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SERVE

Sustainable Energy in the Rural Village Environment

Work Package 6: Socio-Economic Analysis and Research

Overview of ESCOs in Ireland

Final Report

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Summary

This report includes an overview of energy supply and energy service companies (ESCOs) in Ireland and the UK, while relevant information is also provided for Austria, Finland and Croatia. The review focuses on schemes with a renewable energy element, primarily wood fuel. Examples from Austria and Finland have been included to illustrate the biomass heat enterpreneurship model and solar thermal ESCOs, which is of special interest for the SERVE region.

For the purposes of this report an ESCO is defined as a company which guarantees energy savings and/or the provision of the same level of energy service at a lower cost through the implementation of an energy efficiency or renewable energy sources. This is consistent with the approach termed Sustainable Energy Service, which combines both types of services and focuses on energy supply but may also include demand side measures.

Overviews of the status and potential development of the Irish ESCO market have already been performed by different institutions. In 2005, 11 companies were identified that could be classified as energy service providers. Of these, two multinational companies were found to offer guarantee on their services in the form of energy performance contracting. In order to obtain more up to date information, from March to April 2009 a review of companies offering energy services and dealing with renewable energy sources was undertaken specifically for the purpose of this report. Several new small and medium companies offering energy services mainly in the form of heat providing were identified. However, a general conclusion regarding the status of development of the Irish energy market is that there is still a lack of existence of ESCO models in Ireland.

The main part of the report is presented in Chapter 4 and is focused on the overview of existing ESCO schemes in Ireland, UK, Austria, Finland and Croatia. The information includes the overview of energy services offered by various companies as well as specific projects and schemes which were implemented, focused mainly on biomass energy and solar thermal. Data were obtained through direct communication and from a variety of written information available on the web. Several organizations provide case studies and published information, while direct contact was made with operators of some of the schemes. Based on the the review and analysis of obtained information, drivers/success factors and difficulties/failure factors were identified and are presented in the next chapter.

The two final chapters provide conclusions and recommendations for the establishment of ESCOs within the SERVE region.

1 Introduction

1.1 Background

The SERVE project is funded under the EU CONCERTO Programme and aims to develop a sustainable region in North Tipperary, Ireland, through the implementation of actions in the field of sustainable energy. Actions include energy upgrades for existing dwellings, installation of renewable energy heating systems and the development of an Eco-village in Cloghjordan.

The activities within the SERVE project also include the development of a biomass district heating system for the Eco-village and the establishing of an ESCO which would operate and run the system. The completion of this activity is planned by the end of 2009.

In addition to the technical and environmental benefits which will be brought about by the SERVE project, the objectives also include the assessment of the impact of the project on the SERVE region and its citizens from a socio-economic viewpoint. The work in this area is organised through a separate Work Package, namely WP6: Socio-Economic Analysis and Research, with the following tasks:

- Provide a detailed analysis of the impact on job creation and service supply;
- Provide a coherent overview and prepare (scenario based) forecasts for replication both within North Tipperary and beyond;
- Identify opportunities for the development of ESCOs within Ireland, based on the experience gathered through the establishment of the ESCO in the Eco-village;
- Perform an analysis of local funding and money flows from proposed action;
- Perform an evaluation of the different externalities of the above-mentioned chains compared to key alternatives for the different timeframes envisaged; applicable to regional conditions in the SERVE project;
- Perform an analysis of payback time for proposed SERVE project measures in buildings sector as well as other cost-benefit and SWOT analysis as appropriate;
- Study the effects on health, involvement of citizens, attitudes of building owners and consumers, acceptance and effects of job growth for concrete cases included in this project.

As part of the activities implemented within the framework of WP6, in December 2008 during the third SERVE project meeting a Socio-economic stakeholder workshop was organised with the following objectives:

- To introduce aims and activities of Work Package 6 – Socio-economic analysis to all stakeholders in the region;
- To present and discuss/review overall methodology to be applied during the whole project;
- To initiate discussion and present draft milestones and deliverables after the first 18 months of the project;
- To ensure that the work undertaken is appropriate and backed up by local knowledge and information.

One of the conclusions of the workshop was that the planned modelling of the opportunities for Energy Supply Companies (ESCOs) and Community Energy Supply Companies (CESCOs) within WP6 will be of significant benefit to Sustainable Project Ireland Ltd. In this context it was proposed and accepted that this work would be done earlier than has been originally planned (which was for month 36 of the project – November 2010), which resulted in the preparation of this report.

1.2 Objectives

The general objective of this report is related to the WP6 tasks metioned in the Introduction, specifically the identification of opportunities for the development of ESCOs within the SERVE region and beyond.

The specific objective of this report is to present an overview of the current situation in Ireland regarding energy service companies (ESCOs) with the following tasks:

- overview of the existing Irish energy/ESCO market, including a list of identified companies providing energy services;
- overview of identified ESCO schemes (case studies) in Ireland, as well as in other selected countries;
- perform an analysis of drivers/success factors and difficulties/failure factors;
- draw conclusions and make recommendations regarding the establishment of ESCOs within the SERVE region and beyond.

1.3 Methodology

Two main sources of information were used for the preparation of this report:

- **already published reports on ESCOs in Ireland.** Several comprehensive overviews of the status and potential development of the Irish ESCO market have already been performed by various organisations, providing extensive information about the subject. However, the latest available data are relevant to 2005, hence there was a need to obtain more up to date information;
- **survey of energy service companies and review of energy services throughout Ireland, Austria, Finland, Croatia and the UK.** Data were obtained through direct communication as well as from a variety of written information available on the web. Several organizations provide case studies, while in some cases direct contact was also made with operators of several of these schemes. The review focused on schemes with a renewable energy element, almost invariably wood fuel. Examples from Austria and Finland have been included to illustrate the biomass heat enterpreneurship model and solar thermal ESCOs, which is of special interest for the SERVE region.

After analysing the obtained information, it was possible to identify success and failure factors regarding the starting up and operation of ESCOs and finally to make relevant conclusions and recommendations.

2 Issues and definition

The terms energy services and ESCO are synonymous with energy saving. Specifically, an Energy Service Company (ESCO) is a firm that offers to reduce its client's energy bill, with the cost saving being split with the client. ESCOs in the full sense of the term offer finance for their projects or assist in financing a project by guaranteeing saving will accept the risk of the project and are remunerated in proportion to the savings achieved

This is illustrated by relevant publications dealing with the development of ESCOs across Europe (see for example European Commission, JRC 2007) as well as the EU Energy End-Use Efficiency and Energy Services Directive (European Commission 2006). Specifically, the Directive provides the following definitions:

- *Energy service company* (ESCO): a natural or legal person that delivers energy services and/or other energy efficiency improvement measures in a user's facility or premises, and accepts some degree of financial risk in so doing. The payment for the services delivered is based (either wholly or in part) on the achievement of energy efficiency improvements and on the meeting of the other agreed performance criteria;

- *Energy performance contracting*: a contractual arrangement between the beneficiary and the provider (normally an ESCO) of an energy efficiency improvement measure, where investments in that measure are paid for in relation to a contractually agreed level of energy efficiency improvement;

- *Third-party financing*: a contractual arrangement involving a third party — in addition to the energy supplier and the beneficiary of the energy efficiency improvement measure — that provides the capital for that measure and charges the beneficiary a fee equivalent to a part of the energy savings achieved as a result of the energy efficiency improvement measure. That third party may or may not be an ESCO;

Also, work undertaken by the IEA's demand side management programme (Singer and Lockhart 2002; Westling 2003) considers:

an ESCO to engage in the development, installation, and financing of comprehensive, performance-based energy efficiency measures. Cost savings achieved by the installed energy efficiency measures are used to pay for the project. The energy cost savings achieved by the project are typically guaranteed and there is a performance contract between the ESCO and client. The ESCO's compensation is tied to the amount of energy saved and to the guarantee underlying the project.

