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# The UK domestic photovoltaics industry and the role of central government

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**Abstract**

Microgeneration technologies, such as solar photovoltaics, are an increasingly popular alternative for policy makers looking to address security of supply, fuel poverty, and environmental concerns. In the UK, this industry has benefited from government support in the form of grants but there is uncertainty about how microgeneration policy will evolve in the coming years. This paper uses interviews with stakeholders from across the UK PV industry to describe the current business and policy environment before exploring microgeneration policy as a question of joined-up government. Using a policy 'streams' framework, it is shown that microgeneration policy in the UK remains largely the domain of one ministry and while there is potential for cross-government promotion of microgeneration, departments must be convinced that microgeneration is a solution to "their" problems before policy coordination and consistency can be improved. While the paper focuses primarily on central government, the increasingly important role of local government in microgeneration policy is also briefly discussed.


*Keywords:* Joined-up government; Microgeneration; Photovoltaics

## 1. Introduction

Energy policy is a perennial concern of government as the provision of affordable and reliable energy sources facilitates economic growth and a high quality of life. As demonstrated by the UK fuel protests in 2000 (Doherty et al., 2003), infrastructure and security of supply are vital elements of energy policy and are ignored at the government's peril; however, environmental issues are increasingly important as well (Helm, 2002b). Recently a combination of both supply security and environmental constraints has led a shift toward more environmentally-friendly and indigenous sources of energy—in particular, renewable sources.

Currently 93% of the UK's renewable energy comes from large-scale technologies such as biofuels, hydropower and wind (DTI, 2005b) but there has been increased attention on microgeneration (also known as distributed generation). Although these technologies can use nonrenewable fuel sources and may be as large as 50 $kW_p$, one of the most attractive markets is the residential sector where individual households generate electricity or heat at a smaller scale (less than 10 $kW_p$). However, the diffusion of these technologies, such as solar photovoltaics (PV), is inhibited by their high cost and incongruence with existing energy systems (i.e. "compatibility" after Rogers, 2003). Noting the merit of these technologies, the UK central government has sought to address these barriers with both grant funding and consultations on how microgeneration might be incorporated into the existing electrical system (DTI, 2005c).

Of course, microgeneration forms only a small part of a national energy policy which extends to a range of generation technologies and stakeholders. Therefore any proposed solutions for microgeneration must also mesh with existing ways of formulating and implementing policy. This is difficult, however, as many different government departments are involved including the Cabinet Office, the Treasury, and the Department of Trade and Industry (DTI) to name but a few. The need for coordination across departmental boundaries and cooperation between

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multiple stakeholders makes energy policy a so-called wicked issue (Clarke and Stewart, 1997). When the Labour government first came to power in 1997, such issues were acknowledged and joined-up government (JUG) proposed as a solution. However, while the effectiveness of JUG has been analysed in many policy areas (e.g. health (Higgs et al., 2003) and local government reform (Cowell and Martin, 2003), studies of UK energy policy often focus on the specifics of individual policies with only minor questions about how policy is shaped by the structure and functionality of government itself (Elliott, 1994; Helm, 2002a; Mitchell and Connor, 2004)

Therefore the aim of this paper is to begin exploring the effectiveness of JUG in UK energy policy by focusing on microgeneration policy, in particular the promotion of solar PV. After introducing the principles of JUG and key elements of UK energy policy, original interviews with stakeholders from the UK PV industry are presented to highlight the challenges facing the industry and its interactions with government. The paper concludes by analysing alternative policies to promote microgeneration using a JUG framework.

## 2. Joined-up government in the UK

JUG describes the "consistency between organizational arrangements of programs, policies, or agencies which may enable them to collaborate" and has been a focus of policy makers in many Western nations for the past decade (6, 2004, p. 106). In the UK, JUG is closely associated with the New Labour government as improved policy coordination was a key feature of its Third Way philosophy (Butler, 2000). However, JUG is not simply "the administrative corollary of the politics of the Third Way" and the question of how to deliver effective policy solutions to complex issues is a long-standing one (Ling, 2002, p. 639).

JUG in the UK has been implemented through many different measures (6, 2004, p. 122). A key example is Public Service Agreements (PSAs), department-specific target-based statements of government objectives which, combined with Departmental Expenditure Limits, provide accountability mechanisms to ensure that government aims are being achieved. However, while PSAs have raised awareness of government-wide priorities, there have been criticisms that the effectiveness of this tool is undermined by frequent changes to targets and misrepresentation of performance (James, 2004). In other words, the change in policy implementation which JUG seeks to deliver cannot be achieved simply through new administrative tools (Flinders, 2002). Instead a comprehensive re-evaluation of the structure and values of UK central government is likely required but at present, "it is hard to find evidence of such a dramatic step change" (Ling, 2002, p. 632). Indeed a study of the UK government's approach to sustainable development issues in general found that the predominance of "weasel words" reflects an "unwillingness" to promote major reforms (Munton, 1997, p. 147, 154).

