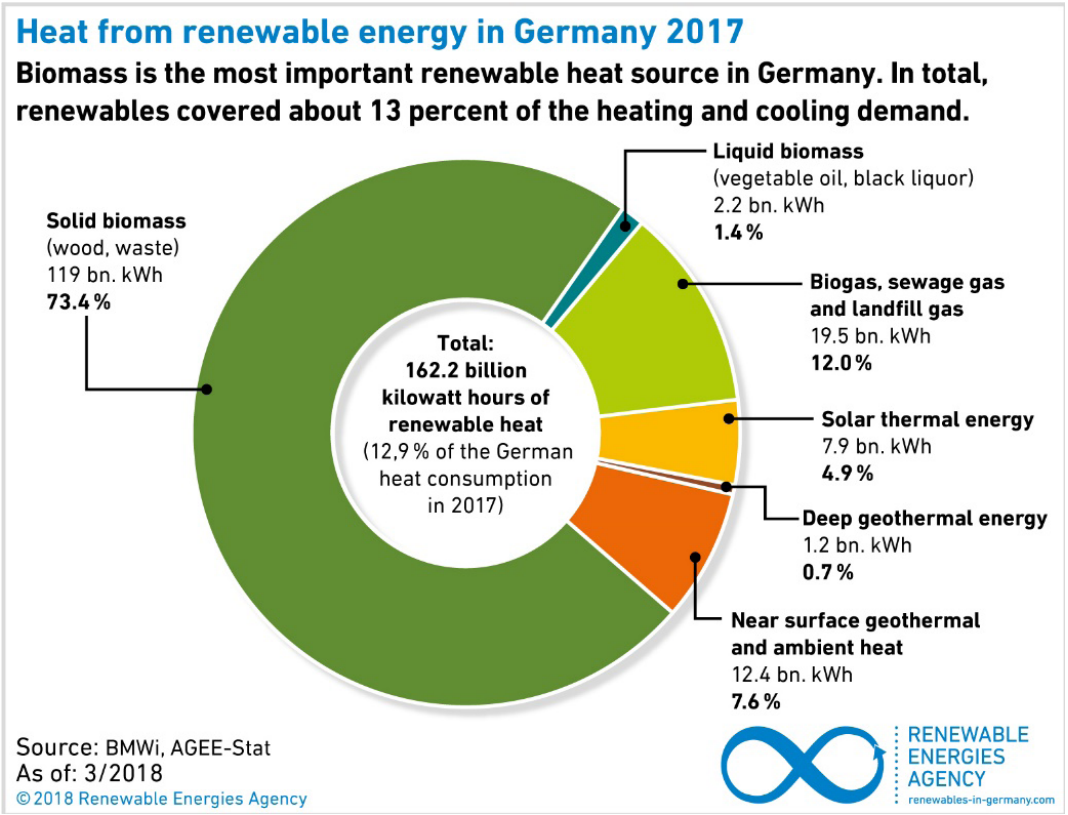

Figure 7: Composition of renewable heat sources in Germany 2017

Future scenarios of heat supply in Germany differ quite significantly, depending on assumed boundary conditions like the heat energy demand and the extent and role of different technologies in use by 2050 and beyond. However, there is a general consensus upon the need to use more renewable electricity for heating and cooling purposes. With sustainability being the main limiting factor regarding biomass use and uncertain but still limited expectations about deep geothermal and solar thermal heat, coupling the electricity and heat sectors is considered to be the only viable option in order to achieve high renewable heat shares in the long term. This includes heat-pump based appliances such as near surface geothermal and ambient heat, the direct use of electricity for heat, and synthetic fuels produced with so-called power to gas technologies (AEE 2015b). Furthermore, the heat-induced electricity demand is expected to be a valuable flexibility option to absorb excess electricity from variable power sources (wind and solar PV), which will dominate the future German power mix (AEE 2017).

Regarding the governmental targets for 2050, newer scenarios point out a hiatus between the forward projection of current trends and necessary development paths to achieve these goals.

7.1.3 Transport

The share of renewable energy in the German transport sector is stagnating for almost a decade at just above 5% (see Figure 8; 2017: 5.2%). It is predominantly composed by biofuels, mostly blended into conventional fuels in order to fulfil the current GHG saving quota (2017 – 2019: 4.5% saving by blended biofuels). Total GHG emissions from the transport did constantly rise since the beginning of the decade. Improved fuel efficiency was counteracted by increasing traffic volume (BMU 2018).

