Notes on the Deep Service Model.

Mass electricity

1. Every long wave has its distinctive energy/power infrastructure. The initial textile revolution was based on water power (hence location in the northern dales); the second machine wave was based on coal; the third steel wave was industrial electricity; the fourth mass production era was oil. But in this fourth wave the expansion of the electricity infrastructure to all consumers (i.e. extension from business to consumer market) meant that electricity became (along with oil) the key energy for the age of mass production.

2. The organisation of the electricity industry followed the mass model. In the early 20th century there were 135 different power companies in London alone, most with differing standards. The first half of the century saw a process of consolidation, and the post war nationalisation brought into being a fully fledged national electricity industry. Its key features were:

    - Large coal fired power stations (later also nuclear and gas) enjoying economies of production, but diseconomies of location (transmission costs and losses)

    - A national grid to provide economies of aggregation in matching supply to variations in demand

    - Regional distribution networks (grids) at a lower voltage, for the same purpose.

    - Inflexibility of supply. This has often been posed as a problem of storing electricity, and storage (i.e. the production of stocks) is one way of dealing with the problem of inflexibility. But it is inflexibility which is the primary problem particularly in an industry with such often unpredictable variations in demand. Nuclear energy is the least flexible. Hydro the most flexible (hydro power can be brought on stream in 5 seconds). But the UK is limited in its hydro power. [1]

    - High costs of breakdown in supply. As electricity became the key source of power for many functions and industries, the effective costs of power cuts rose (hospitals, freezers, banks, lifts). In as much as cities were constructed as machines for living, the cessation of its key energy source could transform them into machines for dying. Hence the growing significance of security of supplies, and the growth of a distributed back up power supply

    - Unified public ownership of the national production and transmission systems.

[1] The predominance of hydro power in many Canadian provinces - Manitoba, Ontario and Quebec is one reason for the fact that until now there has been no national grid).

- The wiring of houses (and commercial/industrial premises) to allow for a distributed system of connections between the new mass produced appliances and the electricity infrastructure. There were two wiring systems: one for light and one for power. They were based on alternating current (220 volts) and were therefore a danger to humans, as against the lower powered direct current.

- Production led. Utilitarian, rather than a consumption good.

- Passive consumers, who were required to pay for the costs and maintenance of their domestic wiring, and who were for the most part charged on a quarterly basis for the units of electricity used. (Electricity sales revenue made up the great majority of the income of the nationalised company). The relationship was of a monopoly seller, and the charge was similar to a fee-for-use tax.

- The invisibility of electricity (like waste). The infrastructure of wires was largely hidden (that was the minimalist aesthetic). Metres were complex and placed in cupboards or dark corners. Plugs were flat and utilitarian. Lighting initially was delivered directly rather than through adaptable plugs and was largely centred in living spaces (in the middle of a room)

3. In this system complexity was centralised. Production on the grid was brought into balance with demand by a central control system, that drew in power sources according to their costs, and their response flexibility. The complexities of energy use and its domestic infrastructure could not be handled by this system, and had to be simplified by the aggregations of power demand, and by national regulations on electrical safety in the home. One of the arguments used by the utilities against two way metering is that it would render even more complex the problems of central control.

Crisis of the mass electricity system

4. The golden age of mass production ended in the early 1970s, and with it the era of mass electricity. The pressures on the system developed from this period and were five fold:

- concerns over resources depletion and later climate change, through the emissions of coal-fired, oil and gas power stations
- resistance to nuclear power as a fuel source
- inflexibility of industry to respond to new lower cost generating technologies (notably gas turbine generation) and the issue of the distribution of costs of technological obsolescence
- failure to introduce more flexible supply, renewables or demand side management, and more generally
- failure to respond to the potential of new information and communication technologies other than to re-enforce the old system

5. The key environmental issue has been the impact on climate change and high wastage of the centralised system (only 21% of power potential is captured for consumption). The key technical issue has been the uneveness and unpredictability of demand and the inflexibility of supply.

Response.

Neo liberal reforms

6. There have been two main responses to this crisis. First has been the neo liberal one, which has focussed on the structure of the industry, its ownership and its means of circulation. Britain and the US were leaders in this field. In the UK the 1980s saw the privatisation of electricity, and its unbundling of vertically integrated companies and the establishment of independent fields for generation/national/regional distribution components. Also introduced were complex systems of bulk electricity markets (wholesale wheeling), of choice in retail markets, and the establishment of an independent regulator charged with ensuring that the new markets were competitive, and where there were monopolies, that the monopoly powers were not abused.

