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Demand Side Management, The Electricity Sector and Town Planning

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SUMMARY

This working paper examines the relationship between the landuse planing system and two innovative Demand Side Management initiatives in the UK electricity sector. There has been relatively little interest in the relationship between the planning system and the provision and management of utility networks. It is usually assumed that infrastructure services are a technical or engineering problem that raises few social or political issues. This paper argues that we need to develop a more sophisticated understanding of the role of utilities in the management of cities and regions.

The paper develops a model of two forms of utility management: Facilitating Infrastructure Supply and Demand Side Management. The FIS models represents the conventional form of infrastructure network management. In response to rising levels of demand the utility strengthens the infrastructure network and supplies more of the resource required by the customer. In contrast the DSM model forces the utility to look more closely at alternative ways of meeting their customers energy needs. Rather than supplying more energy they can help customers manage their demand through the provision energy conservation and efficiency measures thereby delaying the need for new infrastructure and power plant.

Although the FIS model of infrastructure places few demands on the planning system it might be expected that DSM methods of management would require close linkages between the utility and planners. For instance the utility would require advanced warning of new developments that would increase demand on the electricity network. Evidence from the US also indicates that DSM methods may produce important social, economic, and environmental benefits in the areas where the technique is practised. The case studies of two innovative DSM projects in Holyhead and Great Gonerby found little evidence to support the contention that DSM measures generated new demands for more closely coordinated landuse and electricity planning. Instead, the paper concludes, that utilities are now generating their own ideas about the future of the areas they serve that have little connection with traditional landuse planning processes.

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1. INTRODUCTION

There has been relatively little research or policy interest in the relationship between the provision and management of utility services and the town planning system (Marvin 1992). This is surprising given the importance of utility services in almost every aspect of the planning process. Proposals for the allocation of landuses in development plans can only proceed if essential life support services of water, energy, waste and telecommunications are provided by utility companies. Similarly, the level, cost and quality of utility services could become important issues in assessments of the location of new development and the feasibility of specific projects. Despite the obvious importance of these services there have been few attempts to critically examine the role of utilities in planning processes. There is the widespread assumption that these are 'technical' issues subject to largely 'engineering' based assessment criteria and provided to support development above the ground in pursuit of the wider 'public interest'.

Utility services are now provided by private companies operating in increasingly competitive markets. Energy, water, waste, and telecommunication services are now private commodities to be provided in response to customers' demand. It can no longer be assumed that utilities will invest in expensive pre-infrastructure to support development plan proposals. Privatisation and liberalisation of the networks has put infrastructure and planning issues back on to the local policy agenda in a number of different ways:

· serious restrictions on the publication of data and plans regarding utilities infrastructure investment strategies.

· increasing concern about the level of developer contributions towards the cost of infrastructure provision to new development.

· the difficulties faced by low income and marginal households in obtaining adequate levels of access to water, energy and telephone services (Marvin 1993).

· the development of a new role for infrastructure providers in regional economic development policy through land development, inward investment and levels of employment (Marvin and Cornford 1993).

· increasing local resistance to the development of different aspects of infrastructure supply - including reservoirs, energy generation, electricity pylons and roads and wider recognition of the role of infrastructure networks in global environmental change.

· recent advice from the Department of the Environment in PPG 12 which calls for closer coordination between development plans and infrastructure services (DoE 1992).

Although there is growing recognition of the different roles of utilities in key aspects of the spatial, economic, social and environmental management of their territories there are relatively few linkages between the utilities and planning sectors (Marvin 1992, Marvin and Graham 1993). Planners have few tools through which they can influence the cost, quality, phasing or management of utility networks. Instead privatised utilities are enjoying the freedom to adopt their own management strategies for the territories within which they operate.

The central issue is the degree of resonance or dissonance between utility strategies and wider public policy objectives. Rather than underpinning and supporting local and regional agencies, there is now concern that utilities could be contributing to increased levels of social and spatial polarisation and adverse environmental impacts (Marvin and Graham 1993). Despite these concerns there has been little attempt to relate debates about utility regulation with local and regional policy issues.

There are alternative ways of managing utilities which may allow a wider assessment of the spatial, socio-economic and environmental implications of utility strategies. For instance the

State Utility Commissions in the US have used Least-Cost Planning (LCP) assessments of utilities forward plans to encourage them to adopt Demand Side Management (DSM) options (see Hanson et al 1991, Sant, 1984). The goal of least cost planning is to provide energy services at a minimum cost by manipulating not only supply but also demand. Using this approach, it may be more profitable for a utility to provide for increasing demand for energy by investing in the management of demand, ie. energy conservation, than by investing in new supply capacity, for example new generating plant. Least cost planning is a methodology by which it is decided which alternative - investing in demand management or increased supply capacity - is the most cost effective for a specific energy utility. Demand-Side Management (DSM) is a subset of least cost planning. It refers to measures taken to improve the efficiency with which energy is used by modifying the amount or time of energy use. Examples of DSM measures would include building insulation, draught proofing, low energy lighting and timers on water heaters and appliances. The goal of DSM is to improve the economic performance of the utility by the consideration of energy conservation as a resource on equal terms with energy supply. A utility can devise a DSM programme to evaluate the optimum method of encouraging their customers to reduce their energy consumption.

There is much controversy about the efficacy of DSM initiatives in the UK. The regulatory framework in the UK has been increasingly criticised for its strong supply-led orientation which gives utilities few incentives to invest in energy efficiency measures - instead maximising consumption increases profits (see Mickle 1992). At a national level there are debates about the type of regulatory mechanisms that could encourage utilities to invest in energy efficiency (see Wolf & DeRosa Lutz, 1993). OFFER has recently introduced regulatory changes which weaken the volume incentive and each REC now has to spend the equivalent of a œ1 per customer on energy efficiency initiatives (Owen 1994). Although there is still much uncertainty about the regulatory incentives for investment in energy efficiency a number of innovative Regional Electricity Companies (RECs) have developed their own DSM initiatives.

This paper examines the relationship between the town planning system and two innovative DSM projects in the electricity sector. While the focus is on the electricity sector, DSM principles can also be broadly applied to gas (Brown, 1990), water (Dziegielewski & Baumann, 1992) and even transportation networks (Giuliano, 1992). These innovative DSM initiatives were chosen for case study purposes to examine the linkages between new forms of electricity network management and the planning system. The paper examines the ways in which the relationships between planners and utilities are altered by the introduction of DSM strategies.

The rest of this report is divided into 4 sections. Section 2 places DSM in a wider context by examining the origins of DSM, its limited role in the UK, and the relationship between different forms of utility regulation and the town planning system. The next two sections present case studies of innovative DSM schemes in the UK electricity sector. Section 5 examines the wider implications of DSM principles for the town planning system. Finally the conclusion identifies the key issues for further research.

2: DEMAND-SIDE MANAGEMENT IN CONTEXT

2.1 Traditional Vs. Least Cost Planning

Utilities are able to meet their customers' energy needs in a number of different ways. A useful distinction can be made between traditional or supply led and least cost planning methods. In the traditional utility planning process growing demands for energy use are met though increasing power supply options - new power station, transmission and distribution grid construction. This supply led trajectory gives little consideration to alternative methods of meeting energy needs such as investment in energy efficiency and conservation measures. In the US in the early 1970s the traditional planning approach came under increasing criticism. There were a number of problems - demand became more difficult to accurately forecast, construction lead times were more unpredictable and there was public opposition to new power stations, rising energy prices, unmet energy meeds and the declining environmental quality (see Sant, 1984).

In response an alternative method of meeting energy needs was developed based on Least Cost Planning (LCP) which is now used in some form by almost all State Utility commissions in the US. Compared to the traditional planning process LCP develops a range of supply and demand options, encompasses broader objectives and involves the participation of wider interests. The central goal of LCP is to provide energy services at minimum cost using both demand and supply options while paying attention to the broader economic, environmental and social effects of different options (see Hanson et al, 1991). DSM can be defined as measures taken by the utility to reduce a customer's energy demand through improvements in the way in which energy is used. DSM measures include insulation programmes, high efficiency motors and lighting, timers on water heaters, direct load control, differential tariff pricing and interruptible service (see Geller, 1989). The utility recovers the cost of these measures through savings in the cost of supplying electricity and through tariff increases. The customer's energy savings should be greater than the effect of increased tariffs while the utility is still able to make profits.

These measures may have substantial benefits for customers, society and the utility. Customers are concerned about the overall cost of their electricity bills rather than the unit price of electricity. Utility DSM programmes can help customers to reduce their energy consumption, thus reducing their overall bills even if electricity is charged at a higher unit tariff to recover the costs of DSM measures. Utility investment in cost-effective DSM can lower electricity purchase costs while still providing the same level of electricity services to customers. It can also offer cost reductions in the maintenance, operation and upgrading of distribution networks. Many US utilities have now established their own DSM programmes in the context of LCP regulation processes. Utility expenditure on DSM has grown from $1.6 billion in 1989 to $3.1 in 1992. On current utility plans expenditure could reach $6.7 by the year 2000 with some $30 billion spent during the 1990s. There is, however, still substantial variation between practices with the average utility spending 1-2% revenues on DSM but in some utilities this rises to 6% of revenues (see Le Energy Ltd & SRC International ApS, 1992 and Krier & Goodman, 1992). Because of the major differences between the traditional and LCP approaches to utility planning it is a highly contested issue (see Davison, 1992). However, despite these concerns a considerable body of support has developed for LCP and the development of DSM programmes because of their wider environmental, economic and social benefits compared with traditional utility planning and supply processes.

