Local Government Association

The potential for energy efficiency and renewable energy

A guide for councillors and officers

Contents

Foreword

Over the previous Parliament councils saw their central government funding cut by 40 per cent. The Comprehensive Spending Review has handed down a further £4.1 billion funding cut over this Spending Review period and comes on top of almost £10 billion in further demand-led cost pressures facing councils by the end of the decade.

It continues to be a very challenging time for local government and it is widely accepted that in terms of making savings, the easy wins have been carried out and councils are now having to find new and more innovative ways of saving money and generating income.

I am therefore pleased to introduce this report which sets out the scale of the financial opportunities available from energy efficiency and renewable energy sources. The report shows that the potential savings for low cost, quick payment energy efficiency measures alone range from £60,000 to £2.4 million a year for an individual council.

A large number of councils have already begun realising the potential for energy-related savings and income, but there is still huge untapped potential. And most exciting of all are the possibilities in what is still an evolving market with new technologies being developed and existing technologies becoming increasingly more affordable. I encourage you to read on to find out more about the different technologies councils are using, and to explore what the scale of opportunity is for your council using the handy checklist of questions for councillors and senior officers to ask.

Councillor Shirley Pannell
Deputy Chair, Improvement and Innovation Board

Executive summary

Councils have long been at the forefront of the move to a low carbon economy by adopting energy efficiency and renewable energy technologies. This has already led to impressive cost savings and a wide range of additional benefits. As local government continues to suffer cuts to its budgets there is an even stronger incentive for councils to maximise the potential for energy-related income and savings.

Recent years have seen councils invest time and energy in making better use of their land and property assets in response to the reduced resources available to them. In 2012/13 the total value of local government land and property was estimated by the Audit Commission to be almost £170 billion and in 2012 councils' total energy spend was estimated to be approximately £900 million with a further £190 million spent on transport fuels in vehicles. Although many councils have made significant strides in adopting energy efficiency and renewable energy technologies there is still a large untapped potential within these local government assets.

Even for councils that have been championing sustainable energy for some time, new opportunities are constantly becoming available through technological development, changing project economics and maturing supply chains.

This report explores the opportunities councils have to make direct cost savings or additional revenue for councils through energy efficiency and energy generation. For this reason it focuses in on council owned assets and operations where the council pays the energy bill, or renewables projects within their boundary where the council can bring in a revenue stream. The report also considers schools and leisure centres as councils still play an important support role in energy matters despite outsourcing, devolved budgets and an increasing numbers of academies.

The potential for energy efficiency

Annual energy costs range from £150,000 for a small rural district council to £25 million for the largest city council. Straightforward, low-risk measures such as lighting controls, lighting upgrades, heating controls, boiler replacements and building fabric insulation typically result in a 10-18 per cent saving with an average payback of 2-3 years on the cost of the measures. Opportunities of this nature should exist for all councils to varying degrees depending on the nature of their assets and their existing level of efficiency.

This equates to between £60,000 and £2.4 million per year in energy cost savings depending on council size. Projects with longer payback periods can achieve even greater levels of savings. The wider benefits of energy efficiency make opportunities even more attractive, such as reduced maintenance, supporting the local economy, improved comfort for building occupants and local energy resilience.

The potential for renewable energy

Renewable energy is now the fastest growing source of energy worldwide and supplies 7 per cent of the UK's total energy including nearly one fifth of the UK's electricity needs in 2014. However the financial performance of renewable energy projects is highly location-specific and the policy and incentive framework is subject to frequent changes.

Renewable energy projects are characterised by higher upfront capital costs and longer payback periods than is commonly achievable through energy efficiency. Stand-alone projects, such as wind turbines and solar farms, have a high degree of risk in the pre-planning stages and development costs may run high. Nonetheless projects can generate substantial revenue streams for successful developers and a valuable asset that can be refinanced or sold on if the owner wishes to exit. Therefore although the potential rewards can be high the decision to develop a 100 per cent council owned project should not be taken lightly.

This report contains estimates of income potential for councils based on a representative portfolio of renewable energy projects under different development options for illustrative purposes. Many combinations of renewable energy deployment can be considered depending on local circumstances. The table below shows the income generation potential of a portfolio of solar and medium wind scaled to the size of the council under three generic development scenarios, based on current subsidies. It is important to note that subsidies change frequently, impacting on potential revenues.

