6: Financing Community Energy Initiatives

Why would I spend my grand-children's hard earned inheritance on a project like this?

Theo Paphitis, investor on UK version Dragon's Den TV show, (most weeks – it's a regular refrain of his)

In the widely syndicated show *Dragons' Den* (*Shark Tank* in the United States) entrepreneurs pitch their new business ventures to four wealthy *dragon* investors. If their pitch is successful the dragons take a stake in the business; the dragons are looking for the entrepreneur's proposition to make sense from a business point of view and the individual has to have credibility that he or she can deliver what is promised. Each week most of the budding businessmen and women leave empty-handed. Their pet ideas, which friends and family assure them will make them rich, fall apart under financial scrutiny. The reasons for failure are varied: over-optimistic sales forecasts, insufficient protection of copyright, little prospects for growth, lack of confidence that the venture will scale or profit margins too slim. This is the world of finance. Grotesquely unsentimental, the dragons are interested on whether the idea will make sense in the world as it is, not in some theoretical spreadsheet, nor in the entrepreneurs' fanciful imaginings.

What would happen if we pitched community energy to the Dragons? We'd have to be clear about the precise product we had in mind. The type of investment we are seeking finance for is community energy – by this we mean area-based energy efficiency programmes, new networks (like heat pipe-work), small-scale renewables of up to 50 Mw (sufficient to power a small town) or combined heat and power plant of up to 50 MW (sufficient to power and heat a small town). These are the type of investments that engineers and economists looking at the efficiency and cost-effectiveness of the system overall do favour, but which are tricky to finance. We would be excluding large-scale power plants – these can raise finance relatively easy already. Investors understand these sorts of investments; they are safe bets and will make a return if well managed. We'd also be excluding investment in electricity and gas pipes that have been approved by the energy regulator. Again these are easy to finance since, once they are constructed, the regulator allows the energy company to pass on the cost to customers (see box 1 below). We'd also be excluding minor energy efficiency measures in the home which cost less than €500 since these can usually be financed by the household or business.

Box 1: Raising funds to finance new electricity and gas transmission and distribution

The companies that own the electricity and gas transmission and distribution systems are monopolies. No customer has any choice but to use this infrastructure. No generator has any choice but to connect their plant to their systems. Governments have established economic regulators that set a charge for the use of the wires and pipes, or so-called *regulated assets*. This charge is based on the value of the assets and a reasonable rate of return to provide shareholders and banks a profit. This charge is added to the cost of the electricity and gas.

But how does the company that owns the wires and pipes get paid for any investment it makes in extending or strengthening its networks. The regulators have designed a cunning mechanism to rewarding new investment. Firstly, the regulator asks the company what its investment and maintenance plans are for the next few years. It looks at this list sceptically, figuring that the company has every reason to exaggerate its spending need. Once the projects are agreed and the capital-spending plan approved, the company is allowed to seek finance and commence work. The approved spend is added to the Regulated Asset Base (RAB), fully rewarding investors for their investment by allowing energy prices to rise. Borrowing money to finance approved investment is very easy since the customer is guaranteed to pay (they're cut off by their energy supplier if they don't) and so network companies typically have access to very cheap finance - cheaper even than some insolvent governments.

Use of the regulated asset base is restricted to investment that the regulator approves. It can't be used for assets that aren't approved, for instance heat networks or improvements to the energy efficiency of the building fabric. Such assets won't have access to cheap loans. Not unless local or central Government guarantees these loans or itself lends the projects with money itself as happens in rural USA, Denmark and Germany.

If such energy efficiency and community generation ever did try to appear on the show - the sad fact is it'd never even make it past the auditions, because the sum of money needed vastly exceeds the £200,0000 maximum allowed in the UK version of Dragons' Den. Community energy is expensive, costing far more than the sums a few business angels can cobble together. A report by the management consultants McKinsey & Company[1] puts the cost of enhancing the United State's 129 million residential homes at $229 billion, (but values the current and future energy savings at $395 billion). The European Commission[2] says €1 trillion has to be invested in energy systems by 2020 to hit energy security and climate change goals. This report goes on to say the opportunities for energy efficiency are mostly untapped and that the EU nations could save as much as €78 billion a year by 2020 in energy costs by installing cost-effective energy efficiency opportunities. Those returns are not being realized, partly because prospective investors feel uncertain about the policy and economic environments. In economists' eyes, this fear is irrational because the energy savings all cost less than the lowest current cost of investing in new power plant. Surely some sort of deal could be done between generators and their customers to avoid building expensive new plant?

The costs listed above, while substantial, still don't include the much higher costs of investments in improving the energy efficiency of existing buildings beyond the low cost measures. This requires investment in measures like solid wall insulation. How much such 'deep-retrofits' cost is uncertain. A report by the UK energy efficiency industry[3] puts the cost of external solid wall insulation at £14,000 for the average home once the cost of scaffolding, extending the roof and refitting the guttering is taken into account. A recent estimate of the cost of deep-retrofit for the UK buildings put a figure of £230 billion of investment between 2010 and 2020[4]. This just covers the cost of upgrading the building shells and the heating and cooling equipment in existing homes. A community that seeks to introduce district heating has to pay for long-lived pipework. The UK Government estimated that £50 billion might be needed to install community district heating networks for 5.5 – 6.5 million households[5].

But let's pretend that a community energy project gets past the audition and gets on the show. Before the Dragons declare: "I'm out" what kind of deviancy would they accuse the project of.

In other chapters we speak about some of the behavioural reasons why people and businesses don't feel confident about spending money on energy efficiency **(Chapter 8)**, and the lack of financial reward for installing renewable or more secure forms of energy **(Chapter 7)**. These issues need to be remedied, but there are other reasons for the dragons' reticence. For one thing there are costs associated with these technologies being unfamiliar (at least in some countries): installers are learning on the job and equipment providers are pricing their wares high because they haven't got economies of scale. Secondly, there is the landlord-tenant issue: the building owner, perhaps a commercial land lord or a social housing provider, who has to arrange the external insulation is different from the person that pays the energy bill and benefits from the improvement. Thirdly, the community might have divergent views - not everyone in the community will want the investment to take place – some might even campaign against it and cause a stink in the press and delay the process, destroying already thin margins. Fourthly, some people in the community who wish to take part might have poor credit records and could not be relied on to pay their bills. Lastly the investment might not necessarily be remunerative at the high interest rates the Dragons' banker will offer for this sort of project.

The last is a major impediment – but there is a degree of circularity in the problem. Because the technologies are relatively uncommon in most countries, they are seen as risky and become expensive to finance. Once they become more familiar, the unit costs will fall and lenders will be more used to them and stop requiring such a hefty return from their 'risky' investment.

Let's do a quick thought experiment to show how important sentiment and technology immaturity is. Suppose the cost of retrofitting a home is £10,000 per home. If the occupier succeeds in reducing his energy use by half – not an unreasonable target for a deep retrofit - the savings will be worth around £600 per year at today's energy prices – a rate of return of around six per cent. So it will take almost fifteen years to pay off the loan. No one has this amount of capital sitting in a zero interest bank account. People will need to borrow the money from a bank or dip into their savings – but at commercial rates of interest, which range from 5 per cent (if added to a house loan) to 15 per cent (if taken out as an unsecured loan), this investment looks at best like marginal investment, and at worst a crazy investment. Far from being free money, deep retrofits will only make sense to people who have ample savings sitting in a low interest account.

But let's see what happens if we play about with some of the assumptions. The numbers above assume that the price of energy stays constant. As gas become scarce or harder to get from convenient locations, the price of gas and electricity (in areas where the price of electricity is linked to the price of gas) will rise such as Europe. In USA the price of electricity is more likely to follow the price of coal. Also the cost of the insulation could come down if there are technological improvements – Prashant has been to a demonstration when lasers were used to accurately measure the internal walls so insulation material could be cheaply cut off-site. There are also economies of scale if someone organises the whole street or building to be insulated in one go.