Energy Savings

There are a wide range of estimates of the energy savings associated with DSM in the USA (see Krier & Goodman, 1992). They argue that all the DSM measures implemented by 1990 reduced energy consumption by 0.6% and peak demand by 4.9%. The large reduction in the peak reflects utilities focus on load management measures which reduce peak demand without reducing energy consumption, rather than conservation which reduced peak and energy consumption. However, the programmes now being implemented are giving more emphasis to saving energy which by the year 2000 could lead to a reduction of 2.2% in energy and 9.3% in peak demand. However, the industry leaders in DSM are setting much higher energy savings targets. For instance the electricity utility Consolidated Edison plans to save nearly 15% of projected sales and 22% of peak demand by the year 2008 (see Le Energy Ltd & SRC International ApS, 1992). These DSM measures can also produce significant environmental benefits - a reduction in energy consumption leads to a reduction in fuel burn at power plants, the deferral of new power station construction, a reduction in transmission and distribution losses and a reduction in emissions of SO2 and NOx.

Economic Benefits

There are important economic by-products of energy conservation measures. The economic implications of DSM measures affect levels of economic development in a number of ways (see Krier & Goodman, 1992 & Taylor, 1992). There are the direct job creation implications of the production, installation and administration of energy efficiency and conservation measures. The jobs involved are likely to be semi-skilled drawn from local or regional labour markets. They also have indirect effects as the newly employed spend their income on goods and services. But there are also other impacts. There are the potential respending effects of domestic fuel bill savings which may be spent on other services or alternatively used to increase levels of thermal comfort. Another impact is the reduction of operating costs in the commercial and industrial sector which lead to reductions in the costs of goods and services, thereby increasing competitiveness. But using electricity more efficiently also reduces the need for utility construction of power stations and grid network. This results in the loss of jobs in the supply sector as a result of lower energy demand. These have been estimated to be a relatively small proportion of the jobs which would be created through energy conservation. Krier and Goodman examined evidence from US utilities and argued that: "investments in electricity efficiency increase profits and real incomes... studies indicate that electricity efficiency more effectively generates employment than traditional utility supply options" (1993: 1). This evidence indicates that respending effects are the most significant as householders and business either respend, increase profits or lower the costs of products and increase market share. The study estimated that DSM spending in 1992 had created an additional 80,000 jobs in the US. It needs to be recognised that these programmes have additional benefits particularly when linked to improving the energy inefficiency of low income households. Many states have special schemes providing low interest loans or even free services to low income households.

Regional Implications

Evidence from those states that have actively pursued DSM approaches indicate that there may be substantial regional benefits. For instance the State of Masschusetts Energy Efficiency Council whose utilities have a very active DSM programme spending over $800 million between 1988-92, has an energy efficiency sector that includes over 750 firms, employs between 15 - 20,000 jobs and is growing at 'an extraordinary rate'. It was claimed that in one year the utility programme created 2,350 energy efficiency jobs, cost savings produced over 700 additional jobs, reduced environmental emissions and created wider social benefits for low income households. They argue that DSM is 'a truly "win - win" strategy' (1992: 4).

2.2. DSM in the UK

The regulatory framework for the privatised energy utilities in the UK has continued the strong supply-led orientation of the industry in the nationalised era. There are powerful disincentives for the RECs to consider DSM options. Under the present regulatory regime the introduction of DSM would result in 'a significant fall in revenue with a much smaller reduction in costs' (Le Energy & SRC International ApS, 1992: 15). There are two disincentives to utility investment in DSM. Increased electricity sales will lead to significant increases in profits while lower sales erode profits. The electricity pricing formula actually prevents RECs from recouping expenditure on DSM programmes. Although RECs have promoted some energy efficiency improvements through fuel substitution and load management, to lower economic costs, they have avoided programmes that are designed to reduce demand for energy (see Wolf and deRosa Lutz, 1993).

This powerful supply orientated trajectory has come under increasing criticism from the energy conservation lobby. Both OFFER and OFGAS have commissioned reports which have favourably reviewed the potential application and benefits of applying DSM measures in the UK energy utilities sector. A study for OFFER made some conservative estimates of the potential energy savings of DSM programmes in the UK, it concluded that: 'across all sectors at least 6% of existing electricity use can be realistically saved on an annual basis within the next ten years' (Le Energy & SRC International ApS, 1992: 12). These savings were estimated to cost the electricity industry œ2.7 billion but to save œ3.8 billion in electricity costs reducing costs to industry and customers by œ1.1 billion. There is even greater potential as the DEn have estimated that 20% of electricity consumption could be reduced by efficiency measures at a cost less than electricity generation. A study submitted to OFFER estimated that the UK could reduce electricity consumption by 8-12% over ten years, produce cost savings of œ10-œ15 billion with an annual investment of œ450-œ732 million a year (Woolf & DeRosa Lutz 1993).

2.3 Utilities and the Planning System

The relationship between the planning system and infrastructure is a poorly understood issue and little researched area. The provision of urban services, energy, water and waste networks, lies outside the direct control of the planning system. Since the privatisation of the major utilities, telecommunications, gas, water and electricity the process of infrastructure has become more complex. For instance utilities no longer publish information about the development of their distribution networks and there are major variations in the cost of infrastructure services for new development. Overall there is probably less information available and the priorities of the utilities have focused even more sharply on cost recovery of new investment in the networks.

The key feature of the relationship between new development and utility services is a negotiation between developers, planners and utilities based on a voluntary "referral" system. When a specific proposal for development is brought forward a three-way negotiation process between developer, planners and utilities is begun, to progressively refine the nature of the development, the feasibility of infrastructure provision and the allocation of costings. The key feature of the system is the provision of the necessary infrastructure, pipes, cables, wires, sewers and the associated equipment, transformers, treatment works necessary to support the increased demand on the system produced by the new development. Each of the utilities makes an assessment of the increased demand that a housing, commercial or industrial development will require, estimates the extra infrastructure costs required to support this and then allocates all or a proportion of the costs to the developer. Broadly speaking the whole process is supply driven. The utilities dynamic is to supply more of their product to consumers which under existing regulatory frameworks is one way of increasing profitability. The company obviously want to externalise the extra costs incurred which are then loaded on to the overall development costs.

Facilitating Infrastructure Supply (FIS)

There are strong indications that the conventional FIS process is strongly supply-orientated and may actually encourage the reproduction of resource intensive development. There are a number of elements to this process:

· little or no debate about the levels of energy and water demand, waste production or trip generation of a new development.

· strong utility and developer interests in maximising the on-going resource use by a new development.
· the costs of extra infrastructure supply are passed on to developers and users of the development.
· increased investment in the supply of infrastructure networks results in the construction of reservoirs, treatment works, roads, power lines, transformers etc.
· none of the agencies involved in the process seem to have an interest in limiting the wider environmental impact of the development in terms of direct resource use or infrastructure network construction.

The institutional processes around the FIS model of infrastructure provision actually have the effect of increasing levels of water and energy use, waste production and trip generation. This strong supply-led orientation is based on the institutional interests of developers and the utilities which combine to reproduce resource intensive environments.

Demand-Side Management (DSM)

As we have seen there are alternative institutional models which could manage the water, energy and transportation requirements of new development in different ways. Instead of supplying more infrastructure and services, DSM seeks to modify the intensity, amount and/or time of energy and water consumption and trip generation of a development. These measures could include energy and water efficiency systems, car sharing and teleworking. Rather than simply providing an energy supply which is monitored and costed at the electricity meter utilities now attempt to help manage how energy is used beyond the meter by managing customers consumption in their own premises. A DSM approach to infrastructure provision would appear to require much closer coordination between different interests:

· utilities engaging with customers to help manage their demand.
· the retrofitting of demand management measures to existing development.
· the involvement of utilities in an early stage of the development process to assist designers, architects and users with the optimisation of energy efficiency in new buildings.
· closer linkages between landuse and electricity network planning.

These different models of infrastructure management raise a number of important issues for the planning processes. DSM practices seem to imply that there may be closer engagement between the utility and planning system than conventional FIS approaches to infrastructure management. As the utility attempts to engage with customers and manage their demand the company becomes implicated in the management of customers buildings and the territory which the utility services. Any form of built development obviously has important implications for levels of demand on a utility network. If DSM measures are practised the utility must be aware of the future development prospects of its territory in order to accurately forecast and manage DSM programmes. In the conventional FIS model this is less important as the supply led orientation means that the utility effectively strengths its network and/or provides additional electricity to service the new development. The next two sections of this report examine 2 case studies of innovative DSM initiatives in the UK to examine whether they generate new pressures for more effective linkages between the landuse and utility network planning processes.

3. THE GREAT GONERBY ENERGY EFFICIENCY INITIATIVE

3.1 Origin of Project

The Great Gonerby Initiative is a joint project of East Midlands Electricity (EME) and Neighbourhood Energy Action (NEA). It was set up in 1990 and completed in April 1991. Great Gonerby was the first example of the application of LCP principles in the UK. Although the monitoring exercise is now complete the publication of the final evaluation has been delayed. The project was developed in response to a new commercial development proposal in an area known as the A1 Triangle adjacent to Great Gonerby. This development was going to considerably boost the demand in the area for electricity. EME were interested in testing out the principle of DSM in order to see if they could help avoid the costs of additional electricity infrastructure required for the A1 Triangle.

