AgroRES
Interreg Europe

Investing in Renewable Energies for Agriculture

Good Practices Guide

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Low-carbon economy

Aug 2019 – Jul 2023

€ 1,31 M ERDF

European Union
European Regional Development Fund

1. Spain

2. Poland

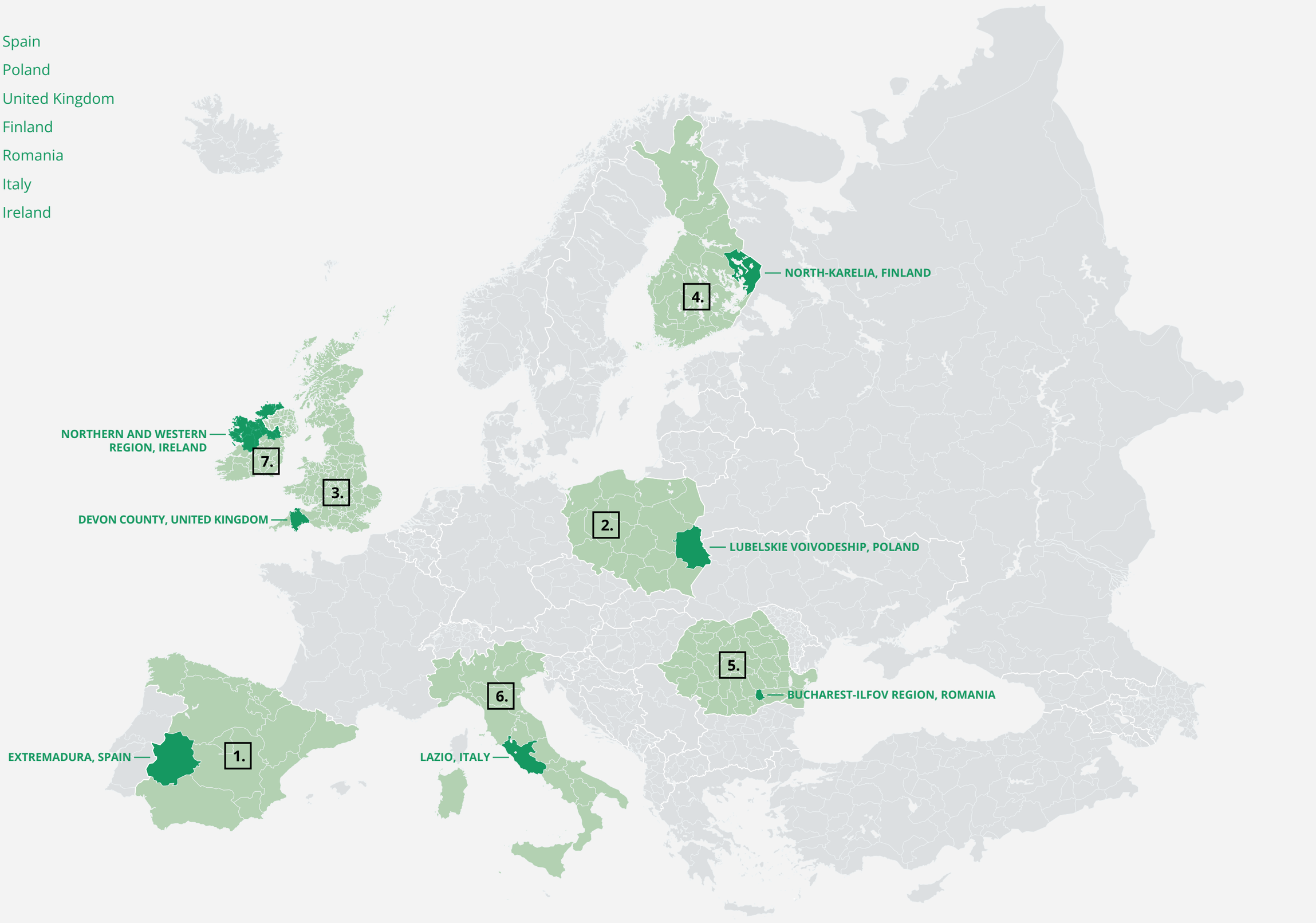
3. United Kingdom

4. Finland

5. Romania

6. Italy

7. Ireland



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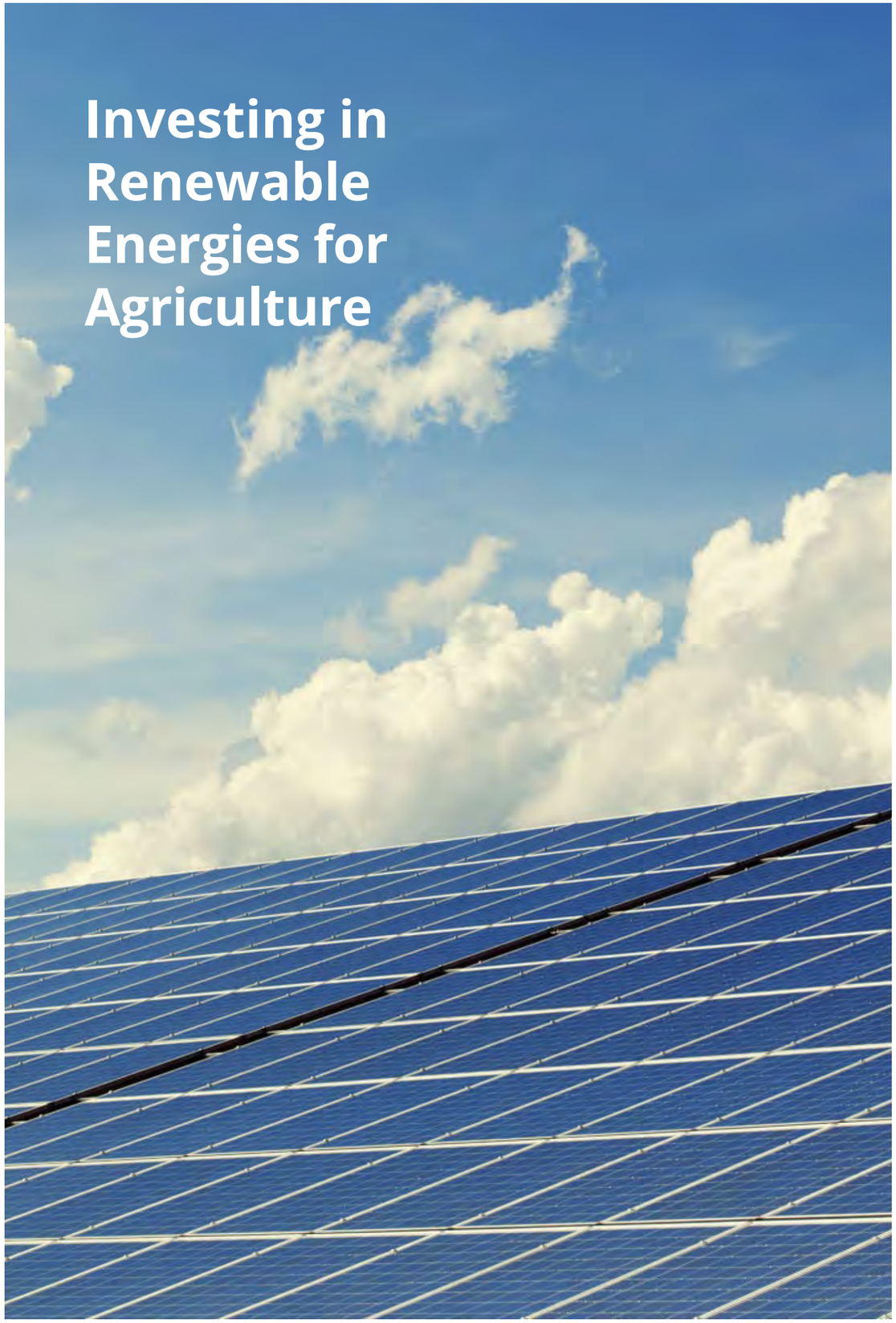

INTRODUCTION

Agricultural sector accounts for almost 10% of greenhouse gas emissions in the European Union, mainly for food production and transport. While there is an enormous potential to produce renewable energy on farms due to the availability of wind, sun, biomass and agricultural waste, important barriers and challenges still remain. Recent studies have proven that the main barriers identified by farmers to produce renewable energy are complex permit and subsidy procedures, high investment costs, and limited access to credit and doubts about profitability. Subsidies and feed-in tariffs are a key factor in encouraging farmers to shift towards a more environmentally friendly production and use of energy.
The European Union's rural development policy helps rural areas meet economic, environmental and social challenges, and it shares objectives with other European Structural and Invesment funds. Member states and regions draw up their rural development programmes based on the needs of their territories, and addressing some of the common EU priorities. At least 30% of funding for each Rural Development Programme must be dedicated to measures relevant for the environment and climate change.

AGRORES PROJECT

The main objective of AgroRES project is to develop measures that encourage the production and use of renewable energy in the agricultural and rural sector. AgroRES will support this sector by solving its energy needs in a sustainable, economic viable and socially responsible way.
AgroRES raises awareness of the benefits of investing in renewable energy in agriculture and promotes public dialogue in order to overcome previously identified barriers and challenges. As a result of the project, partner regions will design policies that support the use of renewable energy in agricultural and rural areas.