On the other hand, in contrast to ESCOs, Energy Service Provider Companies (ESPCs) are natural or legal persons that provide a service for a fixed fee or as added value to the supply of equipment or energy. Often the full cost of energy services is recovered in the fee, and the ESPC does not assume any (technical or financial) risk in case of underperformance. ESPCs are paid a fee for their advice/service rather than being paid based on the results of their recommendations.

However, a new approach termed Sustainable Energy Service is emerging in practice which combines both types of services and focuses on energy supply and may also include demand side measures. Supply-side ESCOs are being implemented in some European countries. Several biomass boiler installers offer contracts whereby clients pay for heat supplied and installers own the plant (in part or whole) and are responsible for operating the plant. Similar approaches are being demonstrated with solar thermal installations. Related to this, there is an emerging concept for medium-scale energy services that combine renewable

energy technologies, conventional energy supply and energy efficiency. Such energy services are likely to include a wood energy component.

A working definition of sustainable energy services is provided below:

Under an energy services contract, a client is provided turn-key energy solutions that deliver locally produced energy - heat, cooling and electricity - together with improvements in the efficiency of energy end use. The inclusion of renewable energy technologies and energy efficiency measures enables carbon emission reductions to be delivered. The provider is a single energy services company (ESCO) that may be formed from a consortium of organizations which, together, provide the range of expertise and experience required. In this way the ESCO is able to offer a comprehensive and seamless package.

Clients may be public sector, including local authorities and housing associations, or private companies, such as property developers or business park owners. The ESCO may be wholly owned by an enterprise or may be a joint venture with public or private sector partners.

The extent of the services varies according to specific client needs. A full package may include:

- Initial consultations & pre-feasibility assessment.
- Feasibility study including audit to analyse current energy conditions & identify improvements.
- Complete engineering design of energy supply & energy efficiency measures.
- Provision of working capital to realize the project.
- Arrangement of capital finance, in part or whole.
- Procurement of equipment & services.
- Plant installation & construction management.
- Project systems & equipment commissioning.
- Training of local personnel.
- Ongoing remote monitoring & control of equipment.
- Ongoing routine maintenance, inspection & servicing.
- Call-out & breakdown repair.
- Measurement & verification of energy savings.
- Utility rate negotiation & purchase, biomass fuel supply if required.
- Operation of energy billing systems for energy users.

The service is paid for over the duration of the contract which may be 5 to 25 years. Payment to the ESCO can include:

- Charges for services provided prior to an unconditional development agreement.
- Energy supplied (heat, cooling and electricity) based on pre-agreed tariffs.
- A charge for capital where the assets are not fully owned by the client.
- A proportion of the value of the energy savings, according to a formula vis-à-vis baseline energy demand before ESCO intervention. The rest of the energy savings accrue to the client.

3 Irish energy/ESCO market overview

Several overviews of the status and potential development of the Irish ESCO market have already been performed by various organisations.

A comprehensive review of energy service companies throughout Ireland has been undertaken by the Economic and Social Research Institute from Dublin and reported in form of a study (Scott 2004). The study contains results for the year 2000 and has been performed within the framework of the investigations undertaken for the European Commission's BARRIERS project, which investigated barriers to energy efficiency. The main finding on ESCOs was that there were very few companies in Ireland that offer ESCO-type services.

Sustainable Energy Ireland commissioned a report aimed at assessing the potential for ESCOs in Ireland (ENVIROS 2005). The main goals of the report include performing a review of Irish/EU regulations regarding energy and energy efficiency that may have an impact on energy prices and the ESCO market, assessment of European ESCO's and ESCO Associations, assessment of the Irish energy services market to determine existing status and future potential and the analysis and presentation of options for future policy initiatives.

Regarding the type of companies analysed, both reports use the EU definition of ESCOs centred on guarantees of energy savings and reward based directly on the energy savings achieved. Based on this requirement, ESCO type organizations operating in Ireland have been grouped in three categories (Scott 2004):

1. Companies that offer contract energy management
2. Companies that engaged in the supply of combined heat and power (CHP)
3. Companies that manage their clients' facilities (facilities management)

In 2005, 11 companies were identified that could be classified as energy service providers (ESPCs). Of these, two multinational companies were found to offer guarantee on their services in the form of energy performance contracting, namely Dalkia Ireland and RWE Solutions (ENVIROS 2005).

In order to obtain more up to date information, from March to April 2009 a review of companies offering energy services and dealing with renewable energy sources was undertaken specifically for the purpose of this report. The source of gathered data was mostly information available on the Internet, however direct communication through e-mail and telephone was also used in some cases. Several new small and medium companies offering energy services mainly in the form of heat providing were identified. The list of companies, their short description and activities provided, including those identified in the previous overviews, is provided in Table 3.1. The presented list is not exhaustive.

A general conclusion regarding the status of development of the Irish energy market is that there is still a lack of existence of ESCO models in Ireland. There is a considerable number of small companies which are doing their business through supply and installation of equipment, which is facilitated by several grant programmes implemented by SEI. These companies are in the position to potentially start doing business through energy supply contracts. This would typically include long-term energy supply under which the client enters into a long term contract to buy metered energy at a preagreed price.

The most typical motivation for potential clients is to outsource energy management to a specialized company, with or without the actual ESCO service and concept. The most

prevalent contract model in Ireland is the Build-Own-Operate-Transfer (BOOT) model. [1] On the other hand, Irish ESPC companies do not often use energy performance contracting models, but prefer to work for a fixed service fee, and thus face little risk.

Table 3.1. List of identified ESCOs in Ireland

Company name	Description	Energy services provided
International companies		
Dalkia Ireland	Dalkia is the inventor and leading European provider of energy services. It is an energy services company based in France with two shareholders. Primary energy usage will be paid for by Dalkia. The client will be subsequently invoiced for the use of utilities during a predefined period - typically one month. In this way the client need only concern themselves with utility consumption as Dalkia take ownership and accountability for keeping all equipment in a functioning state.	Provision of financing packages such that repayments can be made over the life of the project - providing potential savings from day one. Full turnkey package and managing of the entire installation from Design and Build, through to Operation and Maintenance of the asset. Dalkia Alternative Energy (DAE) currently operates and maintains 24.6MW of electrical generation through combined heat and power (CHP) units within Ireland alone, but there are also some government's Combined Heat and Power (CHP) grant aid support programme
RWE Solutions	RWE Solutions plans, builds and manages energy infrastructure for utilities (power, gas, water, steam, heat and cooling) and is one of Europe's leading service providers. RWE does not have a base in Ireland, however Diageo (manufacturer of leading drinks brands such as Guinness, Beamish, Harp, Smirnoff and Baileys) has entered into a long term multi-utility alliance with RWE solutions, at its breweries in London, Dublin and Dundalk.	RWE employs a total cost of ownership concept by optimising the total costs of a clients' infrastructure. Services are delivered in three areas: • Energy Generation • Energy and grid infrastructure • Energy Supply
Irish companies, large		
ESB Independent Energy	ESB Independent Energy (ESBIE) was established in January 2000 to compete in the liberalised electricity markets and build long-term relationships with customers. ESBIE has contracts in place with	ESBIE offers green energy sales, energy management, energy auditing and CHP services to clients. Under its CHP service offering they offer the potential to enter into commercial arrangements for the

