



WARES PROJECT PUBLICATIONS

Financial Support for Renewable Energy Implementation

in Finland, Norway, Scotland, Northern Ireland and Ireland

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UNIVERSITY of OULU





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Introduction

This report is published within the Water Asset Renewable Energy Solutions (WARES) project. WARES is a two-year strategic project of the Northern Periphery Programme, which explores the opportunities to generate renewable energy at water utility assets. The project is led by the International Resources and Recycling Institute in Scotland, in partnership with Action Renewables in Northern-Ireland, Mayo County Council and Clár-ICH in Ireland, Narvik Science Park and Northern Research Institute in Norway, and the University of Oulu in Finland. The map of the Northern Periphery region and the location of partners is illustrated in Figure 1.

The aim of WARES is to provide innovative renewable energy solutions to remote areas by finding unused opportunities for renewable energy generation within the activities and property of the water sector. WARES will establish partnerships between the water industry and neighbouring communities and help sourcing the capital investment required to commercialise these opportunities, such as creating Public Private Partnerships.

This report describes the types of financial support, which can be used by water companies for renewable energy implementation in Finland, Norway, Scotland, Northern Ireland and Ireland. In addition, the report will also provide a brief overview of renewable energy potential and types of technologies supported in these countries.



Figure 1. The map of the Northern Periphery region and the location of partners.



1 Finland

Financial support for renewable energy implementation is provided by the Finnish Energy Authority and the Ministry of Employment and Economy. The two key categories of financial support are subsidies and the feed-in tariff.

Subsidies, or energy aid, for implementing renewable energy can cover up to 15-30% of investment cost. Energy aid is also applicable for research projects dealing with renewable energy solutions. The extent of support varies depending on the renewable energy technologies. In Finland, support is provided for solar photovoltaic and solar thermal, anaerobic digestion, bioenergy, wind power, geothermal energy, heat recovery from wastewater and small-scale hydropower. In addition, if a project is aiming at improving energy efficiency and decreasing environmental impacts from the energy sector, it can also be eligible for support. These investments are expected to implement state-of-the-art technologies. If a research and development (R&D) project intends to implement a new technology, the financial support can be up to 40% of total costs. Private companies, municipalities or organization are all eligible applicants. The applications for subsidies are sent to regional Centres for Economic Development, Transport and the Environment (ELY Centres). The ELY Centres are in charge of funding decisions for renewable energy projects with a budget up to 250 000 euros and for research projects or implementation of new technologies - up to 5 000 000 euros. In case the budget is higher, the decisions are made by the Ministry of Employment and Economy. The received energy aid is paid either in several parts or at once depending on the decision of the competent authority. The only limitation for the subsidy holder is that at least 25% of the total project cost should come from non-state financial sources. Subsidies cannot be given to farms, households, co-operatives and construction projects that already have been granted state aid. If a project is done in collaboration with several organizations, the subsidy is given to the lead partner of the project. All the subsidies are paid by the Ministry of Employment and the Economy, which is the main responsible authority, and provide from the state budget. (Mikkonen, 2013; Brückmann, 2013)



Figure 2. Schematic representation of feed-in tariff (FIT) support in Finland. The blue line represents the target price, the black line the daily power market price fluctuation and the green line the three months average of power market price. The amount of feed-in tariff is represented by the red arrows.

The feed-in tariff (FIT) support became available in Finland in 2010. In 2012 about 100 million euros were provided to subsidize renewable energy. The concept of FIT is illustrated in Figure 2. In general, FIT makes it profitable for a renewable power producer to be present on the energy market with the help of financial support from the government. This support is meant to cover the difference between the average energy market price and the target price. Currently, the target price in Finland is $83,5 \in MWh$.

As illustrated in Figure 2, the energy market price varies daily (black line). FIT is the difference between the target price and the average of last three months' market price. If, for example, a biogas plant can sell for the energy market for an average of 38 € per MWh, the Finnish government will support bioenergy production by paying the biogas plant an extra 45,5 € per MWh. (MEE, 2013b; Brückmann, 2013) This financial support can relate to different renewable energy sources; however, in focus are especially wind energy, energy production from wood chips or wood fuels and anaerobic digestion. There is a special feed-in tariff of 105,3 €/ MWh for wind energy, which is valid until the end of 2015, as shown in Table 1. In addition, if a bioenergy or biogas production utility generates also heat, they are allocated extra 20 and 50 €/MWh. (Brückmann, 2013)

The application process starts when energy producer with an already constructed plant informs the Finnish Energy Authority about the intention to start energy production. The energy producer provides the authority with all the technical specifications of the facility. The exception is a wood chips

energy production plant, which can start operation and then apply for the feed-in tariff support. If all the formal requirements are met, the Energy Authority decides about the allocation of financial support. The allocation criteria are as follows (Brückmann, 2013):