If energy prices rose by 2.5 per cent a year, the project would generate a return of 8.5 per cent; this is acceptable to banks if the loan is added to the mortgage. If the cost of the investment is reduced - either through government subsidies, innovation or economies of scale - it looks an even better bet. Still not enough to set an investment banker's heart a flutter, but a tidy return. If the bank or energy company is certain it will be paid back, this is something that could in theory be financed. Sadly banks and businesses aren't certain. Investing in improving the energy efficiency of people's homes is presently seen as a risky investment. A working group of the UN's Environment Programme[6] concludes: "Energy savings … are not a conventional 'asset' against which a bank will lend…cash-flow from energy savings is not a familiar form of revenue or collateral to back lending…financial institutions, particularly local ones, need to become familiar with the nature, as well as the performance and credit risks of energy savings financed projects in order to be comfortable with providing debt."

Funding energy efficiency is difficult for banks for a number of reasons. Firstly, the sums of money being lent – say around ten thousand pounds per home – are small compared to the cost of setting the loan up. Secondly, what if the homeowner doesn't pay? The investor can't just peel the insulation off and sell it to someone else. Or what if the insulation doesn't perform as expected – will the investor be exposed to further costs in having the problem fixed, or be exposed to the customer's ire?

If anything, the situation is even worst for communal investments like district heating. By their nature the economics of collective or community investments are tricky. There is the scope for substantial economies of scale: a 10 MW combined heat and power plant is far cheaper to build and operate than a thousand 10 kW micro-units. But the costs of linking a community by district heating pipes can be very high. (However, once these costs are incurred and the network is established, it requires little maintenance and lasts for decades.) The worst worry for an investor is the uncertainty about whether people will choose to connect to the heating network. They will be aware of the many network companies that have gone bust, not because of the business proposition or technologies were flawed but because the company had incurred huge debt building the water, fibre optic, railway (delete as appropriate, there are examples of bankruptcies in each of these sectors) networks, and then haemorrhaged cash in the first few years of trading. In these early years, the company has to pay interest to its creditors but it has a small customer base. The irony is that from a societal perspective the new network might have been a huge success and though the original investors who took the risk lost their shirts our generation is still benefitting from these long-lived assets.

In the Den the dragons sit behind a big pile of money – a palpable demonstration of the gulf between those with capital and those wanting capital. Over the course of the short (and often humiliating) audience; the dragon and entrepreneur negotiate the terms of a possible deal, so that all parties know what is expected of them.

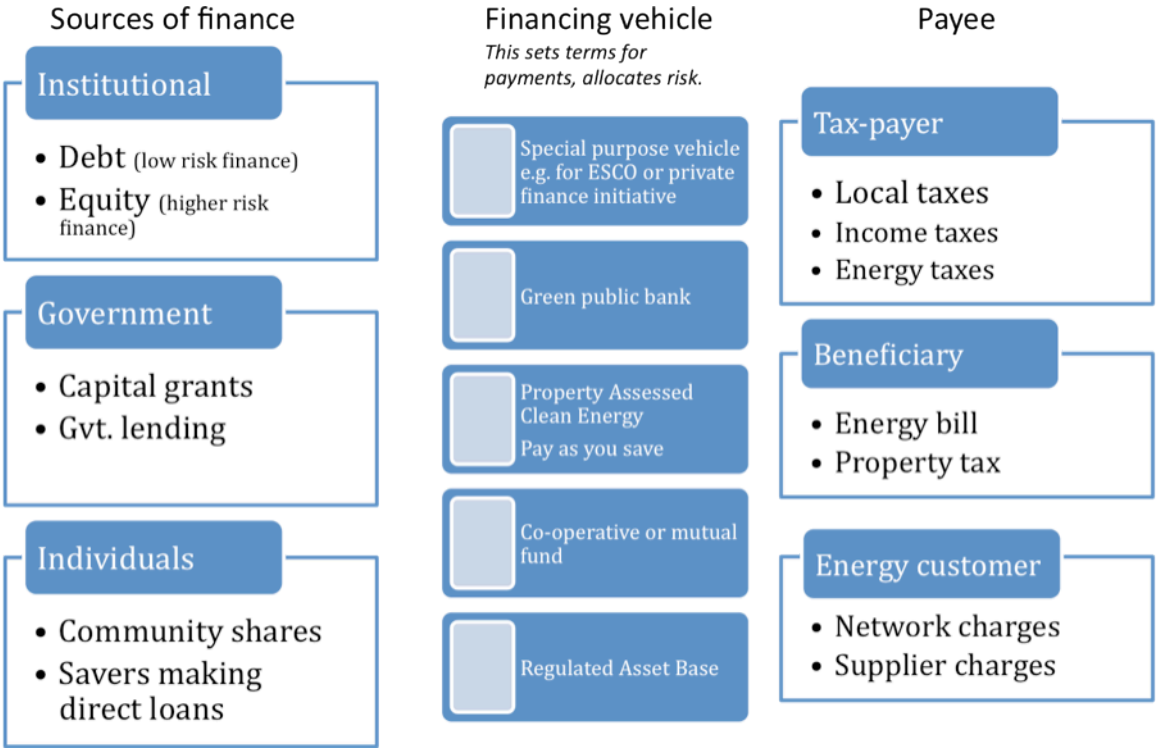
If money is to flow from financiers into community energy, investors aren't going to be wooed by dizzying financial returns. It's not that sort of business. The capital markets have to start viewing energy efficiency and distributed generation as a safe and low risk investment – it has to be boringly reliable. Sorry dragons, we don't want you. Community energy has to flirt with pension funds, not venture capitalists. To do this, the policy framework has to be stable and predictable and renewable and distributed energy has to be fully rewarded for its environmental

and energy security benefits. This would be a dramatic reversal from the present situation. So the big question is: how can we make community energy a boring and predictable investment?

How does community energy get financed at present?

Financing community energy in real life has some similarities to the Den. Someone has to provide the finance and someone has to be the "payee" responsible for paying back the investor. There also has to be a set of terms of rules and conditions to govern how the money will be repaid and what happens if things don't go according to plan and someone has to picked up the pieces – we can call this the financing vehicle. Figure 1 shows how this might work in practice.

Figure 1: Structuring the relationship between investor and project



Capital can come from financial institutions like banks and pension funds which *loan* money and are paid a fixed rate of interest, or from equity investors that own a share of the infrastructure and are only paid once and if the project makes a profit once everyone else has first been paid. Banks and pension funds are prepared to accept a lower rate of return on their investment than equity investors but are unwilling to take on risks. Projects that carry little risk, such as building a gas pipeline that has been agreed before hand with the regulator, can borrow money at 1 or 2 per cent more than (solvent) governments – at the time of writing this was around 4.5 per cent. The only risk the bank is facing is whether the business will go bust and default on their loans. Credit rating agencies assess this likelihood. New companies find it difficult to access cheap finance and pay more when they borrow. Unlike banks, equity investors are prepared take on some project risks, but need a higher profit margins to tempt them. A venture capitalist is a special type of investor who seeks out innovative new ideas. They look for a high return in exchange for providing guidance as well as capital.

Government grants are an important source of finance for community energy projects. Government provides capital to community energy either as an outright grant or through lending money to the project at below-market rates of interest through a publicly owned bank. The grant might subsidise part or all of the cost of energy efficiency for poor or vulnerable people – in the United States there are state weatherization programs (largely funded by federal government) see Box 2. In Denmark government met part of the cost of connecting poor households to district heating networks. In the UK there have been various capital grants for small domestic renewable plant like the Low Carbon Building Programme. Below market interest rates are common in many countries. The publicly owned German bank KfW Bankengruppe lends at substantially below commercial rates. Government guarantees KfW loans and also provides the bank with grants, and spares it corporation taxes. It's quite common for the subsidy to be paid as a tax-credit, allowing companies to reduce their liability to corporation taxes or rates. A slight variation on this is where government takes on some of the project risks instead of handing out cash. For instance, government sometimes covers excess liabilities for accidents beyond a certain level - handy for nuclear power plant, which would otherwise be uninsurable. Such facilities could be useful for off-shore wind too, to insure against delays caused by bad weather.

Box 2: USA's weatherization programme provides grants for energy efficiency

President Obama made a promise during his election campaign "to weatherize at least 1 million low-income homes each year for the next decade, which can reduce energy usage across the economy and help moderate energy prices for all."