7. These changes opened the way for the new lost cost generating technologies, but at the same time required the nationalisation of the costs of decommissioning (notably from nuclear plants) and led to both a reduction in reserve capacity and system gaming (Enron in California being the most notorious instance of the latter).

Post Fordist proposals

8. The second radical response has been to propose a post Fordist system of electricity production and consumption. Its key features are:

    - a shift to distributed energy systems, centred round small-scale generators, linked into local trigeneration systems providing power, heat and cooling (Woking, Lovins, LCCA, latest Greenpeace Report on DE).[2]

    - the introduction of small-scale renewable energy generation, notably wind, solar and geo thermal, either as part of the local tri-generation systems or as a component of a new household energy economy (micro CHP, solar, and micro wind, solar and geo thermal; Green Alliance, Woking, LCCA)

    - the development of flexible sources of electricity supply to complement intermittent sources such as wind and solar ('fast response spinning reserve') The problem of intermittent sources of supply (notably wind and solar) is often posed

[2] The past 12 months has seen a sharp change in Greenpeace policy. For some years they favoured the development of large-scale wind farms as the most promising renewable alternative to nuclear power. They were offering an alternative within the structure of the mass electricity model, Their July 2005 report has embraced a distributed alternative - what they refer to as a decentralised energy system - which foreshadows a quite new electricity regime.

as one of unreliability, but we see it rather as the lack of flexible sources of supply which can be used as a supplement. These could be either hydro power, or micro generators. (Manitoba)

- the development of new, distributed means for storing electricity, for example through the integration of plug in hybrid cars into the electricity system, the introduction of hydrogen power sources, as well as improved storing of the outputs that use electricity (better insulation and draught proofing of homes, of hot water systems, and battery powered appliances). The promotion of hydro electric power (like hydrogen) can also be seen as a means of storage, in this case of potential electricity that can be rapidly generated.

- the introduction of intelligent appliances whose energy use can be programmed to respond to periods of excess system generating capacity (the so called responsive load approach, applicable particularly to fridges and freezers, air conditioners, washing machines, and battery-fed electronic equipment - see David Hirst)

- a change in the form of prices, shifting from inflexible, average prices, to real time prices that reflect changes in supply and demand; similar to that now operating in the wholesale market. Retail pricing of this kind would entail intelligent metering that conveys current and future retail market information.

- the new system would not be supplying a single standardised commodity, electricity, but one that was different in quality, in time of delivery, and even in voltage (for example DC up to 44 volts as appropriate for many electronic goods as against AC at 220 volts).

- the reduction of domestic electricity demand by improvements in the home and in the energy used by domestic electrical appliances

9. The post Fordist model to date has still been largely supply led. It has re-engineered a system on the basis of a new constraint - the reduction of CO2, and drawing on developments of generation and transmission technology. From a technical point of view the post Fordist energy model comprises a set of technical and economic propositions (the viability of distributed energy production and transmission) and a proposition about how the system is integrated (through common standards, measurement and pricing).

10. Its propositions about household behaviour are primarily utilitarian and narrowly economic, or idealist in the invocation of the environmental imperative. As a result is has little to say about the service economics of household retrofitting, even though it is the widespread adoption of retrofitted measures which is critical if demand side management(DSM) is to play the role of the 'fourth' energy source and an alternative to the construction of conventional power stations.

The technical proposition

11. One of the conditions for the new model of electricity production is the volume production of smaller generators, which reduces the economy of scale gap between large and small electricity plant. If a reduced cost gap can then be outweighed by the locational gains of a distributed system (saving transmission losses and capturing heat through local combined heat and power) it is possible for local operating systems to undercut the price of the mass energy model. This is what has happened in Woking, where they have used small gas powered generators to supply their tri generation networks.

12. The volume production of general purpose plant and components is one of the key developments that permit the development of flexible production systems and mass customisation, with assemblers developing bespoke products from cheap standardised components (the Lego model of production). It gives a central role to industrial and product designers, required as they are to design a continuous stream of new products rather than the episodic standardised designs of the mass production period.

13. The economic possibility of local energy systems raises in a new way the question of the aggregation economies of the grid. To what extent does a national system based on distributed generation require more generating capacity than one furnished by large-scale power stations. This issue may be hidden by the cost comparisons of large and small, because the comparison will have to assume a certain average load. But we need to distinguish the full load comparison from the cost of keeping reserve capacity in each system, both for predicted and unpredicted movements in demand.