A small area of housing at Great Gonerby was chosen to form a pilot project area, as the substation serving that area was reaching peak load capacity. If the growth in peak demand was not stabilised, the substation would need uprating. The project area consisted of 154 dwellings (90 local authority and 64 owner occupied) (Green 1992). The substation at Great Gonerby contains a 200kVA transformer (the substation is technically the housing for the transformer). Transformers can operate at 30% over their capacity for short periods, which means that in this case, winter peaks of up to 260kVA are tolerable. The target reduction of electricity demand was 30kw so that peak demand would be kept at around 230kVA (kw and kVA in this case are virtually interchangeable) (Green 1992). The main aim of the project was to increase domestic energy efficiency in order to reduce peak electricity demand, and avoid the need for new supply equipment. But other agendas complicate the picture.

3.2 A Partnership Approach

Besides EME, whose interests lie solely in increasing their own cost-effectiveness, the other major player is Neighbourhood Energy Action who focused on the alleviation of fuel poverty amongst low income households. The local authority, South Kesteven District Council (SKDC) wanted to improve the energy efficiency of their housing stock, particularly to help elderly tenants to avoid hypothermia. A further active body in the initiative is Lincoln Energy Save (LES), the local Network Installer for the provision of energy efficiency measures under the Home Energy Efficiency Scheme (HEES) run by the Energy Efficiency Office. Although the project's objective was restricted to investigating whether it was possible to substantially reduce peak electricity demand through demand-side measures there were a range of competing agendas around which the success or failure of the project would be evaluated.

3.3 Operation of the Initiative

The initiative began in autumn 1990 when the major organisations involved held a planning meeting. A rolling programme of work was devised (Green 1992):

1. Training in Energy Awareness

Those staff (10 in total) who were involved most closely with the project from each of the agencies, undertook a 3-day course in energy awareness and sat the NEA/City and Guilds examination. The costs of the course were provided by EME.

2. Survey visit and distribution of low energy light bulbs.

Staff from Lincoln Energy Save visited each household to interview the householder and assess the requirements for energy efficiency measures and advice on heating and appliances use. Eligibility for HEES grants was also checked. Two free energy saving lightbulbs were given to the householder. These were paid for by EME. There was a choice offered between 20W bulbs and 11W bulbs (replacing 100W and 60W conventional bulbs respectively).

3. Insulation and draughtproofing

Almost all of the local authority households were fitted with draughtproofing and insulation, or existing measures upgraded where necessary. Hot water cylinders were lagged. Where Council tenants were eligible for HEES grants (57%), SKDC paid the clients contribution.

Where they were not eligible, SKDC funded the necessary work entirely. Owner occupiers were offered a service to fit the measures, although they had to pay for them.

4. Energy advice visit

Advisers visited householders to provide information, literature and advice on the use of heating and appliances. A check-list was used to cover all the relevant areas. Householders were asked to permit NEA access to records of electricity and gas consumption. The householder was taught how to monitor their own consumption, and the adviser identified whether Economy 7 would save them money.

3.4 Results of the Initiative

Overall around two-thirds of the households participated in the project. However, more than 60% of the owner occupied households refused to take part in the project. These residents felt that they had already dealt with the energy efficiency needs of their homes. As a last resort in obtaining the cooperation of the middle class households, an offer of a free Home Energy Rating was made. But only another ten households were attracted into the scheme. This may be partly a result of inertia and ignorance about the connection between energy use in the home and CO2 levels in the atmosphere. Alternatively council tenants may have been more willing to take part because they were used to the authority routinely carrying out work on their property, and were more likely to take part in the project when invited by their housing manager.

The assessment in the project report (Green 1992) is that the target reduction of peak demand is achievable, with most potential electricity savings coming from the use of low energy lightbulbs. However, since lightbulbs were fitted in only 95 homes, the actual potential reduction is 12.26kW as opposed to 19.87kW if all households had accepted the lightbulbs. Unfortunately, figures for actual electricity savings are still confidential. Some of the reduction in peak demand may occur from encouraging people to switch to Economy 7. Although this is a demand-side measure, because it manipulates demand and leads to benefits for the REC, no wider environmental benefit results from this switch, as there is no reduction in actual electricity consumption.

The Great Gonerby Initiative has brought several benefits, for example in working with the community on energy projects, providing data on the way in which people use energy, and how they can be helped to use it more efficiently. Lower income households have obtained significant benefits in higher levels of comfort and savings in energy consumption. It is not clear whether EME has actually profited from the project, as no figures regarding the financing of the project are available. However, on such a small scale project the potential savings to be made by the REC are also likely to be small. In this initiative, EME only contributed low energy lightbulbs, some of the project development and management costs, and energy awareness training course costs. They have been able to benefit from the contributions from SKDC, NEA and LES. However if EME were to commit themselves in a much larger way, with higher targets for peak reduction, the chances for the success of the project may be correspondingly higher, and the benefits to EME may also be greater. EME are now looking for opportunities for DSM projects, but they stress that despite changes in the regulation formula which give less disincentives to investment in energy efficiency, DSM is not universally justifiable on profit grounds, and they will of necessity be very selective in deciding where to run projects. Unfortunately, the development plans for the A1 Triangle have fallen through, so the impetus to carry through the results of the pilot project has been lost.

4. THE HOLYHEAD POWERSAVE PROJECT

4.1 Origin of the Project

The Holyhead Powersave Project is the largest pilot DSM programme in the UK. Holyhead is a town of approximately 13,000 inhabitants, which is situated on a tiny Welsh island called Holy Island located off the North West tip of the island of Anglesey, in North West Wales. The project area, with a total population of about 15,000 inhabitants, takes in the whole of the island. Holyhead is the major port for ferries to Dublin but as a peripheral rural Welsh town is very depressed economically, and has social problems more usually associated with large urban areas, including severe unemployment, high crime and drug-taking. Economic regeneration efforts are being made through the Holyhead Joint Venture, a consortium of private businesses and public organisations, while Holyhead Opportunities Trust, an independent community organisation initiated and partly funded by the Welsh Development Agency, is involved in a variety of activities to do with regeneration. There is a proposal to upgrade the A5, a narrow single carriageway, which is the main road to the island across Anglesey and further proposals include redeveloping the western waterfront and building a marina.

In 1990, MANWEB, the REC for North Wales and part of North West England, was facing the prospect of having to build a new transformer for Holy Island, at a cost of œ850,000, including associated network provision. Only two substations of 33,000 KVA capacity exist on Holy Island. The peak use of electricity is 7.5 MW. If one transformer is shut down, the other would have trouble in meeting this peak demand. Without a third transformer to provide back-up continuous supply is jeopardised. Electricity demand in Holyhead is already increasing by 2% per year. With economic progress, stimulated by regeneration efforts and the forthcoming new road to the island, demand is expected to increase further, thus leading to greater need for a new transformer. A member of MANWEB's Board suggested that instead of building the transformer now, it could be deferred through the use of DSM. The suggestion was taken seriously and the Holyhead Powersave Project was developed, with the aim of reducing peak demand for electricity on Holy Island by 1MW. The project was taken up primarily by the Domestic Marketing section of MANWEB. A good deal of research was carried out before the form of the project was agreed. However, lack of up to date British data meant that taking on this project was to some extent a leap of faith. MANWEB expect to complete the project in 6 months from 9th December 1992.

4.2 The Benefits of DSM

It was estimated that œ0.5 million would be spent on the project. The EC contributed œ80,000. MANWEB spent œ420,000 on the scheme which leads to a saving of œ430,000 by avoiding the need to invest in a new transformer. Further savings will be achieved through delaying refurbishment costs. Wear and tear on the network on Holy Island is particularly severe because of the harsh coastal environment. An electricity network runs much more efficiently and needs less upkeep where the demand curve is flat - the higher the peaks, the quicker the network will deteriorate. By reducing peaks in demand, DSM will reduce refurbishment costs considerably. These associated savings have not been quantified, as they are very difficult to estimate, but they are a significant incentive to the project. The capital costs of new equipment in an electricity supply network are immense. If the life span of equipment is increased by 50% significant economic savings are possible. For instance MANWEB has 1.3 million customers and spends œ50 million per year on their distribution network so if applied on a large scale, DSM holds the potential for cutting costs in refurbishment as well as in costs of new supply and transmission.

Despite the disincentives described in section 2, MANWEB aims to show that DSM is profitable for RECs. Although the costs of DSM measures cannot be passed on to customers and despite the loss of sales of electricity, MANWEB believe that DSM will be profitable for the company where it is used to defer reinforcement of the distribution network. RECs already have an incentive to reduce the costs of the distribution network - because low costs to customers reduces competition from gas and other RECs. DSM therefore provides one way of fulfilling the existing aim of reducing the costs of the distribution network. The DSM project not only has the potential to save money but it fits with MANWEBs corporate strategy - of all the RECs they have shown the most interest in the environment, and they use their environmentally friendly image as a marketing tool. For instance, MANWEB have no shares in electricity generation, except wind power, they do not buy any nuclear power, and have not signed contracts with any of the huge new power stations which have been commissioned. DSM would be an excellent public relations tool. And practising DSM is very visible - it brings the staff of MANWEB, or their local representatives, into frequent contact with the public, both bringing benefits in terms of extremely cheap energy efficiency equipment and explaining how they are helping the environment. Finally MANWEB also felt that DSM will help to stimulate economic progress on Holy Island by lowering energy costs for industry. This will help MANWEB obtain new opportunities for the marketing of electricity. If industrial, manufacturing and retail enterprises become more energy efficient, they may be able to realise considerable savings in their running costs. For example, as a result of their free energy auditing for businesses, MANWEB enabled one industry in Holyhead to save œ12,000 per year by installing Power Factor Correction equipment, at a total one-off cost of œ4,000. If businesses are more profitable, they are better able to expand, thus providing more custom for MANWEB. The end result is that, say over a period of ten years, there may be no actual decrease in load use of electricity but a vast increase in energy efficiency. The net effect of DSM will be to reduce the increase in peak demand, build up new customers, applications for electricity and avoid losing customers to the gas sector or other RECs.