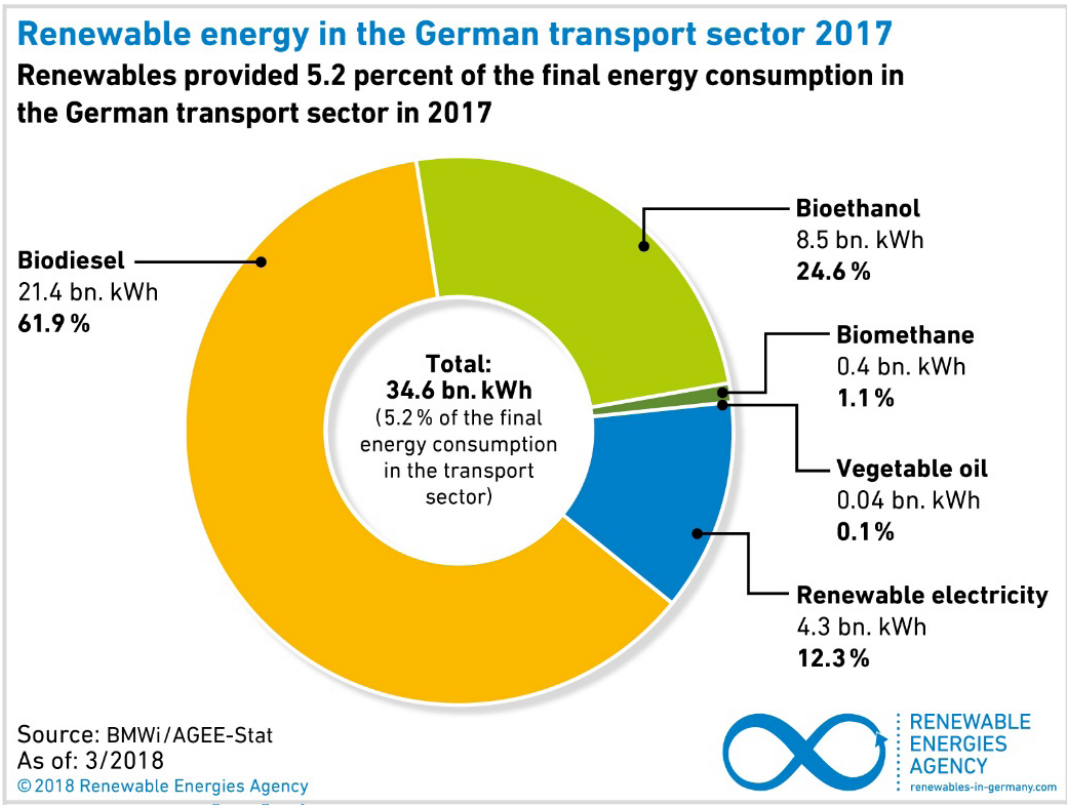

Figure 8: Composition of renewables in the transport sector in Germany 2017

The number of electric vehicles in Germany is far lagging behind the governmental target of 1 million by 2020. As of October 2018, there some 73,000 electric cars plus another 63.000 plug-in hybrids among the 57 million registered passenger cars in Germany (KBA 2018).

According to the "Climate Action Plan 2050", the federal government seeks to reduce overall GHG emissions from the transport sector by 40-45% until 2030 compared to 1990. This is intended to be achieved by the promotion of better fuel efficiency, alternative powertrains and fuels, improved public transport services, bicycle-friendly infrastructure, digital and multimodal transport models as well as traffic avoidance through intelligent traffic- and urban planning.

7.2 Legislation

7.2.1 Federal Level

Germany has no overriding Act covering renewable energy and/or climate action (a new climate protection law is set to be established in 2019). Respective legislation is so far spread among a number of laws and ordinances on the federal and state levels. This and the following section will highlight legislation directly affecting energy community activities in Germany.

7.2.1.1 Feed in tariff

In federal legislation, the Energiewende is backed by a number of laws and ordinances promoting renewable energy and energy efficiency. Among them, the Renewable Energy Sources Act (EEG, Erneuerbare-Energien-Gesetz) that initially became effective in 2000, did not only play a key role in the development of renewable energy in Germany, but also turned out be a key incentive for community energy in Germany.

Fixed and guaranteed feed-in tariffs (FIT) over 20 years for renewables along with feed-in priority over conventional electricity provided a secure and simple investment model for private individuals, energy cooperatives, farmers, public local utilities, local businesses and other decentralized actors. Since the entire amount of FIT-based electricity was aggregated and marketed by the transmission system operators (TSO), the FIT participators were disburdened from any technical and regulative requirements as a power provider, including balancing group management and power trading. This "produce and forget" model allowed even laypersons to participate in the renewable electricity business.

Starting in 2012, new renewable power plants over a certain capacity were obliged to directly trade the electricity at the spot market[2] and also implement duties as balancing group manager. However, these duties are mostly delegated to dedicated power trading companies ("direct marketers" or "aggregators"), largely upholding the "produce and forget" principle.

