ACCELERATING THE ADOPTION PROCESS OF RENEWABLE ENERGY SOURCES AMONG SME'S

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Abstract: *By 2020, intermittent renewable small scale energy sources (e.g. wind and solar energy) are expected to represent about 17% of the EU's total electricity consumption. All national overriding energy policy objectives are to ensure competitive, secure and sustainable energy for the economy and for society. Renewable energy, allied with energy efficiency, is often found crucial to meet these goals of secure sustainable and competitive energy supplies reducing dependency on expensive fossil imports and underpinning the move towards a low carbon economy while delivering green jobs to the economy. This all contributes to national competitiveness and the jobs and economic growth agenda. However, a straight forward implementation of renewable energy options is not easy, due to various barriers and obstacles. For most SMEs, the concept of generating their own renewable energy is still more of academic than genuine interest. In general, several barriers are experienced, such as high capital investments, slow return on investment, and the lack of knowledge of the benefits. There is a need for education on the benefits and drawbacks of sustainable energy, as well as a greater contribution to costs for this to work. In this paper we describe the intermediate outcomes of a European Partnership under the name of GREAT (Growing Renewable Energy Applications and Technologies), funded under the INTERREG IVB NWE Programme. GREAT aims to encourage communities and small to medium size enterprises (SMEs) in Ireland, the United Kingdon, Belgium and The Netherlands to develop technological solutions for Smart Grid, Renewable Energy and Distributive Generation; research and develop policy issues for regulatory authorities and provide structured co-operation opportunities between SMEs and research institutes / technology developers. We developed GREAT spreadsheets to facilitate SMEs in each country to calculate the return-on-investment of renewable energy sources, such as solar panel installation, heat pumps and wind energy, generating electricity. We have a two-track approach: development of a tool to support SMEs in their decision making process about suitable and appropriate technologies and solutions, and research to understand the barriers and obstacles that hinder adoption and implementation of sustainable energy solutions. In this paper we introduce a tool which aims to support SMEs in their decision making process on renewable energy applications in the expectation that this will accelerate that process.*

Keywords: Sustainable Energy Sources, Innovation, SME's, Renewable Energy Applications, Economic tool for decision making

JEL classification: Q55, Q42, O3

Introduction

This paper describes the preliminary outcomes of a Partnership between the United Kingdom, Ireland, Belgium and The Netherlands entitled GREAT: *Growing Renewable Energy Applications and Technologies*. Ultimately GREAT aims to encourage SMEs and collectives of SMEs to develop and apply sustainable technological solutions related to Renewable Energy, Smart Grid and Distributive Generation. In the following sections we introduce the GREAT project and place sustainability in a wider European context. Then, we identify the problem and explain the focus of our research. In this section we will also explain our methodological choices and research design. This forms our theoretical framework and the lenses through which we have carried out our research. The results of our research and its market implications are discussed subsequently. We finalize with conclusions, which also highlight the next steps that are being taken in the project and the envisaged final outcome of the Partnership.

The GREAT Project

GREAT is an EU funded project under the INTERREG IVB NEW Programme in which the following organizations have formed a Partnership: Udaras Na Gaeltachta, University Hasselt, Oost NV, Basildon Council, EnergyVille, Design 4 Sustainability, Westbic, Smart Grid Flanders, Energy North and Wittenborg University.

The overall aims of the project are to accelerate deployment of Smart Grid benefits in North West Europe (NWE). Smart Grid, Renewable Energy and Distributive Generation provide opportunities for SMEs to achieve optimum synergies in the emerging renewable energy sector. The project wants to stimulate enterprises, develop innovations and contribute to the creation of employment in this field; create best practices and policies that will help to push the so-called third Green Revolution forward in North Western Europe by: informing regulatory and policy actors of the opportunities associated to Smart Grid developments; enabling and promoting the renewable energy sectors as a growth opportunity for SMEs in this region and providing a platform across North Western Europe that promotes and develops Smart Grid benefits and encouraging new Smart Grid services and technologies be developed for citizens.

Objectives of the GREAT project are: a) to develop a set of tools to enable SMEs to engage with the Smart Grid, Distributed Energy and Renewable Energy Nexus; b) to provide tools to SMEs to compete for transnational business; c) to stimulate product developments through developing and setting up international consortia and d) to increase awareness of market opportunities through distribution networks.