GOOD PRACTICES GUIDE

This Good Practices Guide presents good practices from seven AgroRES project countries and regions: Spain, Poland, United Kingdom, Finland, Romania, Italy and Ireland. The good practices are presented by each country and region in no specific order. This publication reflects the author's views only and the programme authorities are not liable for any use that may be made of the information contained therein.

CATEGORIES

- Photovoltaics, wind energy and other energy sources
- Biomass-based energy sources
- Renewable energy funding programs
- Renewable energy advancement projects

DEVON COUNTY, UNITED KINGDOM

Devon County Council (DCC) is in the South West of England and is comprised of eight districts. Plymouth and Torbay are covered by independent unitary authorities and are excluded from the Devon County Council administration. The region contains two National Parks and five Areas of Outstanding Natural Beauty and has diverse landscapes of high moors, heathlands, valleys and rolling farmlands. DCC's population was 802,400 in 2019 (ONS, 2019 nomisweb.co.uk/reports) which has grown by 8.2% over the last decade. Agriculture, combined with other primary activites such as mining, water and waste, contributes to 7% of DCC's GVA.

The South West region of England's agricultural production in 2019 was estimated to be worth £3 629 million, 30% of which came from dairy production. The majority of agricultural land is used for grazing (74%). Along with Dartmoor and Exmoor National Parks, there is lots of open moorland grazing, with local farmers given rights to graze livestock. The argicultural sector within Devon is prodominatly made up of small family owned farms. Unfortunatly, the number of small scale farms is declining in Devon, posing a risk to the Devon agricultural sector. With the offering of renewable energy, it offers small farms an option to diversify their income and increse future resilence.

In 2016, 8% (1 507 GWh) of DCC's energy consumption was obtained from renewable energy and there is potential to increase renewable energy use. There are 41 large scale renewable energy installations over 150 kW within Devon.

Community-owned Energy

Devon, United Kingdom

Community energy organisations offer citizens the chance to own renewable energy assets and develop funds to tackle low carbon issues.

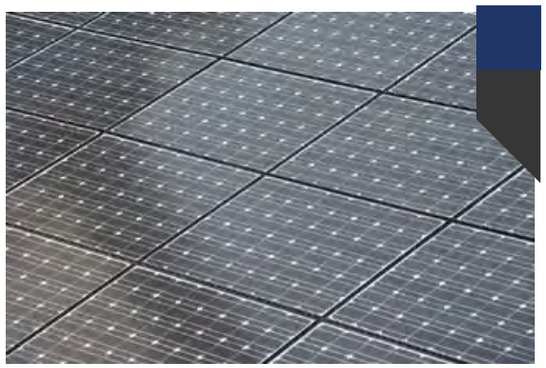

Photo credit Solar Array

Growth in renewable energy isn't as high as it needs to be and citizens are disconnected from energy generation. Equally the renewable energy sector is not fully engaging local communities. An example of this is negative public response to renewable energy planning applications. Revenues generated through the sale of energy are lost to the region as most ownership is by national and international organisations.

Community energy refers to the delivery of community-led renewable energy and energy efficiency projects, which are usually owned by communities. Community-owned projects keep money in the Devon economy and reinvigorate communities by bringing people together with a common purpose to reduce the impact of climate change, increase our energy security and address fuel poverty.

Community energy gives local communities greater control over how energy is generated and used and maximises the engagement and benefit from energy projects. The varied activities of community energy organisations to deliver these goals include reducing energy demand, improving energy efficiency and increasing the amount of energy generated locally from low-carbon and renewable sources.

Devon has been leading the way and has 23 community energy organisations active in the area, more than any other county in the UK. Devon County Council has supported the growth of the sector through funding for support services and grants to community energy organisations. Most of these organisations are grass roots and all are highly committed to delivering the social, economic and environmental benefits associated with community energy.

Stakeholders and beneficiaries of the practice:
- Devon County Council
- Community energy organisations
- Community Energy England
- Regen
- Devon citizens

Resources needed

DCC funded the Community Energy Accelerator Project which ran from June 2014 to June 2017 and incorporated the Devon Community Energy Accelerator Fund, administered on behalf of Devon County Council by Regen.

The fund provided over £62,000 of small start-up grants to community energy groups in Devon. DCC invested a total of £107k in the project and this leveraged £59k of EEF into Devon and facilitated the community organisations (13) receiving £225k from Government's Rural and Urban Community Energy Funds (RCEF) to enable them to develop their projects. So DCC's spend of £107,000 has leveraged in over £284k.

DCC supported community energy groups through the EU joint-funded SEACS project which ran from 2011 to 2014. Tools and case studies have been included in the SEACS Project Toolkit.

Evidence of success (results achieved)

Community energy organisations are found across Devon and have:
- Installed 12.3 MW of capacity through 62 community owned renewable electricity generation projects (1.3% of total capacity)
- Generated 17,431 MWh of renewable energy to date, including 10,610 MWh in 2017
- Saved 6,080 tonnes of CO2e emissions, including 3,701 tonnes saved in 2017
- Raised £14.1 million of investment, including £5.5 million raised through community shares
- Created 33 FTE jobs
- Supported 2,717 households with energy efficiency services or physical installations
- Run 250 events to share knowledge on energy efficiency, attended by more than 2000 people
- 3,457 members, 1,530 shareholders, 297 volunteers and over 8,079 people on their mailing lists

Challenges encountered

The principal reasons for stalled projects are:
- Many of the electricity generation sites have been stalled due to cuts in government subsidies therefore making them not financially viable or high risk for stakeholders
- Lack of cooperation or interest from the host sites
- Lack of suitable host site
- Awaiting legal proceedings

The main barriers and risks highlighted by community energy organisations in Devon include:
- Lack of viable business model due to cuts in FIT and government support for renewables
- Economic uncertainty due to current economic climate and Brexit
- Access to suitable sites that are willing to take on a long-term lease at current payback rate
- Attracting and keeping volunteers to maintain a sufficient skill base.

Potential for learning or transfer

- The community energy sector has the potential to provide the agricultural sector with the capital investment needed to deliver renewable energy
- Support from regional organisations, such as councils, can deliver a productive community energy sector which can then support delivery of renewable energy generation
- This type of intervention has the added benefits of:
  - Increasing awareness in renewables within the region
  - Increasing economic benefits of renewable energy within the region
  - Deliver carbon savings from generation and development of low carbon funds

DEVON COUNTY, UNITED KINGDOM

Main institution in charge

Timescale (start/end date)

Further information:

https://communityenergyengland.org/files/document/151/1524557533_Regen_Devon_CE_Impact_Report_-_Final.pdf

https://www.regen.co.uk/project/community-energy-accelerator/

https://www.devon.gov.uk/energyandclimatechange/community-energy

Countryside Productivity Scheme 2018-19

Devon, United Kingdom

The UK government's Countryside Productivity Scheme 2018-19 was used to support the agricultural sector with investment in renewable heat infrastructure and renewable energy storage.

Tractor credits Tractor on the road – Shredicote Farm

Investment in renewable heat and electricity was being supported by the Renewable Heat Incentive and the Feed-in Tariff in the UK. However, the agricultural sector was having greater difficulty in making this transition through additional costs. A farm could convert to a biomass heating system but there would still need to be substantial investment in a heating network to deal with a number of buildings over a wide area. Renewable electricity through solar panels was being generated mainly at midday when diary farms need the electricity in the morning and evening. Equally, often when farmers were switching on equipment in the early morning this was putting pressure on the supply network.

In response to this problem the Rural Development Programme for England (RDPE) added heat infrastructure and energy storage to the list of measures you could access a grant for under the Countryside Productivity Scheme 2018-19. The scheme for energy storage was limited to 1MW as research showed that over this amount venture capitalist were investing. Also the size of storage was limited to either the amount of energy they could generate or the amount of excess generation, whichever was the smaller.

The scheme benefitted eligible agricultural sector businesses. 'Making better use of renewable heat generated on farm' and 'Making better use of renewable energy generated on farm' projects were funded under the Countryside Productivity Scheme 2018-2019. The Rural Payments Agency advise, that across England in 2018-19, two projects were funded under 'Making better use of renewable heat generated on farm' and two under 'Making better use of renewable energy generated on farm'. The total amount awarded was £389,853. Both were energy storage projects using battery storage technology.

Resources needed

We can't determine the revenue needed to support the administrative function but an idea of the capital grant needed is that two projects resulted in nearly £400k of investment.

Evidence of success (results achieved)

The scheme funded 2 measures, both were energy storage through battery technology.

Challenges encountered

Unfortunately, the inclusion of the measures in the scheme had to be cut short due to the UKs exit from the EU.

Potential for learning or transfer

The scheme highlights the need for incentive schemes to be thought through for specific sectors. Take up of the UK government incentives for renewable energy in the agricultural sector were being hindered by the additional costs incurred to realise the benefit. Additional grants were needed to get over these barriers.