2 On top of the proceeds of sale, they would receive a feed in premium that in total amounts to the respective FIT.

A potentially decisive turning point for community energy is the EEG amendment in 2017 introducing a tendering process in the FIT scheme. Under the new regime, a power producer needs to win the auction for a given capacity in order to be eligible for FIT funding. While the FIT rates were formerly set by the government, they now will be determined by competitive bidding (for ground-mounted photovoltaics and onshore wind energy lager than 750 kW as well as biomass over 150 kW). Critics worry that this tendering process could result in disadvantages for small scale local and citizen owned businesses, since the financial risk of losing a bid might prevent them even from participating in the auction in the first place.

These concerns were addressed by exemption regulations for "citizen's energy companies" regarding onshore wind power:

1. Citizen's energy companies could participate in the tendering process without an existing environmental impact assessment for the respective project. While it is mandatory in advance for other participants, citizen's energy companies were allowed to submit it after bidding successfully.
2. While usual wind projects must be in operation within 30 months after acceptance, citizen's energy companies have another 24 months for implementation.
3. Citizen's energy companies are required to provide only 50 percent of the usual collateral prior to the auction. The rest must be supplied only in case of a successful bidding.
4. Citizen's energy companies will receive the highest accepted FIT rate in the respective auction round, regardless of the own bid price, whereas regular tender participants only receive the amount they actually bade.

However, these regulations were misused in the first tender rounds in 2017. Large scale project developers founded multiple subsidiaries that were legally qualified as citizen's energy companies. Using the resulting competitive advantages, they won the vast majority of the auctioned wind capacities. Thus, exemption 1 was withdrawn from the EEG in 2018. It remains unclear, how citizen's energy will succeed in future wind auctions under the current and coming FIT regimes.

7.2.1.2 Self-consumption of electricity

In order to promote the self-consumption of PV electricity, the EEG grants incentives between 5.6 and 25.01 Cent per kWh of self-consumed electricity additionally to the FIT payments, depending on size and age of the PV installation and applicable to PV installations that started operation between 2009 and mid-2012 and with an installed capacity up to 500 kWp. Due to dropping costs for solar electricity production and battery storage systems, the funding scheme phased out in mid-2012. However, the self-consumption of PV electricity is gaining popularity among home owners, businesses and public facilities in Germany.

In most cases, home owners directly consume the electricity generated by their own rooftop PV system or store it in battery storage systems for later use. Only the excess electricity is fed into the grid in return for FIT payments. Free of levies and taxes, these self-consumption models using modern components now offer a better return of investment compared to the classic FIT-based use case where the generated electricity is entirely fed into the grid while all of the consumed electricity is bought from a utility.

However, in middle- and large-scale use cases with an installed PV capacity over 10 kWp, even the self-consumed electricity is charged with 30 to 40 percent of the FIT surcharge, making respective use cases less profitable.

7.2.1.3 Landlord-to-tenant electricity

While PV self-consumption requires power producer and consumer to be the same person or legal entity and is therefore largely limited to owner-occupied buildings and properties, landlord-to-tenant models allow delivery of electricity to consumers in close proximity unless the public grid is being used.

In Germany, having a home ownership rate way below average (2016: 52% as opposed to 69% in EU-28 average (Eurostat 2016)), including tenants has a potentially large leverage to increase the share of renewables, especially in cities. The Federal Ministry of Economy and Energy estimates about 3.8 million rented flats in Germany that are suitable to be delivered with rooftop solar PV (Prognos 2017), while other assume a potential of up to 5 million flats (Aretz/Knoefel 2017).

In mid-2017, the Landlord to Tenant Electricity Act (Mieterstromgesetz) came into power, granting incentives to owners delivering self-produced PV electricity to their tenants. The owner receives not only the revenues for the sold electricity, but also the current FIT rate minus a discount depending on the installed PV capacity. From the customer view, landlord to tenant electricity can be an attractive alternative to regular power tariffs, since the electricity is delivered without using the public Grid and therefore is exempted from the electric tax, grid-related fees and levies as well as concession fees.

However, the success of this model limited as of now. Although the support scheme was capped to a total installed capacity of 5MW per year, it has so far only been applied in roughly 300 cases with an overall capacity of about 7,500 kW (July 2017 – November 2018) (BNetzA 2018).

Regarded as a major hindering factor is the trade tax regime. While housing companies usually benefit from reduced trade taxes, this exemption will be lost with the application of the landlord to tenant electricity support. Also, the technical and administrative effort for metering the delivered electricity as well as its distinction from grid injected and grid-obtained power lies within the operator's responsibility, which could question the economic viability especially in smaller buildings. Furthermore, the delivered electricity is still charged with the full FIT surcharge, also curtailing the profitability.

7.2.1.4 Regional power tariffs

Other than renewable heat (and many of its fuels) that in the nature of things will be produced and consumed within some regional proximity, the local consumption of locally produced renewable electricity is a considerably more intricate matter. Although the designation of regional green power is widely considered to be both, a marketable value and an effective factor to foster local acceptance of renewables, the incentive framework in Germany is yet in an early stage.

