

# The Implications of Supply Chain Localisation for the Evolving Sustainable Energy Products Market in the UK Built Environment

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## Abstract

This paper was written to explore the viability of supply chain localisation as a strategy for minimising possible adverse environmental and social impacts of large-scale economic activity surrounding the production of sustainable energy goods and services. Supply chain localisation here refers to the situation of production activities close to the geographical areas in which the sustainable energy products would eventually be installed. Sustainable energy products refer to technologies and other goods and services that minimize negative environmental effects of energy use in buildings throughout their construction and habitation. The paper dwells on the outputs of a major energy-efficiency project that focuses on preparing for the Green Deal – a UK-wide housing retrofit initiative – and the attendant increase in economic and industrial activities that it is expected to generate. As part of measures to ensure that these activities yield minimal negative environmental and social effects while optimising economic benefits, project participants recommended the localisation of the supply chain for the production, installation and maintenance of sustainable energy products. Based on the primary research conducted on the project as well as secondary research sources, the paper discusses the economic, social and environmental benefits and detriments of the supply chain localisation agenda. It also looks at the overall practicality of the implementation of supply chain localism within the context of mainstream business practices in the property, construction and energy sectors.

**Keywords:** Supply Chain, Localisation, Green Deal, Sustainable Energy Products, United Kingdom

# 1. Introduction

Environmental concerns over negative impacts of energy generation and usage on the ecology, coupled with economic/political concerns over the volatility of fossil energy prices and unstable relationships with some crude oil-producing nations, have long since been increasing the UK government's emphasis on energy conservation, carbon emissions reduction, and a shift towards renewable energy sources (Brown, 1996). Within the UK built environment, a recent reflection of this trend is the commencement of the Green Deal programme, a government initiative aimed at retrofitting the country's residential building stock with a range of sustainable energy products that includes insulation, window-glazing, low-energy lighting and heating, 'smart' and automated energy control systems, and renewable energy technologies such as solar photovoltaics, wind turbines, biomass boilers, and geothermal systems. In addition to its intended socio-environmental goals of fuel poverty reduction and energy conservation, the Green Deal is being actively promoted by the government as a major opportunity for the creation of new businesses and the stimulation of economic and industrial growth (DECC, 2010).

Due to their role in reducing adverse environmental impacts of energy use, organisations that are involved in the provision of sustainable energy products for buildings are commonly associated with the 'green economy' and its attendant focus on ecosystem preservation and social development (Placet et al, 2005; Brand, 2012). However, previous research suggests that the application of traditional business practices to green building initiatives could give rise to the following risks: one, new environmental and social problems could arise in the process of solving existing ones; and two, the sustainable energy products could fail to achieve the expected level of technical performance if not installed in the right manner (Schmidt, 2003; De Simone and Popoff, 2000). This is mainly because traditional, mainstream business practices are based largely on economic considerations, with environmental performance and social success having only secondary relevance (Isaksson et al, 2010). It is conceivable that a combination of the aforementioned risks could lead to a worsening of socio-environmental problems associated with the use of energy for the construction and operation of buildings, damaging investor and consumer confidence within the still-evolving UK market, and thus discouraging further uptake of sustainable energy solutions.

Perhaps in awareness of this situation, a number of organisational networks, research institutes and think-tank groups have planned and are planning the development of a major industry around the Green Deal which will be economically, environmentally and socially viable all at once. One such initiative is a major energy-efficiency project based in the West Midlands and made up of members of several organisations from the construction, energy, housing, local/regional authority, and education sectors. The project focuses on the challenge of developing the supply chain, skills, resources and market demand for the Green Deal, and of optimizing economic, environmental and social returns from this activity. One of the outcomes of deliberations within the project was that the supply chain for the manufacture, installation and maintenance of sustainable energy products for buildings should be localised. Based on the

project case study as well as literature sources, this paper attempts to explore the supply chain localisation concept and analyse its economic and socio-environmental implications.