Income generation potential of a portfolio of solar and medium wind

Benefit to the council	County council (£k/yr)	Metropolitan council /unitary (£k/yr)[1]	Rural district council (£k/yr)
Option 1: Council owned and operated	790	220	366
Option 2: Income from loan to a third party developer for 25% of the capital cost.	38	11	17
Option 3: Land rent and business rates from third party owned projects and free electricity from roof mounted solar	97	28	38

1 Solar projects only, on the assumption the wind projects are more likely to be applicable in rural areas

Introduction

In 2012/13 the total value of local government land and property was estimated by the Audit Commission to be almost £170 billion and in 2012 councils' total energy spend was estimated to be approximately £900 million with a further £190 million spent on transport fuels in vehicles. Through this combination of assets and energy use there is a large untapped potential for energy efficiency and renewable energy.

For councils that have been championing sustainable energy for some time, new opportunities are constantly becoming available through technological development, changing project economics and maturing supply chains.

This report highlights the opportunities for councils in England to make financial savings and increase revenue through energy efficiency measures and renewable energy generation schemes. The focus is on income that can be realised in the short term, to help councils reduce their costs and find new sources of income.

Drivers for energy efficiency and renewables

In addition to efficiency savings and income, energy efficiency and renewable energy opportunities can provide a wide range of other benefits:

- Financial: reduction in utility costs, mitigating the impact of future price rises and the creation of new long-term sources of income. Income to community funds from community renewables to support local projects.
- Local economy: creation of local jobs and improved skills.
- Health and wellbeing: improving building environments and the comfort of building occupants. A growing body of evidence suggests that this improves productivity and reduces absenteeism[2]. Active travel options (walking and cycling) can have a similar effect.
- Carbon reduction and renewable energy targets: contribution to national and local targets.
- Reducing fuel poverty: through increasing access to low cost energy and energy efficiency of council housing stock (if relevant) and wider private sector stock.
- Creating a safer environment: through improved lighting, reduced equipment failure and better building management systems to identify issues.
- Local energy resilience and security of supply.

2 'The Business Case for Green Building, World Green Business Council', 2013. http://www.worldgbc.org/files/1513/6608/0674/Business_Case_For_Green_Building_Report_WEB_2013-04-11.pdf

Report scope and structure

This report is focused on opportunities that can lead to direct cost savings or additional revenue for councils. The scope is thus drawn around council owned assets and operations where the council is the counterparty to energy supply contracts, or renewables projects within their boundary where the council can obtain a revenue stream. Reference is also made to schools as council's still play an important support role in energy matters, despite a system of devolved budgets and increasing numbers of academies.

The report is structured as follows:

- **Section 1:** The introduction contains background information, including the breakdown of typical energy spend by three generic council types, and a summary of the current regulatory framework for energy efficiency and renewable energy.
- **Section 2:** The potential for energy efficiency, providing an estimate of the financial saving potential of energy efficiency projects within the three generic council types.
- **Section 3:** The potential for renewable energy, including descriptions of the renewable technology options relevant to council assets. It goes on to present estimates for the potential income of an assumed portfolio of renewable energy assets within the generic council types.
- **Section 4:** Key questions for councillors and senior officers to consider.
- Standalone appendices with glossary, references and sources for further information.