Since the EEG demands FIT funded green electricity to be sold at the wholesale power market, and prohibits multiple sales, only power producers outside the FIT scheme were allowed to deliver some sort of regional power. However, with production costs just recently becoming on par with others, the competitivity of these tariffs against regular power providers was limited. The only exception for FIT receivers was the "green electricity privilege (Grünstromprivileg)", a partly levy exemption, effective until 2014 and withdrawn due to competition concerns of the EU Commission.

Starting on Januar 1st 2019, the federal government introduced a regional certificate that can voluntarily be traded along with FIT funded electricity (German: Regionalnachweis). If the consumers postal code area or municipality lies at least partly within a 50 km radius from the producer, the certificate can be applied to certify that a given share of the electricity in the tariff is regional (green) power supported by the EEG. Being a certificate scheme rather than an incentive, it is still to be determined if this system will give regional power tariffs in Germany a boost.

7.2.2 State Level

In Germany, a federally organised state, major parts of the of legislative power are held by its sixteen federal states. Following the subsidiarity principle, matters of energy and climate policy shall be dealt with at the most local level suitable. While the federal level accounts for e.g. grid-bound energy supply such as electricity and gas, and the EEG within its responsibility for clean-air policy, the federal states may have wide-ranging competencies regarding the heat supply, spatial and building planning, as well as municipal law, and may even pursue energy and climate action policies of their own. The latter, if present, include own target values and road maps as well as individual support schemes and others.

7.2.2.1 Municipal Codes

Regarding community energy, most federal states have amended their municipal codes (Gemeindeordnung) allowing municipalities to own and operate renewable energy facilities and participate in the energy markets.

The German tradition of public local utilities (German: Stadtwerke) dates back to the era of municipal socialism during the late 19th century, when urban infrastructure such as electricity, gas, and water supply as well as public transport and waste management were largely put in public ownership. Many of these public companies were privatized in the 1980s and 1990s in an effort to consolidate municipal budgets. However, with the liberalisation of the energy markets starting in 1998 and the emergence of decentralized renewable energy, this trend inverted. Between 2000 and 2017, 284 companies in the German energy sector were (re-)municipalised (Kishimoto/Petitjean 2017). As of 2018, the German Association of Local Utilities (VKU) counts 733 members active in electricity supply, 646 in heat and 574 in gas (however not necessarily operating renewable energy) (VKU 2018).

Municipal business activities in Germany are regulated by the municipal code in each federal state. The general principle of the legislation is to prioritise private businesses over publicly owned corporations, unless it a) fulfils task in public interest, b) is appropriate in regard to capabilities and needs of the municipality and c) the task cannot be equally or better fulfilled by a private company (subsidiarity clause).

Following the general trend of (re-)municipalising the local energy sector, the majority of states have excepted electricity, heat and gas supply businesses from at least one of these limiting conditions. Energy supply is either explicitly defined as public task or implicitly acknowledged as such via the municipal obligation to secure public services (Daseinsvorsorge), which is defined in the federal constitution. The subsidiarity clause is in most cases either weakened (equal quality permits public companies) or completely suspended for the energy sector.

However, differing legal opinions have had considerable impact on a number of projects in the past. While the state legislations are generally intended to liberalize municipal activities in the energy markets, jurisdiction tends to decide restrictively, often with emphasis on the postulated local character of the business.

7.2.2.2 Mecklenburg-Vorpommern: Citizen and Municipality Participation Law

Directly impacting community energy is the Citizen and Municipality Participation Law (Bürger- und Gemeindenbeteiligungsgesetz) in the state of Mecklenburg-Vorpommern.

Located at the Baltic Sea shores in north-eastern Germany, Mecklenburg-Vorpommern produces almost half of its electricity from wind power (2017: 48.2%). However, financial benefits from wind park operation tend not to remain in the region the projects are sited. With land owners and operating companies being largely non-local, land lease incomes and operating revenues are mostly draining out of the region, which is considered to be a critical factor endangering the local acceptance of wind turbines.

In order to distribute the financial benefits more evenly among those directly affected by the presence of wind turbines, the state parliament passed the Citizen and Municipality Participation Law in 2016. It obliges every newly developed wind project to offer a share of at least 20% to citizens and municipalities within a 5km radius.

For this purpose, the developer must establish a project company with limited liability. The company has to be solely dedicated to each particular project, while the LLC status is to limit the participating citizens' and municipalities' liability risks to their respective amounts of capital invested. The price for a single share must not exceed 500 Euro, keeping the threshold low.

The standard case in the law demands to provide shares of 10% each to the affected citizens and municipalities. Being regular shareholders, they will receive distributed profits from the wind farm, but also bear the entrepreneurial risk in case of plant failure or poor wind harvest. The profits distributed to the shareholder municipalities will go into their general budgets. Instead of buying shares, citizens and municipalities may also opt for a custom, locally negotiated participation model e.g. like an affordable local electricity tariff.