• The feed-in support holder should be based on Finnish territory or in Finnish waters, and connected to the electricity grid;

All the technical and eco-

nomic requirements related to energy production should be met;

No previous grants or state support;

• The energy utility should be entirely constructed from new parts;

- Minimal capacity requirements:
 - a) For wind energy at least 500 kVA,
 - b) For anaerobic digestion (AD) and bioenergy based on solid biofuel – at least 100 kVA;

• The energy efficiency of AD and bioenergy must be at least 50%;

• There should be both heat and power production with AD;

• If the average energy market price for the last three months is lower than $30 \in /MWh$, according to the Finnish regulations, the target price should be lowered to $30 \in$;.

• The feed-in tariff is applicable only until a production limit is achieved, which is:

- a) 2 500 MVA for Wind energy;
- b) 19 MVA for AD
- c) 150 MVA for bioenergy based on solid biofuels

The Ministry of Employment and the Economy (MEE) and the Energy Authority are in charge of feed-in tariff support decisions. The MEE, as the main competent authority, is responsible for management, supervision and assessments, whereas the EA deals with practical legal matters and payments of the tariffs and the bonuses. The maxi-

tions in Finland. (based on Brückmann, 2013).

Table 1. Amount of feed-in tariff support for renewable energy solu-

Energy type	Feed-in tariff €/MWh	Special feed-in tariff €/MWh	Extra benefits €/MWh
Solid biofuel	02 5		20
(wood chips or wood fuel)	د,ده	-	(for heat production)
Anaerobic digestion	02.5		50
(biogas production)	د,ده	-	(for heat production)
Wind energy	02 E	105,3	
(onshore and offshore)	د,ده	(until 31.12.2015)	-

mum period a company can receive the support is 12 years. The feed-in tariff is funded from the state budget (Brückmann, 2013).

2 Norway

In Norway, if a water company is interested to implement renewable energy technology as an onsite installation, the Norwegian authorities can help the company through "Electricity certificates within the quota obligation program". This quota program was established to support the development of renewable energy market in Norway. The parties under the quota obligation system are electricity suppliers and electricity consumers. The program is based on electricity certificates, which are tradable in the electricity certificates market and function as medium of renewable energy exchange between producers and consumers. Under the program, energy producers are interested to sell the renewable energy certificates, whereas consumers are obliged by the government to buy them in certain proportion or quota. (Pobłocka, 2013) The scheme of the quota program is illustrated in Figure 3.



Figure 3. The scheme of joint quota system for electricity market in Norway and Sweden (NVE, 2012). Key stakeholders: 1) authorities, 2) energy producers, 3) certificates market, 4) quota obligation, and 5) consumers.

The quota system originates from Sweden where it was established in 2003. Since 2012 the electricity certificate market has been carried out as a Swedish-Norwegian collaboration. The main objective of the energy market union is to meet the requirements of the Europe 2020 strategy and the Renewable Energy Directive. Among the mutual advantages are more efficient use of renewable resources, more participants on the energy market, good financial support for renewable energy technologies and more cost-efficient renewable energy production. (NVE, 2012)

The quota system applies to all renewable energy solutions: wind, wave, solar, geothermal, hydropower, anaerobic digestion as well as bioenergy. As Figure 3 illustrates, the electricity certificate flow is directed towards electricity end users and the financial support toward the energy producers. The main source of funding is electricity end-users. The authorities responsible for electricity certificates in Norway are the Norwegian Water Resource and Energy Directorate (NVE), which is in charge of the management and monitoring of the guota system, and the Norwegian transmission grid operator Statnett. Statnett registers the electricity certificates and supports renewable energy production. Each electricity certificate is worth 1 MWh of production. If for instance a water company would generate 5 MWh of saleable power, they would receive five electricity certificates (or green certificates). (Pobłocka, 2013; NVE, 2012) The water company would also have the right to sell the certificates to energy consumers on the electricity certificate market. The market is open for Norwegian and Swedish electricity consumers. Energy consumers are obliged to buy certificates by law; they must have a certain proportion of electricity usage originating from renewable sources. The quota program is set by the Electricity Certificate Act and the yearly quota obligation cofficients are seen from Table 2. (NVE, 2012)

Obligation year	Quota obligation coefficient (proportion of renewable energy)	
2012 (first year)	0,030	
2016	0,108	
2020	0,183	
2026	0,164	
2030	0,094	
2035 (last year)	0,009	

Table 2. Quota obligation values in Norway between 2012-2035. (Based on NVE, 2012).