Energy policy is typical of the 'wicked' issues which JUG tries to address, as it crosses departmental boundaries and requires the cooperation of multiple stakeholders (Clarke and Stewart, 1997). For example, UK energy policy is primarily coordinated by the DTI and this ministry must reconcile its historical concern for energy policy as a trade and industry issue (Helm, 2002b) with newer constraints like the environment and fuel poverty. This balancing act is further complicated by the fact that energy policy is developed and implemented in conjunction with other government departments as highlighted below:

- *The Prime Minister's Performance and Innovation Unit* (based in the Cabinet Office) set the strategic goals of the 2003 energy white paper. This advisory function is now fulfilled by the Prime Minister's Strategy Unit.
- *The Treasury* has PSAs with the DTI which guide their strategic energy policy goals and set funding limits, subject to a 3-year review. Of the DTI's 11 PSA targets for 2005–2008, only one explicitly covers energy policy; the remaining targets are primarily focused on improving the UK economy (DTI, 2006a).
- *The Office of the Deputy Prime Minister* (ODPM)[1] seeks to create "sustainable communities" and sets planning and building regulation policy which influences the energy performance of buildings.
- *The Office of Gas and Electricity Markets* (Ofgem) acts as regulator for the UK's gas and electricity markets, protecting consumer interests and maintaining a competitive market.
- *The Department for Environment, Food and Rural Affairs* (Defra) plays a lead role in UK climate change policy and shares responsibility with DTI on the climate change, fuel poverty and efficiency aspects of energy policy. A recent row between Defra and DTI about greenhouse gas reduction targets delayed the government's climate change strategy by 7 months (Wintour, 2006).

It should be noted that European Union directives often touch on energy issues and hence shape UK government policy. A few relevant examples include the Renewable Energy Directive (2001/77/EC), the Energy Performance of Buildings Directive (2002/91/EC), and the recently approved Energy End-use Efficiency and Energy Services Directive (2006/32/EC).

This brief review has shown that energy policy in the UK may be extremely difficult to 'join-up' and hints at general conflicts in departmental agendas, let alone on the specifics of microgeneration policy. To evaluate microgeneration policy as a JUG issue more rigorously, a framework is needed to guide the analysis. Exworthy and Powell (2004) have proposed a model which states that effective policy implementation must be coordinated across three policy

[1]In May 2006, this department was renamed the Department of Communities and Local Government.

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'streams' and at three policy 'dimensions'. These dimensions include the coordination of policy within central government (centre–centre), vertically to local government (centre–local), and within local government (local–local). At each of these levels, success is determined by the coordination of *policy* (e.g. clear, common goals and vision), *resources* (e.g. adequate funding, willingness to invest time and reputation to assist other agencies), and *process* (e.g. a sense of problem ownership and a feasible role to play in its solution). This paper focuses on the central–central level as the primary support mechanism for microgeneration to date (especially PV) has been a grant from central government. It is important to note however that local–local and centre–local coordination may become increasingly important. For example, the so-called Merton Rule (which requires onsite renewable energy in new developments) is being pursued by 75 councils across the UK (LBM, 2006). This paper will therefore use the Exworthy and Powell 'streams' framework to examine the centre–centre interactions that shape microgeneration policy, while observing that this same framework can be extended to analyse microgeneration as a local government phenomenon.

## 3. Energy policy background

Current energy policy in the United Kingdom is driven by the four goals of the energy white paper: to reduce greenhouse gas emissions, to maintain reliable energy supplies, to promote competitive markets, and to ensure affordable warmth for households (DTI, 2003). However recent concerns about rising energy prices, rising greenhouse gas emissions, and Britain's increasing dependence on imported gas have prompted a new review of energy policy only three years after the PIU's initial survey (DTI, 2006c). The review seeks to assess the effectiveness of existing policies and examine medium and long-term options, including—perhaps most controversially—the future of nuclear power. Currently, nuclear power provides about 20% of UK electricity but 70% of this capacity is due to be decommissioned over the next 20 years, leaving a significant low-carbon energy gap. Therefore the review had to consider whether a new generation of nuclear power stations should be constructed and if so, whether intervention is required to create the necessary investment conditions (e.g. addressing decommissioning and waste management issues). However a recent opinion poll showed that, while 54% of respondents would be willing to accept new nuclear stations if it helped address climate change, three-quarters preferred investment in renewable energy or energy efficiency (Poortinga et al., 2005). Some groups have explicitly tried to highlight microgeneration as an alternative to nuclear, showing how it can address the main goals of UK energy policy in a more effective way than a similar investment in nuclear power (Willis, 2005). Recent studies have also suggested that microgeneration has a unique potential to involve households more directly in the generation of electricity, raising awareness and even changing energy consumption patterns (Dobbyn and Thomas, 2005; Keirstead, 2005b).

A wide range of microgenerating technologies exist (EST, 2005a) but this paper concentrates on solar PV. PV is one of the more mature microgenerating technologies and has been the focus of government support for a number of years, making it a good case study of JUG and microgeneration policy.

### 3.1. PV policy

Photovoltaics are expensive (currently about £6000 per kilowatt-peak) and as a result, there has been major government support for the technology since 2000. These programmes have encouraged growth in the PV sector (Fig. 1) but the UK accounts for only 0.3% of worldwide PV installations, well behind international leaders Germany, Japan and the United States (IEA-PVPS 2005).

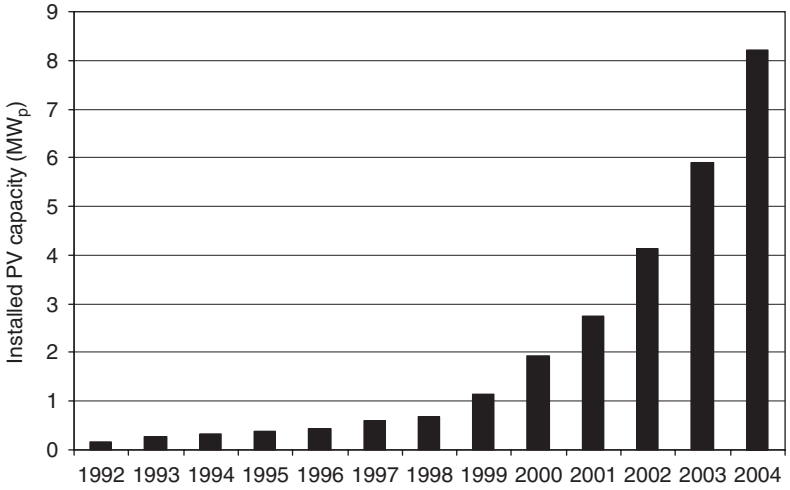


Fig. 1. Installed capacity of photovoltaics in the UK, 1992–2004 (DTI, 2005b; IEA-PVPS, 2005).