With this in mind, in 2009 the federal government assigned "Energy Efficiency and Conservation Block Grants" (EECBGs) to cities with populations above 50,000. The funds, amounting to $6.3 Billion in total, were to stimulate local efforts to reduce energy use through insulating the homes of the fuel poor. As well as trying to improve the energy efficiency of low-income homes, it was also designed to provide decent paid work and skills to poor communities.

Paul Zabriskie from Central Vermont Community Action Committee (CVCAC) found himself in the happy position that his weatherization program budget had swelled by 40 per cent. This has allowed him to increase the number of crews of workers. But the form filling has been a headache: "Government attaches cables, rather than strings to the money." Most of the conditionality is associated with means testing to ensure the individual is in financial need. Eligibility has to be determined by CVCAC: "This is America you have to pretty much strip naked to access services. Throw your pride out of the window. But we try not to make it a degrading exercise."

As a result of the 1930s New Deal era laws workers have to be paid the locally prevailing wage. This has been a head ache as many voluntary organisations don't know what the local prevailing wage is. The result was that the recipients have been very slow to use the funds. The recurrent request from them is for examples of other local governments that have already done what they themselves had already proposed to the US Department of Energy as their action programs in accepting the funds[7].

One major problem with government funding is its volatility as a result of swings in political fashion and the government's budget situation. For example, the UK Warm Front program for the insulation of social and low income housing saw its £345 million budget cut by 60 per cent between 2009-10 and 2010-11. It will shrink to zero in the following two years. Such swings in funding make it impossible for local governments and firms dependent on the grants to plan their investment programmes in concert with plans to upgrade estates or roll-out networks. Should a company with a three-year contract to deliver energy efficiency services to communities invest in innovative techniques and practices, or should it maintain a defensive posture, hiring staff on short-term contracts and use existing technologies?

Individuals can also contribute to community energy projects, either by lending money to a project or by taking out shares in a co-operative or mutual company. Such social enterprises are a mix between a business and a charity. Quite often such schemes will stipulate that the shares cannot be freely traded: perhaps locking in the investor for a period of time, or only paying interest or dividends once the project is generating sufficient revenues. Danish and Swedish wind farms and district heating networks frequently raise capital in this way. These are described in Chapter 5. Here individuals invest their own savings in the community energy system. As well as providing capital on a more flexible basis, this also co-opts their support for the scheme.

This means using soft political influence within the community – talking approvingly of the project with friends and colleagues identifying the venture as being borne from the community, rather than exploiting the community.

It's common for there to be more than one source of finance for any project, for instance with government providing grants for some of the cost and the rest being obtained from institutional or individual funders. It is also common to refinance projects so the baton is handed from one source to another. While a renewable energy facility is being built, it is at its most risky – what if suppliers go bust, or there's an accident, or a vital part is delayed, or poor weather plays havoc with the timetable. Typically the project developer funds it from his balance sheet and from short-term (and expensive) bank loans. Once the plant is complete and has been switched on, the risk profile might be reduced sufficiently for a risk-averse pension fund to take it on.

Different groups can have ultimate responsibility for paying back the costs of the investment. The diagram shows it could be government; but it would be unusual for government to repay the costs of community energy loans through taxes, since government can borrow more cheaply than the private sector so it's more efficient for government to raise the capital itself. Of course, there are always exceptions to every rule…sometimes for no good reason. The UK government made extensive use of the private finance initiative (PFI) to keep public loans off the public balance sheet. Instead of issuing bonds itself, the government asked banks to borrow money for a project and it simply paid the interest. This ploy ultimately failed when the national statistical office refused to ignore the existence of these 'loans' and put them on the government's balance sheet, to the embarrassment to the government. Such PFI deals have financed the construction of energy from waste plant which generate electricity (and could be used to produce heat). Another example of taxes, this time energy taxes, used to repay loans is the widespread use of Feed-in-Tariffs (FiTs). The German FiT[8] raises money through energy bills, which is used to compensate investors in renewable electricity and combined heat and power. As with other FiT systems around the world, a complex system of equalisation payments

takes place behind the scene. These arrangements ensure that an energy company with a high proportion of customers in receipt of feed-in payments are not put at a commercial disadvantage.

Taxation, as well as being an expensive way of raising finance, also raises distributional issues: if taxpayers are responsible for repaying the project cost, the question arises, which taxpayers? Repayment using nationally collected taxes forces all taxpayers in the country to pay for the infrastructure even though the benefits might only be going to a small community: some of the payees might be much poorer than the people benefitting from the investment.

There are a number of mechanisms for the communities directly benefiting from the investment to pay back the cost of the investment. If the community improvement is to the fabric or their home (for instance where a block or street has an area based insulation programme, or community energy infrastructure) the loan might be paid back either through a charge on their energy bill (often called an on-bill financing) or through an additional property tax. This is an attractive mechanism in that it is fair: the person who is benefitting from the improvement is ultimately paying for it. It also makes more intelligent use of the finance: providing (hopefully) cheap capital to someone who might otherwise not have access to capital, potentially allowing an improvement at no up-front cost to the beneficiary.

Energy customers can fund cost-effective projects in another customer's home. This is a common way of funding low cost energy efficiency in USA and UK – this might include projects like subsidised light-bulbs, cavity wall insulation and loft insulation. We have drawn a (slightly artificial) distinction between this and the Feed-in-Tariff "tax" described above. Because many energy efficiency measures are low cost, it is feasible that most customers will receive some benefit from the programme, though there is some redistribution between customers. The low cost measures are cost-effective and so the programme should result in lower energy bills across the entire customer base.

We argue throughout this book that local communities should decide what community energy infrastructure they need. But the investors will also want a say in how their money is spent. Investor owned energy utilities and banks have a duty to achieve the highest rate of return on their investments. The investment they make in renewables and energy efficiency is because of price incentives or regulations to stimulate such investments. This contrasts with government and individual investors. Individuals and governments are not averse to seeing a good return on their investments; but this isn't their only criterion.

We would like to see much more local control of energy investment, but does that mean the local community has to foot the bill? The plausibility of relying on local funds varies across countries. In the US, most taxes are raised locally and the federal government provides only a small fraction of the funds needed for operations of the fifty states, two thousand counties and tens of thousands of local government bodies. As a result, there is a well-developed system of sub-national tax and fee collection. In the UK local Government is allowed to borrow money from national government as long as the revenues from the investment can pay the interest on the debt. Money is lent to the local government from the Debt Management Office, which is a branch of the national government. Local government is audited to ensure that borrowing is undertaken responsibly. Some local governments have also used the European Investment Bank to fund large energy infrastructure projects. In the US, by contrast, there is no nationally

established limit to local borrowing, and there are even federal programs to subsidize and encourage such local financing independent of individual state policies. While the US states, in principle, have the power to limit such borrowing, permission to borrow is almost never denied in practice.

The financing vehicle – managing risks

Uncertainty kills investment prospects. Novel investments in community energy have a myriad of risks and uncertainties that could blow up in the investors' face.

Few public officials, elected or appointed, want to take a gamble on an investment that might become an expensive fiasco. The smaller and lower-level the governmental unit, moreover, the more likely it is that the public officials will look up for guidance. In USA, where full government powers are given to really small communities, that nominal power is often a source of stasis and resistance to change. The expertise to consider options may not be available. The prospect of change is thus scarier than it would be in settings where the alternative paths forward can be carefully compared.

This point is truer of investors than government officials, even investors whose role is nominally to take on exceptional risks. The joke about venture capitalists – those who sink funds into innovative high-risk, high-return start-ups and small firms that have yet to show profits – is that they like to be first in the queue for the second-of-a kind project. They want to build on others' experiences in order to reduce their uncertainty. They are willing to take on risks, so long as their magnitude is known.

The choice of appropriate financial vehicle is really a means of sorting through the morass of things that could go wrong and allocating these risks (and also the potential for rewards) between the investor and community as cheaply and in as straightforward a way as possible. It involves selecting, or maybe combining, different sources of capital or absorbing the risk that otherwise drives up the cost of capital. Who bears what risk, how are benefits shared, what is the precedence among investors in getting paid off, especially in the event of the failure of an initiative?