The maximum value of quota obligation is set for the year 2020, which is 0,183; after which it decreases. The peak corresponds with the 2020 Strategy. Based on this quota obligation, in 2020, for instance, at least 18,3% of the total energy consumption of the end users must be covered by renewable sources. To meet this goal, energy users must buy electricity certificates sold by renewable energy producers. As the energy price with the renewable energy certificates is higher than the regular price of energy, this makes the system attractive for renewable energy producers. (NVE, 2012) The certificates expire at the end of the year and the consumers need to buy new ones to meet the quota obligation. This creates continuous demand. Failure to meet the quota will result in a fine, which is 150% of the electricity certificates yearly average price. (NVE, 2012) The price for electricity certificates is included in the customer's electricity invoice and they pay only for their actual consumption. The system is easy to use for the end-user. For companies to be involved, the conditions are the following (NVE, 2012):

• Renewable energy production should be built within licensing terms;

• Renewable energy production was started after 2009. The exception is hydropower plants;

• Renewable energy producers that would begin to function after 2020 are not eligible;

• The assignment period is 15 years. However, if company has been present on the energy market before 2012, the years of presence shall be deducted from the assignment period. For instance, if Norwegian wind park was launched in 2010, the assignment period is 13 years;

• If a renewable energy producer has received previously government state grants, which have not been repaid before 2012, then this producer is not eligible for the quota program.



3 Scotland

In Scotland, (as well as in Wales and England), a water company as a producer of renewable energy has access to the following financial support instruments:

- Loan;
- Feed-in tariff;
- Quota system (Renewables obligation);
- Tax regulation mechanisms; and
- Other economic mechanisms (e.g. crowdfunding).

3.1 Loans for renewable energy producers

Loans have been available for renewable energy producers since 2013; however, they apply only to the solar energy. This campaign was launched as part of the British Green Deal (Qualifying Energy Improvements) Order 2012. The Green Deal consists of 45 different measures to improve energy efficiency in buildings, including solar energy. Figure 4 illustrates the loan scheme. (Tallat-Kelpšaitė, 2013)



Figure 4. The scheme of loans for solar energy in Scotland.

The targeted parties are property owners, both business and private. The idea is to reduce the need to buy energy and create savings through solar installation. The loans can be paid in two possible ways. The first option is to repay it during the lifetime of the solar panel investment, whereas the second option is to pay it back during a certain repayment period specified in the Green Deal. The specified period can be 25 years at maximum. To receive the loan with the purpose of solar energy production, a property owner should address the Green Deal Oversight and Registration Body, which is the main competent authority. In the Green Deal Oversight and Registration Body, the property owner should be in contact with a Green Deal Assessor. The Green Deal Assessor is responsible for assessing the potential and applicability of solar energy technology on the property. The Green Deal Assessor produces a Green Deal Advice Report on the feasibility of solar energy solution, which contains also recommendations about potential energy-efficiency measures to be taken. Furthermore, the report contains estimates of potential savings from a financial point of view, if all the recommendations are implemented. After this, the property owner should find an appropriate Green Deal Provider to implement the recommendations. The Green Deal Provider is an entity that will receive the loan. Then the property owner and the Green Deal Provider sign a Green Deal Plan, which is a contract between them. The contract states the amount of the loan, that it should be repaid by the property owner to the Green Deal provider and the period of repayment. When this step is completed, the Green Deal Provider should find a Green Deal installer, who is in charge of solar panels installation. After finishing all the installations and implementations, the loan should be paid back by the property owner to the

Green Deal Provider via electricity bills. The loan is supposed to be lower than the actual savings incurred by the implemented solar energy solution or any other stated energy efficiency measure. The latter is the so-called "Golden Rule" of the Green Deal. The source of funding originates from the Green Deal Finance Company created by the government. (Tallat-Kelpšaitė, 2013)

3.2 Feed-in tariff system in Scotland

The feed-in tariff system has been available since 2010 and is applicable for such renewable energy solutions as hydropower, anaerobic digestion, solar photovoltaic energy and wind energy. The main limitation is that the capacity of the technologies has to be fewer than 5 MW. The aim is to support the implementation of renewable energy technologies by making production of renewable energy financially viable for the producers. This extra support helps them to enter the energy market easier and receive guaranteed pay-back of their investments. The general scheme of the feed-in tariff in Scotland is presented in Figure 5 (Tallat-Kelpšaitė, 2013)



Figure 5. The scheme of feed-in-tariff in Scotland.