Sustainability in a European Context

In Europe, under Directive 2009/28/EC, all countries have developed Energy Efficiency Action Plans up to 2020, reaffirming their target to reduce energy consumption.

Table1: Target for 2020 under the Renewable energy directive 2009/28/EC

Country	Energy consumption 2014 (ktoe)[4]	Target for 2020 on renewable energy
Ireland	8.004	16%
Netherlands	34.592	20%
UK	90.400	15%
Belgium	19.243	13%

Source:http://ec.europa.eu/energy/en/topics/renewable-energy/national-action-plans

All national overriding energy policy objectives are aimed at ensuring competitive, secure and sustainable energy for the economy and society in general. Renewable energy, allied with energy efficiency, is often found imperative to meet these goals of sustainable and competitive energy supplies, thereby reducing dependency on expensive and environmentally unfriendly fossil imports and underpinning the transition towards a low-carbon economy. Ultimately this is a means of creating and offering 'green' jobs to the economy. SMEs may be key actors in this respect.

In the EU economy, SMEs make up to 99,8% of non-financial enterprises, providing an estimated 58% to 67% of jobs and contributing the region's GVA (Gross Value Added).

Table2: Definition of SME

Company Category	Employees	Turnover (million €)	Balance sheet total (million €)
Micro	<10	<2	<2
Small	<50	<10	<10
Medium -Sized	<250	<50	<43

Source:http://ec.europa.eu/enterprise/policies/sme/facts-figures analysis/performance-review/files/supporting-documents/2013/annual-report-smes-2013_en.pdf

Table 3: Statistic Information on SMEs in Europe

	Micro	Small	Medium	SMEs	Large	Total
Number of Enterprises						
	18,783,480	1,349,730	222,628	20,355,839	43,454	2,399,291
%	92.1	6.6	1.1	99.8	0.2	100
Employment						
	37,494,458	26,704,352	22,615,906	86,814,717	43,787,013	130,601,730
%	28.7	20.5	17.3	66.5	33.5	100
Value Added at Factor Costs (million €)						
	1,242,724	1,076,388	1,076270	3,395,383	2,495,926	5,891,309
%	21.1	18.3	18.3	57.6	42.4	100

Source: Eurostat, National Statistical Offices, DIW, DIW econ, London Economics

4 Data from National Renewable Action Plans from the four countries; energy consumption includes heating, cooling and electricity. Ktoe = kilotonnes of oil equivalents.

Energy consumption by SME depends on their energy-intensiveness; industry consumes about 25,5% of national energy; the energy costs as a percentage of overall process costs for mining, paper, glass and metal producing industry, range between 5,1%-8,7% for chemical and food industry respectively 2,9 and 1,8%. It seems evident that SMEs have a responsibility in taking their role in relation to diffusion and growth of sustainable energy solutions (Abdelaziz et al, 2010).

For SMEs in Europe, energy costs now account for around 7-11% of operating costs and up to 30-35% in highly intensive energy using businesses. In the current economic climate, all SMEs are cost conscious so energy prices are becoming important. Although energy is traditionally a relatively low engagement area, SMEs are increasingly aware of their behavior with regards to energy consumption and slowly changing their habits (i.e. spend time switching off lights or equipment etc. when going home). Very few SMEs, however are actually making significant investments in the building to reduce energy consumption. For most SMEs, the concept of generating their own renewable energy is still more of academic than genuine interest. In general, several barriers are experienced, such as high capital investments, slow return on investment, and the lack of knowledge of the benefits. There is a need for education on the benefits and drawbacks of sustainable energy, as well as a greater contribution to costs, to accelerate the implementation process.

Problem Definition & Research Design

The importance of investing in sustainable technologies and energy solutions is uncontested in both the public and academic domain. Since the film of Al Gore" *An inconvenient truth"*, sustainability stands high on the national agenda of most countries. Concern for the environment is one of the main reasons in combination with opportunities to innovate. Policy measures are aimed at reduction of carbon dioxide emission, waste management and alternative use of energy sources and materials. In line with these measures companies are urged to integrate sustainability in their business processes and search for innovative sustainable solutions.