Main institution in charge

UK government, Department for the Environment and Rural Affairs

Timescale (start/end date)

September 2018 – March 2019

Further information:

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Dartmoor Woodfuel Cooperative

Devon, United Kingdom

Dartmoor Woodfuel Cooperative enables small woodland resources to be made available for the production of biomass fuel through co-operation between landowners and biomass customers.

Paul Venn Studio. Dartmoor Woodfuel Co-Operative

The cost of creating biomass to generate heat and power can be expensive when you include the labour and machinery if not done at scale. Also, there is a substantial amount of under used, small areas of woodland in very rural areas that could supply biomass if a cost effective way could be found.

Dartmoor Woodfuel co-operative was set up as an Industrial Provident Society in 2009 by a group of like-minded Dartmoor residents, each of who share a common interest in the environment and reducing the carbon footprint of their lifestyles on Dartmoor. Their intention is to unlock the potential of the small woodland resource available locally, thus reducing the transportation of bio-energy within the region and improving the bio-diversity of these woods.

DWC provides knowledge, contractor, machinery and storage facilities to its members, The cooperative aims to 1) encourage local boiler installations and woodland owners to collaborate, 2) reduce carbon emissions by using sustainably managed woodlands and improving their bio-diversity and 3) develop public awareness of renewable energy and encourage eco-tourism around Dartmoor.

Members forward pay for two years of fuel, based on £15 per kW. Over the period, this investment is paid back through the supply of biomass. DWC now has 30 members, all with boilers and has just turned a profit with a turnover of £300,000. Members cover home owners, schools and elderly care facilities. They are storing 7,500 m3 of wood chip and 2,000 tonnes of timber.

Resources needed

Since its start in 2009 DWC has benefitted from grants from the European Regional Development Fund, Rural Development Programme for England and Forestry Commission. This has enabled them to grow and buy new machinery so they can now even harvest hedges and process the material.

A board provides overall management and direction with a team of five people managing it on a day to day basis. DWC then uses three sub-contractors to produce the biomass.

Evidence of success (results achieved)
DWC is facilitating increased use of biomass and supplying them with locally grown fuel with is resulting in carbon emission reduction and supporting the local economy. The cooperative has over 30 members and employs three sub-contractors.

Challenges encountered

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Potential for learning or transfer

Using biomass to produce heat and power has the potential to reduce carbon emission in appropriate areas. Rural locations with a potential supply of locally grown biomass is a perfect location. As soon as you need to transport biomass great distances the sustainability benefits reduce. Biomass manufacture can also provide important rural jobs and by having this run a cooperative the economic benefits are kept within the locality driving further monetary benefits.

Biomass is not as easy a source of heat and power than conventional fuels. The Dartmoor Woodfuel Cooperative also provides an important support service, helping people to make sure their systems are running properly. This knowledge set is invaluable and particularly in rural locations with low population density.

By managing woodlands this increases biodiversity and further reduces carbon emissions. The Dartmoor Woodfuel Cooperative assists in bringing woodlands back into management through a network of trusted, local practitioners engaging with landowners.

Main institution in charge

Dartmoor Woodfuel Cooperative

Timescale (start/end date)

2009 - ongoing

Further information:

http://www.dartmoorwoodfuel.co.uk/

https://www.sylva.org.uk/downloads/Why%20manage%20woodland%20&%20who%20benefits.pdf

https://energysavingtrust.org.uk/renewable-energy/heat/biomass

Local Energy Markets

Devon, United Kingdom

Setting up of Local Energy Markets to enable peer to peer trading between generator(s) and consumers so that generators can receive a higher payment and consumers a saving and/or other perceived benefit (ie carbon reduction) through the realisation of local balancing benefits.

Photo credit Westmill Farm

Growth in renewables needs to increase but the business case can still be difficult. Over half of the cost of retail electricity is charges and some of these relate to the entire electricity network whereas if generation and consumption was in a locality the impact on the wider network would be minimal. Citizens are interested in purchasing locally generated, renewable electricity but are not currently able to. Generating and consuming energy within a locality has local balancing benefits if it can be shown that a kWh generated within a minute/half hour is consumed within that minute/half hour. Flexible, smart energy systems are being seen as key part of a net-zero carbon system with citizens able to offer and benefit from being flexible in their consumption patterns.

As stated by Swan Barton, 'the central LEM commercial proposition relies on suppliers being able to sell electricity locally at a higher price and consumers to buy locally at a lower price. This requires some re-engineering of the electricity pricing stack. [Swan Barton] argue that 50% exemption from distribution charges and 100% exemption from transmission charges is reasonable, because matched power only travels between the source and the sink. Since this local power is not seen by the wider system, and so the wider network benefits from reduced traffic. There is good precedent for this today: for example, electricity consumers connected to the higher voltage tiers in the distribution network do not pay charges associated with the lower voltage tiers. [Swan Barton] also argue that it is reasonable for locally traded renewables to be exempt from environmental levies. These reliefs will save the consumer over 35% on locally purchased electricity vs grid electricity, whilst generators were able to increase revenues by 35% above a standard PPA price.

A way to deliver some of these savings is through Ofgem regulation 'measurement class F' or also known as a multi-sleeve. Within a locality, generation and consumption sites all have smart meters operating on a half-hourly basis and then use the same licensed supplier. By delivering local balancing the Licensed Supplier can achieve some reduction in balancing and settlement charges and as a Complex site the Distribution Use of System charges are lowered. More importantly, to the Licensed Suppliers you create customers who are less likely to move suppliers. The consumers go onto Time of Use Tariffs (ToUT) where by the cost of electricity can change through out the day, primarily driven by the output from the generation sites. The cost of administering ToUT is higher for Licensed Supplier than normal tariffs.

The Energy Local model uses this approach. The generator and consumers must be on the same circuit and form a co-operative. All members of the co-operative will have the same licensed supplier. The agricultural sector could benefit from the Energy Local model by being both a consumer or generator. This could improve the business case for the adoption of renewables.
The main stakeholders and beneficiaries of the practice:

- Ofgem
- Department of Business, Energy and Industrial Strategy
- Energy Local
- Regen
- Agricultural sector
- Community energy sector

Resources needed

The Energy Local project started as a community energy organisation but now has receives funding from the Department for Business, Energy and Industrial Strategy.

We require technical consultants to research and develop a business model and engage Licensed Suppliers in delivering schemes.

Evidence of success (results achieved)

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Challenges encountered

Multi-sleeving or the Energy Local model doesn't create substantial cost-savings for the Licensed Supplier and unless they have a very high-tech billing system the costs of billing could outweigh the gains. Ofgem have concerns that Local Energy Markets could reduce revenue for maintaining the network and therefore increase costs for those not in Local Energy Markets

Potential for learning or transfer

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Main institution in charge

Energy Local

Timescale (start/end date)

September 2019 – ongoing

Further information:

https://energylocal.org.uk/guide1

https://swanbarton.com/1117/lemdex-key-findings/

https://blogs.exeter.ac.uk/energy/2018/05/11/barriers-to-local-energy-markets-in-gb/

https://www.ofgem.gov.uk/ofgem-publications/96863/consultationresponse-communityenergyenglandpdf

Renewable Heat Incentive

London, South East, United Kingdom

The Renewable Heat Incentive is a government scheme offering grant payments in relation to heat generated from eligible renewable technologies.

Paul Venn Studio. Dartmoor Woodfuel Co-Operative

Investment in renewable heat technologies wasn't growing as the payback period was long and the technology unfamiliar to the market. Capital grants had been in place in a limited fashion but this wasn't stimulating the growth levels required. The Renewable Heat Incentive was designed as being able to provide the financial stimulus required but phased over a number of years with payment related to heat output.

Set up in 2011, contributes to the UK's target of meeting 15% of energy demands with renewable sources by 2020. The scheme is open to domestic and non-domestic customers and the following technologies: Heat pumps, biomass, solar thermal, energy from waste, biogas (CHP, gas grid). By the end of March 2019 there were 20,160 participants on the Non-Domestic RHI scheme and in total 4.5GW of heat capacity has been installed.

Heat generated by eligible schemes is either deemed or metered and then quarterly payments made to the owner over 7 years for domestic and 20 years for non-domestic. As take-up increases the tariffs decrease but once an installer is registered the tariff is set for the period of the RHI. The RHI is paid for by the public through charges on their energy

The main stakeholders and beneficiaries of the practice:
- UK government
- Renewable heat supply chain
- Agricultural sector

Resources needed

Between November 2011 and August 2017, total payments under the RHI amounted to £1.4 billion. The scheme currently has a budget for new applicants until March 2021. Final payments to these applicants will run to at least 2040-41, by which time these payments are expected to have cost £23 billion. The scheme was administered by Ofgem.

Evidence of success (results achieved)

Delivered a 44% carbon saving through the RHI scheme by 2020.

Estimated 4.5 million tonnes CO2e saved in 2017-18, c. 1% of UK carbon emissions.

Delivered 78,048 installations by December 2017.