In the idealized case, communities would choose a strategy by:

- Planning the infrastructure and capital needed (and political capital, in some instances) integrating these plans with broader ambitions for the community, for instance, creating jobs and local economic development
- Determining the returns on investment available under best possible future conditions. This will include non-energy benefits and ensure this vision is shared so the program is widely owned
- Determining the alternative futures that might exist – the conditions generating the risks – this might include project over-runs, overly ambitious take-up rates, changes in prices, poor performance

- Managing the risks – perhaps by using financial markets, co-opting opposition, or handing over the risk to someone else (e.g. contractor, insurance company)
- Sourcing the capital and investment vehicle to reduce the cost and risk of project

There are a variety of energy service contract models. In some the energy service company takes over the risks of an energy investment failing to perform[9]. Here the ESCO is paid from the savings they make, rather than the value of kit they sell. Such ESCOs assess building's energy saving potentials and then undertake the necessary retrofits, from whole heating and cooling plants to insulation and control systems. The ESCOs needs to guarantee energy cost savings that will cover the debt service costs of the loans taken out to finance their operations – the firms have minimum scale projects they will undertake and thus are not available to individual homeowners[10]. Box 3 shows how these contracts have been applied in Upper Austria and Berlin. In both cases the ESCO rather than the building owner provides the upfront finance. In Berlin, the KfW has lent money at low interest rates to the ESCO for this purpose.

ESCOs are most effective if they operate at scale – the Berlin model recognises this by requiring buildings to be aggregated. Any construction activity has substantial fixed costs for procurement, management and coordination, for bringing equipment to a site, and the like. As those costs are spread across larger projects, the unit cost (per building, dwelling unit or square meter) will be reduced.

However, neither of these ESCOs have undertaken particularly risky investments. There is a limit to the type of risks the ESCO can bear. The model can't easily accommodate occupiers that flitter away the efficiency by cranking up the heat. The energy market in which they are embedded restricts their freedom of manoeuvre. ESCOs have to buy and sell power through the power markets but don't have the ability to insure themselves against fluctuations in wholesale price as easily as a large integrated generator supplier. They have to buy gas at wholesale gas prices, but without the economies of scale that a major supplier enjoys. There are clear trends that explain why the ESCO business model does not include buying insurance coverage for the risk that energy cost savings will not cover debt service charges. Under normal circumstances, one would expect that businesses would insure themselves to protect against too many claims on their guarantee. But the ESCOs' assurance is absurdly conservative: they will only propose and install those energy efficiency measures that will permit savings to cover costs on the assumption of constant energy costs. Since average energy costs per year have risen steadily over recent decades, what this business model actually means is that the energy efficiency investments ECSOs offer are less extensive than those a breakeven analysis that incorporated price trends would warrant.

Box 3: Energy service contracts in Berlin (Berliner Energieagentur) and Upper Austria

In 1992, Berlin set up its own Energy Agency. It is described as an 'Energy Services Undertaking' and is a partnership between the Land (federal state) of Berlin, the KfW and two private companies Vattenfall and GASAG. The Agency annually lends €2.5 million lending to business and community level projects.

One of its activities is to help commercial offices and public sector buildings reduce the energy consumption of their buildings. The Agency acts as a project manager helping to devise,

negotiate and oversee the process. One of its programmes is to pool nearby buildings into a heating pool. It typically integrates demand of 4 and 400 nearby buildings so their combined energy use is at least €200,000 per year. Between 1996 and 2008 it had arranged 24 such pools covering 1300 buildings. These contracts are then tendered on an Energy Service Contract (ESCo) basis: firms like Honeywell and Siemens might bid. The ESCO pays for the retrofit upfront and building owners pay them back over an agreed period – usually 8 to 12 years in annual instalments from the energy savings. Typically around 97% of the annual savings are paid to the ESCO in the early years.

Once the contract is completed, the building owner realises the energy saving. Altogether the ESCO has invested €49 million into the pools and reduced their energy consumption by €11.3 million or 26 per cent. The ESCO usually invests in insulation, combined heat and power, lighting and better controls.

Upper Austria operates a similar programme. The *Energy Contracting Programme* offers financial support to energy efficiency, with work carried out by an ESCO. Building owners are spared any up front investment. The ESCO guarantees that it will reduce energy costs by a certain percentage every year. It is in charge of financing, installing and, where necessary, operating and maintaining energy saving measures and systems. The money saved by lower energy use is initially shared between the ESCO and the building owner. Once the cost of installation is recouped – which takes 10 to 15 years – the saving goes entirely to the building owner (unless there is an ongoing cost of operation and maintenance).

Upper Austria was the first region to use a third-party financing approach for energy efficiency. At first, the Energy Contracting Programme was restricted to public buildings, and to energy efficiency rather than renewables. It was expanded to businesses and to renewables in 2002. The programme offers financial support up to 6% of the energy investment, or up to 13.5% of the investment costs for renewable heat (up to a maximum of €100,000).

ESCOs can potentially work on homes as well as on commercial properties – for example at the community level across housing estates. The ESCO can invest in enhancing the energy efficiency of homes, perhaps by installing high cost insulation measures or combined heat and power systems. Bundling a mixture of housing and commercial buildings allows a more even demand for heat and power over the course of a day, resulting in better utilisation of heat infrastructure. However, such community ESCOs are not common. One practical issue is that unlike office workers, homeowners are used to paying for domestic energy according to their metered energy use. If their insulation is improved, they might react by keeping their homes at higher temperatures. From a social point of view this might be desirable but from the point of view of an ESCO which depends on the reduction in energy consumption to reward its investment it is a major problem. Community ESCOs can also be fiendishly hard to negotiate. Imagine trying to bring together a group of people: some might be renting their homes on a short term basis, some are owner occupiers, some are well-off and can afford to invest money themselves, some are on benefits in receipt of low price energy, some might hate the idea of change, some might have a deep green agenda. Bringing all these people together takes time – and the discussion might be inconclusive. The agreement has to be between the ESCO and whosoever resides in the home and has to endure even if people move home. So someone has to make a decision and this might not be popular with everyone. The UK established a £50m

Community Energy Programme for three years but most of this money went unspent because it proved impossible to organise and spend the money within the time frame imposed by the finance ministry.

One project that did obtain funding was a scheme in Aberdeen (described in Chapter 5) to install combined heat and power in a tower block. Half the capital cost of £1.6 million was from a government grant, the rest was bank borrowing and avoiding expenditures on individual heating systems in each flat. The local authority established an arms length not-for-profit ESCO owned by the council which bought in private sector expertise and services to perform specific tasks. The ESCO charged residents a flat rate for their heat, so the residents did not bear any energy price risks. This was motivated by a slightly paternalistic desire to stop residents worrying keeping warm. A community ESCO scheme in Woking established a public-private joint venture Thameswey owned by a Danish partner Xergi Ltd (81 per cent stake) and Woking (19 per cent stake) borough council. The set-up costs for the company were substantial but the venture has undertaken some immensely innovative schemes.

Green Investment bank

The UK's coalition government has promised a Green Investment Bank. The Treasury is not persuaded that a new government institution is needed, believing that normal banks will lend viable projects money. Many environmentalists see the bank as a totemic indicator of whether or not the country is serious about environmental investment. Both parties cannot be correct.

We believe that a green investment bank tasked with funding community energy is essential if large-scale community investment projects are ever to get off the ground. Energy service companies and local government have to go through immense and unnecessary hurdles to borrow money for bankable projects – the Aberdeen ESCO ended up borrowing from the Bank of Japan as UK institutions were unwilling to lend. A green investment bank must swiftly develop expertise in low carbon projects, borrow money from the money markets and crucially be guaranteed by government, to access low cost finance from pension funds, as soon as it starts operations. Existing financial institutions like pension funds and banks have neither the experience nor the appetite to invest in unconventional investments projects with little track record. This hesitation puts a self-fulfilling blockade on environmental progress. There is already significant experience of public supported lending to environmental investment. Most famous – among Germans and environmentalists at least - is the German KfW explained in Box 4. The German government guarantees lending by the bank. The bank subsidises interest rates allowing some lending to occur at 2.5 per cent, which means that even long, lived, slow burn projects like district heating networks start to make commercial sense. A number of the international development banks are already active investors in community energy. The European Bank for Reconstruction and Development set up in 1991 to invest in the former eastern block has a substantial array of funds for low carbon investment in eastern Europe and central Asia. Often money is lent to small retail banks within the host country, to develop in-country skill and expertise in assessing such projects. The European Union's European Investment Bank is also a major lender. Neither of these banks are guaranteed by Government but they have a long track record of participating in the money markets and can borrow as rates similar to Government. In the USA the Rural Utilities Service lends money to rural electrification programs at federal interest rates.