Increased adoption and diffusion of renewable energy technologies (RET) is critical in this context (Stern, 2007, IPCC, 2011). The appeal of renewable energy has risen due to its potential for reducing dependence on energy imports (Valentin, 2011). At the same time, renewable energy offers possibilities for generating local environmental and health benefits along with the facilitation of energy access (Mahapatra et al., 2009) and can have positive impacts on employment, competitiveness, and sustainable or "green" growth (Ragwitz et al., 2006, Council, 2009, Edenhofer and Stern, 2009, OECD, 2010, 2011).
While on a national level policy measures towards a more sustainable society are defined, enterprises – and especially SMEs- lag behind and fail in sufficiently incorporating these measures appropriately in their day-to day business.

Wittenborg University (www.wittenborg.eu) located in the city of Apeldoorn in The Netherlands, is one of the Dutch partners at the GREAT project. Wittenborg University has two main tasks within that framework. The first task: to carry out a small-scale research activity among SMEs together with their Belgian counterpart to identify the barriers and obstacles for renewable energy participation. The second task (which is the focus of this paper) involves the development of an economic tool, in the form of spreadsheets, to help SMEs to estimate the return on investment in a sustainable energy project.

Supporting Tool For SME's

As of today, renewable energy cannot compete with fossil fuel in terms of production costs but impressive technological progress has paved the way for promising alternatives, such as biomass, solar and wind energy sources. (Pan & Khler 2007, Nemet 2006, IEA 2004).

In the countries of interest for the GREAT project: UK, Ireland, Belgium and The Netherlands, three renewable energy types are of interest: wind energy, solar energy (photovoltaic energy (PV) and solar heating) and geothermal energy (heat pumps; Table 4).

Table 4: Production of Renewable Energy[5]

Type of energy	UK	Ireland	Belgium	Netherlands
Wind energy production (TWh, 2012)	19.584	4010	2750	4999
Thermal solar collectors installed capacity (MWh, 2012)	455	184	334	608
PV (GWh, 2012)	1188	0,6	2148	254
Heat pumps (ktoe, 2013)	45	4	11	174

Source:http://ec.europa.eu/energy/en/topics/renewable-energy/national-action-plans

For SMEs, the size of the renewable energy system will depend on:

- Location: the physical (unshaded) space available for the installation of PV modules or access to wind if installing micro-turbines;
- Financial: how much investment is possible?
- Energy generation potential

Furthermore, storage applications for off-grid renewable energy may be needed. In order to develop an easily accessible and user friendly economic tool to be able to define the return-on-investment for these types of renewable energy, we set up an excel sheet, including accompanying cash flow statement.

The excel sheets have been developed per type of renewable energy and contain technical factors (e.g. capacity, factors influencing capacity), investment costs (cost of equipment, installation), operational and maintenance costs and energy generation items (annual electricity production in kWh and €). For the heating options, using solar heating, or geological heat (heat pumps), an extra module to convert heat into electricity is added. Per country, a different set of spreadsheets had to be developed due to differences in tax systems and other local regulations (Table 5). Using this approach, various scenarios associated with various payback times and return on investment can be estimated per type of renewable energy in each country.

5 The state of renewable energies in Europe, Ed 2013, 13e Eurobserver Report

Table 5: Tax incentives for renewable energy in the four countries

Country	Corporate taxes	Tax relief system
The Netherlands	20% (2014)	some deduction possibilities exist for investments in sustainable energy such as EIA (41,5% deduction of taxes) and KIA (28% deduction of taxes, at investments ranging from €2301 to €55238). Deduction period for EIA and KIA is 3 years.
Belgium	40,71% (2014)	some deduction possibilities exist for investments in sustainable energy such as EIA (14,5% in 2013 and 13,5 % in 2014 for sustainable energy projects).
Ireland	12,5%	for renewable energy, including solar energy, tax relief regulations exist; it allows companies to write off 100% of the purchase value of qualifying energy efficient equipment against their profit in the year of purchase. As a result of this regulation, we assume that no depreciation is needed.
United Kingdom	21%	for renewable energy, including solar energy, tax relief regulations exist; it allows companies to write off 100% of the purchase value of qualifying energy efficient equipment against their profit in the year of purchase. As a result of this regulation, we assume that no depreciation is needed.