14. The argument has some parallels to those about international trade. If the South of England had high morning and evening demand because of a denser population, and the North had more daytime demand because of more industry, it would make sense to be in the same system, because the downturn in the day in the South would balance the upturn in the day in the North. Similarly, it might be that the demand for winter heating is higher in the North, and for air conditioning higher in the South. So again there would be advantages in planning for a single system. Is this the case, or can the system be decomposed into relatively autonomous electricity zones, which can largely balance the different time profiles of electricity demand.

15. Allan Jones develops his systems on the principle of such a local balance, linking homes to schools and offices for example. In the Woking case some excess is delivered to the regional distribution system, and some is drawn back from it, within agreed limits. But Woking draws almost nothing from the national grid. This suggests that there is a potentially high degree of local self sufficiency for much of the economy, i.e. the system can be economically disaggregated. There is no doubt evidence from the US, with its disaggregated energy sub economies (see Michael Best's analysis of Massachusetts).

16. We need more evidence on decomposibility. The major difficulties are likely to be caused by electricity intensive industries like cement works and aluminium smelting. Currently they receive electricity at marginal cost, (is this a competitive strategy by the electricity industry) whereas the residential sector pays full cost (and above). A distributed system may require a new regime for such industries, and their conversion to alternative fuels, or regimes of electricity supply.

17. But even where there is no full decomposibility, AJ suggests that there can be trading of surpluses between neighbours. This is materially possible to administer and price because of modern technology. It would be a form of local wholesale wheeling, in contrast to the standardised and inflexible regional and national pricing.

18. The issue of decomposibility is significant because systems theory would suggest that distributed energy systems of this kind would have greater diversity, would encourage innovation, and could generate a closer two way inter-action between consumption and production. They would also be less subject to the national system failures that have caused black outs in Italy, New York, California and London; i.e. they are more robust.

Role of the household

19. Households are included as parts of the system that need to be managed, primarily through changes in the fabric of the house and the appliances used in them. It is a technical view of the house as an energy system, with the householder required to carry through the demands of the technical system. This is referred to as 'demand side management' with emphasis put on system imperatives and personal responsibility. It still treats households primarily in mass terms, distinguished only by the technical nature of the housing stock.

20. The principle role of the consumer is as a purchaser - of houses and appliances, and of retrofitting services. Their role as operators of the system - as producers - is minimal beyond the injunction to turn off lights, or unplug the TV when not in use. It is the engineer not the consumer that drives the system.

21. Key features of the old system thus remain in tact: the passive consumer, the invisibility of electricity, the dominance of production over consumption, and of technical over economic means of matching supply to demand.

A new role for the household

22. What scope is there for a consumer led approach to new energy systems? Can consumers to play the role of co-producers, and can electricity change from its status as a utility into that of a consumer good?

23. There are three elements of an answer. First, houses could become sites of production as well as consumption. This is the significance of the micro-generator revolution.

Already micro CHP is economically viable in certain types of housing as is solar water heating. Within a decade solar roofing, micro windmills and geo thermal heating and cooling systems are all expected to become economic. These all involve equipment which require installation and servicing, and generate a new economy of domestic energy support.

24. It is also possible to envisage houses leasing their roofs for solar or wind generation by energy companies just as buildings are leased for the use of mobile phone masts.

25. Secondly, there is scope for a closer inter relationship between the use and production of electricity. This is exemplified by plug in hybrid cars. With plug-ins the batteries enable householders both to charge the cars from domestically produced electricity, and to draw out electricity stored in the battery. Solar and wind can supply power for the charging, and while the batteries can provide power at times of peak demand (boiling a kettle after Coronation Street).

26. More generally, a new metrics and pricing system for electricity will allow householders to match demand to system capacity. Spikes in demand can generate spikes in pricing. This in turn can lead to a warning signal, or to automatic reduction in use by fridges, or battery charging systems. Householders can see the forecasts of energy downtimes and uptimes from their control equipment and plan their usage accordingly, (the controls would be similar to those on the Toyota Prius which shows energy consumption according to the way the driver is driving). Control shifts from the central control room of today's grid to the 24 million households in the UK.

Designer electrics

27. What would mean to transform, electricity into a consumer good? Discussions this week have suggested any of the following

- The designer metre on the wall (like a large pedometer) with buttons that showed up CO2 impact, current and forecast price, electricity usage to date, compared to same period last year. Similar to the milometers on modern cars. The metre would be two way, showing how much electricity (and money) was being generated (a Danish member of a windmill co-operative once proudly showed me his metre clocking up the kilowatt hours).