4.3 DSM Measures

The demand-side measures which are involved in the Holyhead Powersave Project are as follows:

1. Low cost energy saving lightbulbs.

Two lightbulbs are offered per household at a cost of 70 pence each (normal retail price would be around œ10 each). There are approximately 3,500 households on Holy Island. The administration of this exercise is done by the Holyhead Opportunities Trust, who are paid for their work by MANWEB. The lightbulbs are actually installed by members of the Opportunities Trust, to ensure that they are put in the most beneficial positions - and that they are actually used! This arrangement differs from that in the Great Gonerby Initiative where lightbulbs were given free, with no instalment. MANWEB staff believe their method will work best, as people will value something more when they have contributed towards it.

2. Low cost insulation, hot water tank lagging and draughtproofing.

Where a house is heated using electricity, for œ16 per house MANWEB installs roof insulation and comprehensive draughtproofing. This is a fraction of the real cost. Where immersion heaters are used as the main form of heating, hot water cylinders are lagged, or inadequate lagging is brought up to standard, free of charge. A local installer approved by NEA undertakes this work, again paid for by MANWEB.

3. Trade-in for electrical appliances.

MANWEB give œ70 to customers replacing their appliances providing they choose the most energy efficient model on sale by MANWEB. The trade in deal had to be extended to competing electrical appliance shops - there is only one other small outlet in the town - because of Offer's regulations.

4. Free energy audits for industry and commerce.
These are augmented by energy efficiency action programmes tailored to each customer's needs. The local secondary school, which is an electricity guzzler, will benefit in particular from this advice. Small commercial customers are provided with the same low energy lightbulbs and hot water cylinder insulation offers as the householder. In addition a "switch off" night was being promoted where the aim is to significantly reduce the evening peak, to show what can be done, by participants diligently switching off unnecessary lights and appliances.
The project was launched in December 1992. MANWEB then set up the Holyhead Power Save Caravan as a local showroom and information centre, which visited several different areas on the island over the course of the next few months. Opportunities Trust conducted an energy survey of the entire island, which enabled them to publicise and explain the project. The high profile of the project on the island has certainly paid dividends. The take up rate on the light bulb offer has surprised everyone. It now stands at over 80% of households. Although of the 3,500 households on the island, only about 500 are electrically heated: the take up rate among this group of insulation and draught proofing has been disappointing with loft Insulation - 58.8% and draught proofing - 44.92%. But generally it has been a struggle to keep on top of demand, particularly in the initial stages of the project. The tactic of involving different local groups has been a key method of gaining acceptance from the community. As well as The Opportunities Trust, the Prince's Trust Volunteers, Neighbourhood Energy Action and the Joint Venture Board have all been involved in varying capacities.

4.4 Monitoring

The EC have contributed œ80,000 from the "SAVE" energy efficiency programme to spend on monitoring, researching and reporting on the activities of the project. Monitoring devices and loggers have been fitted to all 4 substations of 11,000 KVA capacity on Holy Island. Loggers are also fitted to cooperating businesses - these store data for two week periods, at the end of which the data is loaded onto a laptop computer for analysis. Monitoring is a very time-consuming task, but the results will be of vital importance in assessment for further DSM projects. A further monitoring project is to record the electricity use of a sample house using storage heating, both before energy efficiency equipment is fitted, and after. This will enable an estimation of the amount of savings of electricity possible through the use of demand side measures. Apparently, this kind of data is not available in Britain for recent years - existing data relates to the 1960s or 1970s.

4.5 The Future

The Holyhead Powersave Project is now virtually complete, although there is some outstanding work to be done in the commercial sector. MANWEB now have to undertake an investigation of the data which has emerged. Data will be collected over the next 12 months to show how electricity use is affected over the winter period, which is the most critical. The Holyhead Project has achieved success so far, in that the take up rate has been very high, and the project has achieved acceptance in the local community. It will be very interesting to see whether in MANWEB's final assessment of the project, the results will show that spending on DSM rather than in distribution equipment is more cost effective. But it will take two years before the evidence is really sufficient to accurately assess the success of the project. At present, it looks hopeful that MANWEB will go ahead with further DSM projects. They are already considering a DSM exercise in Crewe focused on the industrial and small business sector. Because Holyhead has relatively little industry or commercial activity, evidence from the project for the success of DSM in this sector will be sparse. In particular, there were no large consumers of electricity over 1MW, in Holyhead who could have chosen an alternative supplier. There has been much interest from other RECs regarding the Holyhead Powersave Project.

5. THE IMPLICATIONS OF DSM FOR PLANNERS

5.1 The Issues

Although both case studies are examples of highly innovative practice they do start to raise important questions about the relationship between utilities, the planning process and the management of individual buildings and localities. Three aspects of these changes merit further discussion: the bridging of consumption and production interests, capturing local benefits from utility DSM and strategies and the nature of the linkages between network and landuse planning.

Production and Consumption Interests

DSM activities do push the utilities into closer relationships with their customers, local authorities, training and local economic development agencies. Utilities are no longer simply considered with ensuring an adequate supply of electricity up to the customers meter. DSM strategies push the utility 'beyond the meter' as they attempt to manage demand within their customers premises. The retrofitting of energy appliance and measures forces the utility into closer and new forms of engagement with a wide range of agencies. In both case studies the utility worked with local training and enterprise agencies over the fitting energy conservation and efficiency equipment and the local authorities in their role as a manager of properties. These trends seem to mark a significant break with supply-orientated practices of utility management. DSM forces the utility to form closer connections with a range of local agencies and start to break the distinctions between production and consumption interests.

Capturing Local Benefits

The two locations selected for DSM schemes may have been able to capture important local benefits which would not have occurred in conventional supply-orientated modes of management. For instance investment in energy efficiency could generate important benefits for utility customers. In particular low income households can benefit through a combination of improved thermal comfort and/or savings in the cost of energy and local business who use more energy efficient methods of production could use the cost savings to increase profits or reinvest in the expansion of their businesses. The retrofitting of energy efficiency and conservation methods is relatively labour intensive and could contribute to local employment generation. There may also be reductions in energy use contributing to reductions in greenhouse and acid rain emissions. These potential benefits may be ongoing as the utility has to engage in DSM practices over long periods to manage peak demand. Consequently those localities in areas where the REC practises DSM forms of management may be able to capture local improvements in economic, social and environmental conditions.

Network and Landuse Planning

Finally DSM practices seem to imply that much closer linkages have to be made between landuse and electricity network planning. In Great Gonerby, the proposal for a major new development in the A1 triangle was a key factor in the establishment of the DSM project. Unfortunately the abandonment of the scheme meant that it was not possible to examine how the relationship between planners, utility and developers may have been restructured as a result of developing a scheme in the context of a DSM environment. The case studies, however, do provide some useful illustrations of the challenge that DSM may represent to conventional planning processes.

The utility is forced to take a much closer interest in the development potential of the area in which a DSM scheme is operating. Although historically, utilities may have taken an interest in development plans as a guide to future network planning, information about future development is much more important in the context of a DSM environment. In both case studies the utilities were attempting to limit demand to reasonably inflexible technical criteria - the need to prevent peak demand exceeding certain limits beyond which the safety and security of the electricity network is compromised. Information about the future prospects of development which will raise demand is therefore essential for any long term DSM activity. The utility can use this information in various ways. The prospect of new development may mean that it would abandon DSM measures or alternatively it may respond by increasing the peak-lopping energy saving targets and attempting to ensure the new development is designed and constructed in such a way that it minimises energy consumption - especially during periods of peak demand. How a particular utility will respond is dependent on technical limits of the local network, local circumstances and an assessment of the economic benefits of supply and demand options. But it must be recognised that DSM may only delay or defer investment in additional supply until it is no longer possible to cost effectively manage demand.

5.2 Linkages with Town Planning

Taken together these trends would seem to suggest that there are important technical and institutional reasons why there should be close engagement between utilities and planners over the development of DSM schemes. But in both case studies there was relatively little evidence of any linkages between the utility and the local planning systems. Both schemes were pilot projects, highly innovative in a UK context and mainly focused on the provision of energy efficiency and conservation appliances. Longer term issues about the future development prospects of the area and the need to maintain the DSM effort over time did not necessarily emerge as important issues at the early stage of these projects. Although local planners regarded the Powersave project favourably there had been no discussions with MANWEB or any consideration of how the system could assist the scheme. Opportunities for development on the island there were very limited because of sewage problems, and no large applications for development had come up within the project period. But since the end of the project major new development proposals have come forward for the port of Holyhead. The increase in electricity demand will require major rethinking of the future of the DSM project. The project manager at MANWEB felt that the utility needed to learn of new development at a very early stage, and that negotiations with planners and developers at an early stage in the development process would allow them to integrate new capacity into the DSM process. But at this stage there is little evidence that DSM practices have challenged the relatively disassociated links between the planning and utility sectors.