In the alternative case provided for in the law, project companies may opt to offer a financial compensation to the municipalities and a saving product to the citizens, instead of making them shareholders. In this model, the involved municipalities bear no entrepreneurial risk, while the total amount of compensation is proportional to the profit of a 10% shareholder. These incomes are, in return, earmarked as non-compulsory expenditure in the municipal budgets with the purpose of improving the local acceptance of wind energy. This may include enhancements of the town scenery, energy-related optimisation measures or cultural, educational and leisure events.

The saving product offered to the citizens (a savings bond, time deposit or equivalent) must be free of any risk of loss, while the minimum interest rate will be determined depending on the expected revenues from the wind farm operation.

The empirical effectivity of this law is yet to be proven. Since wind farm projects require multiple years of lead time for engineering, planning and approval procedures, the first cases under this regime are just entering their implementation stage, as of end 2018. However, the adaption of this law in federal legislation is already being discussed.

7.3 Municipal Planning

7.3.1 General Principles

Municipal planning in Germany is primarily conducted within the local self-government of municipalities. The key procedures and instruments are defined in the Federal Building Code (Baugesetzbuch) and follow a two-step principle.

Firstly, general land-use purposes (e.g. agriculture, residential, green spaces etc.) are assigned in the land-use plan (Flächennutzungsplan, abbrev.: F-Plan). It covers the entire municipal territory and usually reflects long-term (10-15 years) development intentions of the municipality. Although not having legal force, establishing, amending and repealing the F-Plan requires public participation of citizens and other stakeholders in order to reflect local needs and demands. Also, the F-Plan must be approved by responsible authorities (generally on the county level) in order to be in line with environmental restrictions and regional planning matters of the respective federal state, particularly regarding the siting of wind turbines, which is subject to the regional plans.

In the second step, the development plan (Bebauungsplan, abbrev.: B-Plan) refines the F-Plan with specific details for each plot. It specifies type and extent of building utilisation, the building's properties (coverage type, number of stories, roof shape etc.), the type of heat supply (esp. regarding district heating), traffic and other factors to comply with in order to receive a construction permit. Every step in the procedure to establish a B-Plan, including its public consultation, requires a positive decision of the municipal council. After successful establishment, a B-Plan is part of the municipal statutes as therefore is legally binding.

7.3.2 Municipal Energy Planning

A well-established, but not mandatory instrument to include energy and climate action related matters into municipal planning are municipal energy concepts, that in most cases are part of a wider ranging climate protection concept.

Such energy concepts are usually developed in collaboration with a research institution and are funded by the National Climate Protection Initiative (see section 7.6). Based on an analysis of the status quo and future potentials within the municipal territory, energy concepts define a number of specific measures to improve energy efficiency and the use of renewable energy. Most typical measures are:

- energy efficient refurbishment of public buildings
- LED street lighting
- photovoltaic panels on public rooftops
- strategic expansion of district heating networks
- strategic exploitation of regional biomass potentials (particularly biogas wood and biowaste)
- citizen activation campaigns for investments in renewable energy (rooftop PV) and efficiency (home refurbishment, new heating systems and white goods)

Depending on the municipality's size and potentials, a number of 100 to 150 measures is not uncommon. Once an energy (or climate protection) concept successfully passes the municipal council, the measures included will be mapped into the F-Plan and B-Plan accordingly. This way, the municipality makes the concept legally binding and provides for the planning and authorisation basis for its implementation.

7.4 Municipal Tax Regime

Among the economic effects of installing and operating renewable energy on the local level, municipal tax income directly goes into the municipal budget. The total tax income of German municipalities from renewables in 2012 was estimated at about 1.12 bn Euro (IÖW 2013). This amount includes:

- municipal share (15%) of the income tax on employee incomes,
- municipal share (12%) of settlement tax on capital gains
- the entire trade tax on trade gains of a business located in the municipality.

Regarding wind energy, the trade tax is split up between the municipality the turbines are sited in (70%) and the municipality the operating company is located.

7.5 Energy Co-operatives

The Co-operative Societies Act of 1889 (Genossenschaftsgesetz, GengG with amendments 2006) regulates Germany's co-operatives. It ensures low-threshold founding and participation, well-structured and democratic organisation and low financial participation risks.

Co-operatives in Germany can be founded by a minimum of three initial members. All members are equal co-owners, always having exactly one vote in the general assembly, regardless of the number of shares held. Thus, hostile takeovers cannot happen. The members' liabilities are (unless differently arranged in the statutes) limited to the capital invested. It will be fully refunded in case a membership is withdrawn.

Checks and balances within a co-operative are ensured by three organisational bodies: the general assembly, the supervisory board and the executive board. Further, every co-operative is member of an auditing association. During a co-operative's founding stage, it analyses the business plan and provides economic, legal and fiscal advice. In annual audits, it reviews the co-operative's economic conditions and management, securing economically legally sound operation. Today, co-operatives have by far the lowest bankruptcy rate among businesses in Germany.