Challenges encountered
- Although a range of technologies are eligible the vast majority of supported installations were for biomass
- There are concerns that as payments were related to the amount of heat generated installations were incentivised to generate as much heat as possible and therefore installation may not have been sized correctly or used appropriately.
- The UK government Public Accounts Committee found that:
  - BEIS' forecasts of uptake were 'wildly over-optimistic'.
  - 60,000 renewable systems were installed as part of the scheme (compared with 6.2m gas boilers)
  - BEIS cut its expectations of renewable heat produced by the scheme by two thirds, and carbon emissions reductions by half
  - The 'hassle factor' of installing renewable heating means consumers are likely to keep favouring gas and oil boilers
  - Around 28,000 biomass boilers funded by the RHI produce smoke which could damage air quality
  - BEIS does not have an estimate of how much money it overpaid to those who manipulated RHI rules
- The UKk government national Audit Office concluded:
  - Take-up of RHI was lower than anticipated. The NAO estimates the RHI will achieve 22% of the number of installations it originally expected
  - BEIS reduced the amount of renewable energy it expects RHI-funded installations to produce and the amount of carbon emissions saved
  - It's uncertain whether the RHI produces renewable heat cost-effectively
  - There are gaps in how the scheme's success is monitored e.g. it measures number of applications and how fast they're dealt with, but not their quality
  - BEIS can't reliably estimate how much it has overpaid to those who broke the RHI's rules
  - The impact of 'gaming' the system is unknown

Potential for learning or transfer

The scheme was the very first to offer payments for renewable energy generated and for renewable heat specifically.

The scheme did deliver carbon savings and increase renewable heat production in the UK as well as increasing the profile for renewable heat technologies in general.

The NAO concluded that the UK government needed to increase rates of renewable and low-carbon heating in order to meet the UK's legal obligations. The RHI is a novel approach to making progress against these obligations and identifying longer-term options for eliminating carbon emissions from heat production. Measures it introduced to control the scheme's costs have enabled it to avoid the budget control problems that occurred on a similar scheme in Northern Ireland.

Main institution in charge

Government

Timescale (start/end date)

November 2011 – April 2022

Further information:

https://www.nao.org.uk/report/low-carbon-heating-of-homes-and-businesses-and-the-renewable-heat-incentive/

https://old.parliament.uk/business/committees/committees-a-z/commons-select/public-accounts-committee/inquiries/parliament-2017/renewable-heat-incentive-17-19/

Small-scale Farm Biogas

Truro, Cornwall, United Kingdom

Use of anaerobic digestion on a small-scale to generate biogas for use on or off-site.

Bennaman. Chynoweth Farm, Cornwall.

- Dairy farms produce organic waste which costs to manage and dispose of
- Dairy farms operate at very low margins and use electricity for pumping and refrigeration
- Energy is used early in the morning and late in the evening when PV would not be generating

The collection and use of biogas at small-scale farms either through AD plants or collection of biogas from slurry stores would enable dairy farm owners to reduce the cost of waste management and generate savings/income. This would reduce the farms costs and carbon emissions

The main stakeholders and beneficiaries of the practice:
- Renewable energy organisations
- Consumption asset owners

Resources needed
1. Researching existing technology models
2. Researching and lobbying for regulatory changes around environmental waste
3. Output modelling (thermal/electrical)
4. Research finance models
5. Develop overall business model
6. Engage potential customers to gain feedback
7. Refine business model

Evidence of success (results achieved)
- A group of over 600 Italian farmers organised as the Italian Biogas Consortium are redesigning their own farming systems to produce food and bioenergy in a nationwide farm-level movement called Biogasdoneright.

- The Energy Independent Farming project, delivered by Benemann Ltd in collaboration with the University of Exeter, aims to deliver commecially viable high value energy products in biogas and liquid biofuel and reduce the level of artificial inputs such as fertiliser required on farm. The project utilises a 'micro-scale' anaerobic digester, in combination with an innovative small-scale biogas processing and liquefaction plant powered by on-farm renewable energy resources (wind & solar). A key factor is gas is collected from slurry stores so no
- The C J Parish & Sons farm (80-100 cows) in Devon invested in a 80 kilowatt anaerobic digester, which uses a mixture of slurry from the cows, litter from the poultry enterprise and forage maize grown on the farm, to produce enough energy to power the entire farm, with some to spare for the national grid. The system was manufactured by Fre Energy. The scheme does not get payments from the Renewable Heat Incentive or Feed-in Tariff schemes as they received a grant to pay of the infrastructure around the AD plant and the slurry stores needed to be replaced anyhow
- The Renewable Energy Association concluded that:
  - AD can achieve a 'carbon credit' of 3.27 kgC02e saved per kWh net lectricity generated, compared with a maximum achievable electricity replacement carbon credit of 0.49 kg CO2e per kWh electricity generated for other renewables
  - Slurry from all medium and large diary farms was treated in AD plants, 1.8MtCO2e could be saved each year across the UK
  - GHG reduction costs for small-scale slurry-only AD would be £60 per tonne CO2e saved, lower than the GHG reduction costs accepted for other renewable technologies

Challenges encountered

- So far projects have required subsidies or funding to develop a business case due to the high costs of equipment, low savings/income generated, and/or uncertainty over savings/income generated
- In the UK regulations around definitions of waste cause increased costs either in the transfer of waste or in the collection of gas from a slurry pit.
- Although generating cost savings, the C J Parish Farm did need a grant and the amount of digetate storage does need to be increased.

Potential for learning or transfer

- The farming sector in the EU has a large number of small-scale farms who find it difficult to operate due to high running costs (energy and waste disposal), small-scale biogas production could be a positive response to that issue
- Biogas collection from slurry pits involve less capital investment then AD and so could be a lower cost intervention
- Slurry pits need improving and so this offers an opportunity to invest in biogas collection
- Energy Independent Farming is an interesting business model which is looking at the generation of biogas for use by transport, on- or off-site
- Biogasdoneright is interesting in that it brings to gether a number of small-scale farms to achieve the scale needed
- The Parish farm shows that small-scale AD can be shown to work

Main institution in charge

Energy Independent Farming

Timescale (start/end date)

April 2020 – March 2021

Further information:

https://www.cornwallislesofscillygrowthprogramme.org.uk/projects/energy-independent-farming/

https://bennamann.com/energy-independent-farming/

https://www.consorziobiogas.it/wp-content/uploads/2017/05/Biogasdoneright-No-VEC-Web.pdf

http://www.fre-energy.co.uk/mount-stephen-devon.htm

Synthetic Power Purchase Agreement

Devon, England

Synthetic PPAs enable public organisations to secure renewable energy supply outside of their overall energy purchase whilst ensuring the renewables are additional and local.

Petr Kratopchvil. Wind Turbine

Organisations are needing to reduce their carbon footprint. Equally, for the EU to meet its carbon targets deployment of renewables needs to be increased, particularly near to areas of consumption.

Purchasing energy through a green tariff unless backed by a Power Purchase Agreement doesn't provide a high enough price to stimulate renewable energy deployment. Another option is a Corporate Power Purchase Agreement, but this can negatively impact on the price for any remaining energy demand.

Devon County Council wanted a way to stimulate additional renewable energy but to ensure this generation was in the locality to maximise the local socioeconomic benefits but also reduce the energy losses through transmission over the national grid.

A Synthetic Power Purchase Agreement is a financial agreement between a generator and an off taker. The off taker agrees a minimum price for the sale of the energy created by the generator. This enables the generator to draw down finance as their income is guaranteed over the length of the PPA (10-20 years). As the agreement is financial in nature, DCC doesn't need to procure and can enter into an agreement with a local developer. DCC can argue that the extra cost of using a community--owned developer is outweighed by the additional socioeconomic benefits of it being in the locality and owned by the local community. The Synthetic PPA sits outside of DCCs energy purchasing strategy so doesn't affect the ongoing purchased price of energy. As DCC can require that any renewable supplies making up the SPPA are additional it can then claim the carbon credits.

DCC have developed a Synthetic PPA toolbox that enables public sector organisations to enter into an agreement. However, any organisation can in principle enter into a SPPA.

Resources needed

Legal support with procurement route: £5,000
Socioeconomic study to determine added-value of community owned renewable generation: £20,000
Drafting of SPPA legal documents: £20,000

DCC has calculated that a 30MWp SPPA over 20 years based on future energy price projections would be cost-neutral.

Evidence of success (results achieved)
A compliant route to enter into a SPPA with a local, community-owned, renewable energy generator has been determined.

Challenges encountered

-

Potential for learning or transfer

The Synthetic Power Purchase Agreement model can be used in other countries had originated in the United States of America. An SPPA offers a different way to 'purchase' renewables and will be appropriate to those organisations who are looking for a simpler method and one that delivers maximum local benefit.