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To compete globally, a government-industry report in 2001 recommended a £150 million 10-year programme to install PV on 70,000 roofs and 1400 larger nondomestic buildings (Shanahan 2003); while this particular programme has not come to fruition, the UK has had three other support programmes:

- *The PV field trials*: This programme began in 2000 and consisted of both domestic and large-scale projects (total budget of £9.4 million, total installed capacity about 1.5 $MW_p$). The grants were primarily intended to provide opportunities for monitoring system performance, build industry experience and refine installation and design practices (BRE, 2002; Davies and Munzinger, 2003).
- *The Major Photovoltaics Demonstration Programme* (*MDP*): The field trials demonstrated that PV installations were viable in the UK and established the technical knowledge necessary for a wider expansion of PV. Therefore in March 2002, the DTI launched the MDP to generate awareness of the technology and "make considerable headway in preparing a secure platform for long-term and sustained growth in the UK PV market" (EST 2003, p. 3). There were small (0.5–5 $kW_p$) and large (5–100 $kW_p$) streams and the programme's total budget was about £32 million, having been extended several times by government. Approximately 1400 domestic and 160 large-scale projects have been completed, for a total installed capacity of about 8 $MW_p$ (EST, 2005b).
- *The Low Carbon Buildings Programme* (*LCBP*): The MDP finished in March 2006 and the DTI announced its successor, the LCBP. This programme has a budget of £80 million over 3 years (the initial proposal was £30 million) but it covers a range of microgeneration and energy-efficiency technologies, arguably a significant reduction in funding for PVs (Berry, 2005; Solar Century, 2005). The programme hopes to build the market by encouraging the use of microgeneration within large-scale housing developments, with less emphasis on the provision of grants to individual households.

### 3.2. Associated electricity policy

PV is a versatile technology and can be used, for example, as the cladding of commercial office towers, as a stand-alone power supply for off-grid properties, or on the roof of a domestic property. Each application will face different technical and policy issues but understanding grid-connected domestic applications is particularly important because of their impact on consumer behaviour as noted above; domestic installations also account for approximately 40% of the UK's installed PV capacity (Gunning, 2003). The following are some of the key policy issues which affect domestic PV and its interactions with the existing electricity system.

#### 3.2.1. Renewables obligation certificates

Electricity suppliers in the UK are obliged by law to provide a certain percentage of their electricity from renewable sources (5.5% in 2005/6). Each megawatt-hour of renewable electricity is awarded a Renewables Obligation Certificate (ROC), which can then be traded with suppliers who have not met their obligation requirements. Domestic microgeneration installations face numerous difficulties with this system primarily arising from the small size of the installations (perhaps 1 ROC per year). This means that the administrative hassle of claiming ROCs from an individual household may be disproportionate to the benefit received by electricity suppliers (~£40/ROC). To resolve these issues, a consultation was held in 2005 and the final decision supported the creation of ROC amalgamation agents to simplify this process (DTI, 2006e); however the effectiveness of these agents remains to be seen.

#### 3.2.2. Balancing and settlement arrangements

The UK wholesale electricity market is governed by the Balancing and Settlement Code. Under these rules, electricity suppliers must purchase supply to match their customer's demand in a half-hourly market. Since domestic customers do not have half-hourly meters, representative profiles are accepted as a proxy for actual customer demand. However, microgeneration means that electricity might be returned to the grid, disrupting this balance. The regulator has allowed the use of modified electricity profiles to account for the contribution of microgeneration (Ofgem, 2002) and research is currently underway at the British Electrotechnical and Allied Manufacturers' Association to develop these profiles for a range of microgeneration technologies.

#### 3.2.3. Metering for microgeneration

Since microgeneration creates the potential of selling electricity back to the grid, metering options can be more complex than a traditional domestic import meter. For example, generation meteres are required as a condition of the PV grant programme and count cumulative kilowatt-hours of production. Export meters record the amount of electricity returned to the grid but these devices are not mandatory. Smart metering technologies are also frequently mentioned in conjunction with microgeneration and offer a number of potential benefits including easier data collection for meter operators and even 5–10% reductions in domestic energy consumption through improved consumer awareness (Ofgem, 2006). These metering technologies also provide the basis for microgeneration-specific electricity tariffs (Hughes and Bell, 2006).

In the past year, there have been consultations on nearly all of these issues (DTI, 2006e; Ofgem, 2005). However, the most important document was the DTI's microgeneration strategy consultation (DTI, 2005c), which raised questions about future funding support (i.e. the LCBP), identified

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areas for regulatory improvements and explicitly noted that implementing the strategy will require the cooperation of several key ministries (namely DTI, Defra, ODPM, and the Treasury). The strategy was finally published in April 2006 (DTI, 2006b) but it has been criticized by industry as lacking in ambition and specificity (BBC News, 2006; Berry, 2006).

This review has illustrated that microgeneration is an important and contemporary element of UK energy policy and that PVs are a well-established example of these technologies. The paper proceeds with a study of the stakeholders within UK PV industry, first describing the current state of the industry and then using these insights to comment on the degree to which current and future microgeneration policy could be described as 'joined-up'.