5.3 DSM and the Management of Territory

While there may be little evidence of any links with landuse planning at the moment the more widespread use of DSM practices could signal important changes in development planning processes. What the case studies graphically chart is the development of a new role for utilities in the management of buildings and localities. DSM forces utilities into closer management of the areas in which they operate - this has quite profound social, economic, environmental and spatial implications. While these impacts may find resonance with wider public policy objectives - supporting economic development, encouraging social cohesion, reduction environmental impacts utilities - they are also practices that are firmly implicated in the business strategies of privatised utilities. MANWEB certainly see DSM practices as an important strategy for capturing customers and firmly embedding them within their network. Increasing competition in the electricity sector means that the utilities have to develop strategies for capturing customers and then holding on to them. DSM is certainly one response to these pressures.

There are, however, clearly a set of competing agendas around the adoption of DSM strategies. Fuel poverty pressure groups and local authorities see them as an important component in tackling fuel poverty; local economic development agencies are interested in employment generation and lower energy costs; and environmental groups focus on the potential reduction in energy consumption. While we cannot say whether all these objectives have been met in these case studies the central point is that DSM is likely to be driven by the interests of the utility company. If wider societal benefits do accrue these are merely coincidental but they may create comparative advantages for the areas participating in DSM schemes.

The central issue for public policy is that utilities are emerging as important managers of territory which have few linkages with conventional landuse planning processes. It is quite likely that an increasing number of RECs will adopt DSM measures in attempts to firmly capture market share. While these strategies may generate important benefits they are not subject to any wider public debate. Alternatively it could be argued that those areas served by RECs who are not adopting DSM principles could be disadvantaged. A situation could occur within which the interests of electricity network and other aspects of spatial management, such as landuse planning, are in conflict. Control over fundamental and basic resources like electrical power means that private companies are in a powerful position to frame the future development of the territories with which they operate.

6. CONCLUSION

The paper has attempted to examine the potential implications of newly emerging utility strategies for the planning process. Although there is currently little evidence to support the contention that DSM leads to closer demands for integration between landuse and utility planning there are signs that these practices could have profound implications of the management of territory. These issues raise a number of important issues for the planning system.

Planners need to engage in a fundamental re-assessment of the relationship between landuse and electricity network planning. While the DSM strategies considered in this paper provide examples of innovative practices there is still insufficient understanding of the normal supply-led mode of management. Clearly FIS and DSM are ideal types whose validity needs testing against the practices of utility companies. The case studies have shown that there are an identifiable set of practices emerging around DSM and we have attempted to show how these could have important consequences for landuse planning. But there is little evidence of further debate or investigation of what these practices might mean for a wide variety of planning concerns - landuse strategies, local economic policy, fuel poverty etc. If planners do not engage in such a debate, the danger is that utilities will adopt their own strategies for dealing with the territories they service.

Privatisation means that each REC will experiment and innovative with alternative strategies. DSM is emerging as a key part of these strategies evidence by the REC interest in the Holyhead scheme. We have shown how different strategies could have quite profound implications for key aspects of the social, economic and environmental management of these territories. Privatised utilities are now in the unique position of being able to generate their own ideas about key aspects of the future of cities, localities and territories they serve, with few links back into the planning process.

There is clearly a need to carefully examine how the privatised utilities sector relates to processes of territorial management. Practices are highly uneven, little research has examined the interface between the management of what have commonly been perceived as 'neutral', 'boring' 'technical' systems of water, waste and energy and their role structuring cities and regions. While there are pressures pushing some utilities into new roles as territorial managers there are others pushing against disclosure of information on energy consumption, costs and demand patterns which are now important commodities in competitive energy markets. Utilities may have nothing to gain by cooperating with local authorities as they start to develop their own plans for the use of the territories which they serve.

Alternatively DSM initiatives may create new opportunities and potentials for the planning system. The wider adoption of DSM strategies by RECs may start to generate new demands from utilities and developers for closer links with the landuse planning system as the RECs seek ways of more efficiently managing electricity distribution networks. While there is the potential for new conflicts and tensions there are also new opportunities for utilities and planners to develop ways of mutually shaping the development of cities and localities. New modes of network and landuse planning will require innovation in both the utilities and planning sector - without such thinking planners are likely to be left behind as utilities develop their own private visions of planned futures.

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APPENDIX 1

LIST OF INTERVIEWEES

MANWEB	Graham Slatter and Peter Benstead
Holyhead Joint Venture	David Jump
Opportunities Trust	Lesley Austin
Ynys Mon District Council	Dewi Williams, Planner
Gwynedd County Council	Gwynedd Thomas, Planner
East Midlands Electricity	John Duncan
Lincoln Green Energy	Matt Briton
Energy Inform	Julia Green
Newcastle City Council	Adrian Smith, Planner
ACE	Craig Mickle

Constraints on domestic investment in EE/CON

Customers are not investing in energy efficiency, despite the financial savings offered. Some explanations, based on those listed in 10, are as follows:

* the rate of return. The householder expects very quick payback periods, such as two years, before being willing to invest. This actually corresponds to a a very high rate of return, namely 50%. Even higher rates of 100-200% expected return are not uncommon (Brown 1991).
* capital constraints. The cash resources of most householders are limited and energy efficiency is competing with other pressing calls for resources such as holidays or domestic appliances.
* risk. The risk of long payback periods is chiefly that the householder will have to move house before realising the return on their investment. In these times of high mobility, this is a very real risk. The General Household Survey showed that 36% of households move in under five years (quoted in Rydin, 1992).
* lack of awareness. Most consumers are unaware of the benefits of energy efficiency improvements. In a survey relating environmental impacts and the property market, Rydin (Rydin 1992) asked estate agents to gauge whether certain features were valued highly, moderately or not at all by prospective purchasers. Among the items at the bottom of the list were energy efficient lighting (79%) and high standard of floor insulation (70%). These were not valued at all. However insulation in general was valued moderately and double glazing was valued highly by 31% and moderately by 64%.

DSM has the potential to overcome most, if not all, of these market barriers.

Energy utilities invest in projects which generally give rates of return of 5-10% (Brown 1991). They have large amounts of capital at their disposal. Energy efficiency investments may thus be more attractive to the utility than to the householder. If the householder is offered significant incentives, eg. subsidized prices for insulation, low cost loans for triple glazing, cheap energy saving lightbulbs, rebates on energy efficient appliances, then energy efficiency becomes a different ball-game, and the householder is motivated to undertake the improvements. Where the homeowner takes on a subsidized loan from the utility to undertake energy efficiency improvements, they may be able to pay the loan off entirely from the savings they make on energy bills.

It is the utility therefore which takes on the risks of investing capital in energy efficiency. Another advantage of DSM is that it does provide a mechanism to allow the environmental externalities of electricity consumption to be taken into account. For example when considering whether DSM is viable, utilities could be required to add to the supply side of the equation the costs of providing sea walls to protect the coasts from rising sea levels as a result of global warming. Serious thought is being given by the utility regulators in the USA to using DSM in this way. (Davison 1991, p.25)

To sum up, without some form of assistance to the individual householder, the potential for energy efficiency is likely to be unrealised in the domestic sector, at least for the foreseeable future. An estimate suggests that on present trends it could be over 200 years before low energy lighting has penetrated 90% of the domestic market (Offer 1991, p.8) The government's commitment to reducing CO_2 levels means we haven't got that long to wait. DSM is energy efficiency offered on a plate. Can we afford not to encourage it?

EUROPE

Mills (Mills 1991) describes 42 recent programmes by electrical utilities in six European countries (Sweden, Denmark, The Netherlands, Austria, West Germany) which offer financial incentives to encourage the use of energy efficient lighting. Mills views these programmes as the first step towards "least cost utility planning", but concludes that new policies are needed to remove financing rules which prefer investment in supply to investment in end-use efficiency (Mills 1991).

UNITED STATES

Origins

The Public Utilities Commissions have been pivotal in the US in the introduction of DSM. Pressure from environmentalists made new power stations unpopular and difficult to site (Davison 1991, p. 16). Political pressure was also exerted on the Commissions to respond to the need for "energy security", arising from worries over the unstable supply of Middle Eastern oil. A number of PUCs thus began to require utilities to introduce DSM programmes.

The riskiness of building new power plants led to growing financial pressures on the utilities (Davison 1991, p. 15). In response, they began to develop complex assessment techniques to determine whether energy conservation or supply is more profitable, For example, the Bonneville Power Administration, a federally owned generating authority, created a detailed "resource decision making process" (see figure 2) as part of its least cost planning exercise. This involves techniques such as the "least cost resource mix model" which considers which mix of resources meets the needs of the region at lowest cost (ACE 1985).

Despite its early origins, it was only in the late 1980s that DSM really took off in the US (Schreuder 1991). By 1987, 37 states had undertaken least cost planning (Schreuder 1991) (see map 1). Many American states now have aggressive and large scale programmes, some spending more than 5% of total turnover on investment on DSM.(Le Energy & SRC International 1992). As may be seen from Table 3, individual states are spending up to 377 million dollars on DSM (presumably this refers to annual expenditure, although the report (Le Energy & SRC International 1992) does not make this clear). A survey by the Investor Responsibility Research Center in 1987 found that 80% of electrical utilities have implemented formal conservation programmes (quoted in Geller 1989). Some are over ten years old and have cut peak demand by hundreds and in some cases by thousands of MWs.