[1] The BOOT model may involve an ESCO designing, building, financing, owning and operating the equipment for a defined period of time and then transferring this ownership across to the client. This model resembles a special purpose enterprise created for a particular project. Clients enter into long term supply contracts with the BOOT operator and are charged accordingly for the service delivered, the service charge includes capital and operating cost recovery and project profit.

	over 800MW of generation in the Republic of Ireland and Northern Ireland enabling them to deliver competitive prices to enhance the performance of business.	design and installation of equipment to shared-savings schemes and facilities management.
Energia	Energia is Ireland's largest independent energy supply has now 35 000 customers in Ireland. The range of products suits all from the smaller SME to the industrial giants.	Energy efficiency service to business and industrial consumers, which includes energy auditing and financing options for capital projects. Energia provides cost savings through the sale of energy, however the company does not enter into energy performance contracting. Energia can provide a range of energy audits for customers in the area of energy efficiency.
Irish companies, small and medium		
Fingleton White & Co. Ltd.	Fingleton White & Co. Ltd. was formed in 1981 and since then has been involved in many significant projects in the energy sector, in particular power generation. It is the leading company of Engineers and Project Managers in the energy sector in Ireland and holds a number of patented designs. Fingleton White & Co. Ltd. has been pioneering the independent energy sector in Ireland and has been generating and selling electricity since 1981. The company has developed a number of Build, Own and Operate facilities which are operated through separate associate companies.	The services provided include the following: • Consulting engineering • Energy supply • Feasibility studies • Project management • Engineer, Procure Construct projects • Build, Own, Operate and Maintain Facilities
Edina	Since establishing the business in 1985 Edina has grown and developed into one of the leading power generation specialists in Ireland. Edina employs over 94 personnel in 5 key locations providing national coverage of the UK and Ireland for the full spectrum of services demanded by the power supply industry.	The services are based on providing cost-effective solutions via innovative financial options and practical energy designs. This includes conducting research to identify savings before implementing a solution, and offering after sales maintenance. Energy performance contracting is not currently offered.

Clearpower	Clearpower is a wood energy and organic waste management company. The company offers wood energy supply, wood fuel sales and waste management. They are making design, build, operate and maintain installation.	Services include delivering and operating turnkey energy supply solutions for clients at zero upfront capital cost. Specifically, the following is offered: • Design • Building • Operation • Maintenance
Natural Power Supply	NPS is a corporate supplier of high quality wood fuels. The company focuses on bestowing strategies that incorporate reductions in environmental impact delivered at competitive prices.	The following heating solutions are offered: • Homeowners Pellet and Woodchip Boilers • Commercial Pellet and Woodchip Boilers • Feasibility Studies • Grant Applications • Woodchip and Wood pellet fuel supply • Plant and manage willow plantations
Rural Generation Ltd.	Rural Generation specialises in the production of Wood Energy, Organic Waste Recycling and Wood Fired boiler provision, installation and commissioning. The company is committed to the growing of industrial willow plantations for the provision of renewable energy (wood chip). I	A range of services related to the planting and establishing willows, including harvest and process into dry willow chip and recycle organic wastes. Energy provision models for biomass heating provided: • Fuel contract; • Heat contract; • Energy contract.
Energy4You	Energy4You specialises in the engineering design, supply and installation of heating systems that use a renewable energy source. The company has experience in the design and the installation of solar, biomass boilers and geothermal heating.	Services include providing heating systems to both new builds and existing houses, for domestic and industrial applications.
Imperative Energy Ltd	Imperative Energy is a supplier of bioenergy solutions (heat, steam and power) to clients in the commercial, public and industrial sectors.	A full turnkey service is offered covering feasibility, design, fuel supply, equipment supply, finance, installation, operation and maintenance.
CESenergy	CESenergy is a wholly Irish owned company which owns and operates a number of energy centres including the only Tri-generation solution in Ireland at A&L Goodbody at the IFSC, Dublin.	Services include the design, build and management of energy efficient CHP/Tri-generation and district heating and cooling solutions.
REMS	Renewable Energy Management Services - REMS are an award	Services include the supply, installment and operation of RES and

	winning Energy Supply Company, specializing in the provision of energy solutions for buildings and organizations through renewable sources.	RUE technologies without the need for capital investment or the adoption of risk into the future.
KEDCO	Kedco Power are a bio-science renewable energy company operating in the United Kingdom and Ireland which has business interests in the areas of biomass heating and power generation. Kedco develops sustainable energy generation systems which convert biomass and waste to green energy using cutting-edge bio scientific technologies.	Services include the supply and installation of biomass boilers and district heating systems as well as provision of ESCO agreements.

4 Overview of existing ESCO schemes

The information presented in this chapter regarding energy services offered by various companies and specific projects and schemes which were implemented is focused mainly on biomass energy and solar thermal. This selection was made in order to focus the report only on those cases which are of particular interest to the SERVE project.

Data were obtained from a variety of written information, mostly available on the web, while several organizations provide case studies. Several companies and public authorities also provide published information, while as noted direct contact was made with operators of some of the schemes.

The decision was made to include several case studies from the UK and a brief illustration of the *heat entrepreneurship model* commonly used in Finland and the Austrian solar thermal ESCO model, in order to provide a broader overveiw.

4.1 Ireland

Specific projects

Woodchip boiler system at the Department of Agriculture and Food	
Location	Johnstown Castle, Co. Wexford
Outline description of scheme	In 2006 The Department of Agriculture and Food decided to install a woodchip boiler system at their 8,500m2 headquarters in Johnstown Castle, Co. Wexford fuelled on wood biomass produced from local forests. This project would act as a showcase project to encourage implementation of similar scale projects among high energy requirement customers thus helping to develop another use for forest produce and thinnings. The fuel contract was put out to tender as an ESCO type setup and a heat metering system was also installed to allow billing by the ESCO. The delivery of fuel and maintenance of the complete woodchip system is the sole responsibility of the ESCO. The main benefits of a woodchip fuelled heating system for Johnstown are: • Running cost savings – ESCO can provide energy at 3.5 cent/kWh compared to oil at 5 cent/kWh • Use of locally produced forest woodchip stimulating employment in local economy • Woodchip is a sustainable resource whereas oil is a finite resource • Woodchip is a carbon neutral fuel The fuel savings resulting from using woodchip instead of oil will be in excess of €10,000 per annum.
Company name and outline description	Energy4You provides alternative heating solutions, including the engineering design and installation. The company has been involved in a number of large biomass boiler installations with their partner company Igneus. They provide heating systems for both domestic and industrial applications.

Financing	The capital expenditure for the boiler system installation was provided by the Department of Agriculture and Food.
Outline of key success factors	The main focus of this project was not just financial viability but on project feasibility – does woodchip work and the creation of local markets for locally produced wood biomass. The intention was to follow the principle that the public sector needs to lead by example and set the standard for the private sector to follow.

Biomass Heating Installation — Brandon House Hotel	
Location	New Ross, Co Wexford
Outline description of scheme	The Brandon House Hotel management decided to replace the existing oil-fired boiler and in mid 2006 two Austrian KWB 150 kW woodchip boilers were installed. The main objective was to deliver a heating solution that would be cost effective, reliable, had a low carbon footprint with a predictable costs horizon. The hotel signed a 3-year contract with Natural Power Supply to supply wood fuel according to EU and Irish wood fuel quality standards. A delivery frequency of 4 – 7 days was established to ensure a safety reserve of fuel at the hotel. The hotel's energy consumption is recorded from a meter reading on the boiler and the hotel is charged on a metered heat basis, i.e., heat consumed as opposed to fuel consumption.
Company name and outline description	Natural Power Supply is focused on wood energy offering heating solutions, including homeowners pellet and woodchip boilers, commercial pellet and woodchip boilers as well as woodchip and wood pellet fuel supply.
Financing	The capital expenditure for the district heating system was provided by Brandon House Hotel, which received a grant of 30% on capital costs through the SEI BioHeat scheme.
Outline of key success factors	Grant of 30% on capital costs provided by SEI. Very high number of annual peak load hours (over 4000), due to specific application and careful boiler design. Because of savings from cheaper fuel (biomass), this enables the payback time to amount to approximately 2 years. Specifically, total investment in boilers amounted to 106.480 €, costs of oil (at 0,72 €/l, based on previous consumption) amounts to 98.000 €/year, costs of biomass fuel amount to 44.000 €/year. NPS's and partner companies experience with biomass heat production and boiler design.