## 4. Stakeholder interviews

Interviews were conducted with a wide variety of stakeholders from the domestic PV industry in late 2005, before the publication of the government's final microgeneration strategy. The results form part of a larger research programme that began in 2003 with surveys and interviews of nearly 100 PV households in the UK; the earlier findings raised some of the themes discussed here. The selection of interviewees was intended to represent all stages of the PV lifecycle, from the purchase of the system through its use to future issues (Table 1). The responses are presented anonymously at the request of the participants.

### 4.1. PV installation industry

Seven domestic PV installation firms were identified representing approximately 70% of the installations performed under the domestic stream of the Major Demonstration Programme (MDP). Two major issues are discussed here: customer interaction with the installers and the business environment.

Consumer interest in PV typically develops from an introduction to the technology via mass media to experiencing the technology in person at an exhibition or similar event (BMWV, 1998). With a better understanding of PV technology, consumers can make an informed decision to purchase and select an installation firm. In previous research on the UK PV industry, respondents revealed that "no one wants the PV industry to end up like the solar hot water industry", a reference to the aggressive door-to-door 'cowboy' sales techniques common in that sector (Jardine, 2004). Accordingly the MDP grant programme featured an accreditation system for installers, maintained by the Energy Saving Trust (the EST administered the MDP and has continued this role, and the accreditation programme, for the new LCBP). The list of approved installers has grown to about 60 firms since the MDP began in 2002 and is considered by installers to be one of the programme's major successes:

> "[The grant] legitimizes a new technology, it reduces the cost so it makes it more affordable for people to do it and also it provides some quality assurance to people".

The cost of PV has fallen from £9000 per $kW_p$ in 2002 to around £6000 per $kW_p$ currently, largely due to installers gaining experience. Despite this reduction and the contribution of the grant, the earlier household interviews found that an additional financial windfall was often needed to afford PV (e.g. a pension lump-sum payment). Some installers were therefore concerned about the long-term sustainability of income from private installations and had diversified their businesses by operating a network of smaller subcontractors, performing commercial and domestic installations, or installing other microgenerating technologies. However, small domestic installations remain "the lifeblood of many companies in the PV industry" (Hacker, 2005) and installers indicated a great deal of apprehension about how the proposed LCBP, with its smaller budget and emphasis on large-scale housing developments, might affect small firms:

> "I see the industry now collapsing, I see my laying off the people that we've employed… and I see a complete waste of opportunity".

Many installers indicated that they would prefer alternative support mechanisms to a grant (e.g. a German-style feed-in tariff or building regulations requiring PV); yet the most important concern was not the form of support, but that the government needs to provide clear and consistent signals of support for these firms to plan and grow their businesses. The LCBP was initially intended to provide this certainty with a 6-year programme. However, the programme is now 3 years (arguably in line with the Treasury's spending review in 2007) and has already changed budget (from £30 million proposed to £80 million presently). This suggests that the nature of long-term grant support remains unclear.

Table 1
Types of PV organizations interviewed

| Phase of PV lifecycle | Sector | Number of respondents |
|---|---|---|
| Purchase | PV installation firms | 7 |
| Use | Electricity suppliers | 5 |
| | Metering firms | 3 |
| | Monitoring device manufacturers | 3 |
| Future | Trade associations | 4 |
| | Government representatives | 3 |

### 4.2. Monitoring and metering firms

A typical PV system does not consist of only panels and inverters. Surveys with PV households indicated that 86% of installations were fitted with visual display devices, which monitor the performance of the PV system and

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provide a unique opportunity to increase energy awareness among household occupants (Keirstead, 2005a). As a condition of the grant, systems are also fitted with a generation meter to count the cumulative kilowatt-hours generated by the PV system since installation and 48% of respondents had export meters fitted, allowing electricity sold to the grid to be measured separately. The next set of interviews therefore examines the firms which design and distribute this equipment to see how these important elements of a PV installation are affected by government policy.

The most common type of monitor is a portable or wall-mounted device which measures PV generation, both instantaneous and cumulative, although more advanced models are available which display consumption information or even set saving targets for the household. Three firms that produce such devices were identified and notably they were all located overseas, in or near large PV markets such as Germany, the Netherlands and Japan; with the exception of one multinational company, the firms are small to medium-sized enterprises. Monitoring devices have been on the market for approximately five years and the designs were built on existing expertise: as one respondent put it, "a spin-off of other developments". The devices came to market in a two-stage process. First, the firms were often involved in large government-funded PV demonstration projects where there was a desire to demonstrate the potential of PV by including an "awareness" monitor alongside technical monitoring equipment. These initial designs were then adapted for the domestic market when it became clear that there was a demand, for example by monitoring internet discussion forums of early adopters. The monitoring devices are typically sold through wholesalers and PV installation firms who include the devices "as a unique selling point" (approximately 40% of installers included such a device as standard, a further 40% offered it as an option). Not surprisingly, the biggest limitation on demand for monitoring equipment is that PV installations themselves are dependent on government support:

> "As soon as there's a subsidy for PV system, like in the UK you have, then the demand for PV systems goes up and we sell more. And for example in Holland, there's no subsidy at all anymore and the amount has dropped quickly".

While some manufacturers are trying to diversify into other markets (e.g. adapting their devices for use with other microgenerating technologies or trying to get them installed as consumption monitors by energy-conscious architects), there was a belief that the sale of monitoring devices will remain grant dependent for at least the next 5 years. Furthermore since only hundreds of these devices are sold per year, respondents indicated that they could not afford to research and develop new designs.