Main institution in charge

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Timescale (start/end date)

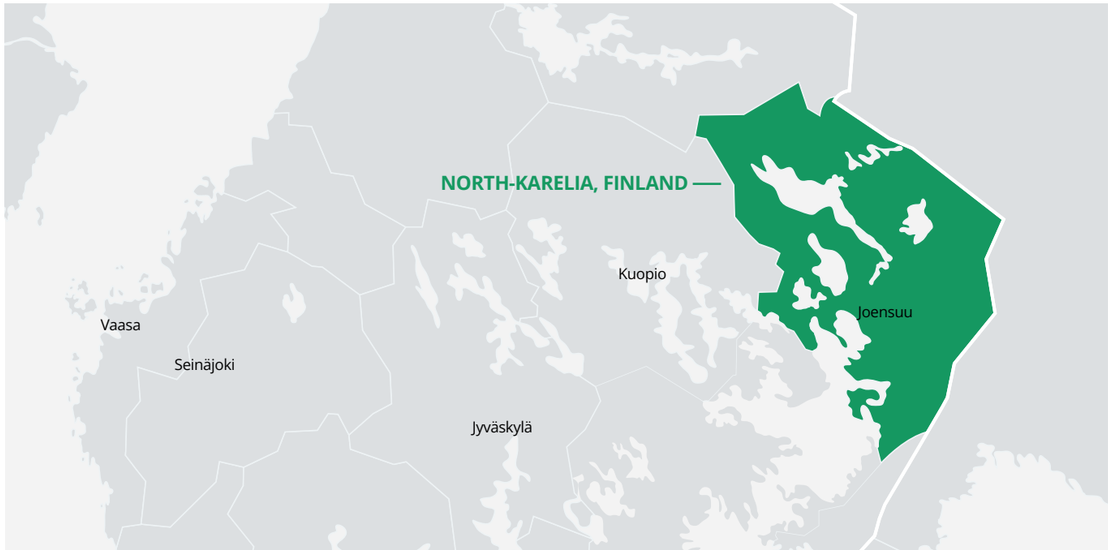
Jan 2020 - ongoing

Further information:

https://www.wbcsd.org/contentwbc/download/4468/60118

http://docs.wbcsd.org/2016/10/Scaling_up_globally_Print.pdf

NORTH-KARELIA, FINLAND



North Karelia is located in Eastern Finland and it limits to the east with Russia. The total area of the region is 21,584 km2. The population of North Karelia is about 161,000 people of which 75,000 inhabitants live in the regional capital, the city of Joensuu. Population density of North Karelia is about 7.5 inhabitants / km2. Regional GDP per capita was 33,582 € and the Gross value added by the agricultural sector is around 40 million euros in 2018. About 89% of the land area is covered by forests and there are over 2,000 lakes in the region. Leading industry sectors are forest and wood, food, plastic, metal, and tourism industries. North Karelia is widely known for its knowhow in forestry.

Agricultural land covers 900 km² of which 860 km² (86,000 hectares) is used actively. The total farm income comes from four main sources: sales of products and services (34%), various subsidies (28%), forests (16%) and other farm income such as cottage rent, accommodation, catering, and other services (22%). Typically, most of the active farmers are also forest owners and an average size of forest is 56 hectares / farm. There is great variance in the income structure between the farms, especially in the category of other farm income.

Dairy farming is the most significant agricultural production line with 59 % of the total production in euros. Livestock farming for meat including beef and pork covers in total 23 %, egg farming 0.56 % and cereal farming about 4 %. Other crop farming such as potatoes, vegetables, berries, caraway, field mustard etc. cover 13 % of total production in euros. North Karelia is the fifth largest milk and beef producer in Finland.

Renewable energy consumption rate in the region was 67 % in 2018. This consists wood energy (51 %), renewable electricity (13 %), heat pumps and other sources of renewable energy (3%). There is a significant potential remaining to increase biomass, biogas and other renewable sources in energy production and consumption. North Karelia has set a target to be oil-free region by the year 2030 and active measures has been implemented recent years and public commitment towards the target is at high level.

Energy self-sufficiency in Kuittila farm

Nurmes, North Karelia, Finland

Kuittila farm has been nearly energy self-sufficient since 2012 when the farm invested in a small CHP plant that generates electricity and heat from wood.

Photo credit Al Leino, Pixabay

NORTH-KARELIA, FINLAND

In Kuittila Farm, the farmer was interested in decreasing energy costs and producing own energy for the farm and a repair workshop located on the site. The farm has a dairy herd of 150 cows. The annual energy consumption of the farm (incl. machines, cow shed, repair shop, grain dryer, main building and woodchip dryer) is c. 955 MWh.

In 2012, the farmer invested in a CHP (combined heat and power) system manufactured by Volter Ltd. The solution is unique because it produces electricity and heat by gasification of wood. The 140 kW CHP plant generates c. 150 MWh of electricity and 375 MWh of heat a year. It consumes 700 m3 (loose volume) of wood chips per year. The farm has a 1,000 m3 storage facility and the wood chips are mechanically dried by using the waste heat of the plant. Wood chips with a moisture content of less than 18% are burned to process gas and converted into electricity and heat in an internal combustion engine. Wood chips are pre-heated before gasification in pyrolysis area. The heat from the gas and engine cooling is utilised in the farm's micro-scale heating network.

To further improve their energy independency, in 2015 the farm invested in photovoltaic systems with a total capacity of 50 kW that cover 300 square meters of roof area. They are expected to generate around 40 MWh of electricity per year.

Due to the CHP plant and solar systems, the farm is completely energy self-sufficient in terms of heating. They can also produce 50 % of the electricity they use at the farm.

Resources needed

The total cost of the CHP plant was around 350,000 €, of which the CHP unit and buildings accounted for c. 220,000 €. The estimated payback period of the plant is 10 years.

The farm received support for planning and implementation of the investment from an EAFRD project and 35% of investment support through the local Centre for Economic Development, Transport and the Environment (regional state administrative authority).

Evidence of success (results achieved)

The plant has been operating for several years and it has attained significant status as a small-scale CHP demonstration site in the region, both nationally and internationally. The small-scale CHP technology is innovative as it uses wood chips to generate heat and electricity.

Thanks to the investment, the farm is now almost energy self-sufficient. They still need to buy fuels for machines (c. 240 MWh / year).

Challenges encountered

Fuel quality was a challenge at the beginning, but it was improved and controlled with the supplier of the CHP system. Cost efficiency of the system depends much on the heat demand and weather conditions.

Repairing of the CHP plant is expensive, and it needs constant maintenance. In 2020, the farm decided to replace the CHP plant with a wood chip boiler due to technical issues. They still consider the investment profitable, but the costs for repairs and parts should be lowered. The new boiler will work well with the existing technology and continues to provide heating for the farm's needs.

Potential for learning or transfer

The energy system improves the security of energy supply in farms and reduces the risks associated with climatic and weather conditions. In addition, the investment leads to significant carbon emission reductions and creates a positive image for the entrepreneur.

The practice would be potentially interesting for regions that have good forest resources. The farmer of Kuittila farm harvests its biomass mainly from local forests (thinning). The harvesting of small-sized wood improves the forest growth and provides high-quality fuel. The high quality pre-dried fuel, together with advanced combustion technology ensure low emissions and reduces harmful environmental and health impacts. The resulting ash can be used as forest fertiliser.

Technology of CHP plants has improved since 2012 and, consequently, their lifespan has improved.

Main institution in charge

Kuittila farm

Timescale (start/end date)

October 2012 – ongoing

Further information:

https://www.youtube.com/watch?v=tIRJiduX6wI

http://grebeproject.eu/wp-content/uploads/2017/09/Small-Scale-Biomass-CHP-Kuittila-Power-Finland.pdf

Agricultural investment aid for energy production

Seinäjoki, Southern Ostrobothnia, Finland

Funding for renewable energy investments in farms in Finland are granted under the Rural Development Programme for Mainland Finland 2014–2020.

Photo credit Henryk Niestrój, Pixabay

Renewable energy investments of farms in Finland are supported through agricultural investment aid (EAFRD) under the Rural Development Programme for Mainland Finland 2014–2020. The programme includes many financial instruments and measures to develop operating conditions and competitiveness of agriculture. These include training and provision of information, investments in physical property, start-up support, environmental compensation payments etc. The agricultural investment aid is one of them and can be used e.g. for construction investments in agriculture, purchasing for joint machines and energy production investments.

Investment aid for energy production

The aid promotes efficiency and quality of agricultural production in accordance with the principles of sustainable development. It may be granted for construction, renovation and extension of on-farm heating plant if the plant serves all or some of farm's production activities. The heating plant must use renewable energy.

Aid may also be granted for the construction of a biogas plant to produce heating or electricity for agricultural buildings. More than half of the biomass used in the biogas plant must come from a farm managed by the applicant or its shareholder.

Installations are supported only if the generated energy is used in agricultural buildings.

Beneficiaries:
- farmers
- private bodies engaged in farming
- associations of farmers

The Finnish Food Authority that operates under the Ministry of Agriculture and Forestry of Finland is responsible for the use of agricultural and rural development funds in Finland. Applications are submitted to the Centre for Economic Development, Transport and the Environment (regional state administrative authority).

Resources needed

Renewable energy investment aid covers 40 % of total investment costs. The amount of support is always over 7,000 euros. Maximum grant per farm over a period of 3 tax years is 1.5 million €. The total budget for agricultural investments under the Rural Development Programme for Mainland Finland 2014–2020 is 985 million euros out of which 329 million euros is co-financed by the EU. This budget covers all agricultural investments.

Evidence of success (results achieved)

By the end of 2018, a total of about 4,300 investments (EAFRD) were supported in Finland. Out of these around 360 were related to the use of renewable energy.

Since 2016, the EAFRD has supported 27 farm investments in North Karelia. These investments included 1 biogas plant, 4 wood chip plants and the rest were solar energy installations. Total budget of these investments was around 1.4 million euros and the financial support amounted to 0.55 million euros.