The entitled parties are renewable energy producers. With the help of the feed-in tariff, they are able to sell electricity to energy markets under the actual production cost, but still cover their own costs. This mechanism lowers the barriers of entry to the energy markets for potential renewable energy technologies. (Tallat-Kelpšaitė, 2013)

In order to become a feed-in tariff support holder, a renewable energy producer first needs to know what is the planned capacity of the proposed energy installation. If it is less than 50 kW, renewable energy producer has to inform the electricity supplier about the energy installation. The electricity supplier then registers the installation in the Central Feed-in Tariff Register. If the renewable energy producer generates more than 50 kW, then the application for feed-in tariff support has to be directed to the competent authority, which is the Gas and Electricity Markets Authority (Ofgem). At Ofgem the application goes through an accreditation process. For some technologies, there is a preliminary accreditation available, e.g. for anaerobic digestion, solar energy and wind energy with the capacity of more than 50 kW. After all the requirements are met, the accreditation is issued, the energy installation is connected to the grid, and the renewable energy producer can receive the feedin tariff support. The support is paid by the electricity supplier, or feed-in tariff licensee, that must purchase it from the energy producers. The feed-in tariff licensees are obliged to take part in the feedin tariff system and buy electricity from renewable energy producers. Small electricity suppliers covering fewer than 250 000 households can participate in the feed-in tariff support on a voluntary basis. In turn, electricity suppliers include the feed-in tariff payments in energy bills that are paid by electricity end users. (Tallat-Kelpšaitė, 2013)

Ofgem also has a levelisation fund, which was created to ensure that all the costs for feed-in tariff licensees are in balance. The levelisation fund is formed by payments paid by the licensees, and is used to redistribute finances between electricity suppliers. In case the fund is in deficit, the licensees need to cover this with additional payments. (Tallat-Kelpšaitė, 2013)

The levels of feed-in tariff support are decided on annual basis by Ofgem, in collaboration with the Secretary of State for energy. The common trend is that small-scale wind energy along with hydropower production receives more support per produced kWh. In large-scale renewable energy production, the priority is given to solar energy and anaerobic digestion. (Tallat-Kelpšaitė, 2013) Table 3 lists the feed-in-tariff rates for the period of April 2013 to March 2014. The prices are converted from pound sterling to euro based on currency rates of March 27th, 2014.

Table 3. Feed-in support rates in Scotland (based on Tallat-Kelpšaitė, 2013).

Renewable energy type	Capacity, kW	Feed-in tariff support, €/kWh
Small scale		
Solar energy	10 - 50	0,1520
Anaerobic digestion	up to 250	0,1833
Hydropower	15 – 100	0,2443
Wind energy	15 - 100	0,2618
Large scale		
Hydropower	2000 - 5000	0,0391
Wind energy	1500 - 5000	0,0502
Solar energy	250 - 5000	0,0828
Anaerobic digestion	500 - 5000	0,1117

The conditions of the system are as follows (Tallat-Kelpšaitė, 2013):

• For solar energy (up to 250 kW) there are three feed-in tariff support levels: lower, middle and higher. To get the higher feed-in tariff, solar panel installations (up to 250 kW) must have an Energy Performance Certificate of Level D or higher. Those installations, which do not meet this requirement, can receive only the lower feed-in tariff. The installations with 25 or more solar panels receive the middle feed-in tariff that is considered a multi-installation tariff;

• The rates of feed-in tariff for solar panel installations decrease every 3 months since November 2012;

• The period of guaranteed feed-in tariff support is 20 years at maximum;

• Renewable energy installations supported by the quota system are not eligible for feed-in tariff.

3.3 The Renewables Obligation

The Renewables Obligation, or quota system, is similar to that of Norway. The difference is that, in Scotland, the idea is to oblige electricity suppliers to produce and sell renewable energy, whereas in Norway electricity end users were targeted. In Scotland, within the quota system, an electricity supplier needs to buy Renewables Obligation Certificates to present them to Ofgem. The difference between the Scottish quota system and the feed-in tariff is the capacity of renewable energy. In the Renewables Obligation, preference is given to higher generation capacities, those more than 5 MW. However, also 50 kW to 5 MW capacities can be supported. An energy producer, whose production capacity is between 50 kW and 5 MW, can choose between the feed-in tariff or quota system. (Tallat-Kelpšaitė, 2013) The scheme of the quota system in Scotland is represented in Figure 6.



Figure 6. The scheme of the quota system in Scotland.

According to the quota scheme, electricity suppliers should verify that they met their obliged proportion of renewable energy supply by presenting Renewables Obligation Certificates, or Green Certificates. A Green Certificate is awarded for every MWh of electricity generated by the energy producer and respectively received by the electricity supplier. The names of the green certificates are different in Scotland and Northern Ireland, but the general scheme is the same. To get the Green Certificate, the electricity supplier needs to buy it from the competent authority, Ofgem. The purchase should be done within a certain period during the obligation year: from April of the previous calendar year to March of the next calendar year. All the obligation payments for the Green Certificates are collected into a special fund. When all electricity suppliers have made the payments, the financial support is distributed among the electricity suppliers. If the electricity supplier did not buy obligated proportion of the Green Certificates by September, apart from the price of the Green Certificate, there is special penalty of 5% interest per day of the price of the Green Certificate that should be covered by the end of October. In case of shortfall (e.g. due to failure of one electricity supplier to meet an obligation) in the fund, electricity suppliers need to make additional payments. The sources of funding are electricity end users through payments of energy bills. (Tallat-Kelpšaitė, 2013)

Under the quota system, support can be provided to onshore and offshore wind energy, solar photovoltaic energy, geothermal energy, anaerobic digestion, hydropower and bioenergy based on solid biofuels. (Tallat-Kelpšaitė, 2013) The quota obligation for electricity suppliers in Scotland and Northern Ireland is presented in Table 4.