ESCO biomass district heating in Ballymountain, Waterford.	
Location	Ballymountain, Waterford
Outline description of scheme	The Ballymountain district heating system serves a mixed use development which includes a large country house and the Ballymountain Business Centre, comprising office space for 25 people in four separate office buildings. The client, Seedtechnology Ltd. chose an Energy Service Contract (ESCO) arrangement whereby Natural Power Supply (NPS) at its own cost installs a boiler, fuel handling system and related infrastructure and only invoices the client for the heat delivered to the system. It is the responsibility of NPS to ensure an adequate supply of fuel, to clean and maintain the boiler and to respond to any issues there may be with the running of the boiler. After the biomass heating installation, NPS records energy consumption from a meter reading on the installed plant and charges the client on a metered heat basis. The boiler consumes around 1 ton (between 3 and 4 m3) of wood chip per week. Fuel is delivered from the NPS depot at New Ross by truck once every month or two. The customer does not need to organize fuel deliveries or search for the most competitive fuel quote but simply receives a monthly bill charging for the number of kilowatt-hours consumed for the period. Ash is removed every month and recycled as a fertiliser in the forest.
Company name and outline description	Natural Power Supply is focused on wood energy offering heating solutions, including homeowners pellet and woodchip boilers, commercial pellet and woodchip boilers as well as woodchip and wood pellet fuel supply.
Financing	The capital expenditure for the district heating system was provided fully by Natural Power Supply. The contract regarding heat supply was signed for a period of over 10 years.
Outline of key success factors	One company (NPS) manages the whole district heating system from wood production and supply to the operation and maintenance of the system and heat production and sale. Specifically, NPS plants and manages its own willow plantations and integrates the sale of willow harvest into wood fuel supply. NPS's experience with biomass heat production and works with all relevant professionals in the field (plumbers, mech. and elec. companies).

Services and energy models offered

Imperative Energy – Energy Supply Contract	
Location	New Ross, Co Wexford
Outline description of scheme	Imperative Energy is offering clients in the UK and Ireland the option of an Energy Supply Contract (ESCO) on biomass projects. Under this model, the client enters into a long term contract (e.g. 10 years or more) to buy metered energy from Imperative Energy at a pre-agreed index-linked price. Imperative Energy assumes all responsibility for the design, financing, installation, operation and maintenance (including fuel delivery and ash removal) of the biomass system at the client's site which means that there is no capital cost required on the part of the client who simply pays for the output of the system.
Company name and outline description	Imperative Energy supplies a complete range of leading biomass boiler products, ranging from 30kW to 6MW for typical commercial/public sector clients, and anything up to 25MW and more in the industrial sector for applications covering heat, steam and CHP.
Financing	The ESCO model offered by Imperative Energy is a low risk option that delivers energy cost savings and carbon emission reductions with no capital cost or operational responsibility.
Outline of key success factors	Imperative Energy assumes all responsibility for the design, financing, installation, operation and maintenance (including fuel delivery and ash removal) of the biomass system at the client's site, while the client pays for the output of the system. Suitable applications for the ESCO model are those clients with a relatively constant heat load such as hospitals and nursing homes, process plants (industrial/food/beverages/timber/etc.), district heating for public/commercial buildings, and leisure facilities.

Rural Generation Ltd. – Heat energy ESCO	
Location	Londonderry, Northern Ireland
Outline description of scheme	Rural Generation Ltd has been supplying quality wood chip to clients for over 6 years and recently started offering a number of energy provision services described below: • Fuel contract: 2 years contract with price reviewed after 1 year. Currently 5 contracts in operation. • Heat Contract*:* Typically 5 years contracts. Client incurs the capital expenditures of and owns boiler and kit. Fuel, maintenance service and ash removal provided by Rural Generation. Price per kWh agreed with client and price index linked to a bundle of agreed indices. Cost savings to traditional fossil fuel guaranteed. Guaranteed quality and security of fuel supply. Clients are mainly private sector. • Energy Contract: Typically 10 to 25 years contracts. Capital expenditure for and ownership of boiler and kit by Rural Generation, as well as fuel provision, maintenance and ash removal. Price per kWh agreed with client and price index linked to a bundle of agreed indices. Cost savings to traditional fossil fuel guaranteed. Guaranteed quality & security of fuel supply. Clients

	are mainly public sector.
Company name and outline description	Rural Generation specialises in the production of wood energy, organic waste recycling and wood fired boiler provision, installation and commissioning. The company is committed to the growing of industrial willow plantations for the provision of renewable energy (wood chip), as well as providing customers with a range of integrated organic-waste management and recycling services.
Financing	The company was formed in 1996 to commercialise the wood fuelled gasifier, which had been developed by the Department of Agriculture in Northern Ireland. That development work included a DTI sponsored project to develop a gas turbine running on wood gas. Over the last years the company has diversified into all aspects of willow production (planting, harvesting, chip production) as well as heat energy provision. The Forest Service offers grants through the Woodland Grant Scheme and the Farm Woodland Premium Scheme.
Outline of key success factors	Initial financing partly through projects sponsored by Department of Agriculture in Northern Ireland and DTI. First project included the installation of a cogeneration system (small scale gasifier) at Brook Hall Estate in Londonderry, Northern Ireland. The family property plus rented areas amounts to 1000 acres, considerably more than the 60 acre average. The estate is run by John Gilliland, significantly younger than the 65 year average and a local champion in willow production.

4.2 UK

Linthwaite, West Yorkshire	
Location / Outline description of scheme	The derelict Titanic Mill was refurbished to provide 130 residential apartments on the upper five floors and offices, a restaurant and a spa/leisure facility on the ground floor. In line with the aim of making the development carbon neutral, the developers installed a 100kWe / 140kWth biomass-fired CHP unit and a 50 kW PV system. Gas boilers provide back-up and peak loading.
Company name and outline description	Mill Energy Services offers heat, hot water and potable water (from a borehole under the mill) at competitive prices to the residents and businesses within the mill. Mill Energy Services is a company limited by shares wholly owned by the Titanic Mill Management Company (TMMC). TMMC is owned by the residents and businesses. Each apartment has one share, with the ground floor shares split by area. The owners of the apartments pay for this share as part of the price of their property.
Financing	Some residents sit on the board of TMMC. All the company's activities, such as the service contract for the CHP system and the day-to-day management of the company, are contracted out.
Outline of key success factors	The capital cost of the renewable energy systems was a hurdle. Grant funds were provided by EST but the bulk of the additional capital outlay was met by the developer Lowry Renaissance Ltd. These costs reduced the profit of the project. The developer undertook this investment to gain experience for future developments. Finding a buyer for the small amount of excess electricity generated by the CHP has proven difficult.