Challenges encountered

Majority of the investments supported through the programme are connected to solar power systems. Other renewable energy technologies are still expensive which has slowed down their deployment in agriculture, despite the available financial support.

Potential for learning or transfer

Financial support granted through the Rural Development Programme has increased the availability and use of renewable energy in farms and utilization of agricultural by-products and waste that promotes circular economy. Between 2015 and 2018, the total investments in renewable energy production within the programme were around 22.5 million euros in Finland. Thanks to the programme, the use of renewable energy has increased by 342.5 GWh a year by the end of 2018.

NORTH-KARELIA, FINLAND

Main institution in charge
The Finnish Food Authority

Timescale (start/end date)
January 2014 – ongoing

Further information:
https://ec.europa.eu/info/sites/info/files/food-farming-fisheries/key_policies/documents/rdp-fact-sheet-finland-mainland_en.pdf

https://mmm.fi/en/rural-areas/rural-development-programme

BioKymppi Ltd. – Turning agricultural waste into bioenergy

Kitee, North Karelia, Finland

Biogas plant BioKymppi is specialised in organic waste treatment and converting waste to energy and fertilizers.

Photo credit Reijo Telaranta, Pixabay

Agricultural waste is a problem for farmers as it contaminates groundwater and emits greenhouse gases. By recycling residues from agriculture, we can reduce the sector's carbon footprint and waste streams.

BioKymppi Ltd. is a biogas plant in Kitee, eastern Finland that is specialised in treatment of organic waste and converting them to energy and fertilizers. The raw materials used by BioKymppi include manure, household bio-waste, bio-waste from grocery stores, side streams from the food industry, sewage and waste fat (from cooking). The total treatment capacity of the plant is up to 25,000 tonnes a year. The collected raw materials are used to produce biogas and organic fertilizers which can also be used as supplementary fertilizers in organic farming.

The BioKymppi plant has two separate waste treatment lines (mesophilic and sludge digestion): the capacity of the biogas reactor that produces certified organic soil improvers is 3,000 m3, while the capacity of a reactor for sewage and grease sludge treatment (non-organic fertilizers) is 1,000 m3. All fertilizers produced by the plant are utilised in agriculture which reduces the use of industrially produced and imported fertilizers. The biogas produced in the second reactor is used for heat and power production. Some of the biogas produced in the plant is used for district heating for local communities and all surplus electricity is transferred to the national grid.

BioKymppi in numbers:
- The plant can treat 35,000 tonnes of waste per year.
- Biogas production (methane): 1.5Mm3 (for own use 0.5Mm3).
- Produced energy for sale: 7,000MWh/year (5,000 MWh heat, 2,000 MWh electricity)
- c. 20,000 tonnes of fertilizers produced per year

Resources needed
Investments made in 2007–2016 amount to 8.5 M€.

Public funding received for setting up the company:
- Business establishment & development support: 185,000 €, Rural Development Programme (RDP)
- Energy aid (investment support) from the Ministry of the Economic Affairs & Employment: 1.3 MEUR (30%)
- Investment support for biogas production: 130,000 €, RDP

Evidence of success (results achieved)
The practice reduces carbon footprint and waste streams of agriculture. The biogas plant collaborates with an energy company from Oulu, who sells green electricity to the national grid. BioKymppi Ltd. produces 1,400,000 kWh renewable electricity per year and all of this is sold through the energy company. There is a high demand for environmentally-friendly electricity, and it is sold out every year.

Challenges encountered
-

Potential for learning or transfer
This practice reduces all types of waste streams, promotes circular economy in rural areas and decreases the carbon footprint of agriculture. The practice is transferable to other regions and can be implemented also in a smaller scale. A lot of agricultural and organic waste is left unused in many parts of Europe although it could be used for energy production. Farms can invest in on-site digesters that will generate electricity for their own use. Although the initial investment may be high, it can lead to major savings and even profit in the long run.

Main institution in charge
Biokymppi Ltd.

Timescale (start/end date)
2007 – ongoing

Further information:
https://bio10.fi/
(in Finnish)

https://www.youtube.com/watch?v=rDN5TMWJ3YE
(in Finnish)

https://www.interregeurope.eu/fileadmin/user_upload/tx_tevprojects/library/file_1603348227.pdf

Eno Energy Cooperative - district heating from local sustainable forest resources

Joensuu, North Karelia, Finland

The Eno Energy Cooperative generates heat from energy wood for local public buildings, commercial premises and housing companies.

Photo credit Reijo Telaranta, Pixabay

Eno Energy Cooperative is a community-based enterprise located in Eno, which is one rural neighbourhood of Joensuu in North Karelia, Finland. It was established in 1999 by 12 local forest owners. At that time, there was no proper market for energy wood, but the cooperative created that for Eno district. The initiative was well-received as the municipality wanted to profile itself as a clean and environment-friendly place.

Currently the co-operative is owned by 54 local forest owners and the aim is to generate heating energy by providing wood chips for the 3 district heating plants. Members provide about 20–30% of energy wood and the rest is acquired from different suppliers nearby, e.g. from the fellings of forests owned by the city of Joensuu. The raw materials used are small diameter trees by manual felling (15%), by multi-tree processing (70%) and logging residues (15%) from clear cut areas.

Local approach is central in the operations of Eno Energy Cooperative, not only in terms of its members but also in terms of energy wood procurement and other related services. In addition to affordable price of heat (municipality building and private customers have saved without taxes about 2 million euros during 15 years compared to light fuel oil), there are many local benefits such as, local forest owners receive income from selling energy wood, energy wood harvesting entrepreneurs get work, thinning of too dense young forest improves growth and quality of remaining trees, net carbon dioxide emissions are reduced because imported oil is replaced by renewable forest chips (5 million kg annually) and local networks are created. In addition, the actions employ between 7–10 persons/year.

Currently the cooperative owns three heating plants and about 11 km long district heat distribution network. Energy produced in the plants per year is approximately 15,500 MWh which corresponds to the energy consumption of c. 800 detached houses in Finland.

Resources needed
Public funding granted for the construction of heating plants and heating pipe network was vital for the cooperative. It received 20–30% investment support from regional state administrative authority: Centre for Economic Development, Transport and the Environment. The net cost of the first own heating plant and the heating network was EUR 530,000 (excl. VAT).

Furthermore, the Finnish Forest Centre and their projects provided important background data for the founders.

Evidence of success (results achieved)
District heating replaces c. 2 million litres oil every year. As a result, the local economy saves around 2,000,000 euros and net carbon dioxide emissions are reduced by near 5 million kg annually. Use of

the plant and wood supply employs about 7–10 persons/ year.

The Eno Energy Cooperative has received two national level recognitions:
- Winner in heat entrepreneurship competition in 2014
- Emission reducer of the month in 2017 by Finnish Environment Institute

Challenges encountered

In the beginning, there were people who doubted the sufficiency of energy wood resources. Currently more households are willing to join the district heating network than is possible. The most common reason for that is the heat loss from the heating pipe network. In rural villages, commercial premises and settlement houses situate quite far from each other, which complicate the profitability of district heating system.

As a result of the population loss, demolition of properties and houses without district heating has become more common. This will reduce turnover of the cooperative.

Potential for learning or transfer

The Eno Energy Cooperative has gained wide acceptance through transparent operation and open information delivery. Due to concrete benefits to locals, inclusion of residents and openness of the operations, Eno Energy Cooperative has become a good example of successful and environment-friendly solution that supports the transition towards oil-free and low-carbon region.

The benefits:
- Most of the capital investment stays in the area
- Positive effects on forestry and landscape
- Positive effects on employment
- Local energy source brings safety and independence during possible energy crisis
- Combustion of wood reduces carbon dioxide emissions by about 5 million kg annually
- The ashes and its nutrients can be returned to the forest
- Cheaper heat for consumers compared to oil
- Wood replaces approx. 2 million litres of oil annually
- Local economy benefits about 2,000,000 e/year

The Eno Energy Cooperative could work as a model for other rural and agricultural areas that are looking for ways to reduce their carbon footprint and become energy self-sufficient. Similar wood chip heating plants could provide renewable energy to farms with a competitive price and replace existing heating systems based on fossil fuels.

Main institution in charge

Eno Energy Cooperative

Timescale (start/end date)

09/1999 - ongoing

Further information:

http://www.enonenergia.fi

https://www.kau.se/files/2019-04/Workshop%20D%20-%20Olli%20Lehtonen%2027%20March.pdf

http://bioresproject.eu/wp-content/uploads/2015/08/Best-practice-from-Finland-Eno-Wood-Energy-Cooperative-2015.pdf

Joint procurement and purchase of solar power

Joensuu – all cities and towns in the region, North Karelia, Finland

Joint purchase of solar power for private properties and companies was organized in North Karlia (FI) as part of an ERDF co-financed project.

Photo credit Erno Nykänen

The joint procurement and purchase of solar power was organised as part of the North Karelia Towards Oil-Free and Low-Carbon Area project (ERDF) which objective was to increase the share of renewable energy in the region of North Karelia, Finland. The project, managed by the Regional Council of North Karelia (RCNK), looked for and tested new methods for developing markets for cleantech solutions and products. Joint procurements and purchases were one of the methods.