Table 4. Quota system in Scotland and Northern Ireland (based on Tallat-Kelpšaitė, 2013).

Obligation period	Quota obligation coefficient (proportion of renewable energy)		
	Scotland	Northern Ireland	
April, 2009 – March, 2010	0,097	0,035	
April, 2010 – March, 2011	0,104	0,040	
April, 2011 – March, 2012	0,114	0,050	
April, 2012 – March, 2013	0,158	0,081	
April, 2013 – March, 2014	0,206	0,097	

The conditions of funding are as follows (Tallat-Kelpšaitė, 2013):

• The installations completed before 1990 without further renovation, offshore wind mills older than 20 years and large-scale hydropower plants (>20 MW) launched before 2002 are not eligible for the quota system;

• The renewable energy installations supported by the feed-in tariff are ineligible for the quota system;

• The period of the financial support under the quota scheme is 20 years;

• Applications delivered after 2017 are not considered.

3.4 Tax regulation mechanisms

There are two types of the tax regulation mechanisms (Tallat-Kelpšaitė, 2013):

a) Climate Change Levy. This is a tax created for greenhouse gas reduction and climate change mitigation. It is applied energy, which has been generated from sources of energy considered as nonrenewable. It applies to both industrial and commercial electricity end users as well as households. Coal, gas, liquefied petroleum gas are referred as the traditional, non-renewable energy sources. The Climate Change Levy (CCL) is charged from electricity suppliers. The renewable electricity suppliers are supported in this case by being excluded from the Climate Change Levy obligation. The electricity end users as electricity suppliers include the CCL costs in the energy bills, which means that the end users pay for it in the end. To prove that an energy producer generates renewable energy, they have to hold a special license. The competent authority, Her Majesty's (HM) Revenue and Customs, is responsible for issuing the licenses. To receive the license, the electricity supplier should enter into an agreement with the electricity end user, which states that a certain portion of energy originates from renewable sources. The other way to achieve this is through a Levy Exemption Certificate (LEC) which means that the electricity supplier provides the electricity end users with renewable energy. The amount of renewable energy provided is related to one LEC. LECs are issued on a monthly basis by an appropriate regulatory authority. In case an electricity supplier owns a LEC, it gives the supplier the right to receive the license. Once the electricity supplier has either of the options, HM Revenue and Customs can issue the license to free an electricity producer from the Climate Change Levy. In 2013 the CCL was 0,00633 euro per kWh.

b) Carbon Price Floor. This is a tax with a main objective to increase the use of renewable energy sources in electricity production. Non-renewable energy producers are charged the Carbon Price Floor (CPF) tax. Approximate rates (converted from pound sterling to euro) are shown in Table 5. Main renewable energy technologies supported by the tax mechanisms, which free them from the described taxes, are solar energy, geothermal energy, bioenergy based on solid biofuels, wind energy, hydropower and anaerobic digestion. The competent authority is HM Revenue and Customs.

Table 5. Carbon Price Floor (CPF) tax mechanism in Scotland.

Non-renewable source	CPF rates, euro per kWh
Gas from gas utility	0,00404
Hydrocarbon gas	0,06415
Coal	1,9649



3.5 Crowdfunding

The concept of crowdfunding is usually referred to internet based platforms, where different parties (e.g. individuals, organizations, institutions, companies, public authorities) can support a project of a company or individual, who is seeking extra funding. With the help of this funding, the planned project can be completed and the parties, who have invested in it, can benefit from its realization. Crowdfunding has been used in funding of software development, cultural projects, etc., and has been implemented quite recently also in renewable energy projects. In the UK for instance, crowdfunding is still in its beginning phase and is rapidly increasing its popularity. One of these was the installation of hydropower generator in the Osney Lock Hydro project, which gathered via crowdfunding about 665 000 euro for installation of a hydropower generator. Another example is in the Gen Community project, which raised approximately 555 000 euro for implementation of solar panels in Newport. The largest amount of financial support gathered for a renewable energy projects was in the Abundance Generation project, around 7 308 000 euro. (NFI, 2013; ANRG, 2014)



4 Northern Ireland

In Northern Ireland, the following financial support mechanisms can be used in the implementation of renewable energy technologies (Tallat-Kelpšaitė, 2013):

- Loan;
- Quota system (Renewable obligation); and
- Tax regulation mechanisms;
- Other economic mechanisms such as crowdfunding

The tax regulation and crowdfunding system have already been described for Scotland. This section discusses only the loan and the quota system.