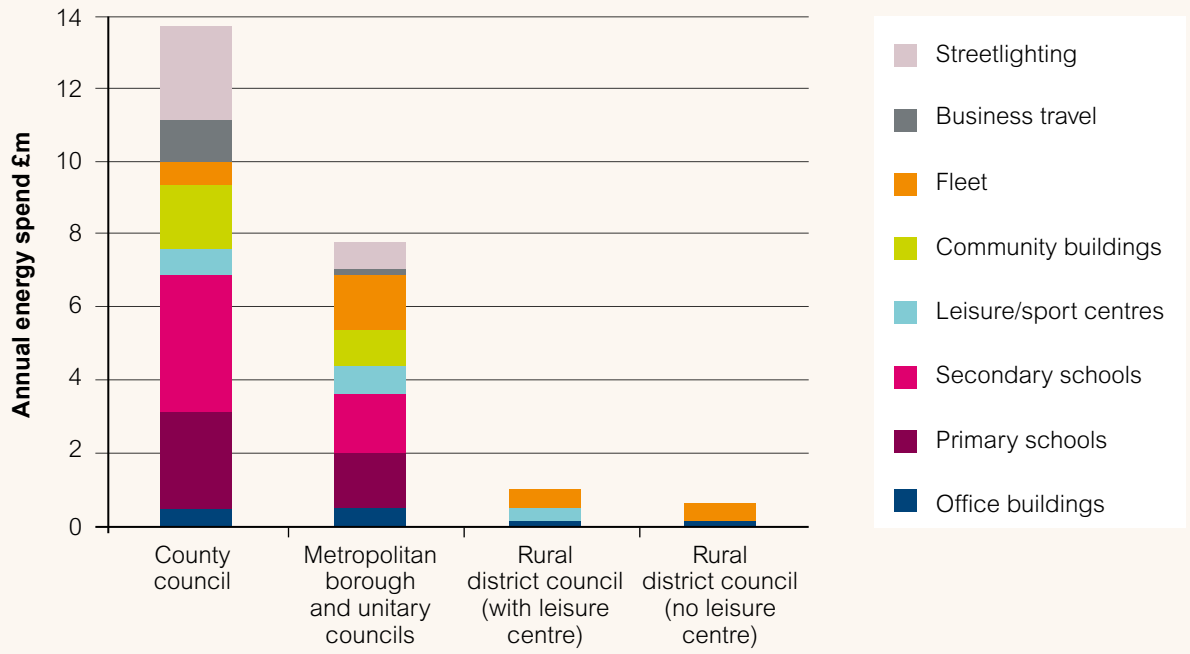
Generic council types

There are three generic council types used throughout this report. This is for illustrative purposes in order to reflect the diversity of councils in terms of scale, activities and assets. However the potential for each technology may be very different even within each type.

1. **County councils:** which cover the whole county and provide 80 per cent of services in these areas[3]. Their annual energy spend is typically in the range of £4 million to £18 million. Energy uses include children's services, adult social care, schools, corporate buildings, leisure centres, vehicle fleet business travel and street lighting.
2. **Metropolitan borough councils and unitary councils:** these typically have an annual energy spend in the range of £3 million to £15 million, although the largest, Birmingham City Council, spends in excess of £25 million. Typical energy uses are similar to that of county councils, though with less business travel and street lighting.
3. **Rural district councils:** these typically have an annual energy spend of £150,000 to £1.5 million. Energy uses typically include offices, vehicle fleets and business travel. Leisure centres are sometimes also present, and being energy intensive buildings, can account for a substantial share of total energy spend.

3 Local Government Information Unit http://www.lgiu.org.uk/local-government-facts-and-figures/

Figure 1: What is a typical energy spend?



Assessing the potential

Figure 1 shows a typical breakdown of energy spend for each generic council type. This breakdown of energy spend is not centrally recorded and therefore has been estimated using a ranges of sources[4]. The diversity of councils means that this provides an indication only and individual circumstances may differ. For individual councils, the total energy spend can be identified from financial records allowing the council to assess the areas of opportunity by looking at the number and type of buildings that the council owns and operates.

Energy use in schools and leisure

Leisure centres and schools account for a large proportion of energy use for councils, however these are usually outside the direct control of councils, with energy use being managed and paid for by private sector operators or the schools themselves.

Schools, for example, may include council-maintained schools, academies and free schools with different levels of council involvement.

The degree of outsourced management of these assets can have a large impact on the total energy spend. The generic figures shown in the report cover all schools, but assume that a proportion of leisure centres are outsourced.

Regulatory framework

The regulatory context for energy efficiency and renewable energy in the UK has been a constantly evolving landscape over the last 15 years. The regulatory framework inherited by the current Conservative Government (2015-2020) is considered to be relatively complex and crowded. Consolidation and simplification is likely to be preferred over the introduction of new policies over this period. Some policies may be phased out either due to policy overlap or having fulfilled their original purpose. However the Climate Change Act 2008 creates an overarching,

4 Camco ibid page 8; 'Saving energy in *local authority* buildings', Carbon Trust Guide *CTV028*; anonymised data from Verco's council clients and information posted on a sample of council websites.

long-term driver for energy efficiency and renewable energy. The Act places legally binding targets of at least a 34 per cent reduction in greenhouse gas emissions by 2020, and 80 per cent by 2050, against a 1990 baseline. Many councils have adopted their own ambitions in line with this target.