Table 3

American Utility Spending on DSM

Source: Demand-Side Measures (Le Energy & SRC International 1992)

A variety of DSMs have now been explored and implemented in the US. Free energy audits to both domestic and commercial customers tended to be the first strategy to be used. Some utilities provide low or zero-interest loans to customers to encourage them to draughtproof and insulate their homes, or to buy energy efficient appliances. BPA found that customers who receive loans as well as audits save three times more energy than those who only receive an audit (Geller 1989). But admistrative costs are high, and customers tend to prefer rebates or cash grants. (Geller 1989).

Direct installation of subsidized draughtproofing and insulation is a popular demand side measure in the US. Free installation has also been employed. Rebates on new appliances are also offered by many utilities if consumers agree to choose an energy efficient model.

The amount invested each year in the US on DSM still represents only a fraction of the amount invested in new power plants. But the trend seems to be for utilities to increase their investment in DSM. Studies show that DSM does cost less than conventional supply options (Prindle 1991).

Prindle (Prindle 1991) finds that although there has been a 20GW reduction in demand and utilities are spending in excess of 1 billion dollars per year (soon to hit 2 billion dollars) DSM will only fill the gap in the need for electricity if better data and more money are provided. He argues that if improved evaluation data and greater predictability is achieved, this will lead to more investment flowing into DSM and DSM will reach maturity.

An important direction in which American DSM has been moving throughout the late 1980s is in the development of Energy Service Companies (ESCO's). A new competitive energy services industry has grown up, where third party businesses called ESCO's offer performance contracts for providing energy efficiency measures. They are then paid by the utility for the electricity that has been saved. ESCO's offer the customer a one stop shopping approach to energy efficiency, auditing, identifying the optimal mix of demand-side measures, installing and maintaining the selected measures (Davison 1991). However the customer does not obtain any decrease in their bills, but continues to pay the amount which applied before the energy efficiency measures were installed. The difference accounted for by energy savings is then passed on by the utility to the ESCO. The ESCO passes on a part of its payment back to the customer to compensate for the inconvenience caused and to provide greater incentive (Davison 1991 and Williams 1989). The actual price paid by the utility to the ESCO is determined by competitive bidding between ESCOs. This system is likely to lead to the least cost solution for the utility and for society as a whole (Davison 1991). The problems of equity between customers are neatly minimized and the ESCO develops the experience to become an effective organisation with a wide range of expertise.

Examples of DSM Programmes

Pacific North West and Pacific Gas and Electric. The Sacramento Muncipal Utility, a state owned utility, plans to meet all future growth in demand for electricity through efficiency improvements (Schreuder 1991).

The Southern California Edison Company (SCE), based in Los Angeles, serves 8 million customers in southern California. They undertake market surveys to estimate the potential of DSM. They have confidence that their econometric modelling process enables an accurate comparison of demand and supply options. The results produced have given the SCE a strong commitment to energy conservation (ACE 1985). SCE offers free home audits as a first step to energy saving, and supports this by two financing schemes, involving either low interest loans or cash rebates. Rebates are offered to customers who agree to install a variety of demand side measures or who buy energy efficient appliances. SCE also works with local government and voluntary agencies to ensure that low income households have special consideration.

In the southern states of Tenessee, Alabama, Georgia and Mississippi, the Tennessee Valley Authority (TVA), is a publicly owned electricity generating and distributing authority. They operate an extensive range of DSM programmes which are designed to save 3,000 MW of capacity by the year 2000 (ACE 1985). An example of one measure offered by the TVA is a loan system for solar heating. Customers can obtain a loan to install a solar heating system for their water, then repay the loan from the savings they make on heating costs (Morris 1982).

In the Pacific North West, the BPA (Bonneville Power Administration) already mentioned takes conservation very seriously. The Regional Power Act legislates that BPA must puchase conservation wherever the cost is within 10 percent of the cost of alternative power generation technology (Morris 1982). BPA pays local utilities to install demand side measures in homes, and also directly pays commercial enterprises and municipalities for installing energy efficient lighting (Morris 1982).

2.2. demand side management in the uk

The 12 RECs in England and Wales both distribute and supply electricity. The RECs distribute electricity for their own supply business and for other supply companies called Second Tier suppliers, which are companies able to contract for supply to large customers in their area. The REC's supply businesses buy electricity, and pass the costs involved in buying and selling electricity on to their customers. (Le Energy & SRC International 1992).

How DSM is Discouraged

The supply price control is the main mechanism by which the Director General fulfills his major objective of protecting consumers by ensuring that RECs keep the costs of electricity as low as possible. It covers all costs of supplying electricity, including electricity purchase costs, transmission and distribution costs, costs of billing and metering, and the Non-Fossil Fuel Levy. Since the supply price control regulates the way the REC's electricity purchase costs are passed on to the customer, it influences the incentive to the REC to promote energy efficiency. Electricity purchase costs represent about 65% of the costs to customers, whereas distribution costs are only about 20% (ACE 1992(c)).

Full competition is expected to keep the costs passed on to customers to a minimum. However, competition is at present restricted by franchise limits which mean that Second Tier Suppliers can only have supply contracts with customers with a demand of over 1 MegaWatt (MW). At present there is therefore limited incentive for the REC to reduce costs for customers. In addition there is an incentive to sell more electricity within the distribution price control formula, which is regulated separately.

If DSM is introduced in this situation, the result for the REC will be reduced sales and therefore reduced profits. At the same time, the REC cannot pass through the costs it has borne for the puchase of the demand-side measures. This double blow greatly limits the potential for the introduction of DSM.

The cards seem stacked against DSM in the present situation. What could be done in terms of the regulation of the industry to allow DSM to become more financially viable?

Options for DSM?

Various ways of enabling the REC to recover some of the costs of DSM have been suggested by various bodies such as the Association for the Conservation of Energy (ACE) (ACE 1992(a) and 1992(b)) and Friends of the Earth (FoE) (FoE 1990)). In October 1992, a report was commissioned by Offer into the potential of demand side measures (Le Energy & SRC International 1992). The consultants made a series of recommendations on how to encourage DSM.

The introduction of an energy efficiency "E" factor into the price control formula has been widely recommended as an effective means of encouraging DSM (Le Energy & SRC International 1992). This would allow certain permitted costs of DSMs to be passed through to the customer. For the customer, this mechanism is easy to understand, and the price of electricity would be the same whether or not the customer took up the DSM.

There are problems with this mechanism, mainly arising from the problem of discrimination and regulatory difficulties. It is suggested by Offer's consultants (Le Energy & SRC International 1992) that it should be used only in the short term. Other mechanisms of cost recovery are discussed in their report (Le Energy & SRC International 1992). However, ACE strongly recommends the adoption of the E Factor in the supply price control formula.(ACE 1992(c)). They also recommend a cap on the pass through of electricity purchase costs, so that RECs can no longer simply pass through to the customer their electricity purchase costs. They would then have the incentive to reduce the cost of electricity through more effective purchasing and the use of demand-side options rather than increased supply.

Distribution businesses in England and Wales have an incentive to increase their customers' energy use. Offer's consultants (Le Energy & SRC International 1992) and ACE (ACE 1992(c)) suggest an approach based on the Northern Ireland formula for distribution regulation, which would remove this incentive. This change is called "decoupling", ie decoupling sales from revenues.

ACE (ACE 1992(a)) recommends that as well as an E factor, Offer should establish clear objectives for RECs' energy efficiency programmes. Each REC should be required to consider DSM as an alternative to supply-side measures.

Offer's consultants concluded that the potential of DSM in the UK is significant. They estimate that savings of 6% of electricity use could be achieved within ten years (Le Energy & SRC International 1992). This would allow a œ1.1 billion reduction in electricity costs, and would represent total capacity savings of 1,950 MW. ACE (ACE 1992(c)) believes that this is a conservative estimate of the potential of DSM, and cite Southern California Edison which expects its DSMs to reduce electricity demand by 13% by the year 2000.

The Director General has just completed a supply price control review (OFFER 1993). His proposals represent an important first step in the encouragement of DSM by Offer. A new control on revenue is proposed which gives each REC a basic constant revenue of œ10 million (with an extra œ1 million for five RECs who have additional costs) plus standard allowances based on numbers of customers and kiloWatt hour sold. This will have the effect of reducing to some extent the incentive to the RECs to sell more electricity.

In addition, the Director General proposes to give the RECs an obligation to "explore more thoroughly the potential for cost-effective demand-side management measures." (OFFER 1993) He proposes a special allowance of œ1 per customer to be added to the revenue control above. Over four years, the Director General estimates this will finance nearly œ100 million of new expenditure on energy efficiency.

But many issues are still unaddressed, in particular the incentive to increase sales in the distribution business. The allowance proposed is a small step in the right direction, and may provide the incentive for many RECs to begin introducing DSM. The Director General's proposals now have to be accepted by the RECs before they can be implemented.