The loan support in Northern Ireland is represented by the free loan scheme. The principle is similar to that of Scottish. However, there are some small differences. The loans in Northern Ireland are available for any business, which intends to invest in energy efficient, low carbon and environment friendly technologies. The free loan scheme is available to projects that include such technological solutions as air conditioning, heating control, recovery of heat, building insulation, energyefficient lighting and renewable energy, for example solar energy. The only exemption to the free loan scheme are the public organizations, which are not eligible for this scheme. The size of the loan, which the organizations can apply for, depends on the amount of carbon dioxide savings achieved through the implementated investment. For every annual 1 500 kg of carbon dioxide saving an interest free loan for 1 200 euros can be granted. Invest Northern Ireland, which is in charge of these loans, can grant loans from around 3 700 to 491 500 euros and invest in renewable energy investments. The

loan scheme is used in the whole Northern Ireland, and for example in 2012 Invest Northern Ireland granted interest free loans for over 6 145 500 euros. As a rule, the loans should be paid back within 4 years after receiving the loan. (Carbon Trust, 2014a; Carbon Trust, 2014b)

The quota system under the Renewables Obligation in Northern Ireland is similar to the quota system in Scotland. The general scheme is illustrated in Figure 7.



Figure 7. General scheme of quota system in Northern Ireland. The key players of the system are authority, energy producers, traders and brokers, electricity suppliers and electricity end users. The main flows in the scheme are energy flow (the red arrows) towards the electricity end users, certificate flow (the green arrows) towards the electricity suppliers and money flow (the yellow arrows) with special role towards the energy producers.

The key players are, as listed (DETI, 2013):

The Gas and Electricity Markets Authority (Ofgem) in collaboration with the Northern Ireland Authority for Utility Regulator, as an authority;

- Renewable energy producer;
- Traders and brokers;
- Electricity supplier; and
- Electricity end users.

According to the Renewables Obligation, the electricity supplier must provide the end users with a certain amount of electricity (i.e. quota) from renewable energy sources. Suppliers have to verify this to the authorities by purchasing Green Certificates. The Green Certificates are also known as Northern Ireland Renewables Obligation Certificates (NIROC). The NIROCs can be bought either directly from the energy producer or from the traders and brokers. As in Scotland and Norway, every megawatt of power, which has been produced from renewables, is worth one certificate. The organization responsible for issuing these Green Certificates is the authority (Ofgem). The NIROCs are provided to the energy producer on free of charge basis. The renewable energy producer shall apply for accreditation from Ofgem; once this has been done, then financial support can be granted to the applicant. The certificates make the renewable energy investments more viable by closing the gap between higher energy production prices of renewable energy technologies and the lower prices of energy in the markets. The financial support comes directly from the electricity supplier. The source of funding of the quota system originates from electricity end users through payments for energy bills. (DETI, 2013)

If the electricity supplier cannot present the authority with sufficient Green Certificates to meet the Renewables Obligation, then the so-called "buy-out" fee is used in Northern Ireland. The electricity supplier can pay "buy-out" fee, which is a direct alternative to the Green Certificate. If the electricity supplier, for instance, does not have access to the renewable energy producer, they can comply with the Renewables Obligation by paying the charge. It also works as a combination of the two. The electricity supplier can purchase the NIROCs and pay the "buy-out" fee. When the obligation period is over and all the obligations (NIROCs or "buyout" fees) have been met, the "buy-out" fees are redistributed among the electricity suppliers. The redistribution is done according to the proportion of the NIROCs that the electricity suppliers have at the end of the obligation period. For instance, those suppliers, who have the highest amount of NIROCs, get the highest financial support in the form of the redistributed finances. Currently, Northern Ireland does not meet the Renewable Obligation set for it, which has led to the use of "buy-out" fees, which are consequently redistributed among the electricity suppliers. Due to this fact, NIROCs have a certain value on the energy market. The latter condition plays a motivating role for renewable energy developers to make appropriate investments. (DETI, 2013)

The quota system provides support for the following renewable energy technologies: wind energy, solar photovoltaic energy, anaerobic digestion, hydropower and bioenergy based on solid biofuels. (DETI, 2013)

There are some limitations, which restrict quota scheme. These are the following ones (DETI, 2013):

• The Green Certificates are valid only for one Obligation Period;

• The applications energy producers should apply for it by the end of 2017;

• The maximum period of the financial support is 20 years or until 2037.