Source:http://ec.europa.eu/energy/en/topics/renewable-energy/national-action-plans

An elegant and low-cost approach to become more aware of electricity usage by SMEs, is the installation of a so-called Smart Meter. A Smart Meter measures electric current, records consumption of electric energy and enables two-way communication between the meter and the central system for monitoring and billing purposes enabling the use of variable pricing.
It facilitates energy savings and several customer benefits, such as enhanced energy efficiency, lower peak demand, more convenience through automation and online interaction with utilities, and intangible benefits such as improved customer satisfaction. Smart meter costs involve: up-front (capital) costs include meters, and communication system (software), as well as ongoing costs include operating maintenance, data transfer, service cost. In our excel tool for SME the inclusion of smart meters is also an option.

The model consist of three spreadsheet pages per type of renewable energy (no. 4: solar energy (photovoltaic and solar heating), wind energy, heat pumps) and country (no 4: The Netherlands, UK, Ireland, Belgium). So in total 16 different spreadsheets were developed.

The first spreadsheet (quick calculation) enables the input of a limited amount of variables, and results in a return on investment calculation.

The second spreadsheet (extended calculation) enables the input of several variables, in 7 categories: technology, investment, exploitation, electricity output, finance, taxes and revenues. In each category, input of several parameters is feasible (green fields), such as roof surface, specific capacity of the solar panel, investment, exploitation costs, specific

regulatory issues (such as tax) per country etc.

Some general data, such as costs of electricity (kWh), feed-in tariff per country, tax data etc. are used as standard values (Table 6). In the calculation cells, the results of calculations, i.e. the amount of electricity generated by the type of renewable energy selected as well as the return on investment is determined.

Table 6: Data on electricity prices per country

Country	Average price per €/kWh at peak[6]	Annual change in price (%)	Sale of excess electricity: price per kWh
Netherlands	0,08	6,7	0,20
Belgium	0,09	3,3	0,0722 + green certificate
Ireland	0,13	6,6	0,16
UK	0,11	6,6	0,21 feed-in tariff + export rate

Source:http://ec.europa.eu/energy/en/topics/renewable-energy/national-action-plans

The third spreadsheet (CashFlow Total) encompasses a cash-flow analysis, using the data input from the first spreadsheet.
The four spreadsheets (for NL, Ireland, Be and UK) and our SME tool is available from the website of the GREAT project (www.greatproject.eu.com) and can be used for further application and evaluation.

Conclusions & Further Research
In Table 7 below we have compared the four different energy generation methods regarding to their Internal Rate of Return (IRR) and payback time.

Table 7: Comparison of different energy generation methods (Internal Rate of Return (20 yrs) for four countries

	Capacity	Investment	NL	Be	UK	Ire
Solar PV[7]	12225 kWh/yr	14852	9,2%	5,5%	12,5%	7,5%
Wind energy[8]	2 kW	13000	7,1%	negative	8,5%	7,3%
Solar heating[9]	12500 kWh/yr	13750	7,9%	7,0%	13,2%	7,9%

6 Source: Eurostat, 2013 for industrial users using 20-50kWh/year

[7] Self consumption 75%, Si cells,
[8] Self consumption 75%
[9] Self consumption 100%

Heat pump[10]	10,9 kW	14181	8,5%	3,3%	9,7%	7,0%

Source:http://ec.europa.eu/energy/en/topics/renewable-energy/national-action-plans

Variability between countries is due to the fluctuating prices of electricity and electricity index, the regulations for feed-in and the tax regimes. Solar technologies are favorable for all countries, esp. for the UK with a very high feed-in tariff.

Wind energy in the UK and Ireland is more interesting than in Belgium and The Netherlands as the capacity factors are assumed to be higher (40% instead of 25% for Belgium and The Netherlands, thus lower investments for better capacity).

We believe that financial tools like the one we developed can be instrumental to increasing the acceptance of renewable energy applications by SMEs. In the coming months this tool will be tested and we expect to carry out further research to understand better what the inhibiting factors are that constrain SMEs.

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[10] Self consumption 100%

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