- Techy gadgets on display - from the triple helix windmill, to the geo thermal system, to the new intelligent window, a Richard Rogers style water tank (designed by Anthony Gormley), a new solar door (with holographic diodes), the chipper and wood hod for the bio mass boiler. Appliances with their own financial budgets. What about plugs and switches. Could these be redesigned and their functions extended? Should they have their own sub metres? The task would be to provide a distinct narrative of the energy system in the house. (how to deliver aspirational lighting with low energy - cf the Australian CD?)

- A house rating (for use in the sale of the house, to include data on running costs et al - the 'energy deeds' of the house)

- Annual 'green house' competitions, similar to garden shows. A long established means of encouraging distributed innovation. It would give awards for the most innovative house et al (awarded on a local or town basis). We would expect to see certificates on the wall, like a farmer shows the prize certificates on the walls of his/her shed.

- An open house for green buildings, either launched separately or as part of the London Open House initiative in September.

- The development of energy mobs/collaboratives, either for joint generation (a windmill in a village, or geothermal for a terrace of houses) or for the sale of surplus electricity (and the accompanying ROCs). What scope is there for residents to sign on to a Woking style energy club or does it require them to part of an integrated development like BedZed? (we need to programme a visit to BedZed do we not?)

- A website with operational details of the local and national energy systems, providing the context of a householder's own actions, and the basis for local quality circles analysing performance. Opening the way to the intriguing fetishism of figures that is common in sport (particularly US baseball).

- The website could also develop as a site for enthusiasts - just as people buy hobby magazines. So part Which, part Motorsport, part Ecologist, part Elle Deco.

- The ubiquitous green card - last week we met one of the people who ran a local energy advice centre (he came to the charette) who was planning to launch a card called planet points. How could this be made aspirational.

- A carbon club, with its own wristband, in which all members agree to do their own personal carbon rating, and participate in a carbon trading scheme - could be developed like time banks/LETS, with special currency issued that could be spent on a range of services or green goods. So instead of paying money to future forests to plant a tree in recompense for a plane trip, could offer hours of carbon reducing services, such as compost doctoring, or shares in a windmill co-op.

- The re-organisation of energy services to be part of an integrated local utility, providing various types of energy, water, and waste handling. This refers to the development of distributed systems of water purification and sewage treatment, as well as local recycling circuits (notably in the treatment and use of organic waste). The connection between these basic services could also be established virtually, by accounting water use as part of the carbon metrics, so that the energy/CO2 intensity of water was registered in the household (and its own financial

accounting). Waste similarly connected because of the 'grey energy' embodied in materials, which needs to be conserved (the Dutch Government estimates that 50% of their CO2 savings comes from their resource/waste policies through the conservation of grey energy).

- The re-naming ('re-branding') of these initiatives. Mathew suggests smart energy; or intelligent houses. Cool energy. The 40% house doesn't really do the job. Factor Four (double the impact at half the price)? Brenda Boardman's figures on p.49 show a near halving of Kwh per head for lights and appliances by 2050.

- The 'self-tailoring' of packages of tools and services to the specific needs and aspirations of different householders.

28. A number of possible strategies are implied by the above.

- The introduction of a conventional consumer design aesthetic to energy (the Conran electricity metre).

- The application of the modernist dictum of showing the workings, making the invisible visible (Beaubourg, Lloyds Building etc - in this case using bright electricity wiring on the wall surfaces rather than underneath them, transparent water systems)

- The post modern narrative - an aesthetic of meaning rather than form. Instead of bringing the pipes above the surface, bring the story from beneath the surface. Construct the visual, the metrics, and the websites to provide a continually updated narrative, in which the user plays a central authorial role, as an actor, and narrator.

- The development of energy consumption/production as a pastime, a hobby, with its own club, magazine, tip-swopping, joint deals, metrics, tables, competitions, cultures. Energy not enough on its own, but part of wider 'light living'. How to make this popular? Celebrity led? Key, is the space for householders to shape and innovate, to be active producers. This is where DIY comes in. As well as scope for economic collaboration.

- Power over power. Control through controls. Is there a way of mimicking mobiles or attaching energy to mobiles? Can the production/consumption of energy be made part of the search for autonomy/identity. You decide who you trade surpluses with. Who you providers services to as part of carbon accounting. Could we give a new meaning to carbon dating. Could there be a CO2 device (like a mobile) called iPower.

- The healthy house. What scope for this? Temperatures in excess of 24 degrees or below 12 degrees increase the risk of strokes and heart attacks, between 12 and 16 degrees increase risks of respiratory disease, and below 9 degrees increase risk of

hypothermia. An issue of health through good ventilation and heating (the atmosphere of the house), and of the reduction of hazards (switch from AC to DC, health impact of fluorescent lights - see Google; and what of low level radiation, see Rosalie Berthel).