2.? Case Studies

DSM may already be cost-effective in enabling RECs to avoid investment in the distribution network. This possibility is at present being explored by the two pilot projects - the Great Gonerby Initiative and the Holyhead Powersave Project - examined below as case studies. However, it should be emphasised that opportunities for such DSM projects are limited, as they are only economically viable where there is a problem in the capacity of the network to meet demand, for example where new substations are needed. Where there is overcapacity, DSM would be a loss-maker.(ACE 1992(c), p.12)

The widest application of DSM will therefore be where it is used to save electricity purchase costs. Electricity purchase costs are the primary costs the RECs can avoid by investing in energy efficiency. This is why an E Factor in the supply price control formula is so important, and the Director General's new move towards this change is to be welcomed.

But Offer must not only remove the disincentives to DSM, it must also develop incentives, otherwise the perceived risk associated with DSM means that the status quo is likely to remain. If the variety of measures recommended by Offer's consultants and by ACE are eventually taken on board by Offer, then DSM will have the potential to increase energy efficiency over large areas of the country, to a level not attainable using any other mechanism.

It would now be in the government's interests to review the role of Offer and the structure of the electricity industry in order to take account of energy conservation objectives. The government could instruct Offer to adopt a package of measures designed to facilitate DSM, and could examine the wider question of how to integrate the industry to allow the maximisation of both the industry's profitability and the potential for DSM.

Suggested Planning Tools

1. Creating the Conditions

In conjunction with targets for the reduction of CO_2 emissions, such as the policy in Newcastle's UDP, development plans should include policies which use very high technical standards as targets for energy efficiency in all new buildings. The use of energy efficient appliances and lighting should also be specified. New development is where energy efficiency comes cheap: retrofit is expensive.

Where a DSM area exists or is being set up, a policy could be established supporting the initiative and setting out the detail of the way in which assistance from local government will be given. This would act as a vehicle for information to developers and the community, and would help to create the right atmosphere for the project's success.

2. Development Briefs and Design Guides

The use of both development briefs and design guides for the promotion of DSM would be of valuable assistance in existing DSM areas, such as in Holyhead. Although the following idea could not be included at present as a requirement, it could be recommended that an arrangement should be made between the developer and the utility.

The sort of arrangement envisaged would entail the development providing increased energy efficiency performance, (to a standard to be agreed between the planner and the utility) plus the use of energy efficient appliances. The utility's side of the bargain would be that a proportion of any extra costs of providing higher standards beyond those laid down under Part L of the building regulations would be borne by the utility (the amount to be agreed in advance).

The use of the development brief or design guide would at least provide a means of providing information and increasing the developers' awareness of the DSM initiative. It also has the advantage that the negotiations entailed between planner, developer and utility would inform the utility at an early stage of any large new development project, and allow the utility an input at an early stage. But use of development briefs and design guides will have further significance because, by implication, the application has more chance of planning consent if the recommendation for the developer to work with the utility on demand-side measures is agreed to be followed.

The use of design guides and development briefs would also lead to developing awareness of DSM among building control officers and architects, who are usually involved in the preparation of these documents. Their assistance in promoting DSM could be elicited in this way, and a team approach to facilitating DSM could be adopted. Three-way negotiations would have to be carried out between developer, utility and design team to formalise the exact arrangement.

3. A City-Wide Strategy

This suggestion relates to a way in which planners could become involved not only with DSM activities for new development but in the retrofit of demand-side measures in existing housing, which is actually more important than new housing in terms of numbers and therefore capacity to reduce CO_2 emissions.

Where regeneration areas have been identified, for example as in City Challenge, Energy Action Areas could be formed to coincide with these areas, for example as Newcastle have done in their City Challenge area. In Newcastle's Energy Action Area, general energy efficiency improvement measures are taken, limited by the finance available.

When a DSM area is set up, an Energy Action Area could provide an exciting opportunity for planners to work with the utilities in retrofit activities. The planner's local knowledge, collection of statistics and maps, and their experience with local agencies could be of great value to the utility. Their precise role would have to be carved out, and would vary according to the local situation, but many interesting possibilities may exist if this suggestion is explored further.

A more comprehensive strategy could involve the setting up of an "Energy Agency" on the lines suggested in Newcastle's report (Newcastle upon Tyne City Council 1992). If the aims of the agency were specifically to foster energy independence in the community by pursuing a programme of demand management through the facilitation of DSM, the potential would be enormous. Such an agency could help to formalise the relationship between utility and council, and to draw in the relevant council officers.

Planners have not involved themselves so far in the two projects I have studied. This is not surprising, since the projects have been relatively small, pilot projects, where no large new development was occurring. If the proposal for the A1 Triangle adjacent to Great Gonerby had gone ahead, and EME had initiated a DSM programme, it is highly likely that planners would have been approached by the utility because of their role in new development. They would then have had to make a choice about whether to involve themselves in the project or to leave it entirely to the utility to negotiate about standards of energy efficiency with the developer.

I have shown that the implications which DSM holds for planners are significant, and it is now time for planners to consider their response to DSM. The utilities are already aware of the challenges involved. Because DSM has the potential for enormous environmental benefits, I believe that, once made aware of those benefits, planners will choose to work with utilities and contribute to the success of DSM, in whatever way they can.

The first step will be one of developing awareness. Planners need to be informed about the development of DSM, how it operates, and the environmental, economic and social benefits it could bring (see table 8). The planner will also have to develop greater expertise in the technical side of energy efficiency. Policy will be an important tool in facilitating DSM, but it is in the implementation of DSM projects where planners can give most practical help.

Where a DSM project is set up, new ways of working will have to be developed, incorporating planners negotiating with utilities and developers at an early stage in the development process. Greater interaction between building control officers, architects and planners will also be needed. Depending on the situation, creative thinking will be called for regarding the planner's role in assisting in the retrofit of existing housing, particularly in regeneration areas.

introduction

1.3 The Planning System and DSM

Implications for planners:

* major changes in planning processes
* new approach to development control
* challenges established relationships between utilities and planners
* utilities become managers of space
* retrofit energy efficiency to existing development
* goes further than recent DOE advice
* a mechanism that goes beyond traditional planning concerns with new development and effects of landuse patterns on energy consumption.
* demand management. Chris Williams describes this as "probably the main mechanism for implementing sustainable development". He goes on "It also signifies a major shift in approach for planning - from trying to predict demand and then to provide for it, to trying to control the forces which give rise to the demands in the first place." (Williams 1993)

The principle of demand management has had most recognition in the field of transport. Demand management methods in transport include ride sharing, resisting peripheral development and limiting development to public transport nodes. The interrelationship between land use and transport demand has long been recognised, but at last, with government encouragement (see below), planners are beginning to actively manage demand in this area.

the concept of demand management is central.

PPG 12 (DoE 1992) contains the most important central government advice to planners on the need to work towards sustainability and how to bring sustainability into the planning field.

Consequently an attempt has been made to place this paper in three sets of debates:

Urban Environmental Management

Urban infrastructure networks consisting of water, energy, transportation and telecommunications networks have a key role in the effective economic, social and environmental functioning of modern cities. Unfortunately there has been little research and policy interest in examining the linkages between these networks and the urban management process (Marvin 1992). However the environmental performance of waste, water, energy and transport infrastructure have been identified as the core issue in urban environmental management (CEC, Elkins, Breheny). But it is less clear how cities can attempt to intervene to improve the environmental impacts of these networks. The main research and policy thrust has been attempts to identify landuse patterns that help reduce transport and energy consumption. The Department of the Environment have put considerable efforts into this area (DOE 1993), but the research findings indicate that the linkages between urban form, energy consumption and transport are not as strong as originally anticipated (Breheny).

Infrastructure Networks

Infrastructure networks must have key role in any attempt to reduce the environmental impacts of urban areas. Unfortunately recent policy developments have tended to ignore the wider institutional context within which the owners and managers of infrastructure networks actually operate. There is clear evidence that the existing institutional framework actually encourages road transport, water and energy providers to increase flows of resources through and along their networks (Marvin 1992). Basically there is a strong supply orientation which involves forecasting increases in demand which is then met with extra supply. Consequently there is the curious paradox of the DoE and DoT attempting to developing land use planning policies that might reduce flows along the networks while the companies and organisations responsible for providing the service have incentives to increase the magnitude of flows along their networks.

The Development Process

There are major difficulties getting inside the institutional processes that reproduce resource intensive environments. This paper focuses on the development process to open up a window onto the institutional processes by which infrastructure networks are provided to new developments. It provides a mechanisms for examining how the environmental impacts are assessed, the form of the debate about the options for meeting demand and the range of variations in practices and procedures. The provision of infrastructure services to new development is based on the interactions between three sets of actors:

· Local Planning Authorities - statutory planning and highways authority.

· Utilities - privatised water, electricity and gas companies responsible for negotiating with developers over provision of their services.

· Developers - largely responsible for design of building with important consequences for resource consumption, liaise with user and negotiate with utilities.

There is very little research which has looked closely at the institutional context and negotiations between these three sets of actors. Most of the previous research has focused on the economic costs of infrastructure usually before privatisation of the utilities sector (Loughlin, Rowan Robinson). The literature has almost nothing to say about the environmental implications of infrastructure provision processes. Consequently we have a very poor understanding of the environmental implications of infrastructure provision processes.

section 5

Consider reasons why there should be closer engagement - DSm takes off, how might it work, , and what are tnsions and conlficts between utilities and planners.

exceeds existing energy efficiency

If DSM schemes are to

It is clear that

GG - key points about this project:

stimulated by a development proposals therefore should be of great interest to planners - starts to show connections between development plans and proposals and utility networks.

really exciting point is that a new development proposal can result in retrofitting of new energy efficiency measures elsewhere on the same grid.

does this mean that the A1 development would have had to be very energy efficient

brings together lots of different groups supply-consumption interest plus LPA to discuss energy issues

a major change in development processes.