The most important policies and initiatives for energy efficiency are currently:

- Energy Performance of Buildings Directive
- Part L Building Regulations, CLG, 2013
- Carbon Reduction Commitment Energy Efficiency Scheme

For renewable energy, the important polices and incentives are:

- UK Government Renewable Energy Strategy to 2020
- Renewables Obligation (RO), which is now being phased out
- Feed-in Tariffs with Contracts for Difference (CfD), for generation over 5MW to replace the RO
- Feed-in Tariffs (FITs), for generation less than 5MW
- Renewable Heat Initiative (RHI)
- local authority powers to sell energy.

Frequent tariffs reviews are carried out for the FiT and RHI, therefore the level of incentive of individual technologies may change rapidly.

The potential for energy efficiency

Many councils have been developing and implementing energy efficiency programmes for more than a decade, with government funded support available through the Carbon Trust's Local Authority Carbon Management Programme between 2003 and 2013. Every council will therefore be at a different point in their energy management maturity.

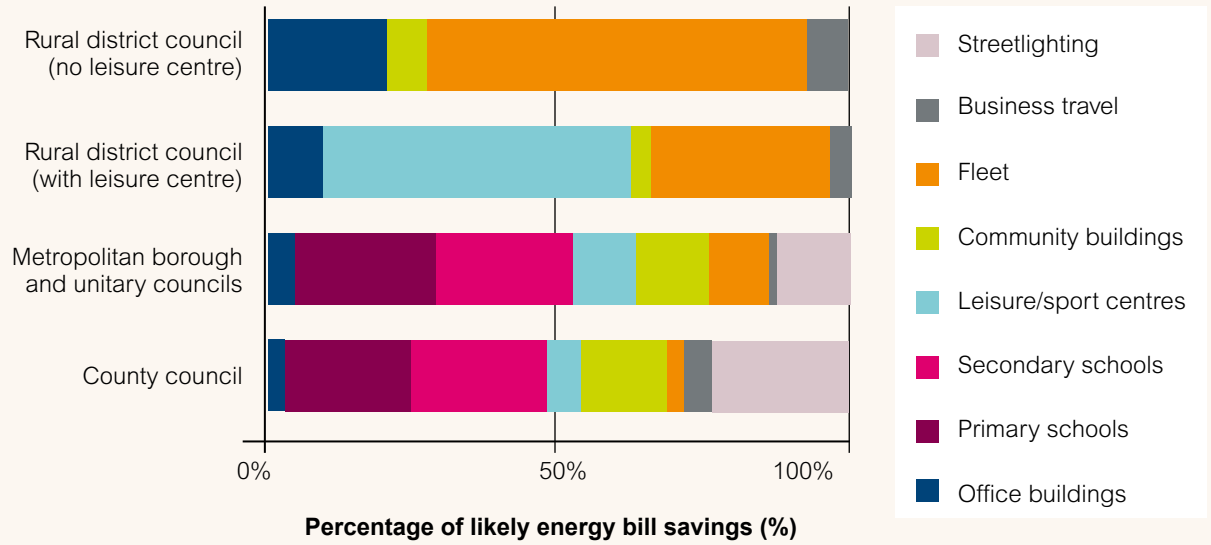
Regardless of a council's starting point, the fast changing background of technology innovation and energy market reforms, combined with constant operational challenges, means there is a good chance that opportunities to realise cost savings will still be available.

Figure 2 shows the typical energy saving potential for the three generic council types based on the typical opportunities applicable to their energy uses and assets. This assumes a proportion of the measures have already been realised, or are not applicable in some cases, such as planning restrictions or technical barriers[5]. As such Figure 2 provides an indication of the potential for energy efficiency only. Detailed analysis on an asset-by-asset basis would be required to estimate the potential within individual councils.

Approximately half of the savings potential in metropolitan and county councils is within schools. Leisure centres and community buildings are other large energy spend areas and significant areas of opportunity. Office buildings make up a relatively small proportion of energy spend, although these are under the direct council of the council, unlike schools and potentially leisure centres. Savings potential in rural district councils covers fewer asset types and is dominated by fleet transport and, where present, leisure centres.