- The house that makes a difference. Here there is a link between what the householder does and the wider impact on climate change. This is a strategy that on its own will have limited impact initially.

29. Mathew has suggested the importance of using energy as a means of connectivity. This is in part connecting consumption and production through smart metering. But it could also be explored in terms of social connectivity - a means of local connection, and service connectivity - with its links to water and waste for low carbon practices.

Post-post Fordism

30. The general point raised here is whether there are three models in play. The first is the old centralised system where energy is external and invisible, and the consumer passive. The second is similarly external but distributed, with energy still invisible and the consumer passive. This has many of the features of post Fordism. A third is a system in which the consumer becomes an active participant in the production of power and the interaction between use, storage and generation.

31. In part this is a shift in the role of the householder from receptor to interactor, from object to subject. Like the new health economy, it is a distributed system, with peer to peer collaboration, and co-production, and new institutional forms (energy mobs, local collaboratives, local energy trading exchanges). As such it takes complexity out of the centre and distributes to the user, and as a result provides users with the scope for innovation.

32. To what extent could it be described as an open system? If it followed the gardening model, there would be open sharing of information and ideas. People could join the system as they would join Fedex. But could we apply the platform/tools/roles concepts? The platform would be the energy trading systems. The various micro or collaborative generating systems could be conceptualised as tools, along with the intelligent metres, the triple glazing, the new external wall varnishes. The roles would be primarily the new support services.

33. In contrast to the linear model of electricity - production, transmission, consumption, have we now got a more complex model. A user led one, in which the household is both a producer and consumer of electricity, drawing on a range of generating sources according to time, capacity and need (wind when it is windy, the plug in car for boosters, the local grid as back up and so on). Demand is interactive with a flexible production system that possesses the capacity to respond rapidly to new demand. We can speak of energy on demand, of a pull through rather than push through system.

Just in Time Energy. (Of course energy has always had to be delivered just in time, but it has required great excess capacity in order to do so).

34. Or could we speak of Energy Direct, with the distributed systems cutting out the intermediation of the grid and the regional distribution companies? The old intermediators now become subsidiary, part of a national reserve system like the Territorial Army.

35. How far can we push this? Is energy (or more generally the way in which our personal lives impact on the environment) sufficiently central to generate the motivations identified for health?

The policy response.

36. Government and municipal policy has largely been couched in terms of the traditional model. It has sought to introduce renewables within the framework of the old system, promoting large scale wind farms, together with much smaller R&D funds for other non nuclear renewables. Moreover it has left in place a number of restrictions to the development of distributed generation, notably the restrictions on the sale of surplus power to households outside the established system.

37. Its efforts to decouple household energy demand from income growth has been undertaken largely independent of supply. It has been piecemeal, relying on traditional government instruments (regulations and subsidies) with measures geared to changes in the energy intensity of appliances, and the physical changes in houses. The measures have included:

- Regulations (compulsory condensing boilers, tighter building regulations and planning requirements for new construction)
- Introduction of rating systems for appliances
- The provision of free retrofitting for the council tenants and the fuel poor
- The imposition of a requirement for the energy distribution companies to increase the energy efficiency of homes, both fuel poor and able to pay, (the EEC or Energy Efficiency Commitment).
- The establishment in 1993 (by the Major Government following Rio) of an animating agency to promote domestic energy efficiency (the Energy Savings Trust).

38. Strikingly it is social policy as much as environmental policy that has driven the bulk of measures for home retrofits. For low income households, home energy costs can account for more than 10% of income, so that energy efficiency measures have been found to be an effective way of increasing residual disposable income (in Woking for

example, the new energy systems including some retrofitting means that energy costs are only 6% of net income for the fuel poor).[3] Fewer resources have been targeted at those able to pay.

39. In summary potential elements of a new energy economy have been grafted onto the old, and their impact restricted as a result. This is exemplified in the EEC scheme. Here the responsibility for reducing energy demand through retrofitting has been given to the tradition utilities. As one of them said to me last week, what other industry is asked to cut the demand for the product on whose sales the business depends.

40. Traditional utilities have found it difficult to integrate demand reduction into their business model. In the UK case, the Government have sought to remedy this by creating a quasi market, allowing utilities to charge householders a fixed sum on top of their normal bills, and then meeting their CO2 reduction targets at least cost. The result is a modern variant of tax farming, where the Government sub-contracts the collection of tax and also (this is the difference to the 18th century practice) the spending of the tax.

Energy support services

41. In the case of EEC (which involves resources of £400 million a year) the institutions of the old order (the utilities) are engaged to provide a limited range of standardised packages of retrofit measures, usually insulation and low energy light bulbs. For ease of management, the services are provided free. It is a low level mass service.