Together with the Finnish Environment Institute and the Carbon Neutral Municipalities (HINKU) network, RCNK planned and organized joint purchase for solar power units which was addressed to residents and private companies in HINKU municipalities in North Karelia. They organized 5 info-events, advertised in and communicated through local and regional newspapers and social media. More than 250 persons were contacted during this process.

Planning of the purchase took place in July to August 2016, events were organized in September 2016, registration of interested participants in October to November 2016, invitation to tender in December 2016, comparison of the offers in January 2017, and installations of 41 solar power units in April to June 2017. RCNK requested tenders for 2.5, 4.5 and 7 kWp units and compared the offers. Prices were approximately 30 % lower than the average market price. Stakeholders involved in implementation: public authority, research actors, industry, civil society. Beneficiaries: industry, residents.

Resources needed

The project budget was 655,015 euros (70% ERDF). Resources are needed for planning and organising procurement, comparing offers and purchasing solar power units & installations. Regional municipalities provided event venues and promoted joint purchase for their residents.

Evidence of success (results achieved)

41 new solar power plants were installed to private buildings with a total power capacity of 142.4 kWp. The units were approx. 30% cheaper than the average market price. In 2017, the region's CO2 emissions decreased by c. 20,000 kg due to the instalments. Around 60% of the participants were from rural or agricultural areas. The process was effortless for them: they did not need to find suppliers and were offered guidance and help from an unbiased organisation.

Challenges encountered

Successful implementation requires involvement from several stakeholders. The possibility needs to be advertised effectively and potential participants should know about the benefits of joint purchase method (clear cost-savings). Timing of the joint purchase is important. People are more interested in solar power when it's sunny.

Potential for learning or transfer

Solar power is increasingly seen as a cost-effective way to produce energy also in Finland. Joint purchases have offered an easy way for purchasing solar power. The method has been tested couple of times and it is easy to transfer to other areas. The practice has high-impact potential and the events organised by the project are good tools for raising awareness of renewable energies, their benefits and investment potential. Another joint procurement and purchase of solar power was implemented in 2018. This time the equipment supplier was selected before organising information events to households and companies.

Main institution in charge

Regional Council of North Karelia

Timescale (start/end date)

July 2016 – June 2017

Further information:

https://s3platform-legacy.jrc.ec.europa.eu/joint-purchase-of-solar-power

https://www.pohjois-karjala.fi/web/hinku/yhteishankinta

(in Finnish)

Liepala Farm heat recovery from the milk production

Ilomantsi, North Karelia, Finland

Liepala farm in Ilomantsi has been searching new innovative ways to save energy in milk production process. They have invented a compressor-line that restores heat from the milk. This energy is used for heating the drinking water of the livestock and water used in the production process. Same energy is also used in underfloor heating of cowshed during wintertime.

Photo Credit Manfred Richter, Pixabay

Energy amount needed in milk production process is relatively large. The process itself produces energy that can be exploited in other parts of the production if it can be stored somehow. Liepala farm has planned and executed a heat restoring system for catching the heat from the fresh milk. Temperature of the milk incoming is around 30–34 degrees Celsius. Milk has to be cooled in 3–4 degrees Celsius for the storage tank. When heat is taken off from the process before cooling, there is also savings in cooling system, because it has to be in use for shorted period of time. When cooling process is faster the quality of milk stays better.

Stored heat is used in warming the big amount of water used in process. Drinking water for the cows is also heated with this excessive heat. This way, especially during wintertime cows drink more and milk production is increased. In wintertime there is also constant need for heating the cowshed. This is partly done by using under-floor heating system that takes part of its energy from the invented system.

Compared to the normal milking system (twice a day) milking-robot system used in farm produces milk constantly. This ensures that there is also heat and energy available for the system all the time. The system is basically working 24 hours a day.

Main beneficiaries of the system are farm owners.

As a result of this system:

- Energy used in cooling process is decreased by one third or even half.
- Energy needed for heating the water is reduced significantly.
- The usage time for both cooling- and water heating system is increased because of lesser load.

Resources needed

Investment cost is around 8000–10 000 euros depending on the facilities available. Payback time for the investment is c. 5 years and usage age for the system is appr. 15 years.

Evidence of success (results achieved)

After launching GP energy savings has been 30,000 kWh yearly.

The farm intends to further improve its energy-efficiency by installing solar panels.

Challenges encountered

For the optimized solution the placement of the gadgets in system need to be thought carefully.

Potential for learning or transfer

As agriculture sector in different parts of Europe is operating in different conditions this good practice might be more usable for those areas that has a colder climate and wintertime. Although using excessive energy for water heating also reduces energy used for cooling process and this way is usable also in warmer climate areas.

As investment cost for the system is relatively small, it is better accessible also for small-scale farms as well as bigger units.

Main institution in charge

Private company Liepala Farm

Timescale (start/end date)

Step by step in year 2017 – ongoing

Further information:

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Hybrid heating system powered by solar and biomass energy

Juuka, North Karelia, Finland

Nevalainen dairy farm in the municipality of Juuka, Finland, has invested in a hybrid heating system that is powered by solar and biomass energy.

Photo Credit Maria Godfrida, Pixabay

The Nevalainen dairy farm in the municipality of Juuka in North Karelia, Finland, decided to upgrade their heating system in 2017 when the old wood chip boiler was already around 20 years old. The previous boiler was prone to faults during peak load, required active monitoring and overheated during the summer. The new system needed to be easy to maintain and reliable. In addition, the farmers wanted to use solar energy for heating domestic water and when energy demand is lower, ensuring that the boiler is not overused and lasts longer. As a result, the farm invested in a wood chip boiler which is used to heat the buildings and hot water in the farm. In the summer, solar thermal collectors are used as the primary source of heat for heating domestic hot water.

The heating system in the Nevalainen farm includes a 60 kW wood chip boiler (Fröling T4) with automatic hot air ignition, automatic residue and ash removal and a patented air ventilation control system. The boiler includes a touch-screen and remote control systems and sensor based monitoring. The farm uses wood chips that are produced from their own forest raw material. The annual consumption of wood chips is about 200 m3 (loose volume), leading to an energy saving of about 160 MWh. A total of c. 250 m3 (loose volume) chips can be stored in the chip storage in the farm.

The thermal storage tank on the farm has 1,200 solar coils and 2x6kW electric resistors. Solar collectors (5 pcs, Jäspi Solar 3kW) are installed vertically on the south wall of a building where the wood chip boiler is. This way the transfer distance is short and the collectors are easy to clean. The heat generated by the solar thermal system is transferred to buildings on the farm (residential building 250 m2 / 600 m3; workshop and extension 250 m2 / 1,000 m3 and barn) mainly during the summer.

Resources needed

Investment costs (incl. VAT):
Wood chip boiler and feeder 21,700 €
Solar collectors and water tank 8,400 €
Pipe installation 4,000 €
Electrical installation € 1,000
Other costs 900 €
Total 36,000 €

No public funding was applied for the investment.

Annual consumption of wood chips is about 200 m3.

Evidence of success (results achieved)

The former woodchip heating system was old and laborious. It required a lot of monitoring and high-quality wood chips. The current system is less sensitive to changes in chip quality and is more reliable.

The solar collectors generate enough energy to provide hot water for the farm during the summer months. The need to use the wood chip boiler throughout the year has decreased. The wood chip boiler is not switched off during summer, but it is set to start if the temperature in the thermal storage tank drops below a desired level.

The investment price has been reasonable compared to the system performance and results. The farm does not need to buy a lot of electricity for heating due to the investment. In addition, multiple types of fuel used in the system creates security.

Challenges encountered

When planning a similar investment, it should be ensured that the size of the boiler room is optimal for installation. If a new building is constructed for the purpose, its placement should be carefully considered, so that the solar collectors face the correct direction. All trees creating a shade to the wall should be removed.

Potential for learning or transfer

The hybrid heating system in the Nevalainen farm is powered with renewable energy. Multiple types of fuel used in the system creates security, making sure that the farm always has sufficient heat. The system also ensures that the equipment last longer because they are not overused.

NORTH-KARELIA, FINLAND

The system is cost-effective and energy-efficient. The farm has their own fuel supply so they can chip wood directly into their fuel storage. This also saves costs.

Similar practice could be taken into use in other regions, taking into account their characteristics. Hybrid heating systems may be interesting for farms that have high energy demand throughout the year. The types of fuel used may vary depending on the region and available technology. However, large rooftop areas in farm make them particularly suitable for solar energy farming.

Main institution in charge

Nevalainen farm

Timescale (start/end date)

April 2017 – ongoing

Further information:

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Solar energy on Alava dairy farm

Kitee, North Karelia, Finland

Alava dairy farm is among the first farms in North Karelia, Finland, to generate electricity for the farm's needs by photovoltaic solar panels.

Photo Credit Alava farm

Alava farm in the municipality of Kitee, North Karelia, Finland, is a dairy farm that was established already in 1675. The farm milks around 60 cows and requires a lot of electricity for its daily activities. The annual electricity consumption of the farm is about 120,000 kWh. The largest share of electricity is needed for ventilation fans, milk machines and cooling of milk.