Kielder, Northumberland	
Location / Outline description of scheme	A district heating scheme supplying various users. A 300 kW wood-fired boiler with a circa 1km pipe network. Heat customers are: Kielder Castle visitor centre; six new-build houses; workshops; a primary school and a youth hostel.
Company name and outline description	Kielder Community Enterprise Ltd. (KCE) manages the district heating system, the village's filling station, campsite and a local bus service. KCE is a company limited by shares and is the trading company wholly owned by Kielder Ltd., a not-for-profit company and charity. All village residents may become members to Kielder Ltd. Kielder Ltd. was set up as part of the economic regeneration of the village. The board of trustees of the charity is elected by its members (i.e. the residents) at an annual general meeting and this board appoints representatives to the board of KCE.
Financing	Initial finance was provided from a range of sources including national regeneration funding and the EU's Objective 2 fund. Tynedale Council managed the capital work.
Outline of key success factors	Kielder is not on the mains gas network so customers benefit from lower cost energy than oil-fired boiler or electrical heating alternatives. A driver for Kielder Ltd was the circulation of money within the local community including local forest workers involved in wood fuel supply. Kielder Ltd. and KCE had been set up prior to development of the scheme. These took circa one year to establish and included tendering for costly legal advice.

Barnsley, South Yorkshire	
Location / Outline description of scheme	Local authority housing in three tower blocks in Union Street built in 1960s. Heat demand is met by two wood chip-fuelled boilers (320kW and 150kW) with gas back-up and peak load. These replaced coal boilers. Wood fuel demand is circa 530 tonnes per annum and the boilers can use wood with moisture content up to 50%. The system was commissioned in 2005. Wood fuel includes chips from the Council's arboriculture operations.
Company name and outline description	Econergy Ltd. has a long-term energy services contract with Barnsley Metropolitan Borough Council.
Financing	Biomass boilers and heating system capital investment was £130,000. The project received grant-aid £35,000 from the Bio-energy Capital Grant scheme.
Outline of key success factors	BMBC has adopted a policy of positive preference to biomass heating for new installations in public and commercial buildings. It is the first local authority in the UK to do so. Further projects are planned including supply of heat from wood chip to a development with offices, town hall and library (Westgate). A coal fired boiler in a secondary school (Kirk Balk) has been successfully trialled with wood pellets.

Glenshellach, Oban, Scotland	
Location / Outline description of scheme	West Highland Housing Association Ltd (WHHA) installed community heating in a development in Glenshellach, Oban to supply space heat and hot water from a wood chip fuelled communal boiler plant. In 2005, 44 of the Association's homes were connected to the system (phase 1) and an additional 46 homes were connected by 2008 (phase 2). Residents are each issued with a pre-payment card which can be used to purchase heat units from a local shop to be transferred to heat meters within their homes.
Company name and outline description	ALIenergy is a registered charity with the mandate of promoting energy efficiency and renewables and has a role as project facilitator. Vital Energi have been contracted by WHHA to install, operate and maintain the boiler and systems including the prepayment system. Vital Energi purchases all wood chips from single supplier, WoodTherm. WHHA own all assets.
Financing	The capital investment for phase 1 is circa £0.5m (the boiler is sized for all 90 houses). Funding has come from numerous sources including: Communities Scotland £288k; Fresh Futures (lottery) £50k; Scottish Clean Energy Demonstration Scheme £58k; Scottish Community and Householder Renewables Initiative £72k; West Highland Housing Association (private donations/investments) £62k.
Outline of key success factors	Quality of Danish boilers noted as important. Residents were supportive. Vital Energi has a single part-time staff member on site in Oban. Securing wood supply has been difficult. Boilers have not been optimized for high moisture content of chips that is inevitable in north west Scotland. WHHA took the idea of biomass heating from Fyne Homes Housing Association's heating system for the Whitegate Housing Estate in Lochgilpead. WHHA and FHHA are both within Argylle and Bute.

Llanwddyn, North Powys	
Location / Outline description of scheme	A 520kW wood-chip fuelled system provides heat to a school, community centre and up to 38 houses.
Company name and outline description	The system was installed and is being operated and maintained by energy supply company, Dulas Wood Energy Ltd, which is a partnership between Dulas Ltd and Econergy. Powys Energy Agency (PEA) - a charity and not-for-profit limited company - acted as facilitator. PEA and the Forestry Commission Technical Development Branch undertook an initial wood energy audit, under invitation by Llanwddyn Forum. This was followed by a detailed technical feasibility funded by EST. Powys County Council and PEA both own assets. In the longer term it is planned that a new or already constituted community group will take ownership
Financing	The total cost of the project (includes development and implementation of health and safety measures, purchase, delivery and installation of fuel shed, boiler and civils, district heat-main, fuel reception area, mobile chipper and delivery vehicle) was around £350,000. Finance providers were ERDF Objective 2 fund, EST, Welsh Development Agency and Powys County Council (Local Regeneration Fund). In kind support was provided by Severn Trent Water Ltd and Powys County Council which replaced the wet central heating system in the community and school facilities. Forestry Enterprise assisted in research, advising and provided free fuel for the first year.
Outline of key success factors	A community-led initiative involving many organizations. Health and safety, planning and environment (particularly in terms of emissions) were significant hurdles. Financing sourced from several parties and this took substantial time. New contractual approaches had to be established, notably between the ESCO and the client.

4.3 Austria: Solar thermal ESCOs

In Austria delivery of energy efficiency services via ESCOs is established with some 40 companies active in the market and an extensive number of projects implemented in the public sector. By 2003, energy performance contracts had been in put in place to improve energy efficiency in 600-700 buildings in Austria. The main clients have been the federal government, local government (especially Graz and Salzburg), some smaller municipalities, and housing associations (GEA and Nahwaerme, 2005). Many of these projects were undertaken via third party finance, i.e. bank lending.

In recent years, the energy services approach has become more comprehensive. ESCO deliver their services to a pool of buildings. Also, innovative technologies including renewable energy technologies have been integrated into the service offering.

The ESCO concept has been adopted by solar thermal installers. The heat contract is a core issue for Austrian solar thermal ESCO projects. This contract is concluded between the energy user and the operator of the plant. Duration is typically 15-20 years. Typical clauses and contents are outlined in the table below.

Part	Clause	Outline
Technical	Minimum energy use	Stated minimum energy use, provisions if energy use is lower such as penalty fee. To avoid difficulties, energy demand profiles should be established in as much detail as possible.
	Minimum energy supply	Guaranteed minimum energy output provisions if output is lower.
	Technical interfaces	Details of technical interfaces between the plant, the customer's premises, and any other parties, identification of responsibilities.
	Monitoring and verification	Details of how energy supply and use is to be measured, by whom.
Financial	Energy price formula	Basic energy price. Link to fossil fuel price is typical or perhaps to consumer price index.
	Premature exit	Reasons enabling withdrawal by either party such as inadequate technical performance lack of payment. Provisions such as penalty fees, payment for disassembly.
Other	Equipment insurance	Liability insurance for equipment.
	Service and maintenance	Clear identification of each party's responsibilities.
	Duration and timing	Duration for energy delivery – start and end dates. Service and maintenance schedule Time points for energy price review.
	Installation	All responsibilities regarding installation and commissioning phase.
	Ownership	All details of ownership, including third party investors.

GEA and Nahwaerme (2005) provide several recommendations for solar thermal ESCOs. It is recommended that schemes should be reasonably large, with minimum collector area 200-300 m^2. Size of scheme helps to enable improved equipment to be used – better technical performance, greater efficiency, more durability, better control systems. Technology should be kept as simple as possible to reduce risks of faults and failures. The control system should be relatively advanced and sophisticated, though it must also be reliable and robust.

Two examples of installations are provided below.