## **2. Supply chain localisation as a resurgent practice**

Alaane and Saari (2006) present the concept of localisation of the manufacture and distribution of energy products as one that has come round full circle, a resurgent phenomenon that is a reasonable alternative to the practice of globalisation and its attendant environmental and social detriments. However, the existing body of literature that offers an exposition on this perspective is quite limited. Practical applications of supply chain localisation to the commercial provision of sustainable energy products appear to vary depending on the nature of the energy product, technology or service in question. Nor does there seem to be an established, quantitative definition of localisation in terms of distance or other geographical terms, e.g. how far away from its eventual point of use can a sustainable energy technology be produced before its production can no longer be described as 'localised'?

In general though, localisation refers to the improved utilisation of local resources in energy systems, and it could take the form of local fuel harvesting and storage, the promotion of local business opportunities, and the development of products and services based on local raw materials and labour (Alaane and Saari, 2006). Within the renewable energy sector and indeed other economic sectors, a prevalent trend has been western firms' location of their manufacturing – and ever increasingly, research and development – infrastructure in countries like India and China (Cusmano et al, 2010; Christopher, 2005). Lewis and Wiser (2007) report that notable wind turbine manufacturers from major western markets such as USA, Germany, Denmark and Spain first grew and developed a stable base within their home countries before eventually relocating their facilities to China, India and other developing economies. If the home countries provided a conducive business climate for these companies to grow and stabilise to begin with, then why did the firms choose to relocate their production activities?

Within the late 20th century, a tendency grew among manufacturing and service companies to achieve greater specialisation of their functions (Kim, 1995). Outsourcing of tasks that fell outside their core competencies became a way of realising this (Humphrey, 2003; Nassimbeni, 2003). According to Perrot and Filippov (2011), within the renewable energy sector there was also the issue of high operational costs that characterise markets like wind and solar, and which make the markets dependent on production incentives, local subsidies and tax benefits. Thus, sustainable energy companies became attracted to the low-cost advantages and large market size in emerging Asian economies, the relatively adequate level of existing skills and facilities there, and the previous success of destination countries like Taiwan and China in the manufacture of semiconductors and microchips; the stagnation of western markets at intervals between the 1980s and the current decade further catalysed this trend (Perrot and Filippov, 2011).

All through this period of off-shoring, however, locally manufactured products retained their reputation for offering shorter lead times and higher quality assurance, and in more recent times,

there appears to be an increasing interest among governments and businesses in parts of the developed world in encouraging localised production (Melani, 2006). Straka (2002) offers a political perspective on the reason behind the re-emergence of localisation in the energy sector in particular, stating that concerns over political conflicts in some of the major crude oil-producing nations and their attendant risk to supply chain security heighten the need for other countries to focus on the development of local energy options. Another common social argument against the 'internationalisation' of companies' operations is that it results in the loss of jobs in the companies' home countries (Li, 2005; Hamilton & Summy, 2011; Alaane & Saari, 2006). However, Perrot and Filippov (2011) suggest that the transfer of functions such as research and development to overseas locations is not always a 'zero-sum game', as it does not by default lead to the closure of corresponding jobs in the home country. Other reasons that are attributed towards the support for localisation include rising labour costs in developing countries, rising energy costs, the export-import balance, currency depreciation, and the leaning of public attitudes towards environmental protection and social responsibility (Ristola & Mirata, 2007; Longo et al, 2008; Sheffi, 2001; Walker, 1995). The Economist (2012) reports that with a 5% p.a. inflation rate in shipping costs and a wage inflation rate estimated at 30% p.a., by 2015 it will be just as cheap to manufacture in North America for the domestic market as it would be to manufacture in China.