42. Similar packages have been offered over the decade by a succession of government programmes aimed at council tenants and the fuel poor and delivered through municipalities. The packages have often had more elements than provided under the EEC programme (Lewisham for example had a scheme to fit condensing boilers, and new ventilation and double glazing, as well as insulation and low energy light bulbs) but the economics have been similar - standardised packages, delivered by sub-contractors, free at the point of delivery and funded through taxation.

43. As with all such services, the householder plays a marginal role, confined largely to agreeing to let in the fitter.[4] Decisions on the materials to be used for insulation, for central heating, or for windows are taken by the scheme managers. The service is thus supplier led.

44. Such a service model is not operable if consumers have to pay for the service. Questions of the qualitative and quantitative value of the service have to come into

[3] One of the most innovative councils in pursuing this policy has been Newark and Sherwood in Nottinghamshire. The leading figure there is David Pickles, one of the borough architects.
[4] In Lewisham's case approximately 500 of 10,500 council tenants in unretrofitted properties refused to have central heating installed even though it was free and even when it would not impact on their level of rent

play. There have been some examples of commercial services of this sort - notably the sale of double glazing - but by and large they are limited, and the EEC services to the able to pay households have significantly been generally free.

45. The Government's policy to this sector has been one of non interference in the market, save for the provision of information. There is an information advice service delivered through 52 Energy Advice Centres, 5 of them in London, again based on the mass service model. The service operates as follows. Standard forms are sent out by the local centres and returned to a central processing office in the West Midlands, which automatically scans the forms and sends back recommendations directly to households with recommendations for action. There are local and national numbers for any follow up queries, but these are limited.

46. Some Councils have provided discount schemes for particular measures (Lewisham has a Warm and Wise programme which gives discounted quotations for the installation of heating, controls, loft insulation and cavity wall insulation, and used to have a discount boiler scheme). But their coverage is limited.

47. The limitations of this 'light' mass service model are three-fold:

- The schemes have a low penetration rate of private sector housing (which accounts for the large majority of CO2 emissions from domestic housing), and a low impact rate within the houses served.

- There is little support for the technical, financial, commissioning and supervision of retrofitting work for able to pay households.

- There is no attempt to address the behavioural factors involved in energy husbandry in the home.

48. To take Lewisham as an example, where the borough has implemented Government policies imaginatively, and has also contributed finance of its own, it has delivered packages to 18,000 households in the past decade, out of a total of 115,000 households. A significant number of the 97,000 'uncovered' households have filled in the standard self survey form (which has been sent out to all households along with the electoral forms over the past five years) but there is no information on how many have invested in retrofits as a result. There is some EST survey work on this issue (including that done in the 1990s by Robin Sadler who came to the charette) and one of exercises we could do is to survey a street near our flat to find out the state of retrofitting. What we can say is that in London the SAP ratings of the owner occupied sector is significantly below that in the public sector, and this is circumstantially confirmed by our user research.

A deep service model

49. The charette explored a different approach which we called a 'deep service' model. It differs from the mass service model, not only by conceiving it as a commercial, user centred service, but by framing it in terms of the new energy economy rather than an adjunct of the old. It covers, therefore, not just the retrofitting of the house, but the potential production of energy, the link between energy and other household activities, as well as the householder's interaction with energy supply.

50. There are three key features of this service:

    - it is an information and advisory service, that assists householders in identifying their needs, and assembling packages of supplies. It is a form of intermediation.

    - it is a service that depends on trust. It is a form of environmental support economy in the Maxmin and Zuboff sense, of providing support for householders in deciding on their policies of consumption/investment and navigating/supervising the often hostile fields of service supply.

    - it is a complex service, not providing standardised packages, but rather means for auditing the current environmental impact of particular houses and practices, of developing customised strategies, and feedback tools for assessing impact.

51. The nature and organisation of the service needs to be shaped by these considerations. With respect to the substance of the service, the charette considered some of its potential linear elements, distinguishing the following stages:

    - Generation of awareness of the service
    - Initiating a response
    - Assessing possibilities (the audit)
    - Assembling a package, including finance
    - Identifying suppliers
    - Process of supply/installation
    - Quality control
    - Process of payment
    - Feed-back and follow up.

52. Central to the service was the home visit, and the continuity of personal relations. This raised the central economic question about the service, which was how to finance what is necessarily a labour intensive service, with each home visit of 2 hours costing an estimated £100. The business concept immediately suggested widening the service beyond energy to environmental support more generally (including travel planning), funded in part by the householder, in part through discounts, and in part by fees paid by bodies concerned with environmental outcomes and with service savings through changes in householder practices (primarily municipalities).