In contrast to the small number of monitoring devices installed, there are nearly 26 million domestic electricity meters in the UK and representatives from three major UK metering companies were interviewed. The industry has a long history and has faced many changes, in particular since liberalization in 2003 led to specialization within the industry of meter manufacturers, procurers and operators. The metering industry is also carefully regulated. Since all electricity customers must have a meter to measure the amount of electricity purchased ('imported') from the grid, the regulator Ofgem limits how much metering companies can charge for this service in the interest of consumers. Combined with the desire to simplify the maintenance of millions of meters, this has led to import meters becoming "a commodity item", standardized to a few low-cost models. As discussed above however, microgenerating technologies invite the use of other metering technologies, ranging from additional standard meters (e.g. to count exported and generated units) to smart metering technologies. Since such devices are neither required by law nor sold in large volumes, there is little incentive for metering companies to get involved with these meters. As a result, smart metering technologies have been limited primarily to pilot studies and export and generation meters have been paid for almost entirely by the PV households themselves. Nonetheless, there are no outright obstacles to the installation of these devices and the metering industry is preparing for possible future changes:

> "We don't really make any money out of microgeneration or export metering at all…what's important is that there are people out there who are capable of doing it and they are willing to do it….that's all we're really there for".

However large-scale growth in microgeneration may be inhibited until these metering questions are resolved, as accurate data on the flows of electricity from a microgeneration facility would facilitate a variety of microgeneration tariffs and improve the accuracy of national statistics on renewable electricity generation.

### 4.3. Electricity suppliers

One of the attractions of owning a PV system is the ability to sell excess electricity back to the grid. The exact nature of this arrangement depends on the metering equipment available but also the value of this electricity to the suppliers. For example, the microgeneration tariffs offered by electricity suppliers are influenced primarily by the policy issues identified in Section 3.2. However, these constraints are not obvious to consumers and in earlier interviews, PV households often indicated that they were frustrated that the price of imported electricity would rise without a corresponding increase in the microgeneration tariff. In response, the electricity suppliers noted that the administrative costs of claiming the ROC and settlement values from a small number of microgeneration customers

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outweighed the benefits. In the UK, there are currently three common tariffs for microgenerated electricity:

- *Generation*: customers are paid for all microgenerated units regardless of whether they are used in the home or sold to the grid
- *Export:* customers are paid for all microgenerated units that are sold back to the grid
- *Profile*: customers are paid a flat-fee based on typical generation and consumption profiles for the household and its particular microgeneration technology

Fig. 2 summarizes the take-up of current offers for domestic PV-generated electricity. Given this variety, one might suspect that consumers have a great deal of choice and can select the supplier that best meets their needs. However, most of these tariffs are not widely advertised and cold-calling a supplier for details can be difficult: as one programme manager said, "people like me are hidden within businesses". A potential explanation for this secrecy is that the suppliers do not make any money by offering these tariffs: rather they are "aspirational" products, giving electricity suppliers experience in what might become a significant market:

> "We're at the very early stages of something that could potentially be very large so we need to be in the party now as it were, understanding what's going on out there so we're ready when things really do start progressing".

While the recent reforms of the ROC system and the opportunity to use revised settlement profiles may give suppliers more flexibility in the future, these firms are generally seeking simple solutions that will enable them to run a profitable microgeneration operation with thousands of customers. One respondent mentioned although some companies may offer more complicated or tailored tariffs, most customers are likely to prefer hassle-free options. This may mean that an energy service company model is used, allowing customers to sign up with a supplier which then installs and maintains the microgeneration equipment, perhaps paying for generation through a profile-based tariff.

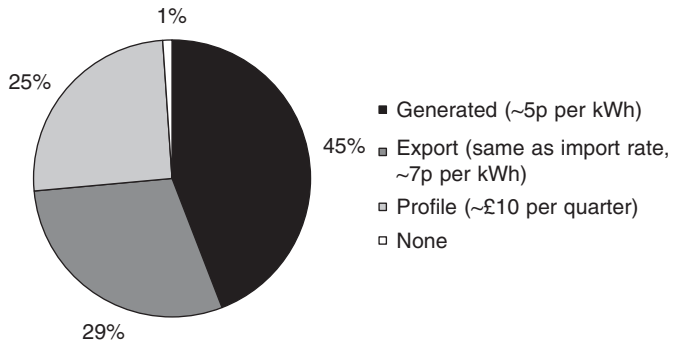


Fig. 2. Tariffs for microgenerated electricity from PV installations ($n = 510$).

### 4.4. Trade associations

Each of the stakeholders discussed thus far could be said to have a wish list of policy changes they would like to see the government implement: continued grants for the installers and monitor manufacturers, a clear regulatory environment for the electricity suppliers and metering manufacturers to plan new businesses. As one electricity supplier indicated, each part of the microgeneration industry has a slightly different interpretation of the issues at hand and so it is important to speak up and ensure that the voice of each industry is heard. Interviews were therefore conducted with representatives of industry trade associations to understand how these groups worked on behalf of their members and interacted with government agencies.