### **3. Case study of an energy-efficiency project**

The Green Deal and ECO are UK governmental policies aimed at encouraging the widespread implementation of a diverse range of sustainable energy products across the country, from insulation to window glazing to low-energy lighting and heating systems to renewable energy technologies, and it went 'fully live' in January 2013 (Richards, 2013). In order to investigate how the production and installation of sustainable energy products for buildings can be expanded to become a significant UK industry through the Green Deal, while minimising possible adverse environmental and social impacts of such a large-scale economic action, this author became involved in a major energy-efficiency project in the West Midlands County. The project focuses on developing supply chain, skills, and finance and other resources in preparation for the Green Deal and Energy Company Obligation (ECO) programmes, and on optimizing the economic, environmental and social returns from this activity. In this regard, the project represents a situation in which the economic activities involved in the provision of sustainable energy solutions for buildings are actively considered within social and ecological contexts. The project is made up of representatives of 30 organizations from the construction, energy, and property sectors, most of which are involved in the procurement, supply, installation and/or maintenance of sustainable energy products in buildings. The project also includes the contribution of big UK utility companies such as Eon.

The study of the project for the purpose of this research began in February 2012 and concluded in August 2013. The study involved not only listening to, watching and recording the verbal and written interactions that took place among participants, but also the participation the researcher in these interactions. This was in order to gain first-hand knowledge and experience about the

planning and decision-making processes involved, and also to gain the confidence of the other participants and ensure that the researcher's presence would not alter how they responded to issues. This field research technique of participating in a culture or context while at the same time recording what is being observed is identified as participant-observation in several research literatures (Iacono et al, 2009; Trochim, 1999). To ensure that the researcher's presence in the project would not compromise the reliability of the data obtained, the researcher's participation was limited to a relatively minor role. This involved carrying out instructions given by complete participants, i.e. staff from member organisations of the project, rather than contributing an independent perspective. Thus, the outputs of each session were based on the contributions of the other participants and did not reflect the researcher's own views. To establish consistency, care was taken to maintain this approach at a constant level for the project's duration, without the researcher becoming more active. Empirical qualitative data was obtained during participant observation via the recording of field notes. Also, other important documentation created by the participants during the course of the project – such as formal reports about the outcome of each project task – were obtained as additional evidence.

In addition to participant observation, interviews were also conducted to determine the effects that a company's implementation of environmentally and socially responsible practices could have on its business capacity. The interview respondents were the management-level company representatives involved in the energy-efficiency project. This ensured that the respondents had expert perceptions of business development and its relationship with environmental and social responsibility. The interviews were semi-structured, as this provides consistency while also allowing a sufficient degree of freedom and adaptability in getting information from respondents (Haigh, 2008). In all, 20 interviews were conducted, at which point 'saturation' – new data fitting into categories already devised from old ones without introducing any new category (Charmaz, 2003) – was considered to have been achieved.

#### **4. Research findings: Supply chain localisation as part of a socio-environmental business strategy**

The observation of the energy-efficiency project indicates that supply chain localisation is viewed as a useful measure that could be taken to ensure that the expansion of commercial provision of sustainable energy solutions for UK buildings does not create new environmental and social problems. Possible new environmental and social problems that could arise as a result of the expansion were identified in the programme as the following: the production of sustainable energy technologies and other products could result in new emissions releases, energy losses, and waste generation across the products' supply chain; the wholesale installation of sustainable energy solutions could have a disruptive and invasive effect on existing housing structures, fittings and occupants; and energy costs could be increased rather than reduced.

While the invasive and disruptive nature of the installation of sustainable energy products in buildings appears to be temporary in scope, lasting only for the duration of the installation process, project participants felt that it could nevertheless serve as a disincentive for building

occupants to view sustainable energy solutions favourably. The prospect of an increase in energy costs was attributed by participants to the inability of the current electricity grid network to absorb additional power from solar PV and other micro-generation technologies. This presents a significant case of sustainable energy solutions creating a social effect opposite to that which was intended, i.e. the alleviation of fuel poverty. The risk of an increase in emissions, energy loss, and waste as a result of the intensification of production activity was also acknowledged by the participants, as was the underperformance of sustainable energy products in buildings due to the inadequate integration of the products with the existing building facilities and the behaviour of building users.