Box 4: KfW banking group

KfW is the German development bank jointly owned by the Federal Government (80 percent) and the states of Germany (20 percent). It was set up in 1948 to finance the Germany's reconstruction following the Second World War. It operates independently of the Government but is required to encourage economic, social and ecological development worldwide. In 2009 KfW borrowed €74 billion from international capital markets through issuing bonds. It is regarded by ratings agencies as one of the safest institutions in the world to lend to, and so can borrow cheaply, and also borrow many times more than the capital the two shareholders have paid into the bank: the bank currently borrows and lends 38 times its paid up capital[11]. The bank pays no dividends to shareholders and also is exempt from corporation taxes, allowing it to lend money at below commercial rates of interest. It is forbidden from competing with commercial banks.

It is now active in financing renewable and low carbon enterprises and around half its loans are now for housing and environmental purposes. It is the world's biggest lender to renewable energy projects. It has offered low-interest loans for refurbishment since 1990. From 2001, loans have been available specifically for energy efficiency improvements. In 2006, the KfW programme on energy efficiency was almost tripled, to around €1 billion a year (and subsequently increased to €1.5 billion). Since 2007, direct grants have been offered alongside the loans. Such is its dominance in energy efficiency lending that it now sets the standard for low energy retrofit in Germany – the KfW-40 and KfW-60 have become standards for energy efficiency. In Germany the KfW development bank raises AAA rated, Government backed bonds for its energy efficiency household loan programme. It then subsidises these loans so they can be offered to the consumer at a rate of 2.65%[12] much lower than the market rate of interest, or indeed the rate the Government can borrow at. This is supported by further grants and some regulation. As a result the programme is achieving 100,000 retrofits of residential homes a year.

KfW's CO_2 Building Rehabilitation Programme is carried out by local banks and offers loans to owner-occupiers, landlords, housing companies, housing cooperatives and local government, for energy efficiency, CHP and renewables. Some Laender support the programme with reduced interest rates. In 2007, grants for owners of one and two-family houses were also made available. There have been specific KfW loans and grants for non-profit organisations, local authorities and associations of local authorities since January 2007.

Upfront payments – dealing with uncertainty

"Let us eat and drink; for to morrow we shall die."

Bible - Eccl. 8:15 and Isaiah 22:13

People hate spending money now for benefits they will receive a long time in the future. This is even true of economists who should know better. Prashant's desire for instant gratification has made taking a lunch box into work impossible – since it is consumed shortly before noon. Economists dignify this short sightedness by saying individuals have a high rate of discount, as though that makes it OK. When they're being super-smart, they say people have hyperbolic

discount rates, meaning they care a lot about now but are largely unconcerned about the difference between ten years away and eleven years – both are simply points in the distant future.

This makes getting people to invest in pensions, or energy efficiency for that matter, difficult. This is where schemes that avoid the need for any up front payment comes in. Box 5 sets out two schemes: PACE from USA and the Green Deal from the UK, that allow homeowners to access capital to invest in energy efficiency or micro-renewable energy without any upfront payment. Instead they pay an agreed regular charge either on their local property tax (PACE) or as an extra fixed charge on their energy bill (Green Deal). The Green Deal also promises that the savings from the energy efficiency are greater than the monthly charge being levied by the company installing the energy efficiency, which means that the homeowner not only avoids paying up front charges, to flatter his impatience, but he is also no worse off from putting in the measure, appealing to his prudence. We are actually quite sceptical that there are many investments that can be made in the average home that are capable of achieving the latter condition and that this will quietly be dropped in a year or two, once political face has been saved and ministers have moved on. Crucially, the agreement to pay the charge on energy or properties bills binds not just the homeowner but future home owners that take over the house.

Box 5: Property Assessed Clean Energy (PACE) at Palm Springs, California and the Green Deal, UK

The initial capital cost is a barrier to investing in renewable energy and comprehensive energy efficiency improvements of homes. Property Assessed Clean Energy (PACE) financing is a financial model that addresses the upfront cost issue by attaching the loan to the property rather than the home's owner. This way the homeowner is confident that if they move home before the loan is paid off they're not stuck in the situation where the new homeowner benefits from the investment yet they are paying the capital cost.

The PACE mechanism was devised by Berkeley City specifically to provide residents the means to finance the installation of solar photovoltaic panels at no up front cost. The average requested loan when the scheme was introduced was $28,000 but this could be ultimately be paid off from the generous subsidies offered in California for electricity produced from PV. The PACE model has been widely copied and the largest scheme is one operating in Palm Springs. In Palm Springs the program lends residents money for 20 years at 7 per cent interest. Between August 2008 and early 2010 the city had approved 220 applications. The City has issued bonds of $1.1 million and $2.5 million to raise the finance. The interest is paid by the home owner through a lien (surcharge) on the property tax levied by the city. The new owner inherits the lien if the property is sold before the loan is paid off.

While the PACE scheme while widely copied across many states, it has not been hugely successful. For one thing the rate of interest charged by the city is not particularly attractive. Most of the people who applied for the original Berkeley scheme did not ultimately sign up for the programme since they could borrow money more cheaply by simply extending their property loan. The problem has been that small cities have simply not had a large enough group of loans to pool, this means the cost of arranging the set up and administration of the debt is large compared to the value the city is borrowing. The mortgage lenders have been deeply unhappy with the scheme since the lien is regarded as senior to their mortgage. This means that if the

homeowner throws in his keys the city will get paid ahead of the mortgage company. This point has been a bit of a showstopper. The two Federal agencies that act as backstop guarantors for home loans in the USA, Fannie Mae and Freddie Mac have protested about the greater level of risk they are exposed to. (Given they are already insolvent and have been under the conservatorship of the Federal Government since 2008 one does wonder what there is to fear from a little more risk.)

In the UK the coalition government is launching the Green Deal. This flag-ship policy means that homeowners can install energy efficiency measures in their homes at no up-front costs. Instead a private company, local authority or social housing provider borrows money from the money markets, install the measures and is paid back from the savings from the energy efficiency measures. The homeowner repays the provider through a charge on the energy bill. At the time of writing government ministers are promising that the homeowner will be better off from the investment, so only measures that have rates of return higher than the cost of finance will take place. The Government is also promising that the green deal provider cannot take the credit-worthiness of the individual into account when making the loan. This means that the green deal provider will be paid once the measure has been correctly installed. This is to reduce the riskiness to lenders of, say, a new owner deciding he didn't approve of the previous owner's decision to install some grotesque looking external insulation and unilaterally decides to cease paying. A recalcitrant customer would be cut off by their utility.

At the time of writing it was unclear whether the problems encountered by PACE – lack of volume of loans driving up interest rates, and the baulking by other lenders of the energy efficiency charge's favoured position will unseat the Green Deal too.

Work on piloting the Green Deal (then confusingly and optimistically called the *Pay As You Save* model) showed that very few measures in the home would actually *Pay As You Save* if the installer had to pay commercial interest rates, but thankfully this didn't much matter to consumers. Most people didn't know exactly what they spent on energy, and so long as the monthly repayment sounded reasonable they weren't that concerned whether it saved more than it cost. They were motivated by a desire to improve the environment and the comfort and value of their home. What consumers actually prized the most was being spared the hassle of researching technologies and finding reliable suppliers[13].

One significant risk that faces investment in community energy is that beneficiaries procrastinate in signing up to a service like district heating. A community might agree the network is built, but individuals will be slow to sign up to the service when it is complete. This ruins the economics of the scheme and exposes everyone else to paying the fixed costs of the scheme. This situation will be all too familiar to anyone that has ever tried to organise an office party. Everyone puts their name down to attend and the price is negotiated with the venue on that basis, but as the day approaches people start to cancel, unseating the viability of the event. Society has created mechanism like deposits or advance payments to ensure risks do not fall on others.