UPC Arena

A solar thermal plant was installed on the roof of a sports stadium in Graz (formerly called the Arnold Schwarzenegger Stadium). It began operation in June 2002. As well as having innovative technical features – the system feeds a district heating system – the scheme is one of the first examples of an ESCO. The collector area is 1,407 m² and individual collectors comprise 14.3 m² large area flat plate collectors. Solar energy output reaches is around 560-600 MWh per year. The district heating net in Graz has a minimum summer consumption of 10 MW. The solar plant reaches a maximum output of about 800 kW.

The plant is operated and financed via a third-party financing model. The project was developed by three partners: S.O.L.I.D. Gesellschaft für Solarinstallation & Design mbH; nahwaerme.at Energiecontracting GmbH & CoKG and ÖkoTech Produktionsgesellschaft für Umwelttechnik mbH. S.O.L.I.D. was responsible for the design and the construction of the plant. The company nahwaerme.at was responsible for financing via a third party. The plant also benefited from support from the city of Graz and other government sponsors. Nahwaerme.at is responsible for ongoing operation of the plant. The collectors were manufactured and mounted by ÖkoTech.

The company nahwaerme.at and the stadium administration signed a user agreement for the roof. Between nahwaerme.at and the Grazer Stadtwerke (district heating company), a heat delivery contract concerning the feeding of solar heat into the district heating net was signed. The duration of the contract is 15 years with an option of prolongation.

Berliner Ring

The *Berliner Ring* is a residential area in Graz-Ragnitz (Austria). It consists of 25 multi-storey buildings which comprise 756 apartments. Before the installation of the solar system, hot water and heating were provided by fuel oil boilers.

On the roof of selected buildings of the Berliner Ring residential area, a solar thermal plant was constructed. The first phase comprised 479 m². When completed, the collector area of the solar system is expected to total 2600 m². The system is then expected to deliver approx. 1 GWh of solar thermal energy to the district heating net per year. The solar plant feeds the local district heating system. If there is surplus energy available from the collectors, this can be fed into the city-wide district heat scheme. This scheme was delivered by the same partnership that delivered the UPC Arena (above), namely S.O.L.I.D. Gesellschaft für Solarinstallation & Design mbH, nahwaerme.at Energiecontracting GmbH & CoKG and ÖkoTech Produktionsgesellschaft für Umwelttechnik mbH.

The local district heat scheme is operated by the company Wärme-Direkt-Service (WDS). WDS takes the energy either from nahwaerme.at or from the large-area district heating system of Energie Graz. Heat supply contracts are signed between nahwaerme.at, Energie Graz and WDS. Moreover, a contract is signed with the homeowner community in order to manage the usage of the roof areas.

4.4 Finland: biomass heat entrepreneurship

Heat entrepreneurship has emerged from the early 1990s in Finland as a new form of business model for the delivery of wood fuel heating projects. This model is synonymous with the ESCO model.

Under conventional wood heating delivery, prior to the 1990s, the following elements were typically carried out as discrete steps by separate organisations:

1) Design
2) Financial investment
3) Construction & commissioning
4) Operation and management of plant
5) Wood harvesting
6) Wood chipping and transport
7) Servicing of the plant

Under the heat entrepreneurship model, an organisation – the entrepreneur – has responsibility for several of these elements. Typically, the entrepreneur is responsible for wood delivery and the operation of the plant, i.e. steps 4-6, and the entrepreneur is paid for heat delivered rather than wood fuel. It is usual that the purchaser of the heat, typically a municipality, owns the wood chip fuelled heating equipment.

Alakangas (2003) provides a review, statistics and case studies for this sector. It is reported that the first three schemes using this approach were implemented in Finland in 1992. The model has clearly been successful and there has been rapid year-on-year growth in the number of sites implemented. At the end of 2002, the number of sites had reached around 140. By early 2006, there were over 250 such schemes in operation with total installed capacity ~130 MW_{th}, using over 400,000m^3 wood chips per year.

The majority of schemes are single-buildings such as schools, municipal offices and sheltered homes for the elderly. Some schemes are larger and supply clusters of buildings via a mini heat grid. From 140 schemes operating in 2002, 40 of these were known to be district heating schemes with average capacity 1.1 MW_{th}.

Most of these schemes have replaced heavy fuel oil use, so the environmental benefits have been considerable, both with air quality at immediate local level and carbon emission reductions at the global level. In addition, the social and economic benefits have been profound. As a rough rule of thumb, each 1MW_{th} equates to two person-years of employment so the sector has some 260 full time job equivalents associated with it. However, many individuals working in the sector are farmers who are involved on a part-time basis. The implication is that the sector provides valuable income to a large number of people with the rural economy – it is an excellent illustration of agricultural diversification.

Alakangas (2003) identifies several factors as contributing significantly to the development of the heat entrepreneurship model. These factors are noted below – it is evident that some are wider initiatives focussed on wood energy generally and others are targeted at this sector. The initiators of these various interventions have been Finnish Ministries (Agriculture and Forestry; Trade and Industry) and local centres for employment and education.

- Forest improvement funds for pre-commercial thinning i.e. harvesting small trees, with separate payments for harvest plus transport and for chipping.
- Investment grants for wood fuel harvesting equipment and for establishment of new enterprises.

- Local promotional projects, for both wood heating projects and the ESCO model in particular.
- Research including studies of existing sites and analysis of commercial models and contractual issues.
- Wood energy advisors trained in heat entrepreneurship.
- National dissemination activities including: a brochure on how to establish a cooperative; guides for heat entrepreneurs; best practice case study leaflets; training courses; a national competition for biomass heat entrepreneur of the year (held in 2000, 2001 and 2002).

4.5 Croatia

There is only one Energy Service Company in Croatia, namely HEP ESCO Ltd., which develops, executes and finances energy efficiency projects on a commercial basis. The company was founded by Hrvatska elektroprivreda – HEP, the state owned electric utility and is a recipient of financial support from the GEF and World Bank loans through the *Energy Efficiency Project Croatia*. The project was initiated by the World Bank (IBRD) and Global Environment Facility (GEF) in collaboration with HEP and Croatian Reconstruction and Development Bank (HBOR). For this purpose HEP and/or HEP ESCO was extended a loan by the World Bank in the amount of 4.4 million euros and a GEF grant in the amount of 5 million USD. The total value of the Project, with participation of domestic banks, is estimated at 40 million USD over a six-year period.

HEP ESCO provides a full range of energy services with repayment through savings. The service includes project development, execution and financing in the manner that savings in energy costs and maintenance are used to achieve investment return. The risk of savings being achieved is assumed by HEP ESCO by giving guarantees to the client and after the investment is repaid, HEP ESCO withdraws from the project and passes all benefits to the client. HEP ESCO currently manages more than 50 projects in the areas of public lighting, buildings, industry and energy supply systems. The projects are in various stages of development, execution or financing.

The sources of financing are various. Besides international aid and loans (World Bank, GEF), local financial institutions have proved to be interested, and the HEP ESCO's own equity is being used for project implementation. There are further funds and programs in Croatia for energy efficiency, such as the Fund for Environmental Protection and Energy Efficiency (in the form of subsidies) and the UNDP program (grant for feasibility studies). The "first out"[2] contract model has been used in past projects.

Since the ESCO that is working in Croatia is a state-owned company, primary attention is not on large profits, but on supporting national interests, mainly energy efficiency and environmental protection. Therefore, the objectives of the company when it was set up were to develop capacity and know-how, find sustainable project financing mechanisms, and develop consumer demand.

[2] One sub-types of the Build-Own-Operate-Transfer (BOOT) contract type is the "First out" approach where the ESCO is fully paid from the energy savings until the project costs, including the ESCO profit are repaid. The duration of the contract depends on the level of savings achieved: the greater the savings, the shorter the contract.