53. The organisation and economics of the 10UK concierge service is relevant here. It too is based on the notion of trust and the support economy. It too provides help in

navigating the quicksands of small firm markets (builders, plumbers, car salesmen). Significantly the great majority of its income comes from firms who wish to provide the support service for their employees, both as a perk, and a promotor of productivity.

54. It also highlights the areas where there are economies of scale, as distinct from those of trust. Trust relies on personal contact, continuity, and the evidence of practice. Economies come through the ability to perform services at lower cost once trust is established (for example having a key to let the service provider into the house thus avoiding missed appointments). But scale economies also apply to the following for 10UK as for deep energy services:

    - The establishment of information and accounting systems
    - Metrics and data bases
    - Call centres
    - Supply packages
    - Knowledge of a sector and its networks (10UK employs people from within those sectors, such as used car salesmen, to act on the householder's behalf).
    - The development of a network of trusted supplies
    - Negotiation of discounts reflecting scale
    - Systems of quality controls
    - Training
    - Branding
    - The development and servicing of websites
    - Policy advocacy

55. Economies of scale and economies of trust suggest the following structure. First a network of local deep service enterprises. They would be responsible for personal relations with householders, for the audits and follow ups, and continuing contacts. Their role would be the front line support workers. Distributed enterprises of this kind would have local knowledge, local networks, contacts with suppliers, and connections to other services. They could take a range of forms - user collaboratives, to community organisations, social enterprises, municipal services, or hybrids. They would have a flexibility and provide a diversity of approaches, that would encourage innovation within the service as a whole.

56. At the same there would be a central service organisation, governed by the local organisations, which would provide the support services that are subject to economies of scale. The economics of establishing such a service are determined first by the investment necessary to establish these systems and scale-oriented functions. This could be funded by an initial 3 year public grant, with the results made available on an open source basis to similar enterprises operating elsewhere in the country. The aim after 3 years would be cover operating costs and overhead from operating income.

57. There are a number of examples of enterprises providing elements of a deep service model of this kind. They include:

    - A number of the energy advice centres for example CEN (run by Dominic Gooding) and LEEN (run by Tony Rose). These are social enterprises with a limited number of clients.

    - Private enterprises like Encraft. They charge £25 for an advice on a particular energy source, and provide a service package geared to larger houses and the upper end of the market. We need to look at the experiences of other private providers of this kind, and consider how they could be adapted to lower priced mainstream services.

    - The Ontarian green communities, all of them social enterprises, many of which are now economically self-reliant. In their case, the Government Ontario developed some of the 'scale' services as start up support, and this function has now been taken over by a consortia body (run by Clifford Maines who came to the charette). The Federal Government has also provided some of the systems - notably the audit software, the system of follow up and provides the financial incentives for householders in response to their energy saving.

58. The development of the business model cannot be developed as part of the RED project, but should be part of the follow up phase, which frames the shape and tender of the pilot. The only point to note at this stage is that none of these to my knowledge has adopted the designed approach which we are considering, and their rate of penetration in particular communities remains limited (the Toronto figure I think was 12,000 households in a decade).

Other models.

i) Energy clubs

59. What other models might there be for encouraging domestic energy production and intelligent consumption? The first possibility is an energy club. Membership would offer access to a package of CO2 saving measures, providing a range of benefits (and savings) for those who joined. This might include:

    - Access to deep service advice as described above (part financed by the Council)
    - Discounted services supplied by proven contractors
    - Discounted equipment (e.g. cheap windmills)
    - Cheap finance
    - Talks on technological developments
    - Trips to see low energy buildings and towns - e.g. a week-end in Freiburg led by an architect
    - Engagement with the LCCA to be incorporated in a community energy scheme

- Shareholding in a community energy generator such as a windmill or geo thermal heat pump
- A web-based newsletter/blog
- Participation in publicly funded pilots/trials
- Participation in a network of green architects and designers (including lighting designers)

60. One model for the organisation would be the Women's Institute with local groups and a federated structure, similar to that suggested for the deep service model. There would have to be a significant initial transaction e.g. subscription of £100 for which the subscriber gets a comprehensive audit, and immediate access to a set of discounted goods and services.