Interviews with spokespeople from metering and electricity industry associations revealed that their main role is currently collecting data to support their members (e.g. revised consumption profiles for microgenerating households) and advising on regulatory matters. It was noted that part of this second task requires ensuring that various European directives are implemented in a consistent manner by DTI; however, coordinating these policies into a coherent framework is difficult:

> "I think there is—shall we say, not yet *joined-up policy* on what has to happen to cater both the Esco directive, the [Measurements Instruments Directive], and the emergence of microgeneration" [emphasis added]

The PV trade association, PV-UK, was also interviewed and indicated that in recent years there has been increased pressure from its 50 members to become actively involved in lobbying. Unfortunately the association has insufficient resources to mount a significant campaign and it has since joined with the larger Renewable Energy Association (REA). Although the REA represents all renewable energy technologies (such as large-scale wind), it does employ a microgeneration policy expert and recent lobbying efforts have focused primarily on ensuring the continuation of the grant programme. As noted above, many installers would actually prefer other forms of support but the desire for a consistent and ambitious support framework is most important. Indeed there is a sense of frustration in the industry that despite the government's repeated aspirations for an internationally competitive PV industry in the UK, there has yet to be sufficient funding to make that vision a reality:

> "Does it make sense to keep persisting with this pretence that the Low Carbon Buildings Programme is somehow going to deliver the economies of scale and all the rest of it they talk about in the consultation document? I mean it just isn't going to happen at the level of funding that is on the table".

The respondents also indicated that their biggest challenge is simply working with the structure of government. While

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formal consultation documents are relatively easy to respond to, informal relationships are also an important means of communication but they are impeded by two obstacles. First, energy issues are spread across a number of different departments making it difficult to focus limited lobbying resources. Secondly, energy matters seem to be plagued by ever-changing working relationships:

> "[Since] I've been working directly on solar issues for example, we've had eight energy ministers and I've personally dealt with at least four different DTI officials on the same issue. What you find is that they don't actually bother reading or go back to what was agreed last year, never mind three years ago. So you are constantly having to re-educate people who are fresh to the job".

It was suggested that although this turnover is common throughout the UK government, energy responsibilities have been particularly changeable.

### 4.5. Government

Lastly, the government's own views on PV and microgeneration policy were sought. Interviews were conducted with representatives from three key government agencies: the DTI (which coordinates energy policy), Ofgem (the electricity regulator), and the Energy Saving Trust. It should be noted that the EST is strictly speaking not part of government, although it does receive 90% of its funding from government departments (Defra, the Department for Transport, and DTI) and plays a key role in implementing energy policy, specifically the Major PV Demonstration Programme and subsequent LCBP (EST, 2004).

An EST representative confirmed many of the findings described above: for example, that the accreditation of installers had been a major achievement of the MDP grant programme and that uncertainty over funding makes it difficult for the industry to plan its future. It was also noted that the EST's status on the edge of government enables it to act as an intermediary between industry and the government, providing informal reinforcement of messages that may also be coming to government through consultations or lobbying.

As the regulator, Ofgem has an important role to play both in protecting consumer interests and encouraging competition within the industry. In the case of microgeneration, the interviewee acknowledged that Ofgem was a key figure in the debate and that their work on microgeneration sought "to give a bit of leadership to the industry" by clarifying the roles and expectations of the major stakeholders. However there is only so much that Ofgem can do to promote and coordinate microgeneration policy, as its role as an independent regulator limits its accountability to the general public:

> "Beyond a certain point, if there are major significant financial implications [for consumers resulting from a policy decision] then it's not a change we'd make. We'd say to government, ministers must take responsibility if they want to make those changes".

Despite the DTI's central role in the promotion of microgeneration, they are not completely unfettered in the actions they can take. Part of this is internal: for example, the DTI seeks the promotion of "fair competitive markets" (DTI, 2006a) which is arguably a reflection of prominence that trade and industry concerns were given in historical energy policy (Helm, 2002b). These attributes may consequently make market interventions on behalf of consumers or the environment more difficult. For example, a German-style feed-in tariff was suggested by many installers as a potentially valuable policy to kick-start microgeneration; although it was acknowledged that this policy has been successful in other countries, the DTI spokesperson indicated that:

> "We have a fully liberalised market where government dictating the price of electricity essentially is not something, you know, not a road that we should go down".

However, this position is not entirely consistent and the government's chief scientific advisor recently suggested that a levy could be placed on household electricity bills to pay for a new generation of nuclear power stations (BBC News, 2005). This is remarkably similar to the way in which German electricity suppliers charge their customers to raise the funds needed for the renewable feed-in tariff premium.

There is also reason to believe that the reasons why these alternative policies cannot be implemented are ineffectively communicated back to industry. That is, the DTI respondent reiterated that the department's role in energy policy is one of "coordination" and "driving [other departments] and hopefully working with them to develop policies in their own areas". However, while there are visible mechanisms for coordination (most notably, the Sustainable Energy Policy Network which tries to implement the energy white paper across departments), the role of informal networks and working relationships with other government departments are also very important. These structures may be invisible or confusing to outsiders, even if "for us sitting in the government, it's more sensible. We see the logic of it".

## 5. Is microgeneration policy joined-up?

The interviews have demonstrated some of the challenges facing the microgeneration and PV industries in the UK. The role of central government, particularly the DTI and Ofgem, was shown to be very important but returning to 6's (2004) definition of JUG, specific questions can be raised about the extent to which microgeneration policy is consistent and enables collaboration between government departments. The discussion therefore presents an overall assessment of the PV industry before considering current

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and future microgeneration policy within a JUG framework.

### 5.1. On your mark, get set…

The UK PV industry is at an important transition point. After years of grant support, it has developed experience with a wide variety of installations and implemented a number of best practices, like the accreditation of installers and the installation of monitoring devices. However, both installation and monitoring firms remain dependent on government support and there is a great deal of uncertainty about how this assistance might change in the coming years (see also Stantzos, 2005). In some ways then the PV industry is poised on the starting blocks, waiting for the starter's gun to go off: but who is responsible for pulling the trigger?