The opportunity is also lost to study the impact on local planners of such a project, where, because only new development would be involved, the potential for planners to become involved in the project would be high.

must emphasise these points

HH: key issues

need to combine production and consumption interests

importance of future development could upset dsm calculations if not close links with forward planning and economic development startegies

economic benefits for local firms seem to be important

plus other issues identified in gg

5.1 Cases Compared

Table 4 compares the features of each scheme. It will be seen from this table that the Holyhead project, which is more recent than the Great Gonerby Initiative, is on a much larger scale and has involved much more commitment from the REC. This is a sign that DSM is being taken more and more seriously by RECs. Both projects are now being watched with great interest by the other RECs in the country, and the new proposals from Offer may well provide the incentive for a spate of new projects. If these are successful, the experience and confidence which is built up on the part of the RECs and the increased awareness of the public may in turn lead to further changes by Offer. These changes may allow DSM to be used to save electricity purchase costs. Ultimately, the structure of the electricity industry may change to take advantage of the potential cost-effectiveness of DSM.

The Case Studies: A Comparison of Features

Scheme Features	Great Gonerby Initiative	Holyhead Project	Powersave
Reason for choice of area	200KVA substation needed uprating	New substation 33,000KVA needed	
Size of area	154 households	3,500 households	
Sector	Domestic	All	
Agencies Involved	NEA, EME, SKDC, LES	MANWEB	
Spending on the project	Details not available	œ0.5 million	

Target	To reduce peak demand by 30kW	To reduce peak demand by 1MW

now use case case studies to examine impacts for planners
- although not very involved in these projects need to link to issues identified in introduction.

5.2 The Challenge of DSM

Should planners ignore DSM, and leave it to the utilities? Or should they positively involve themselves in an active new role as energy efficiency facilitators? What would the results of either inaction or action be?

* closer links between utilities and development planning process
* development control and development plans
* linking utility with landuse planning
* new strategies for management of new and existing built development
* closer linkages between different interests
* econ/soc/envir benefits
* very dependent on utility stance
* need to develop strategies to capture local benefits of dsm

Planners at present do very little regarding the provision of services. Conventional planning has been strongly supply-orientated, and until recently, there has been little interest in limiting the environmental impact of new development.

PPG12 advises that:

"Authorities should consider both the requirements of the utilities for land to enable them to meet the demands that will be placed upon them, and the environmental effects of such additional uses. The utilities ... should be consulted about these questions." (5.37) (DoE 1992)

But the environmental effects of the activities of utilities and the way energy is consumed are generally ignored by planners. Electricity supply is left to the developer and utility to sort out between themselves, and the planner rarely intervenes. Under present conditions, there is no incentive for the utility or developer to minimise the resource use of development, and all costs of extra supply can be passed on to the consumer.

The development control officer is working under great pressure, and environmental issues may come low on their list of priorities. Planners tend to assume that building control officers will ensure energy efficiency standards in Building Regulations are adhered to, and that architects will play their part in finding the optimal energy efficient lighting arrangements, glazing etc.

If DSM becomes more viable due to the likely changes in the regulation system, as discussed in section 3, it seems probable that the utilities will wish to take advantage of the opportunity to increase their performance, and invest in DSM.

Planners then have a choice. They may decide that DSM is a matter for the utilities, and not to rise to the challenge posed to their customary role, as described above. While this may not lead to the downfall of DSM, the utilities would lose an extra layer of support and assistance. But planners as a profession would also lose: they would miss the chance to develop a new role in one of the basic elements of town planning - the design of the basic physical structure of the built environment - and its restructuring to incorporate sustainability.

Planners are in a key position as gatekeepers to influence both developers and the community as a whole. What can they actually do if they decide that they have a role to play in gaining an energy efficient built environment, and to accept the challenge of DSM?

What is needed from planners is to help create an atmosphere in which DSM can flourish - with energy independence as the goal. The management of demand for energy calls for many agencies and individuals to play their part and to integrate their efforts for maximum results.

Planners must therefore identify their position as part of a network, and examine the possible links between its constituent parts. A suggested schema for a network is set out in figure 4. When the RECs have geared themselves up to working towards energy efficiency, much new information and many new relationships will need to be established. Planners, if they opt for a proactive approach, will need to consider how to work with their local utilities. Their new role will require new expertise and skills - for example, an awareness of the local electricity network and where there is overcapacity or where there are problems in meeting demand.

Figure 4

Network of Relationships Involved in Developing DSM

DEMAND-SIDE MEASURES

Housebuyer Householder

Planners

Developers

UTILITY

Offer Government E

Energy Policy

Public Opinion

Planners will have to begin a new dialogue with utilities, to consider where DSM programmes are feasible, to develop information on and maps of energy consumption throughout the area, to discuss new development areas and their energy needs, and to work out the details of how planners can best assist in the implementation of DSM programmes. They may decide that the capacity of the electricity network should become a new criteria for evaluating development proposals. They may be able to help with DSM by steering development to particular locations. A comprehensive view of the energy needs of the area will be required to decide on the optimal interventions.

Table 8

The Benefits of DSM

Recipient	Major Benefit	Related Benefits
Utility	Increases profitability	Good for public relations:Network improved
Householder	Saves on energy bills	Increases comfort Health benefits
Developer	Increases saleability of property,at little extra cost	Good for public relations
Environment	Reduces global warming	Reduces pollution Conserves fuels Reduces need for power stations

arNeed to questions our existing prodcedures and disaassocietd links - utilities adopting a rnage of startgies have to look ta what they are up to in any case,

If DSm takes off need for closer enegamanet becuase of threats and potential beenfits

How might this work through development plans, briefs and development control

potential constrints on this happening - control of information compartiative advatges, what is happening in utilities ector - competiton may undermine etc.

Need to get inside role of utilities

Esp - whole sector taken togther plus potential for joint ownership

DSm likley to become more important.
But whose controlling use of space.
This review indicates that there may be potential for harnessing an alternative method of utility management based on DSM with wider economic, social and environmental policy considerations. Privatisation of the utility sector may have actually created more potential for new types of policy linkages between companies and regional policy debates and agencies. As utilities develop strategies for maximising the profitability of the their networks there is evidence of important variations off the approaches adopted in particular places - for instance a number of innovative utilities have developed initiatives for small scale DSM projects.
While the widespread adoption of DSM measures will depend on important changes in the regulation of the fuel industries regional agencies can help by increasing pressure for change. There is already the potential for starting to formulate wider policy proposals by encouraging other utilities to follow the example of MANWEB and start developing DSM experiments and models where these are economic within the constraints of the existing regulatory structure. Economic development and training agencies could assist in the training of staff, identification of suppliers of energy efficient equipment or encourage production of new products or packing of new energy efficiency services. These initiatives could converge with utility companies increasing interest in regional economic development processes. Regionally embedded utilities have powerful commercial incentives to attract inward investment and support local businesses to provide a secure, growing and long term market for their services. For instance in the North East the three largest funders of the regions inward investment agency - Northern Development Company - are Northern Electric, Northumbria Water and British Gas.
There are other reasons why regional policy agencies need to start putting a regional input into debates about DSM in the energy sector. The US experience indicates that there are substantial variations in the content, structure and funding of DSM programmes. These reflect the form of the regulatory agency, the interests of the utilities and the need to tailor DSM to the specific characteristics of the region or locality. Each programme has different impacts on regions within which the schemes are developed both in terms of energy savings, environmental benefits and economic implications. It is quite likely that with 12 REC regions in the UK different types of policy would be developed. However there are other reason why regional debates may want to take a more pro-active approach and encourage the formulation of specific types of programmes.
For instance the South West region is likely to experience substantial rises in gas and electricity tariffs as charges are rebalanced to reflect the costs of transmitting energy resources across the country. The remoteness of the region from power stations will increase regional tariffs and could put significant pressure on domestic and commercial customers. In this context DSM measures could have substantial benefits to help reduce energy imports into the region. As argued in the introduction DSM measures are also applicable to the gas, water and probably the transportation sector. In the South East of England a shortage of water resources and sewage treatment facilities is already placing an important constraint on development. The adoption of DSM measures could provide a more economic and publicly acceptable alternative to the construction of new reservoirs and treatment works.
There is a need to start meshing debates about the future role of planning, regional policy, utilities, energy, environmental and economic issues more closely together. Privatisation may present new opportunities for linking utility strategies with wider economic and social objectives of regions and localities. There is clearly an new opportunity for harnessing private companies strategies to underpin and support regional policy objectives.

abbreviations

DSM	Demand-Side Management
EME	East Midlands Electricity
LES	Lincoln Energy Save
LPA	Local Planning Authority
NEA	Neighbourhood Energy Action
OFFER	Office of Electricity Regulation
PPG	Planning Policy Guidance Note
REC	Regional Electricity Company
SKDC	South Kesteven District Council
UDP	Unitary Development Plan
KVA	
KW	
MW	

list of FIGURES

 The limit applies until 1 April 1994, when the limit will be reduced to 100 kiloWatts (kW). Customers then taking 100kW or above will have the freedom to choose their supplier. But until 1 April 1998, when all such restrictions are removed, customers below 100kW do not have the protection of competition. (ACE 1992(b))