61. The advantage of the model is that allow the householder to engage collaboratively in the project. The subscriptions could be marketed in a variety of ways depending on the market segment (e.g. the young policeman as against the FT journalist), but while there would be many ports of entry, there would then be the opportunity to extend the engagement in many different ways.

ii) Carbon 10 collaboratives

62. This is the mobbing version of clubs. People would join a group of 10 friends and neighbours - the Lewisham 10, the Bow Street 10, the Anglers 10 - (it could be 5) in order to pursue the goals of carbon reduction as a group. These groups would differ from the club model in that they would be self-formed and self governing, but would have access to a range of services and incentives (as described for the club).

63. The benefits of embarking on low carbon strategies collectively is that (a) people encourage each other; (b) it is often more enjoyable to do these kind of things together; (c) there can be a certain division of labour and expertise within the group; in other words there is more collective intelligence; d) there may be economies of commissioning - an installer contract for 10, plus a sense of security that if the installer is satisfactory for one, he/she will be alright for the others; e) each group could have a dedicated adviser - some of who support work could be delivered collectively.

64. It would be possible to develop the carbon mob concept into a pyramid organisation, with those who had been through a carbon reduction programme, being able to go on a training course and either establish a new group, or become an adviser.

iii) Green card

65. A green card of the kind we have discussed, comprising a range of green pages that both provide information on such things as boilers, 4 litre water toilets, lighting, metres, building materials, as well as discounts on them, could develop from a tool into a platform. It could both act as a gathering point for service, product and

operational information, but provide the basis for a new economy: its means of communication and commensuration could be used by time banks, as well as a chart through the mainstream money economy.

66. It could grow by affiliating to existing member organisations such as trade unions, environmental networks, credit unions, mosques, consumer groups. In this sense it would both be a means of connecting people individually, but also build on and re-enforce member organisations (including the energy clubs discussed earlier).

iv) Smartpower.com

67. This would perform many of the functions of the club and the green card on the web. It would act as:

- a catalogue of catalogues (guiding participants to approved websites on any particular types of information - boilers for example, or windmills.). It could combine the software of Peoplelink with the user feedback of Amazon, or other filtering devices. Or it could be curated more directly.

- it could combine information (including tools of self assessment) with purchasing capacity, and means of quality checking and performance rating.

- an on line chat room/advice service for problem solving

- a system of environmental accounting which could be automatically aggregated, and potentially used for earning carbon credits/ROCs, or whose carbon savings would be sold to utilities for crediting to their EEC scheme.

68. The point of distinction from the club model of such web functions is that it would be an open club, not depending on membership but merely participation in the procedures and systems of the site.

v) iCarbon.com

69. This would be primarily an economic site, a virtual trading floor both for the purchase of services/equipment, and for the sale of carbon savings. The key here (as for all carbon trading) would be to have an auditable means of measurement. For example tradesmen and women who had carried out retrofits would issue certificates of completion. Or impacts could be audited in a similar way to the Canadian retrofit scheme, so that even if the work is not done under any recognised scheme householders could still claim credits for what they had done at their own expense.

70. This might be the way to operationalise Brenda Boardman's idea of personal carbon accounting. The task would be to develop a system, then argue for government recognition of its validity, and generate marketable credits from there.

71. Credits could, of course, become another currency on such a site, not necessarily being converted directly into cash on the market, but acting as a quasi currency for an e Bay of low carbon services.

72. The site could also offer to lease assets for others to use for low carbon purposes. The roof lease was one example. But there could be other things: gardens for example.

Conclusions

73. None of these are mutually exclusive. But it is useful to distinguish them because they imply different forms of organisation, and different types of relationship between the participants. What is distinct about the two service models with which this note is mainly is concerned, is that these are both services, whereas the last four are all platforms on which information and services are available.

74. The first theme of this note was the nature of the energy economy as a productive system, and the potential alternatives to the existing mass electricity model.

75. But linked to this is the nature of the house as a productive system. What are we doing when we change the fabric and conditions of operation of a house. Le Corbusier would say that we are engaged in the alteration of a machine. That we should conceptualise the task as if we were operating in the machine sector. But it would be more appropriate to see it as creating an environment for living, even developing a platform, in which the plugs provides points of access to electricity on that platform, and the appliances are so many tools. This perspective puts the householder at the centre rather than being cast as the passive recipient of technical desiderata and production driven services.

76. Finally we have discussed the nature of such an active household energy economy, what information, services, and inputs are needed by a householder engaged in the shift to low carbon living. The deep service model can be formulated as a linear service, albeit that it is providing a far more complex service than that of the 'light' retrofit kind. But reframed as a form of environmental support role, the linear service becomes more of a succession of feedback loops and a co-created system of living.

77. It may even merge into the more open platforms of the latter series of options, drawing on them and playing the necessary personal support role in a particular way.

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