By end 2017, there were 855 energy co-operatives organized in the German Raiffeisen and Cooperatives Association (DGRV) since 2006 involving 183.000 citizens as members. They owned €682m in capital brought up by members with an average share of €3,729. They have carried out total investment of €2.5bn. A majority of 81% of the co-operatives is active with PV electricity production due to a profitable system of feed-in tariffs until 2014. This business model is guaranteed for 20 years after investment. After changes in the Renewable Energies Act the founding of Energy Cooperatives decreased dramatically.

7.6 National and regional incentives

National and regional incentives promoting renewable energy and energy efficiency in Germany are numerous, diverse and therefore difficult to overview. Their providers are situated in different fields of policy (economy, environment, agriculture, rural development, research & innovation) as well as levels (federal, state, county/region, municipality) and social spheres (politics, corporate, civil society). This section highlights the major incentive schemes relevant for energy communities in Germany.

7.6.1 Market Incentive Programme (MAP)

While the feed-in tariff (see section 7.2.1) is the dominating incentive programme regarding investments in renewable electricity production in Germany, the Market Incentive Programme (Marktanreizprogramm, abbrev.: MAP) is the biggest incentive programme for renewable heat. With the MAP, the Federal Office of Economics and Export Control (Bundesamt für Wirtschaft und Ausfuhrkontrolle, abbrev.: BAFA) provides investments grants for heating systems based on solar thermal energy, heat pumps or woody biomass. The amount of funding depends on the technology, its' scale and whether it is combined with other technologies (e.g. solar thermal heating in combination with a wood boiler). As an example, a solar thermal heating system for combined heating and warm water supply with 20 m^2 of collector surface would receive 2,800 Euro plus another 500 Euro when combined with a heat pump. A 20% bonus is granted if the new system replaces an old fossil heater (gas or oil without condensing technology or fuel cell) and additional efficiency optimizations are carried out. In 2017, 61.401 Heating systems received MAP support with a total volume of 210.7 million Euro (BAFA 2018).

7.6.2 National Climate Protection Initiative (NKI)

The largest funding programme for climate protection related projects is the National Climate Protection Initiative (Nationale Klimaschutzinitiative, abbrev.: NKI). Since its establishment in 2008, over 790 million Euro of subsidies were granted for some 25,000 projects, ranging from energy efficient building refurbishments over LED lighting to communication campaigns.

Of particular interest for this report is the municipality guideline (Kommunalrichtlinie), a sub programme to the NKI dedicated to municipalities. In this sub programme alone, the NKI has granted a total of 560 million Euro to 12,500 projects in 3,000 municipalities between 2008 and 2017. Among these projects were more than 2,000 municipal climate protection concepts (see section 7.3.2). The NKI also grants staff costs for a climate protection manager (3 years) and the establishment of a local climate protection network.

7.6.3 Regional incentives

Since each of the 16 federal states in Germany pursue policies of their own on the fields of energy and climate protection as well as rural and urban development, all of them have implemented incentives according to their policies and specific regional needs. The federal Ministry for Economic Affairs and Energy provides a searchable database of all federal, state and EU funded programmes (http://foerderdatenbank.de). As of January 2019, it contains 178 ongoing programmes for renewable energy and energy efficiency funded by a federal state.

7.7 Institutional overview

Among the vast number of public, private and civil societal institutions in the German energy sector, the following is a non-exhaustive selection of institutions most important for the demands of community energy.

7.7.1 Federal Level

The **Federal Ministry for the Environment** is the governing body of the National Climate Protection Initiative (NKI). For municipalities, the central point of contact in order to receive NKI funding is the **Service and Competence Cetre for municipal Climate Protection (SK:KK),** provided by the German Intitute for Urbanistics (Difu). It provides orientation within the vast number of incentives and financial aids and helps municipalities develop their projects. https://www.klimaschutz.de/service/das-beratungsangebot-des-skkk

The **German Energy Agency (Dena)** is a subordinate institution of the Federal Ministry for Economy and Energy and provides comprehensive information regarding energy efficiency and energy saving in municipalities. http://www.energieeffiziente-kommune.de

The **Agency for Renewable resources (FNR)** is a subordinate of the Federal Ministry for Food and Agriculture and is the governing body for project funding granted by the

Ministry. Regarding energy, it provides project funding and practical information and networks about biomass energy.
https://www.fnr.de

The **German Association of Local Utilities (VKU)** is the industry association of about 1,400 public local utility companies in Germany. Being their lobby organisation, the VKU carries the political demands of the public utilities to governmental actors, and provides legal and practical consulting for their member companies.
http://vku.de

The **German Raiffeisen and Cooperatives Association (DGRV)** is the is both the apex and auditing association of the German co-operative organisation. In its headquarters in Berlin, there is also the office for energy co-operatives, representing the demands of energy co-operatives in policy.
https://www.genossenschaften.de/bundesgesch-ftsstelle-energiegenossenschaften

7.7.2 Regional Energy Agencies

Regional Energy Agencies are an important player in the German Energy Transition. Being intermediate institutions in both, geographic and organisational terms, they are familiar with specific circumstances of their particular region, but still serving an overarching objective which connects (state) policy, private sector, municipalities and citizens. They are, however, certainly diverse depending on their genesis, organisational structure, financial resources and task.