5 Ireland

Water companies as renewable energy producers can be supported by the Irish government through two financial support mechanisms, which are (Maroulis, 2013):

- Renewable Energy Feed-in Tariffs (REFITs); and
- Tax relief scheme.

REFITs are available for renewable energy producers (REPs). Renewable energy can originate from such technologies as wind energy, anaerobic digestion, hydropower and bioenergy based on solid biofuels. However, a partnership with an electricity supplier (ES) is required. This REP-ES union is called a Power Purchase Agreement (PPA). Only when the PPA document is presented can the renewable energy producer start the application process for financial support. The renewable energy producer does not receive the financial support directly; it is the electricity supplier who does. The renewable energy producer generates and sells energy to the electricity supplier, who sells it to electricity end users and receives the REFIT as financial support. This general scheme is represented in Figure 8 (DCENR, 2012; Maroulis, 2013).

Three types of REFITs are currently used in Ireland, which support various renewable sources, as illustrated in Figure 9. They are REFIT 1, REFIT 2 and REFIT 3. The period of application for the REFIT 1 ended in 2009, whereas the REFIT 2 and the REFIT 3 opened up for applications in 2012 and should be closed in 2015. The financial support for Irish renewable energy implementation should last until 2027 for the REFIT 1 and until 2030 for the RE-FIT 2 along with the REFIT 3. (DCENR, 2012; Maroulis, 2013)



Figure 8. General scheme of Renewable E.nergy Feedin Tariff (REFIT) support in Ireland.

Wind energy, biomass, hydropower
Renewable Energy Feed-in Tariff 2 (2012-2015)
 Large and small scale onshore wind energy, small scale hydropower (≤5 MWh), landfill gas
Renewable Energy Feed-in Tariff 3 (2012-2015)
Biomass: combined heat and power, combustion Anaerobic digestion

Figure 9. The types of Renewable Energy Feed-in Tariff (REFIT) financial support in Ireland. The respective renewable energy technologies are mentioned below each REFIT scheme. The application periods are given in brackets (based on Maroulis, 2013).

The general scheme for all the REFITs is the same. Every REFIT will provide PPA-holders with guaranteed support, which can be calculated in two ways. The first one is based on the the reference prices represented in Table 6. (Maroulis, 2013; Devitt, et al. 2011) Table 6. Financial support in Ireland within Renewable Energy Feed-in Tariff (REFIT) scheme. The support varies depending on REFIT and related renewable energy solutions (based on Maroulis, 2013).

Renewable energy source	Reference price, euro cent per kWh	Renewable energy feed-in tariff (REFIT)
Large-scale wind energy (>5 MW)	6.9	
Small-scale wind energy (\leq 5 MW)	7.1	DELLT 2
Landfill gas	8.5	REFILZ
Hydropower (≤5 MW)	8.8	
Biomass combustion (other)	8.9	
Biomass combustion (crops)	9.9	
Anaerobic digestion (non-CHP) (>500 kW)	10.4	
Anaerobic digestion (non-CHP) (≤500 kW)	11.5	
Combined heat and power (biomass) (>1,5 MW)	12.5	KEFII 3
Anaerobic digestion (CHP) (>500 kW)	13.6	
Combined heat and power (biomass) (\leq 1,5 MW)	14.6	
Anaerobic digestion (CHP) (\leq 500 kW)	15.6	

The electricity supplier will be paid 15 percent of the reference price of the appropriate technology. If the producer of the energy is a small scale wind energy plant, then the support is 15 percent of the reference price of 7,1 euro cent per every kWh per every kWh (1,065 euro cent). If the market price is lower than the reference price, then the difference between the market price and reference price will be paid. The REFIT is funded and paid ultimately by the electricity end users, who are obliged to pay the costs within the Public Service Obligation (PSO) and appropriate Irish regulation. (Maroulis, 2013; Devitt, et al. 2011)

The renewable energy producers has to complete an application process in order to get benefits from the REFIT scheme. The application is sent to the the Irish Department of Communications, Energy and Natural Resources together with documents regarding planning permission for the energy production installation; a document about date of construction; and connection offer to the grid from an operator. If the planned investment is combined heat and power (CHP) plant, then the application should be accompanied with appropriate documents which can verify that all high efficiency standards (Directive 2004/08/EC) are met. Additionally, there should be also a certificate from the Commission for Energy Regulation (CER). When the process is completed and the application has been accepted, the renewable energy producer receives

a so-called letter of offer. After that the renewable energy producer should enter in Power Purchase Agreement with a licensed electricity supplier. (DCENR, 2012; Maroulis, 2013)

Competent authorities in the application process are the CER and the Department of Communications, Energy and Natural Resources (DCENR). The CER produces certificates and does the calculations related to the REFIT financial support. In addition, the CER is in charge of Public Service