In order to prevent the occurrence of these environmental and social risks, participants endorsed the localisation of the supply chain for sustainable energy products. They also recognised other measures such as whole-life costing; the reorientation of skills; a ‘whole-house’ approach; and the inclusion of building users in the capacity development process. All five measures are further highlighted in the paragraph below.

The participants appeared to share the view that the adoption of supply chain localism for the implementation of the Green Deal has the potential to stimulate UK economic growth to a significant extent. The creation of new businesses and employment and poverty reduction opportunities in Local Authority Areas throughout the United Kingdom was identified as a major potential benefit of supply chain localism. For instance, participants were observed to target the Not in Education, Employment or Training (NEET) section of the populace as a source of new members of a multi-skilled workforce for the Green Deal. The NEET category’s current lack of work experience, as well as the need for sustainable energy products to be installed and maintained with minimum social disruption and optimum technical performance, led the participants to propose the reskilling and multiskilling of the workforce. They also proposed that building occupants and other building users should be engaged in the capacity development process in order for their perspectives to be obtained on how sustainable energy solutions can be installed with minimum disruption to their lives. However, the skills training and setting of up of local supply chain activities require a high level of financial investment, and so the participants recommended a ‘whole-life costing’ standard that particularly highlighted the economic benefits that might accrue to the companies in the future to offset the initial investment costs. The aim was to encourage companies to take a longer-term view of the business rather than seek quick economic wins. In addition, the participants supported the adoption of a ‘whole-house’ approach that focuses on the integration of different sustainable energy solutions within buildings (rather than on the efficiency of any single solution in itself), in order to ensure that different solutions fully complement each other.

Beyond the social and economic rationale behind the participants’ support for supply chain localism, there also appeared to be environmental reasons as well, in terms of the need to minimise the energy, emissions and waste issues associated with procuring, transporting, installing and maintaining both production materials and finished sustainable energy products. The participants were of the view that the localism approach would allow for a closer

monitoring of the production and delivery of sustainable energy solutions to guarantee that only minimal or zero harmful environmental impacts are yielded.

The interview data suggests that companies acknowledge local sourcing and procurement as a major way by which they can implement socio-environmental responsibility. The interviewees acknowledged the role of localisation in reducing the embodied energy of sustainable energy solutions (the energy consumed in the process of sourcing, producing and distributing them), carbon emissions, and negative social impacts. As one interviewee put it: *“If you are sourcing locally, you’ve got a little bit of comfort that ...the product itself is being manufactured in the right kinds of ways”*. Another questioned: *“What’s the carbon emissions to bring that piece of material from China? ... That could be a substandard material and it’s not got the lifespan that you think it’s got and then you’ve got to dump it anyway”*. However, interviewees emphasized that finance is a significant barrier to the development of business capacity for the implementation of supply chain localisation and other measures recommended during the project. One interviewee mentioned that *‘There’s a lot of investment required for new manufacturing facilities’*, while another states that *‘The costs are more upfront as well ...which is what the stumbling block, I think, is’*. Environmental and social criteria were also found to increase the intensiveness of materials specification and add to the overall complexity of the procurement process. Local partners may not always offer the financial quotes, however, and this means that the company may have to forego cheaper partnership options. Apart from this, a conflict is set up between the environmental business value of localism and the mainstream business practice of globalisation. The emphasis on localisation may also require a company to forego expansion opportunities. For example, an interviewee states: *‘We could have had the model of being the biggest nationwide installation company covering the whole country, but I decided ...that wasn’t the best model. The better model is for there to be an installation company in every town or village or wherever ...it creates local employment’*.