The **Energieagentur.NRW** is the energy agency of the federal state of Northrhine-Westfalia. A private company acting on behalf of the state government, it carries out public information, consulting and education activities for companies, municipalities and administrations as well as citizens. It coordinates research projects within the state and conducts the state's foreign trade promotion on the energy field.
https://www.energieagentur.nrw

The **Energieagentur Rheinland-Pfalz** is the energy agency of the federal state of Rhineland-Palatinate. The 100% state-owned company is financed by the budget of the state Ministry for Environment, Energy, Food and Forestry. It provides information and consulting services regarding renewable energy, energy efficiency and energy saving primarily to municipalities and their citizens. With eight regional branch offices, it seeks close connection to the local level.
https://www.energieagentur.rlp.de

The **Energie- und Umweltzentrum Allgäu (eza!)** is a non-profit energy agency in the south German region of Allgäu. Joint shareholders are the regional business development agency, counties and municipalities as well as local utilities and businesses. It provides building and energy consulting, educational seminars and funding consultancy.
https://www.eza-allgaeu.de

7.8 Germany - Summary

Community Energy in Germany profits from largely favourable conditions. In terms of citizen activities, the feed-in tariff scheme for renewable electricity provided long-term security of investment paired with low administrative thresholds ("produce and forget"), even for large scale projects. As a result, a large share of the installed renewable power production capacities is citizen-owned. Besides private investments of home-owners, the model of energy co-operatives proved to be successful. However, due to recent amendments of the feed-in tariff system, citizen's energy has suffered a setback. The federal government, recognising the importance of citizen participation, has introduced new legal concepts, such as citizen participation models for wind energy, landlord-to-tenant electricity and regional power tariffs. These have yet to prove their effectiveness.

The government also recognises the role of local communities for climate protection. Thus, municipality-driven clean energy activities profit from a comprehensive support scheme provided on all political levels. Most significantly, the National Climate Protection Initiative (NKI) provides funding for municipal capacity building through climate protection concepts and the hiring of climate protection managers. On top of this comes a rich "toolbox" of investment support programmes, aiding the implementation of such concepts. Legislation in most federal states has opened up in favour of public local utility companies, supporting a significant wave of (re-)municipalisations on the energy field.

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8 SUMMARY

All LECo partner countries have their mandatory planning procedures in place – from national to regional, county, city and community planning, which consider national interests, environmental restrictions and to a certain extent land use for energy projects. Different levels of obligatory requirements exist for update cycles and consultation, potentially resulting in inconsistencies between levels, especially in Ireland, which demands extensive planning efforts on several levels. Spatial master planning is compulsory in all municipalities, while county or regional levels can be mandatory or shall at least provide guidance and support coordination between municipalities.

Sweden is the only country in the NPA-region, which legally requires municipalities to prepare and regularly update energy plans and implement energy efficiency measures, follow up and consequences of violating these requirements are however weak or non-existent. About 75% of municipalities in Sweden had an updated plan in 2015.

Smaller municipalities are exhausting their human and financial resources with comprehensive planning and mandatory monitoring and reporting procedures, leaving little room for developing own energy initiatives, writing project proposals for funding and actually implementing such projects.

Challenges in general

In all investigated NPA-regions, there is a need for better long-term funding for permanent human resources in smaller municipalities, who can drive the energy transition on the local level. National policies usually recognize the importance of implementation on local level, but governments do not provide sufficient financing.

No legal requirements for local ownership or other comparable long-term financial benefits from energy projects exist in any of the investigated NPA-regions.

In addition to ownership regulations, Sweden needs to review its property tax regime. It is the only country in the NPA-region, where property tax of energy facilities does not benefit the exploited municipality directly. Denmark e.g. has obligatory community ownership shares of a minimum of 20% for windfarms within a radius of 4.5km according the guidelines set out by the Danish Renewable Energy Act. Germany has designed specific rules for wind energy companies where a certain share of corporate tax needs to contribute to revenue in the municipality, where the actual wind park is located. The NPA-regions should consider adopting such specific mechanisms for energy projects.

Funding for renewable energy and energy efficiency projects in the forms of diverse portfolios of support schemes and incentives are available for many stakeholders in all countries, including green electricity certificates, feed-in-tariffs, investment grants, CO_2-taxes and tax exemptions. Such programs often prefer a technology to the other (wind and less solar and biomass) or focus more on one sector (electricity over heating). Countries should therefore investigate into more balanced funding schemes with regard to renewable energy technologies. Balancing should take into account the different local resource potentials, mitigation potentials and socio-economic benefits including local value creation effects.