5 The applicability of measures has been estimated for different building types, based on the consultants' experience of undertaking energy audits of non-domestic buildings.

Figure 2: Where might the savings come from?



The types of measures included in the potential are outlined in Figure 3, indicating their typical payback period for different energy uses. The measures covered have an average payback period of three years, and few measures have been included that have a payback period over five years, so the potential shown can be considered as the quick wins of the cost effective measures.

Longer payback period projects also have relevance within a strategic approach to energy efficiency, unlocking long-term savings. Packages of measures (including renewable energy projects) with varying payback periods can be created that result in greater cost reduction and income generation than quick wins alone, but are still economically viable.

Councils with mature energy management programmes may have implemented the majority of these quick win projects. Nonetheless, new opportunities will arise, through equipment replacement cycles and as technologies advance and reduce in cost. Despite the recent dramatic fall in oil price, over the long term energy prices are also expected to follow an upward trend ahead of inflation, due to increasing global demand for energy and, more locally, the substantial investment required to renew the UK's aging energy infrastructure. This is likely to reduce the simple payback period of energy efficiency projects over time.

Another important area of opportunity is asset rationalisation, however it is outside the scope of this report to provide extensive detail on the opportunities this provides. It is worth noting that from April 2018, privately rented buildings (domestic and non-domestic) will need to be EPC-rated E or above, unless exempt on a cost effectiveness basis or through being listed. This is expected to impact on the asset value of buildings rated F and G[6] and stimulate investment in energy efficiency refurbishment.

6 Private Rented Sector Minimum Energy Efficiency Standard Regulations (Non-Domestic), Department of Energy and Climate Change, 5 February 2015.

Figure 3: Typical energy efficiency measures[7]