Similarly, the idea of attaching repayments to the energy bill (or property tax) does not have to be restricted to investments that homeowners voluntarily enter into. It could, in theory, be applied at the community level as a means of compulsorily recovering the cost of community

infrastructure like district heating networks, local generation plants or improvements to a tower block to allocate the cost to all beneficiaries and more controversially *potential beneficiaries*. When community infrastructure is financed in this way, it is functionally equivalent to the way utilities presently finance enhancements to gas or electricity networks. These expenditures are authorised by the energy regulator and the costs recovered through a return on the regulated asset base. This finance mechanism could also be used to cheaply borrow money from wholesale money markets or a green bank. Prashant and Ed Mayo argue this approach elsewhere[14].

Co-operative ownership is also a good means of reducing the risk of backlash from local communities since the communities themselves have pooled their interests and taken over joint ownership of the community energy infrastructure. We speak in Chapter 5 about the Baywind co-operative in the UK that has been responsible for developing community level wind projects, and the much larger Danish wind and district heating co-operatives. In the former the capital is largely supplied by well-off individuals, in the latter funding either comes from individuals or from government guaranteed loans. Co-ops can galvanise local community support for some types of projects. Such forms of local participation work up to a certain scale of project – where all affected parties can gather and discuss and participation is genuinely inclusive. It is more difficult for large projects: say to develop energy plant for a whole town, or entire systems of inter-connected works where the decisions and trade-offs are more technical. Also mutual or co-operative organisations – where members volunteer to work together - don't usually have the powers to compel people (aside from contractual obligations) or inspect and enforce its decisions. In these circumstances we have to turn to investment by local public authorities.

Investment and local government

Local government is the big beast in any community and inevitably needs to be a major player in any local energy infrastructure investment programme. It has substantial resources to invest in community infrastructure, powers to raise taxes, it is a major owner of commercial buildings and also builds and rents out social housing. But working with local politicians presents its own challenges, one of which is that local energy production is usually not uppermost on their list of concerns.

On 2 September 2008 Toronto mayor David Miller made a speech on the Tower Renewal project. The City has a thousand residential tower blocks built before 1984. Retrofitting these blocks could reduce electricity and gas consumption by half (relieving the problems the city is having on its transmission lines), saving around 700,000 tonnes of CO_2 per year. This is same as is emitted by medium sized town. Each building will cost several million to retrofit. In the speech he articulates his motivation for the program. "Why are we doing this? Toronto is a city of towers…tower renewal seeks to reduce greenhouse gas emissions by cladding buildings to reduce emissions by 50 per cent, it's about creating local green jobs, it's about upgrading green space around the buildings and installing green roofs to help biodiversity and water management, and its about taking greater responsibility through on site management of waste. We want to create expectation of green sustainable communities." The process of agreeing this programme involved consultation with dozens of local organizations, and not surprisingly it had a multiplicity of objectives. It is not just about energy management – and even if it was he probably would never have admitted the fact. Local politicians are voted in by one section of their community, but they have to govern on behalf of their entire community. The speech was

made outside near one of the towers; his audience included people living in the flats who wished for warmer, cheaper to run flats; construction professionals who he wanted to inspire into producing excellent work, his electorate who he wished to woo through promises of jobs and improved inner city environments. At the time Miller chaired the C40 group of mayor's concerned about climate change issues.

How would this ambitious scheme be financed? The cost of the programme might be two billion dollars over the next 10 to 15 years. Most cities – Toronto is no exception – do not have this kind of money lying around. And anyway, since the blocks were privately owned, why should the city pay? Consultants[15] recommended the city create a special purpose organization (The Tower Renewal Corporation) whose job it was to raise finance from the capital markets to finance each block renewal (costing some $2 million each) and manage the renewal itself. The building owners would pay back the Corporation over the next decade or two. This approach aggregates the individual projects to make them large enough to take to the money markets. But, banks and pension companies are unused to this type of project and would still charge a risk premium. To reduce this, Toronto would put in a modest capital injection (between 3 and 10 per cent of the fund value) to reduce the riskiness of the bond and reduce the interest rate passed on to the property owners. This they clunkily call a credit-enhanced capital pool. This works for the landlord as long as the value of the tower is increased through the renewal project and if residents are prepared to pay a premium for the better facilities, living conditions and lower energy bills. The report recommended that to manage the risk of default by the property owner the loan be collected back through property taxes, by putting a lien on the property tax. This is the PACE mechanism described in Box 5.

Not only does each investment project have to embody a multicity of different objectives – there are also a lot of other matters in the in-tray. Other speeches he made in that three month period included comments on Remembrance day honoring the casualties Canada suffered in the second world war, a response to Mumbai terror attacks and comments about the $280 million contribution the province of Ontario had made to the city's infrastructure.

Local politicians have to articulate the case for community energy in a way that will be politically sellable in their locality. In some cases, the commitment may be to addressing climate change, but in others, the drivers may be purely economic gain. That gain may not even relate directly to energy costs.

Box 6: The Rotterdam Climate Initiative

Rotterdam has a concentration of heavy industry, oil refineries and power stations and 600,00 inhabitants. It is a major source of greenhouse gas emissions. The Netherlands is vulnerable to sea level rise, Dutch politicians and businesses have a shared concern about climate change. It is an active member of the C40 Cities climate leadership group.

The City established the Rotterdam Climate Initiative (RCI) in 2006, in partnership with the port, a not-for-profit called Deltalinks and the Dutch environmental protection agency. RCI was the initiative of Ivo Opstelten, Mayor of Rotterdam between 1999 and 2009. His motivation was partly to win greater public support for the expansion of the port and partly to 're-brand' Rotterdam in order to attract more investment.

RCI is well connected: it works with the Clinton Climate Initiative, and its Board is chaired by former Dutch prime minister, Ruud Lubbers. It has a target to halve the city's emissions by 2025. To achieve this, it works extensively on energy efficiency (retrofitting of existing stock), renewables (predominantly biomass and wind energy) and district heating.

Stephen visited Rotterdam in July 2010. RCI's initially received €50 million from the city council, which had been raised by selling waste incinerators. This was not enough to fund RCI's ambitious plans, so it has always had to cultivate partnerships.

RCI is focused on the existing building stock. Housing corporations own half of the homes in Rotterdam and the city council owns 4,000 homes. Many are apartments making it difficult for residents to get a decision allowing them to improve the building fabric. RCI has persuaded housing corporations to enter agreements to retrofit existing buildings, and half have now done so. The average efficiency of buildings is improving by 2.5 per cent a year. Woonbron the most active housing corporation allows people to choose whether to buy or rent their property. It has established an NGO to encourage its resident to improve energy efficiency. This view is shared by RCI. In its judgement NGOs are the best organizational format to promote energy efficiency – energy companies do not want to be involved as the pay-back times are too long.

District heating is not yet widespread in Rotterdam but new biomass district heating plants are being planned. There are helpful national policies on biomass in the Netherlands. In 2009 the Dutch government adopted criteria to define the sustainable use of biomass. Biomass plants receive no public subsidy unless the heat is used efficiently. Rotterdam has a local law that any building constructed has to be connected to a DH system if one exists. It took five years to get this adopted as a law, as most people assumed that natural gas would remain plentiful and cheap.

The City is planning to extend district heating through an infrastructure company, owned by the city, and an operating company, owned by the City and E.On Benelux. Heat will be supplied by a waste incinerator. The City council is providing €38 million of capital, and providing surety for the loan of €149.5 million. RCI considers the leadership from the Dutch government as lack lustre. This contrasts with the national leadership shown in, for example, Denmark.

Rotterdam's efforts to reduce its GHG emissions by 50%, for example, appear driven as much by business development considerations as by climate change concerns (see Box 7). The city and its region are pursuing a reputational change for what is now Europe's largest port. The economic development potential of becoming a green power hub (it is promoting itself as a potential Carbon Capture and Storage center) and of attracting other businesses by offering a green, not gritty industrial, image would make energy efficiency efforts economically attractive, even if power cost savings did not pay for the improvements in buildings (which they do).