Obligation and payments to the electricity suppliers. The DCENR is responsible for REFIT administration and processing of REFIT applications. (DCENR, 2012; Maroulis, 2013)

The renewable energy feed-in tariff scheme has several limitations, which restrict its use. They are as follows (DCENR, 2012; Maroulis, 2013):

• The renewable energy feed-in tariff is limited and dependent on the duration and terms of Power Purchase Agreement: e.g. price and electricity amount to be bought;

• 15 years is the maximum period for the Power Purchase Agreement between a renewable energy producer and a licensed electricity supplier;

• Duration of the REFITs: REFIT 1 support is due until 2027, REFIT 2 and REFIT 3 – until 2030.

The tax relief scheme has been used as a financial support for renewable energy implementation also in Ireland since 1999. There are several renewable energy sources that can be supported under the tax relief scheme: e.g. solar energy, hydropower, ocean, tidal and wave energy, wind energy, and bioenergy. The responsible authority for the tax relief application process is the Irish Revenue Commissioners. A company, which is going to implement a renewable energy production investment on behalf of the energy producer, can apply for the tax relief. Thus, there are two key players: the investment company and the renewable energy producer. The renewable energy produc er must get approval from the DCENR for the renewable energy production technology and obtain an appropriate certificate. Then the renewable energy producer must be certified by the Revenue Commissioners to meet all the legislative requirements. Afterwards, the two players, must enter into an agreement about the terms of investment. In the end, the investment company applies for the tax relief to the Irish Revenue Commissioners that makes the final decision. The tax relief support cannot be more than 50% of the investment cost of the renewable energy project, or 9 525 000 euros. The funding is paid from the state budget. (Revenue, 2014; Maroulis, 2013)



6 Summary

Renewable energy technologies are becoming more and more popular in northern and sparsely populated areas of Europe. Wind power, hydropower, bioenergy produced through anaerobic digestion and solar energy are all commonly used technologies in the discussed countries. However, depending on local geographical conditions and policies, there is often preference toward certain technological solutions. For instance, geothermal energy utilization is rather common in Finland, Norway, Scotland and Northern Ireland, wave energy is considered in Norway and heat recovery is practiced in Finland.

What is common for almost all the renewable energy technologies in all of the discussed countries, is that all of them need some sort of support in order to enter the energy markets in earnest. Some of these mechanisms are used in several countries, e.g. feed-in tariff in Finland, Scotland, Ireland. However, there are differences and special features to be found in each of the countries in relation to economic support mechanisms. The number of economic mechanisms for renewable energy support is highest in Scotland and in Northern Ireland: five and four respectively, while in Norway the number is lowest: one. This can be explained by the high share of renewable energy production in the country: 46% of total primary energy supply (IEA, 2011).



Table 7. Renewable energy potential in Finland, Norway, Scotland, Northern Ireland, Ireland, and available economic support mechanisms.

Country	Renewable energy potential	Economic support mechanisms	
	Wind energy	Energy aid (Subsidy)	
	Biomass energy jointly with anaerobic digestion	➢ Feed-in tariff	
Finland	Solar energy		
Finiand	Geothermal energy		
	Hydropower (small-scale)		
	Heat recovery from wastewater		
	Hydropower	 Electricity certificates (Quota obligation) 	
	> Wave energy		
Norway	Wind energy		
Norway	Solar energy		
	Geothermal energy		
	Biomass energy jointly with anaerobic digestion		
	Wind energy	▶ Loan	
	Solar energy	➢ Feed-in tariff	
Scotland	> Hydropower	 Quota system (Renewables obligation) 	
	Biomass energy jointly with anaerobic digestion	Tax regulation mechanisms	
	Geothermal energy	 Other economic mechanisms (e.g. crowdfunding) 	
	Wind energy	▶ Loan	
	Solar energy	 Quota system (Renewables obligation) 	
Northern Ireland	Hydropower	Tax regulation mechanisms	
	Biomass energy jointly with anaerobic digestion	 Other economic mechanisms (e.g. crowdfunding) 	
	Geothermal energy		
	Wind energy	Renewable energy feed-in tariffs	
Iroland	Hydropower	Tax relief scheme	
ireidilu	Biomass energy jointly with anaerobic digestion		
	Solar energy		

Sources: Brückmann, 2013; Pobłocka, 2013; NVE, 2012 Tallat-Kelpšaitė, 2013 Maroulis, 2013



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WARES (Water Asset Renewable Energy Solutions) is a 2-year Northern Periphery Programme strategic project which explores the opportunities to generate renewable energy at water utility assets. The focus is on sites with previously unused, hidden potential. The outcomes of the project will be used to propose a scheme of policy refinements for each region. The project is implemented during 2012-2014.

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