Each stakeholder has a particular issue or grievance which brought them in contact with central government. For example, installers felt that they had been promised a world-class industry and were therefore seeking consistent and improved financial support; electricity suppliers and metering companies were keen to have regulatory matters clarified so that new microgeneration business models can be developed with confidence. At first glance, the definition of "government" implied by these comments is not homogeneous. The electricity suppliers mainly referred to Ofgem, as regulators of the Renewables Obligation and Balancing and Settlements Code, whereas the installers cited the DTI. However, there are two factors which complicate the picture.

First there appears to be a perception among installers that DTI is almost exclusively responsible for microgeneration policy, ignoring the interdepartmental dynamics and history which limit the measures that are likely to be considered. This is demonstrated by a recent press release from a PV installer: "The DTI tells us there is not enough money to support renewables the way they would like. We do not accept this" (Solar Century, 2005). The same press release later refers to "pan-government efforts to resurrect nuclear power" but makes no suggestion that microgeneration might also be a pan-governmental issue. As the DTI respondent and microgeneration consultation indicated, intra-governmental relationships are an integral part of policy development and influence what options are considered feasible. The larger electricity suppliers and metering companies seem to have a better understanding of this complexity, perhaps stemming from their years of experience in the electricity industry. The established nature of their business models arguably also makes their lobbying on microgeneration issues less urgent than that of installers. Correspondingly, these large firms are currently concerned with maintaining flexibility and preparing for a microgeneration market and their desired role for government is primarily limited to the removal of any obstacles to future business models, as opposed to direct intervention in support of a specific technology. However the search for administratively convenient alternatives, like profile tariffs, may limit the potential of microgeneration to engage consumers with their energy consumption.

This therefore suggests a strong leadership role for government and, although government decision-making is influenced by more than one department the DTI does has much of the responsibility for microgeneration policy. For example, suggestions that microgeneration measures might be included in building regulations were recently rejected by ODPM on the basis of cost (ODPM, 2005). (These cost calculations are contentious, assuming constant energy prices over the 25-year lifetime of a PV system although electricity prices in the UK have in fact risen 8% per year since 2003 (DTI, 2006d). However a number of technologies, such as micro-CHP, ground-source heat pumps, solar hot water, and absorption cooling, could be cost-effective with a small (less £1000 per installation) or no additional investment from the DTI (EST, 2005a). Such financial interventions can be seen in the nuclear industry, where in 2005 alone DTI provided a grant of £1.8 billion to the decommissioning authority and additional support for nuclear liabilities, compared with £78 million for new and renewable energy sources (DTI, 2005a). Therefore, while there may be some debate about the level of funding provided by the Treasury's Departmental Expenditure Limits and the need to service existing liabilities, the DTI can choose to allocate its £6.3 billion annual budget in different ways to meet its PSA targets. DTI also has the ability to change the regulatory environment that shapes cost-effectiveness, for example, by setting the Renewables Obligation targets or specifying the types of metering equipment that should be used; as noted in the interviews, Ofgem cannot make these more ambitious regulatory decisions alone.

Overall, these results suggest that while microgeneration policy may be poorly joined-up across UK central government departments, questions of political will and resource allocation are at least as important. An analysis of microgeneration policy alternatives is now presented to explore this distinction further.

### 5.2. Analysis of current and future policy options

It was suggested earlier that energy policy, as a complex interdisciplinary issue, might be evaluated using a streams framework to assess the coordination between the policy, resource, and process aspects of a programme (Exworthy and Powell, 2004). While this framework addresses multiple dimensions of policy implementation (i.e. coordination between central and local government), the existing PV policy is largely a central government initiative and therefore central–central consistency and coordination are examined here.

In the case of recent PV policy (e.g. the Major Demonstration Programme grants), the interviews suggested that the success of the policy is limited by many factors. Considering first the resource stream, the MDP

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budget of £32 million over 5 years provided enough resources for about 1400 domestic PV installations (in addition to the large-scale installations); it is therefore unreasonable to expect such a programme to deliver a large-scale PV industry to compete with world leaders like Japan or Germany. Part of the disillusionment of installers may therefore stem from poor coordination of the second 'policy' stream, i.e. the mismatch between earlier government-industry statements of intent for the PV industry and the subsequent reality. The policy goals of the MDP are also poorly articulated: it is difficult to imagine how "making considerable headway in preparing a secure platform for long-term and sustained growth in the UK PV market" would inspire government as a whole to commit the resources necessary for a clear and ambitious PV support programme (EST, 2003). Finally, the process stream has some strengths as the accreditation scheme has helped to establish trust in the industry. Overall though, the small budget and central role of the DTI suggest that the MDP PV grant programme should not be considered as a manifestation of joined-up microgeneration policy but instead as a small programme within one department.

Table 2 considers some alternative PV support policies and suggests that the new LCBP is unlikely to make significant advances on the previous MDP grant programme, again due to insufficient coordination of the resource, policy and process streams. First from the policy stream, microgeneration is not a major cross-government priority even though it has great potential to inspire policy coordination as the benefits are relevant to so many departments: microgeneration clearly addresses most of the DTI's energy policy goals, contributes towards the ODPM's desire for sustainable communities, and has the potential for significant market growth, benefiting the Treasury (Merton Council has estimated a potential national annual microgeneration market of £750 million, Aldous, 2005). Instead the government is aligned primarily towards the promotion of competitive markets and economic growth through the use of PSAs. Specifically this suggests that the feed-in tariff alternative is unlikely to proceed because government is 'joined-up' in opposition to distortions of a competitive market. However, there are inconsistencies in this policy stream (e.g. the funding and support provided for nuclear electricity), suggesting that other factors are at work. For example, the ODPM's decision not to include microgeneration in building regulations indicates that there may also be a failure in the resource stream, both in the monetary sense (not