This process of inserting community energy into the job description of the local politics can produce profound and long-term changes. As we see in Box 6 below Upper Austria has invested substantially in developing heat networks that are fed using locally produced forest products. This strategy has created 10,000 jobs many in rural villages with few alternate employment opportunities, and enhanced the region's energy security. The program has managed to re-direct EU and national subsidies for agriculture and capital grants for heat

networks to finance an integrated package of investment in biomass fired combined heat and power. Regulation has also been used to compel the public sector and commercial sector to invest in renewable heat sources like solar thermal.

Box 7: Financing of heat networks in Upper Austria[16]

Austria's regions play a significant role in energy, particularly regarding building efficiency and heating, including district heating. Upper Austria covers 12,000 km^2 and has 1.4 million inhabitants. It is highly industrialised but there is a significant farming community too. Most Austrian farmers own both farmland and forests, but, in mountainous areas, agriculture is not particularly profitable. Energy from biomass has been strongly promoted across Austria. The prime objective has been to support agriculture. Around 10,000 jobs are supported by the renewables industry in the region.

Since the early 1990s, the regional government has been actively and effectively promoting energy efficiency and renewable energy, particularly renewable heat: biomass, solar thermal and heat pumps. Around a third of energy used in the region is renewable: around 78 per cent of electricity and 45 per cent of heating. Hydro-power and biomass are the chief sources of power and heat respectively (though solar hot water and heat pumps are also significant). Modern biomass boilers that comply with air quality regulations are expensive. In order to make efficient use of this biomass it is combusted in combined heat and power plant with district heating to share the heat instead of individual boilers. There are around 300 district heating networks in the region capable of supplying 225 MW, which link 8000 buildings. Most of the networks are owned by cooperatives of forest owners which also supply the fuel. They were built over the past 20 years.

The region has a renewable heating law, which mandates all new and refurbished public buildings (since 1999) and all new private sector buildings larger than 1000m^2 (since 2008) have to install renewable heat measures. Programmes to extend district heating using biomass are managed by the Länder, but the national ministry of agriculture provides around half of the money. Subsidies of up to 30% of the eligible costs of biomass installations are available from the federal government (with regional governments offering up to a third of the cost as additional subsidy). In 1988, the ministry spent €950,000 on biomass district heating; in 1993 this had risen to €7.3 million. In 1999, €11 million was provided by the ministry, €7.3 million from the Länder and €5.1 million from EU regional funds.

Farmers have also been offered money – subsidies and low interest loans – to encourage them to install biomass facilities and connect them to district heating (in addition to the money they get through the EU Common Agricultural Policy for growing the biomass). Farmers or farmers' cooperatives have been able to get a higher percentage of installation costs than have private companies. This has led to some energy companies seeking to enter the heat market, to set up co-operatives with farmers. The federal government has also given grants of €800 to householders for biomass heating. In the 1990s, it spent around €5 million a year helping small firms innovate in their use of biomass.

Local government has access to unconventional sources of finance that aren't available to communities. Local Government has tax raising powers, which vary tremendously between

different countries. These are very circumscribed in the UK, limited to residential property tax that has to be applied uniformly to all citizens. Local tax raising is more varied across US cities and counties. It also has the powers to charge for council services.

Box 8 outlines how the city of Babylon, in New York employed the scientifically illiterate, but legally kosher redefinition of carbon dioxide as solid pollutant to raid one of its funds. Toronto has developed the unique deep lake cooling system, which draws water from the bottom of the lake Ontario, which is a constant 4°C through out the year to cool a hundred commercial buildings in the down-town area. The project was financed using $250 million drawn from the city's pension fund, which now has a controlling interest in the scheme. Employees of the City now have a rather direct financial interest in ensuring that the cooling system remains in good financial shape. In the UK a number of councils have used reserves to finance community energy efficiency through lending funds to residents via 'revolving funds'. Kirklees Council in Yorkshire pioneered this approach, recycling the windfall gains from the reduction in employer taxation that accompanies the introduction of the UK Climate Change Levy.

Box 8: Creative Use of Local Resources: The Babylon Project

Few local authorities find themselves in the situation of sitting on a pile of cash. The problem arises when it's marked in a box labelled: "Solid waste fund. Not to be used for any other purpose." Babylon, NY, USA, found itself in this situation in 2006. Political leaders realized they'd been accepted waste fees way in excess of what it could usefully do to prevent solid waste. Nor would it create much political goodwill, to return the money to citizens.

They decided to tap the fund for loans to private homeowners for energy retrofits. To do this the city had to redefine carbon as a solid waste returning the city to a pre-Enlightenment level of scientific ignorance. The redefinition of carbon dioxide as a solid waste allowed Babylon to assist home-owners retrofit their homes. Homeowners faced two barriers to investing in energy efficiency. First, with the average homeowner moving every seven years, such an investment would have to pay off in 3-4 years and/or would have to increase the resale value of homes to be worthwhile. Second, most would need access to capital, and that could be an issue for middle-income homeowners with already high debt burdens.

Terms for provision of the retrofit funds included bank rate interest. Repayment was assured through imposition of liens on the properties being improved, collectible in the same manner as any outstanding taxes due on real estate. Such "benefit assessments" have a century-long history in the US: localities borrowed funds, and placed supplemental liens on properties to service their debt, to get the capital needed for infrastructure improvements such as new sewer lines, sidewalks or repaved streets. Under the program, homeowners pay $250 upfront for an energy audit that determines the work needed on a home. If the homeowner then agrees to proceed with the municipally-financed retrofit, the $250 can be reimbursed out of the benefit improvement monies. The energy audit establishes the funds needed, but the work is assigned by Babylon itself, so it can limit work to local contractors, and to provide incentives for those contractors to utilize local unemployed people, many of whom need training in the relevant building trades skills.

- With 309 homes audited and/or completed the program showed:
- Average cost of improvements to meet EnergyStar-type standards of $8,080
- Average annual savings to homeowners on heating and cooling bills of $990
- A resulting average payback period of 8.2 years
- A expected Savings to Investment Ratio (SIR) over the lifetime of the improvements of 2.1

These returns were calculated under the assumption of constant costs of heating oil and electricity and thus understate expected returns that adjust for current upward price trends.

Moreover, the pilot has provided Babylon with information on how to deal with contractors doing energy retrofits, standards to apply for work to be conducted, needs for auditing the work completed and the willingness of local contractors to train and employ local unemployed youth as they expand their workforces in response to the offer of new construction work from the municipality.

Local government using public procurement

Local Governments are major landowners within a community. They own and manage school buildings, leisure facilities, civic buildings, halls and commercial offices. They might also own social housing. By using their purchasing powers wisely, they can create and shape the local energy and energy efficiency market. By committing to buy heat or power from a new renewable or energy from waste scheme – and thus provide an anchor stream of revenue for the scheme - they can reduce the project's uncertainty and allow the project to access lower cost capital. This creates a virtuous circle by making the energy from the scheme less expensive to those who might repower communities. In Upper Austria new public buildings had to make use of renewable energy in 1999 a full eight years before the mandate was extended to new private sector buildings.

Local Government can also use their permitting and local planning powers to make new homes and businesses connect up to community energy facilities. The Danish Heat Law explained in chapter three is the most obvious example of this. The Heat Law mandates that homes and offices must connect up to the heat network within ten years of the network being built. This makes planned heat network schemes bankable, since the co-op or municipal authority could go to the money market and show a predictable return.

Local governments, when they act on their own and finance themselves, can accomplish far more than commercial ESCOs. In the US, local governments and independent school districts are expected to borrow for their investments. Entering into such debts is only rarely politically controversial. The Kentucky schools case, however (see Box 9), relies on minimizing overall costs. The requisite planning can take into consideration the trend lines in energy costs, allowing them to act 'imprudently' by normal banking standards looking after their citizens long-term interests. This approach to making its own mind-up on imponderables like future energy security means the education authority has integrated energy efficiency into its day-to-day business of building, and schools can innovate. Some schools are approaching net zero carbon energy efficiency operations through carefully planned investments in retrofitting older schools,

building new ones, and educating staff and site visitors, including students, about energy efficient building operations. In the process, their borrowing is on balance saving tax-payers significant sums.

Box 9: Energy Progressive? … Kentucky in the United States?