To decrease electricity bills, the owner invested in a solar photovoltaic (PV) system that covers one fourth of the farm's electricity needs (30,000 kWh).

The investment was made in 2014 and the farm opted for a 33 kW photovoltaic system that, at the time, was the largest photovoltaic power plant in North Karelia. Photovoltaic panels were installed on a roof of a south-facing cowshed. The building was ideal for this purpose as it is surrounded by open fields and there are no trees around it to shade the PV panels.

The farm has also installed a geothermal heating system to replace oil heating and LED lighting solutions to further decrease its energy bills. The profitability of the farm has increased due to these investments. Moreover, the PV system and other measures have reduced the CO2 emissions produced by the farm.

Resources needed

The solar panel investment cost around 45,000 euros. The farm received investment support from the Rural Development Programme for Mainland Finland 2014–2020. The support rate was 30 %.

Evidence of success (results achieved)

The solar PV system has decreased the farm's electricity bills by one-fourth. This has affected the farm's profitability.
At the same time, the investment has reduced the farm's CO2 emissions by approximately 4,750 kg per year.

The farm owner has been very pleased with the solar panel system. It is easy to maintain and use, it did not require building permits, the investment cost was fairly low and the estimated payback period is around 9 years.

Challenges encountered

During daylight hours, the system generates electricity and the need for purchased electricity is lower. If the system momentarily produces more electricity than is needed on the farm, the surplus can be fed into the national electricity grid. However, the compensation paid for the surplus electricity is miniscule.

The PV system generates electricity mainly during the summer. In winter, when its dark and the sun does not shine much, the farm relies on purchased electricity.

Potential for learning or transfer

PV systems are suitable for farms due to their long lifespan. In addition, they do not cause emissions or noise, they are easy to use and the need for maintenance is very low.

Solar electricity systems can be applied to a wide range of applications on farms, such as irrigation, cooling, air conditioning, water heating or generating electricity for farm buildings. And as this example shows, the technology is suitable even for farms located in the northern part of Europe.

The costs of PV systems have declined over time, making them even more attractive and accessible options for farms that have high energy needs.

Main institution in charge

Alava dairy farm

Timescale (start/end date)

2014 – ongoing

Further information:

https://www.karelia.fi/energiaraitti/esittelykohteet/alavan-maatila-suunnannayttaja-pohjois-karjalan-maatilojen-aurinkosahkoistamisessa/
(in Finnish)

https://www.youtube.com/watch?v=ZEgjefoDM0c
(in Finnish)

https://www.interregeurope.eu/fileadmin/user_upload/tx_tevprojects/library/file_1603352085.pdf

Power from Biomass – a project promoting renewable energy production

Nurmes, North Karelia, Finland

Power from Biomass project, co-financed by the EAFRD, promoted the production and use of decentralized renewable energy in the region of North Karelia, Finland.

Photo Credit Laukkala Cottages

There was a clear need to increase renewable energy production in the region, but the lack of know-how relating to new technologies was hindering the development. To change this, Power from Biomass project was launched to assist companies and farms in planning renewable energy investments. The primary target groups of the project were farms and companies that are interested in the production of renewable energy or utilisation of new technology. The project included several activities. It mapped bioenergy production resources in the region, transferred know-how related to renewable energy through events, information sessions, workshops and study trips, created knowledge and innovation networks, sparred and assisted the target group in business ideas and investment plans connected to RES. The project also mapped renewable energy demonstration sites in the region. These sites are advertised on the project's website that was created for promoting decentralised energy production (www.karelia.fi/energiaraitti/).

The project published several surveys and guides to support the transition to renewable energy. These included: Guide to solar energy systems in farms (advice to assess the right size and location of installation, costs), implementation paths for establishing a farm biogas plant (self-built vs. factory-built plant), report on biogas production in a farm (case study). The project succeeded in raising interest towards renewable energy production in the region and it also resulted in investments and spin-off projects.

Resources needed

The project was funded through the European Agricultural Fund for Rural Development.

Its total budget was 798,645 euros. The lead partner of the project was Pielinen Karelia Development Center Ltd PIKES. Other partners: the Finnish Forest Centre, Karelia University of Applied Sciences and Central Karelia Development Company KETI Ltd.
12 part-time or full-time staff members worked in the project.

Evidence of success (results achieved)

185 companies and farms took part in the project. 100 of them received guidance on energy solutions and calculations of profitability.
The project organised 53 events gathering over 1,000 participants. As a result, knowledge of RE technologies increased among farmers and companies.

It prepared several preliminary studies for farms and companies. These lead to 12 RE investments. Most of which were PV installations. Some investments were realised after project closure (incl. biogas plant in a farm).

Challenges encountered

Although there was a clear interest among the target group to invest in renewable energy technology, the investment costs were too high for most of the farmers. Farmers preferred to invest in solar panels that are more affordable. Low prices of oil and electricity were factors that hindered the transition.
Some of the objectives set for the project were too ambitious. Realisation of large investments during the project was challenging due to short timeframe. Project financing regulations limited activities in the project. It could not provide advisory services that benefit companies directly. The project was only allowed to map initial situations in companies and farms and determine development needs based on the mapping.

Potential for learning or transfer

Decentralized renewable energy production offers good opportunities to improve the employment situation in rural areas and directly supports the goal of a low-carbon society, improving the state of the environment and sustainable use of natural resources.
The Power from Biomass project is an excellent example of development measures aimed at promoting the production and use of decentralized renewable energy at regional and local level. The project strengthened businesses' and stakeholders' competencies and increased interest in RE solutions. The numerous studies carried out in the project on the opportunities for farms and companies to invest in renewable energy production supported the region's goal to be an oil-free and low-carbon region in the future.

Similar projects can be implemented in regions that want to promote low-carbon agriculture and business activities.

Main institution in charge

Pielinen Karelia Development Center Ltd PIKES

Timescale (start/end date)

1.9.2015 – 30.6.2018

Further information:

https://www.pikes.fi/en/poveria-biomassasta
(in Finnish)

Sirkkala Energy Park – a learning, RD&I and service environment for bioeconomy

Joensuu, North Karelia, Finland

Sirkkala Energy Park is a learning and research environment for bioeconomy.

Photo Credit Sirkkala Energy Park

Sirkkala Energy Park as a research, demonstration and educational platform promotes both national and regional development goals to increase the know-how, production and use of renewable energy. Energy Park collaborates with enterprises and increases their knowledge on energy solutions with joint RD&I work. It improves stakeholders' ability to adapt to changes in construction and energy system regulations. It produces actual cost structures of renewable energy production and maintenance, as well as creates synergies between enterprises, education and research.
Sirkkala Energy Park is a real-life R&D environment at Karelia University of Applied Sciences. It is located near the campus area and offers an accessible learning and benchmarking environment for students and visitors. Sirkkala Energy Park provides a large set of technical solutions for testing and development, such as: mobile Volter CHP unit with real-time monitoring, combined wood log/pellet boiler, nano CHP pellet boiler system, large collection of solar collectors and panels, wood fuel dryer and a wide variety of laboratory equipment and analysers.
Sirkkala Energy Park is owned by Karelia University of Applied Sciences. It was created in three ERDF co-funded projects. Two of them were investment projects and one development project. The latter one drew up a plan for equipment maintenance and integration of teaching and research into the activities of the park as well as business plan for the park.

Resources needed

Two investment projects and one development project were implemented in order to create the park.
Project budgets:
- Investment projects: 573,500€ (ERDF, funding rate 70 %)
- Development project: 230,500€ (ERDF, 70 %)

Evidence of success (results achieved)

The Energy park has attracted both national and foreign visitor groups. The micro CHP- boiler using wood pellets as fuel is the only existing commercial-ready unit in Scandinavia. It has raised high interest among researchers, different training organisations, companies and entrepreneurs. Since the winter 2019–2020, the park has been a testing place for mobile electricity storage. Cooperation with energy related SMEs is still growing and has its focus in technical testing and biofuel analysis.

Challenges encountered

One of the biggest challenges is to synchronise many renewable energy (RE) technologies and equipment in the most effective way as the park has many RE technologies and equipment. Location of Energy Park next to a school is challenging due to safety issues, e.g. testing of wood chip CHP plant and fuel preparation equipment has required flexibility from both sides.

Potential for learning or transfer

The Sirkkala energy park includes a wide range of electricity and heat production technologies that are powered either by wood or sun. The park introduces new technologies to those interested in investing in renewable energy and provides objective information to support decision-making. The park offers expert services incl.: calculation of operating and maintenance costs of different forms of energy production, designing and dimensioning energy solutions. The experts have good know-how in biogas production and technologies, solar energy and pellet production.

Sirkkala Energy Park provides an environment to demonstrate the self-sufficient production of heat and power by biomass, solar and it is suitable for rapid practical testing of innovations and renewable energy business development. The environment may encourage local enterprises, farmers and other actors to shift towards more environment-friendly production and use of renewable energy.

Main institution in charge

Karelia University of Applied Sciences

Timescale (start/end date)

October 2014 – ongoing

Further information:

http://www.karelia.fi/energy/energy-park/

https://www.youtube.com/watch?v=ewEYe4P67wg
(in Finnish)