Table 2
'Streams' analysis of microgeneration policy options (central–central dimension only)

| | Current policy | Future policy options | | |
|---|---|---|---|---|
| Stream | Existing grants (MDP) | LCBP grants | Required by building regulations (e.g. the 'Merton rule') | Feed-in tariff |
| Policy (e.g. clearly stated objectives) | DTI goal of "making considerable headway" to a long-term PV market vague compared with earlier government-industry recommendation of 70,000 PV roofs; Treasury PSA does not directly refer to microgeneration, though there is overlap of four energy policy goals and microgeneration strengths | Intended to include energy-efficiency measures and microgeneration (not just PV). Also a greater focus on housing developments, rather than single dwellings. Overlaps with ambitions of some local councils | ODPM wishes affordable and sustainable housing, DTI wants to alleviate fuel poverty and GHG emissions | DTI, Treasury, Cabinet Office all committed to free and competitive markets, which feed-in tariffs would distort |
| Resources (e.g. adequate and coordinated funding, investment of reputation) | £32 million over 5 years, enough for approximately 1400 domestic-scale and 200 large-scale PV installations | £80 million over 3 years, Treasury perhaps unwilling to commit past 2007 spending review despite DTI initial suggestion of a 6-year programme | ODPM recently said microgeneration technologies were not affordable (2005); DTI hopes to encourage construction industry by focusing on large developments through LCBP | Uncertain who would pay for tariff; however, government chief scientist recently suggested a levy on electricity bills to fund a new round of nuclear construction (BBC News, 2005) |
| Process (e.g. policy ownership, accountability) | Accreditation scheme is good but DTI is only department involved in programme. However, related Ofgem microgeneration reforms are happening in parallel | Continuation of accreditation scheme; again DTI is the only department involved | ODPM responsible for building regulations, DTI for overall energy policy. 75 local governments currently implementing this type of policy | Uncertain. Ofgem might implement but would have consumer protection as foremost concern |

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enough funds available to lower the costs of microgeneration technologies) and because different government departments are perhaps unwilling to invest their reputations in a wider cross-government microgeneration initiative. Finally while the process stream is owned almost entirely by the DTI at present, there is scope for other departments to take action to promote microgeneration through alternative mechanisms (such as building standards); again these departments will first need to feel that microgeneration is a solution to "their" problems.

The overall picture suggests that there is potential for significant action on microgeneration from central government but small-scale grants are likely to remain popular as they require smaller investments of resources and reputations. However recent initiatives at the local level, such as the emergence of the Merton Rule, suggest that central government may not in fact be the best place to promote microgeneration. Indeed at a recent microgeneration conference, a spokesman for a PV module manufacturer said his money was "on London not Whitehall", referring to local initiatives over central programmes (Noble, 2005). If this trend continues, the successful growth of microgeneration within the UK will depend increasingly on the consistency and coordination of microgeneration policy at the local level (the local–local dimension) and matching central government resources with local government ambitions (central–local dimension; e.g. the level of funding provided by the LCBP for microgeneration in new housing developments). This focus on local government is supported theoretically by the subsidiarity principle, which states that "decisions within a political system should be taken at the lowest level consistent with effective action" (Jordan and Jeppesen, 2000: 66). Domestic energy issues, like microgeneration, are certainly a local issue and evidence from the UK's local–level energy efficiency HECAction schemes supports this notion, suggesting that citizens have a closer relationship with their local government and are therefore more likely to respond to local policy initiatives than measures led from the centre (Jones et al., 2000).

## 6. Conclusion

This paper set out to examine "joined-up government" in energy policy through an analysis of the PV industry in the UK. Using the results of recent interviews with industry stakeholders, it was shown that the PV industry has been dependent on variable government support. While each respondent had slightly different concerns about the future of their business, all have some connection with central government often through a single easily identified department. These 'government' actors differ from stakeholder to stakeholder, revealing both the complexity of microgeneration policy as well as suggesting that the installation industry may find it difficult to negotiate these relationships and effectively influence microgeneration policy.

It was shown that the DTI plays a central role in the formation of microgeneration policy. There is evidence of some effort to work with other government departments but divergent goals within each institution can constrain the scope and detail of any microgeneration programme. Specifically it was shown that poor coordination of policy, resource and process streams restricted the potential of the recent grant programme and many alternative support mechanisms. From a JUG perspective, the streams framework suggested that a cohesive microgeneration policy might begin by convincing other stakeholders that microgeneration can provide solutions to the problems of their respective departments. However, it was also shown that many of the problems facing PV and microgeneration are not failures of JUG but the consequences of decisions made primarily by the DTI. Therefore, there is scope for the DTI to use its existing capacity more directly to show strong leadership in the promotion of microgeneration. The emergence of local government support for microgeneration, however, returns to the question of JUG, raising concerns about local–local policy coordination and potential changes to the role of central government.

Finally it is important to distinguish between JUG as a broad administrative concept and its implementation regarding a specific policy. At the general level, it has been noted that JUG has not delivered a radical overhaul of how policy is formulated in the UK (Flinders, 2002; Ling, 2002). By taking this more modest view of JUG, and clearly separating it from the more ambitious goal of "holistic" government (6, 2004), it might be said that energy policy is an issue for JUG. That is, by examining the ways in which government is consistent in its goals and seeks to collaborate in their implementation, a better understanding can be gained of why policies do or do not succeed. However, this paper has also shown that JUG issues cannot be the sole explanation for the short-comings of government policy and traditional considerations about how departments choose to wield their power must be considered as well.

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