5 Success and failure factors / lessons learned

The above review provided insights into, on the one hand, drivers and success factors for energy service projects and, on the other hand, the difficulties that were encountered.

5.1 Drivers and success factors

A review of successful energy schemes shows great innovation and flexibility in setting up the ESCO. Different local stakeholders, energy demands, renewable energy resources etc. appear to argue against a generic ESCO model. There are three principal drivers for energy service schemes – carbon savings, affordable energy and security of supply – but the relative priority given to these is varied.

Increases in prices for conventional energy have greatly increased awareness and interest in renewables and energy efficiency and plays a material role in helping to improve the commercial attractiveness of such investments. It does not promote the energy services approach *per se*. It may be argued that rising prices have brought energy to the attention of building owners, operators etc. when it was previously not an issue and this has helped to open the door to new approaches. The energy service approach is partly designed to overcome the classic dilemma faced by renewables, namely capital investment required for generation plant and ancillaries is much higher than conventional options although ongoing operation costs are relatively low because fuels are not required (with the exception of biomass). The ESCO approach does not diminish the need to find high up-front capital investment but it may reduce the client's need to make the investment.

Looking at the energy service companies and schemes listed for Ireland and the UK, it can be noted that several of the actors in the energy services market owe their existence at least in part to the public sector. The public sector has helped energy services actors to be created and survive.

This can in practice happen in three ways:

- **the actual formation of an entity within a local authority**. In the UK, the public sector has directly created and supported organisations that were ESCOs from their first conception or have, over time, become ESCOs. There are several successful examples of this approach, mainly with CHP projects.

- **the public sector has helped is via provision of financial support under various guises (support schemes).** Government support mechanisms are essential for energy solutions that are small-scale and relatively capital cost intensive and high risk relative to competing conventional supplies. Various grant programmes have provided capital grants to renewable energy and community energy over many years. In Ireland there is a large number of small companies working in the energy sector that started doing their business with the indirect aid of the grant schemes administrated by SEI. Most of these companies offer their services to the domestic sector and do not fall under the ESCO category as they provide mainly services related to the supply and installation of equipment. However, several companies have expanded their business to include ESCO type services, especially within the biomass heating market.

- **public authorities undertaking projects that have given companies the opportunity to learn and develop their businesses.** The woodchip boiler system installed at the Department of Agriculture and Food in Johnstown Castle, Co. Wexford is a typical example, where the capital expenditure for the installation of the

system was provided by the Department of Agriculture and Food, and an ESCO type contract was set up for fuel provision.

In the UK, housing associations have also led community energy projects. Notable examples are two wood fuelled district heat schemes in north west Scotland. The two schemes serve 50 homes in Lochgilpead and 90 homes in Oban and have been pioneered by Fyne Homes Housing Association and West Highland Housing Association Ltd respectively. Although not without their problems – the original ESCO Torren Energy Limited developing the scheme in Lochgilpead was bankrupted and the scheme had to be rescued mid-installation – these schemes combine the energy services approach and use of renewable energy. It is reported that a similar scheme is to be installed for a housing association in Kirkwall, Orkney.

Looking at the examples of existing successful ESCOs in Ireland which provide biomass heat contracting (Natural Power Supply, Energy4You, Clearpower, Rural Generation and others listed in chapter 3 and 4) a common feature is the integration of the full package of related activities and services into one company. This is also clearly demonstrated by the Finnish heat entrepreneurship model. As illustrated by the biomass heating installation at the Brandon House Hotel, careful design of the boiler in order to achieve a high number of operating hours per year is also an important factor which needs to be taken into consideration.

Loans and equity from non-commercial investors are characteristic of successful ESCOs. This highlights the fact that the ESCO approach is still not a highly commercial proposition. Such funding also reflects the fact that there are many non-monetary benefits from sustainable energy projects. An important global environmental benefit is the mitigation of greenhouse gas emissions. There will also be local environmental benefits such as improved local air quality and enhanced wildlife habitat via woodland management. Local retention of money and employment may be important particularly if local companies are involved in installing and maintaining renewable energy systems. Security of supply is another issue, notably for remoter communities at the end of the distribution system for fossil fuels. There are diverse investors – public and private – who effectively pay for these benefits by offering finance below market rates.

Features that characterize successful projects are strength of commitment of the individuals and principal parties involved and well-organised and implemented communications between the parties and wider stakeholders. Long-term efforts are needed and results may only be achieved some time into the future – thus a core of individuals who keep their commitment even when progress is slow or backward is required. Project leaders must manage expectations. Communicating progress to all stakeholders is important since lack of evident results is disheartening and silence generates misinformation and misconceptions.

5.2 Difficulties and failure factors

The information regarding difficulties and especially failure factors was not so easily obtainable, in contrast to the previous category. The vast majority of available case studies illustrate the positive results and benefits which were achieved through the project implementation and relatively few provide insight into specific difficulties which were encountered. No case studies focusing on failed projects in order to draw relevant conclusions were available.

After analysing the information presented in the previous chapter, the following general categories regarding difficulties and failure factors have been identified:

- Financial issues;

- Lack of customer knowledge/awareness;
- Reluctance to enter into long term contracts;
- Political, strategic and power changes.

Financial issues further include the following:

- High up front capital costs
- Uncertain energy costs going forward
- Transaction costs for small projects
- Complex and time consuming process to finance
- Small companies and non-profits involved but commercially weak

High capital costs necessitate several financing sources. All the cases reviewed had some grant-aid, though the levels varied. Due to the complex nature of financing, considerable expertise, time and persistence is required. Time, complexity and the need for patience all mean that there are higher risks of the deal falling through. Energy service projects have relatively long pay back periods requiring the investor to look several years into the future. The further forward that one goes, the more difficult it is to forecast energy costs and prices, and the greater the level of risk.

While availability of grants is welcome, schemes rarely meet the expectations of practitioners. The headline figures – for example 50% of investment costs – will often not tally with the actual percentage that may be received because of various exclusions. The opportunity cost of the alternative conventional fuelled system must typically be deducted and this lowers the grant. Owing to the fact that the emerging energy services industry sustainable is a market niche and, as yet, a relatively unprofitable niche dependant upon non-commercial finance, the majority of the players are small enterprises. Many actors are non-profit organisations and justify their role in part through the important functions that sustainable energy serves for society and the environment. Generally, SMEs and non-profits are not highly experienced financially and commercially, and both types of organisation are also asset poor which limits their ability to gain finance.

One hurdle for potential energy supply companies to the public sector is that public authorities are obliged, under European procurement rules, to invite competitive tenders for suppliers of all products and services. Local authorities have a culture of procurement and value for money based upon short-term contracts. The ESCO business model relies on reasonably firm and achievable guaranteed energy demand over the long term. The local authority system and the ESCO business model are not complementary. This problem is faced not only by Irish and UK companies, but is present in many other countries too - it was stated as a hurdle in a recent International Energy Agency review of energy services.

Furthermore, public authorities are subject to changes in elected councillors at regular intervals and such changes can, and do, herald shifts in priorities and focus. The underlying likelihood of change can, of itself, deter the type of innovative thinking and long term commitment required for sustainable energy investment and the ESCO approach in particular.

In comparison to a conventional oil or gas boiler providing heat for a single building, community energy schemes require more organisations and collaborative work. Collaboration is required to wrap several partners up into a single ESCO and this takes time and effort. More partners give higher risks of misunderstandings and conflicts. Risks may be heightened if organisations have different status – public, private, not-for-profit – size, structure and culture. The nature of community energy schemes makes such a scenario likely. Buildings are likely to be a mix of public and private sector. The contractors that install the energy plant will certainly be private companies. It is also quite likely that a not-for-profit

organization will be involved, for example with facilitation, early feasibility, and grant applications.