## **5. Supply chain localisation and its consequences**

The data obtained from the project case study indicate that the localisation of the sustainable energy products’ supply chains has the social benefit of creating new jobs, and it also provides extra income for building occupants through their sale of surplus electricity, which in turn serves as an incentive for the public to use energy more efficiently. Environmentally, it allows for greater monitoring of production activities to ensure that they yield only minimum adverse ecological effects, and it reduces the distance across which products can be distributed, thus reducing the release of carbon emissions in the case of fossil fuel-based transportation. These findings are supported by literature sources (for example, Hamilton & Summy, 2011, and Ristola & Mirata, 2007). Rio and Burguillo (2009) mention that the social benefits of the localisation of renewable energy production activities extend beyond employment creation to impact on social cohesion, education, income distribution. Localisation also acts as a disincentive for emigration, and in so doing it indirectly alleviates environmental problems that are connected with the depopulation of rural areas, such as desertification and erosion (Rio & Burguillo, 2009).

Despite these benefits, there are wider concerns surrounding the feasibility of localisation. From an economic angle, the infrastructure required for the setting up of a completely local manufacturing base involves a high level of initial investment, as identified by participants in the project case study. The situation is further compounded by the ambiguity that still surrounds the funding mechanism for the Green Deal, as well as by the insufficient security of market demand which makes such a high volume of investment harder to justify (Laughlin et al, 2012; Wustenhausen & Bilharz, 2006). There are also lingering issues concerning the disruption that a wholesale transition to localisation could cause the industry, which currently operates on a more globalised, neo-liberal market system and relies significantly on the procurement of sustainable energy technologies from China and other external markets, as noted by project participants. These viewpoints on the economics of localisation are echoed in literature as well (e.g. Omer, 2008; Sawin, 2006). Even in the case of biomass energy systems, which benefit from the local availability of feedstock, Lam et al (2010) state that extensive infrastructure networks are required for harvesting, transportation, storage, and processing activities, and the relatively low energy output produced per unit volume of resource increases the cost, emissions and complexity of supply chains (Lam et al, 2010). Richard (2010) indicates that independent local suppliers may only be adequate for small-scale energy generation activity; a more practical alternative to regional or global market arrangements is the operation of single companies on large contiguous land areas in order to achieve a less fragmented but distributed approach. However, this system comes with problems associated with land access and appropriation and employee rights; and there is also the issue of setting up contingency plans for backup suppliers (Richard, 2010).

The limitations of the supply chain localisation concept aren't just confined to the social and economic fronts either. Environmentally, there is counter-evidence to the view that localisation is truly beneficial in an ecological sense. If global energy consumption remains unchanged and traditional fuels and technologies are still used, the volume of emissions reduced by decentralised renewable power plants in particular would remain constant rather than rise (Alaane & Saari, 2006). In other words, the localisation of energy generation may redistribute global emissions but not reduce it. In regard to this, the intensification of local manufacturing and other production activities within the UK could cause a setback to the country's achievement of its energy and carbon emissions reduction targets (Anderson & Fergusson, 2006; Tsoutsos et al, 2005). Furthermore, the potential benefits of localisation with regard to resource conservation are also liable to be exaggerated because assessment studies do not always fully take into account supply chain-related processes that take place outside a given location (Albino et al, 2002). Putting the whole picture together, while localisation can yield significant environmental and social benefits, there is also an active risk that the localisation agenda could well disrupt supply beyond the short-to-medium-term and have major negative economic repercussions for the industry, thus jeopardising its socio-economic potential without guaranteeing significant positive net energy and carbon impacts.

## 6. Conclusion

This paper has looked at the potential of supply chain localisation to minimise adverse environmental and social impacts of the provision of sustainable energy goods and services on a major scale. The paper relied on a case study of a major energy-efficiency project within the West Midlands, United Kingdom, as well as on a study of literature. While supply chain localisation was found to represent a sustainable business option in principle, the scope for its application remains limited and reliant on standard policy tools such as subsidies, tax reliefs and other regulatory measures that could significantly lower the cost of doing business in Britain. Future studies could focus on how to resolve the barriers to supply chain localisation rather than simply promoting its benefits.

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