Another challenge is that mainly larger municipalities and companies, where human resources are available to develop project ideas and write proposals, apply successfully to such schemes. More financial and technical support is required to enable active participation, as experience shows that only a small number of proposals from smaller organizations reaches the funding institutions.

Local energy agencies

National energy agencies are well established in all countries. Local energy agencies appear to work well in Sweden providing capacity building and networking possibilities; Finland has well-functioning rural advice institutions and cooperative support, but lacks local energy agencies accessible to municipalities and other stakeholders. The situation in Ireland is similar to Finland. Such local energy agencies need to develop their services towards the Swedish level of support and should in addition offer practical support to stakeholders in developing project ideas, in the preparation of funding applications and in the actual implementation of projects.

Energy efficiency

All countries provide support schemes for improving energy efficiency in private and public buildings and industries. Sweden only provides a tax-deduction on labor costs for energy efficiency measures in residential buildings and should investigate in higher levels of financial support for the renovation of the old building stock. Ireland successfully offers special support to low-income households and social housing. It is expected that the implementation of the EU-Directive on near-zero energy buildings, applicable on public buildings from 2019 and on all buildings from 2021, will boost energy efficiency gains in the building sectors of all member states, provided that sufficient funding is made available.

Electricity supply

Different renewable energy resources and technologies receive different levels of incentives. The support for small-scale solutions is also lacking, hampering citizens, SMEs and cooperatives in becoming pro-active with their first energy initiatives. Permitting, licensing and funding application procedures are perceived to be too complicated and too tedious. Improving on these issues – small-scale project funding and decluttering bureaucracy – would reduce the threshold of many interested individuals and organisations to become energy activists.

Heating supply

The high level of electricity use in space heating in Finland and Sweden is stressing the electricity grid in the coldest period of the year (lack of available generation capacities and increasing need for import). Heat pumps are saving energy in general but contribute to winter electricity demand peaks. Ireland has high levels of fossil fuel use for space heating. All countries have significant remaining potentials for bioenergy use from agriculture, forestry and waste and should consider more support for bioenergy use in space heating. Bioenergy, when locally sourced, scores highest on local value creation and should therefore be prominent on any national and local agenda for sustainable development.

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10 APPENDIX

Nordic collaboration institutions

Arctic council - http://www.arctic-council.org/index.php/en/:
The Arctic Council is the leading intergovernmental forum promoting cooperation, coordination and interaction among the Arctic States, Arctic indigenous communities and other Arctic inhabitants on common Arctic issues, in particular on issues of sustainable development and environmental protection in the Arctic.

Barentsrådet - http://www.barentscooperation.org/en; http://www.barentsinfo.org/:
Cooperation in the Barents Euro-Arctic Region was launched in 1993, the overall objective of Barents cooperation has been sustainable development.

Nordic Co-operation - http://www.norden.org/:
Nordic co-operation is a comprehensive regional partnership involving Denmark, Finland, Iceland, Norway and Sweden as well as the Faroe Islands, Greenland and the Åland Islands.

Nordkalottrådet - http://www.nordkalottradet.nu/:
The Nordkalotten is located at and north of the northern circle of poles, and consists of the county of Nordland, Troms and Finnmark in Norway, Norrbotten County in Sweden, Lapland in Finland and Murmansk Oblast on the Ryssegda Kolahalvön. Nordkalottrådet or Nordkalott Council is a border regional cooperation organization. Cooperation in 2017-2020 will focus on four areas such as regional policy, border opportunities, demographic challenges and skills supply, environmental cooperation, and exchange of experiences and regional identity.

NorthSweden - http://www.northsweden.eu/:
North Sweden European Office is Norrbotten and Västerbotten's direct link to the EU. The objective is to create conditions for the region's companies, academia and public sector to act successfully in the EU arena. North Sweden works primarily with influencing and driving issues that are important to the region. Another important feature of the business is to support and encourage regional actors to take part in EU funding opportunities to develop their own operations.

NSPA network - Northern Sparsely Populated Areas. http://www.nspa-network.eu/:
The NSPA network represents close collaboration between the 14 northernmost counties of Sweden, Finland and Norway. These 14 regions share common circumstances such as sparse population, harsh climate and long distances and are working together to raise awareness of the NSPA in the EU institutions, to influence EU policy and to provide a platform for best practice.

LECo

Local Energy Communities

Project Partners

Centria University of Applied Sciences (Finland),
Western Development Commission (Ireland), Luleå University of Technology (Sweden),
Renewable Energies Agency (Germany)*, Jokkmokk municipality (Sweden),
The Gaeltacht Authority (Ireland), Lohtaja Energy Cooperative (Finland),
UiT – the Arctic University of Norway (Norway)

*Outside the NPA Programme area