6 Conclusions

This review shows a variety of ESCO models and schemes in Ireland and the UK as well as two successful approaches regarding biomass and solar thermal ESCOs from Finland and Austria. A short overview of the Croatian ESCO market was also presented as this includes a specific example of initial financing through international projects and grants.

A key aspect is the ownership of the equipment. According to the definition provided in Chapter 2, an ESCO would finance and own the equipment, at least in part. However, it is perhaps more frequently the case that ESCOs do not own the equipment – in Finland, for example, local authorities typically own the equipment, and entrepreneurs are responsible for fuel supply, operation and maintenance and paid for heat delivered. This might be described as a *heat contract* and there are several companies that started doing business in that way in Ireland as well.

The arrangement of finance by ESCOs will typically involve third party financiers, particularly bank lending, but also perhaps equity investors. The terms ESCO and third party finance should not be confused. Another variation is for the equipment to become the property of the host after a period during which the host pays the ESCO for its investment costs as well as paying for the cost of the energy delivered.

Looking at the *pure* ESCOs focused on energy savings only and providing saving guarantees to the client, two such companies have been identified in Ireland, namely Dalkia and RWE Solutions. Both are large international companies and a common feature and similarity with the Croatian ESCO (HEP ESCO) is that all were founded by large electric utilities, thus having a strong financial background. Additionally, HEP ESCO received considerable financial support by the World Bank, GEF and the Croatian Reconstruction and Development Bank in the form of grants and loans with favourable conditions. Obviously, initial financial support for such companies proved to be critical and this can usually be provided by larger companies.

Looking at the broader definition which includes also ESCOs as heat providers from renewable energy sources, several such companies have been identified in Ireland in the range of SMEs. The critical aspect in this case is the willingness of the client to enter into a long term contract (at least 10-15 years), which allows financial security and in that case investment costs for equipment could be covered by the ESCO. A common feature of companies providing heat from biomass is the development of local wood supply chains typically including own wood procurement (through willow plantations or similar).

As indicated in the Introduction, the tasks to be performed within SERVE WP6 include the identifications of opportunities for the ESCO model to be applied in other places within the region, based on the experiences gathered through the establishment of the ESCO in the eco-village. The planned time for the completion of this task was month 36 of the project (November 2010), which would enable the gathering of the eco-village ESCO experience. In agreement with project partners, the work on this task started earlier then planned and resulted in the preparation of this report. However, the completion of this task will still require the analysis of the establishment and operational experience of the ESCO within the eco-village. This information will be included in a separate report.

7 Recommendations for SERVE region

Considering the establishment of an ESCO within the SERVE region, there are two different scenarios:

a) The ESCO within the eco-village. This needs guidance on how it will operate the system, generate billing, manage risk etc.
b) Other pontential ESCOs which might be established in the region looking at local enterprise development.

The main focus of this report is related to the SERVE WP6 task of identifying the opportunities for the development of ESCOs within the SERVE region and beyond.

Consequently, the recommendations provided in this section are more of a general nature and are targetted at the different possibilities to apply the ESCO model, including public or private sector buildings. Some of the points in the report are relevant to the establishment and operation of the ESCO within the eco-village and additional information can be gathered through some of the references. However, in order to obtain more detailed information as well as clear and specific recommendations it would be necessary to perform a feasibility study.

As stated in the conclusions, the key aspect of every ESCO scheme is the **ownership of equipment**. Possible solutions are varied and can include combinations of ownerhip structure. However, it is very important to clearly and precisely define this point at the start of implementation, together with the **responsibilities for equipment maintenance and operation**.

In addition, the following is a list of recommendations regarding the establishment of ESCOs in the SERVE region:

- **Long term contracts for heat supply** should be signed by the ESCO and all future customers (consumers). This is a common feature of companies offering heat energy from biomass services analysed in this report and is needed for the financial stability of the ESCO. The duration of the contract is largely dependent on the ownership structure of equipment: in cases where the ESCO invests and owns the equipment contracts are typically 10-15 years while in cases where the ESCO provides only fuel supply and operation contracts can be 2-5 years;

- **Work with local stakeholders and interest groups to develop a local wood supply chain.** This includes procurement of wood from local forests and/or wood processing industries by local companies as well as local growing of willow or other SRC. This is also a common feature of successful ESCOs and is important for the operational stability of the scheme;

- **Use proven technology for both solar and biomass heating installations.** This was explicitely stated as an important success factor in several analysed case studies and the importance to use proven and reliable technology cannot be overemphasized;

- **Hire professionals** to install the equipment as well as to run and operate the ESCO. The analysis of successful ESCOs focused on providing heat from bioenergy indicates that even though initial vision and enthusiasm are needed to start the business, providing professional services is the critical component for the successful operation;

- **Establish close cooperation with the HOLISTIC CONCERTO project.** The HOLISTIC project started in June 2007 and includes the Dundalk community in Ireland. One of the results of the project should be the establishment of an ESCO which would design, build, operate and finance the biomass district heating scheme.

References

Alakangas, E. (2003). Biomass heat entrepreneurship in Finland. Report for European Bioenergy Networks.
http://www.afbnet.vtt.fi/heatentrep2003.pdf#search=%22Biomass%20heat%20entrepreneurship%20in%20Finland%20alakangas%22

ENVIROS Consulting Limited (2005). Assessment of the Potential for ESCOs in Ireland, Report prepared for Sustainable Energy Ireland, December 2005
http://www.sei.ie/Publications/Energy_Efficiency_Policy_Publications/ESCO_fnl_for_web.pdf

European Commission (2006). Directive 2006/32/EC of the European Parliament and of the Council of 5 April 2006 on energy end-use efficiency and energy services and repealing Council Directive 93/76/EEC
http://eur-lex.europa.eu/smartapi/cgi/sga_doc?smartapi!celexplus!prod!DocNumber&lg=en&type_doc=Directive&an_doc=2006&nu_doc=32

European Commission, Joint Research Centre, Institute Environment and Sustainability (2007). Latest Development of Energy Service Companies across Europe - A European ESCO Update - Authors: Paolo Bertoldi, Benigna Boza-Kiss, Silvia Rezessy
http://re.jrc.ec.europa.eu/energyefficiency/pdf/publications/ESCO%20report-edition%20version.pdf

Grazer Energieagentur and Nahwaerme (2005). Development of pilot solar thermal energy service companies with high replication potential. Short report for Austria.
http://www.stESCOs.org/downloads.htm

Lamb, A. and Richards, K. (2006). Increasing uptake of bioenergy via the energy services (ESCO) approach. Report prepared for IEA Bioenergy Task 29: Socio-Economic Drivers in Implementing Bioenergy Projects.

Scott, S. (2004). ESCOs in Ireland: Investigation of Energy Service Companies in 2000, Working Paper 155, Economic and Social Institute, Dublin
http://www.esri.ie/pdf/WP0155%20ESCOs%20in%20Ireland.pdf

Singer, T.E. and Lockhart, N.K. (2002). IEA DSM Task X – Performance Contracting. Country Report for the United States. US National Association of Energy Service Companies.
http://dsm.iea.org/NewDSM/Prog/Library/frame.asp?RNDKey=zmpvhjvkltbpxgu

Westling, H. (2003) Performance Contracting Summary Report Task X within the International Energy Agency Demand Side Management Implementing Agreement. Promandat AB, Stockholm, Sweden, 2003.
http://dsm.iea.org/NewDSM/Prog/Library/frame.asp?RNDKey=zmpvhjvkltbpxgu