It is a Southern state! It is the third largest coal mining state in the country! It generates 93% of its electricity from coal! Its households consume 125 percent of national average residential use of electricity! But in 2009, the US Energy Star program recognized the Kenton County School District for achieving a 10% reduction in energy consumption. In September 2010, Warren County, KY, opened the first zero net energy school in the entire United States.

These accomplishments are not a new development and have nothing to do with concerns for emissions or global warming. The Kentucky Department of Education has been actively promoting school building energy efficiency. Schools in the state have been installing geothermal heating and cooling loops since 1990. Political progressivism can't explain the pattern, nor can environmentalism. One Kentucky legislator introduced a bill in 2009 that would have made it illegal to spend any state funds on energy conservation! It didn't pass.

Why, then, have Kentucky schools been in the forefront in pursuing energy efficiency?
The simple answer is a four-letter word, cost. A further explanation lies in the process of accessing capital for school retrofitting and construction. Kentucky is very decentralized, with 174 school districts educating some 640,000 students. Each district is responsible for its own finance and capital costs are generally financed through the issuance of 30-year bonds. Such small districts would face high underwriting and interest costs for floating their own bonds, so the state's Department of Education centralizes the process of raising capital for them[17].

The review and approval process assures districts of a common bond rating and fiscal agent fees, derived from the overall state-wide performance of school construction bonds and aggregation of the market. The centralization also provides the opportunity for the Division to promote energy efficiency in school construction and rehabilitation projects. As a result, schools have been able to install ground source heat pumps for their heating and air conditioning needs for about $4 per square foot of interior space to be served. At 2006 power costs, those systems can pay for themselves in 7 to 10 years, with average annual savings of about 20%. Kentucky boasts almost a quarter of its school buildings using geothermal heating and cooling systems. It has also enhanced the energy efficiency of seventeen ENERGY STAR certified schools show an average savings of 45%. These schools include retrofitting of existing buildings, some over 50 years old.

As the energy consumption drops down the prospect for cost-effective solar photo-voltaics installations in the Kentucky climate that could cover the remaining electricity needs push the plans toward net zero energy consumption buildings.

As the Warren County school experience shows, however, getting to this standard is more than a technical matter, but involves attitude and behavior change, community cooperation and staff training. While 40,000 square feet of solar collectors on the roof of the new school has provided the zero net energy result, but that accomplishment would not have been possible without the prior investment in the structural envelope and the modification of the management behaviors of the building users.

The extensive reliance on district heating systems in Scandinavian communities demonstrates that their know how, and political determination to deploy heat networks has allowed them to advantage of efficiencies of scale in providing a needed resource to compact human settlements. This requires creating financial models to provide cheap capital, enduring revenue streams and institutional forms that assure customers that monopoly heat providers will not exploit them.

How can we make it work here?

At the start of this chapter we talked about the show *Dragons' Den.* A better analogy than dragons might be elephants, or ghosts. Infrastructure has a long memory. Decisions made by our forefathers a hundred years ago still haunt us now. Long ago decisions about which direction to orientate our houses now impact on the feasibility to put a solar hot water heating, the lack of easy access to a back garden for heavy drilling equipment is a show stopper to installing ground source heat pumps at many properties. The dense cobweb of pipes and sewers and lines beneath our roads effect the viability of laying new district heat networks.; but it might be cheapest way of substantially reducing the energy use by my household. This is the view of staff in the local council and also of some of the councilors. Infrastructure has a long memory and it doesn't forgive bad decisions.

In this book we reject the idea that distant corporations should decide how much and where to invest in our energy infrastructure. Our system of financing energy infrastructure ought to equip local communities to takeover its ownership, not just in a legal sense, but in the societal sense that reflects their preferences and trade-offs and provides local employment and uses energy local resource where possible. The tea party movement in USA and the idea of Big Society in UK and the is an articulation of this desire to recapture local decision-making. The funding and ownership of infrastructure is a large part of this reconquest.

This chapter has used examples from Europe and North America to show how communities have taken over localised ownership of energy. They have raised finance, assigned responsibilities for risks and arranged for investors to be repaid. Where this has been made to work, it has brought profound, indeed transformational change to the energy use of the community. The Danish deployment of district heating and wind and Upper Austria's successful use of solar thermal, hydro and biomass fired district heating have changed patterns of employment and made their communities more energy secure as well as reduced the emissions of green house gases. By staging and planning their investments intelligently, energy prices have remained affordable, too. These have been great success stories, many of the other examples have been qualified successes. The chapter excludes the many failures that we know have taken place too. We know of examples where money was allocated to projects and never spend, ESCOs that were established with huge political fanfare and massive hopes but which never completed a deal, and of investors who have speculatively sunk millions into low carbon infrastructure projects and lost their shirts. These set back community energy investment, in the sponsor companies' minds for many years. We could be specific and name examples, but we wish to spare blushes.

The truth is that energy policy in most of Europe and North America is getting more things wrong than right. It is supporting high-cost micro-renewables ahead of lower cost community renewables. Most of the licensing for new power plant that the market is seeking continues to be gas and to a lesser extent coal despite their security or supply (in the case of gas) and carbon impacts. There is a desire for instant political gratification about energy policy that needs to demonstrate results within the two to three year political and spending cycle, when the appropriate gestation period is much longer. Again the analogy of mammalian elephant that spends 22 months in its mothers' womb is better analogy than the reptilian dragon, where eggs are spat out indiscriminately in the hope that one might flourish. There is also the excessive faith that competition between companies in liberalised markets, tweaked with a few incentives to encourage security of supply and renewables, send the appropriate signal to investors.

Our examples show the precise opposite. Local communities need to have a plan, they need to articulate a vision of the building, street or neighbourhood they are trying to create and sell this vision to their people. Once that process is complete, they seek investment, Our stories confound any hope there is a single solution; no two human settlements – or governments – are the same. Thus there will always be a replication problem. It may not be enough to know that "they" did it. The question will remain, "can WE?" Kentucky schools have a unique financing system. Rotterdam represents a scale of operations – and some geological sequestration opportunities – that are not common to all local communities. Copenhagen's district heating successes are the result of decades of national effort to promote the technologies. Vermont faces exceptionally high power costs relative to much of the rest of USA. In Toronto David Miller diagnosed the problem as being disfiguring and inhospitable tower blocks that need renewing,

This chapter shows us there are a number of things we need to get right in order to make investment in sustainable community energy systems viable. Government must ensure low cost capital is available to community energy developments.

- It can help reduce the cost of borrowing by lending its reputation through guaranteeing loans, or it can pay in capital
- Local governments need to ensure that loans in discrete schemes are appropriately aggregated before going to the money markets to avoid excessive transaction costs
- Projects should be actively refinanced to ensure that working capital is not tied up

We believe that the beneficiary should ultimately pay for investment in community energy through higher energy or property charges. Costs should not be borne by the general tax-payers or the general energy consumer. Government capital grants should be paid for novel or assist poor and vulnerable communities to access the community investment. Governments should commit to a level of grant many years ahead.

Investment plan needs to be agreed locally – this allows wider benefits (employment, sector support, fuel security, affordability to be given due weight – broadens the constituency of support. Local government has an important role to play in acting as anchor customer, and regulating and enforcing to ensure community decisions are respected.

It's important that the beneficiary, rather than the general energy customer, pays for improvements to their home or their local energy infrastructure. But people hate paying up front

and some can't afford it; so we need to present the costs with minimum up front costs, or show it increases the value of the house. Ideally we can use Governments ability to borrow cheaply to access the capital and then pay the costs of discharging the loans through savings in the energy costs. The USA and the UK are developing ways of attaching the costs of improving homes to property taxes and energy bills respectively. This could be extended to recovering the cost of investment in community assets like new network.

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[7] One of the authors is currently under contract to the US Department of Energy to help those recipients use the funds more rapidly and effectively. These observations come from his field experience and interaction with other technical assistance providers to the EECBG grantees. The failure of the fund recipients to spend them rapidly has become a political problem, as the monies were intended to stimulate the economy in the face of the recent recession. *[I can add references to back up these claims if needed.]*

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[13] *per com* Prashant is on the Advisory Panel for the Pay As You Save pilots and was involved in the original development of the Distribution Network Operator model – the not-very-sexily-titled – original name of the *Green Deal* scheme

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