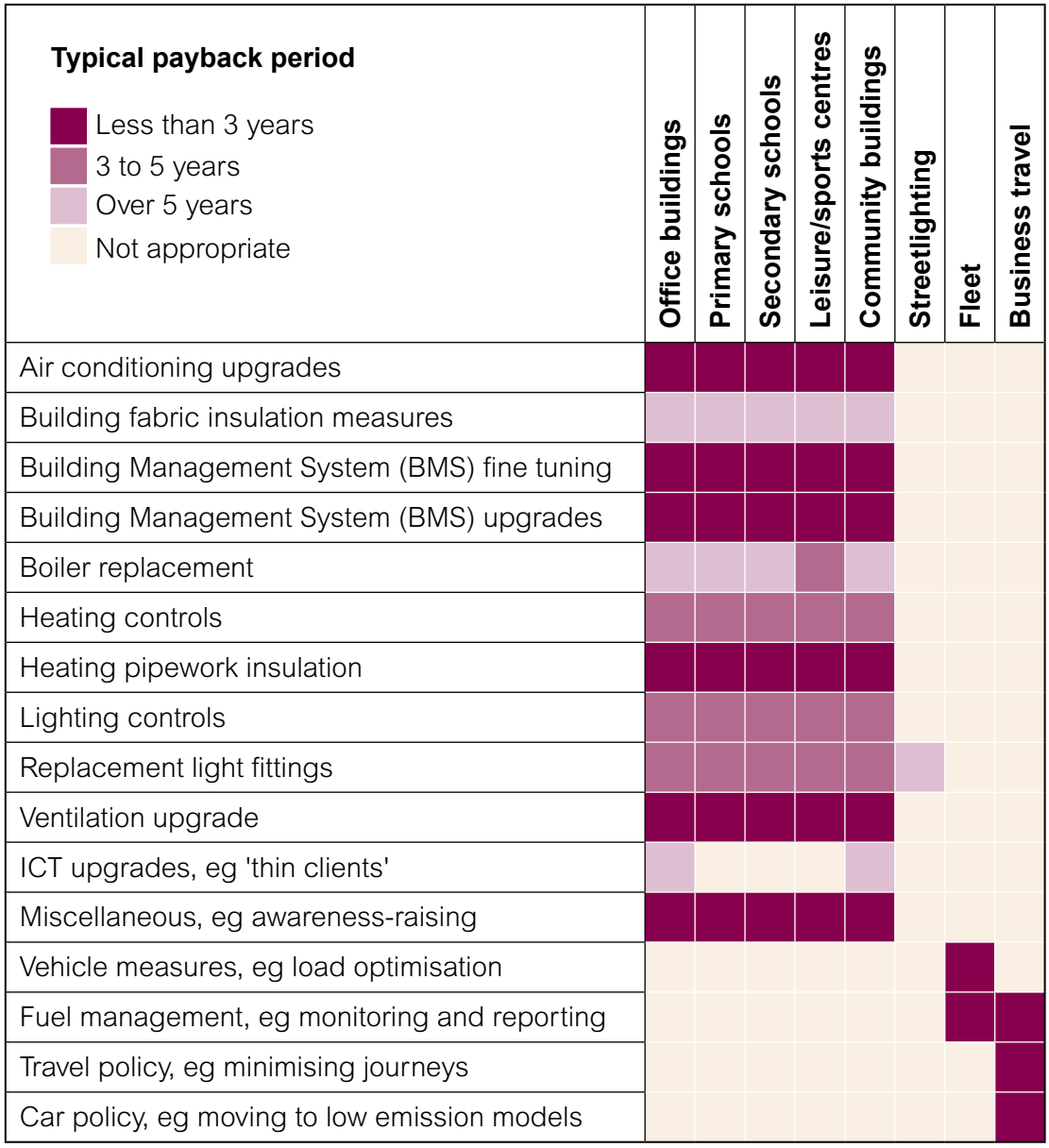


Figure 4 overleaf summarises the potential costs and savings of a package of the energy efficiency measures considered above, applied to the generic council types. Councils can save between 10 and 18 per cent by implementing typical energy efficiency measures with shorter payback periods. This equates to £60,000/year – £2.4 million/year in energy cost savings depending on council size. The potential savings increase if councils implement technologies with longer payback periods. The wider benefits of energy efficiency can further improve the business case for investment, including reduced maintenance costs, supporting the local economy, improved comfort for building occupants and local energy resilience.

7 The costs and savings of energy efficiency measures has been taken from a number of differences sources, including Salix Energy Efficiency Loans Scheme guidance, the researchers' experience of undertaking energy audits and supporting clients with energy efficiency programmes and peer review comments.

Figure 4: Typical costs and savings for a package of energy efficiency projects

Council type	Rural district council (no leisure centres)	Rural district council (with leisure centres)	Metropolitan borough, London borough and unitary	County councils
Example energy spend	£600k	£1m	£8m	£14m
Capital cost	£90k	£300k	£4m	£6m
Typical potential annual savings through energy assuming savings shown in Figure 2 are achieved	£60k	£120k	£1.3m	£2.3m
Typical energy/cost savings (%)	10%	13%	16%	17%
Typical average payback time	2 years	2 years	3 years	3 years
NPV* (3.5% discount rate over 10 years)	£400k	£700k	£7m	£13m

*Net Present Value (NPV): sum of the incoming and outgoing cash flows. This can be considered as the total lifetime value of the projects in today's money.

The potential for renewable energy

This section provides brief descriptions of the main renewable technology options relevant to councils and presents estimates of the potential within the generic council types introduced in Section 1.

Stand-alone renewable energy technologies

Ground mounted solar photovoltaic (PV) ('solar farms'): Solar PV panels generate electricity silently from sunlight with no moving parts. Ground mounted panels can be installed in secure open areas including those that have limited potential for other land uses, such as capped land fill sites, airfields and under-used agricultural land. There are currently three solar farms directly owned and operated by councils in England, and one in Wales, but many more are at various stages of development.

- Kernow Solar Park, Cornwall Council (2012): 5MW, adjacent to council-owned airport.
- Wheat Leasows, Telford & Wrekin Council (2014)[8]: 4MW, on agricultural land owned by the council. Generates a profit of approximately £150k/year with a project lifetime of 25 years.
- Rochdale Borough Council (2015): 250kW on a former waste disposal site[9].
- Legacy Solar Farm, Wrexham Borough Council (2015): 2.65MW with £2.5m capital cost.

A typical 5MW project would require 26 acres of land and have a capital cost of £3.75 million. The net annual income would be approximately £350,000[10] over a 20-25 year lifetime, providing a project return on investment of seven per cent. Project development would have a 'medium' level of complexity and take one to three years depending on issues such as grid connection availability, planning sensitivity and land ownership.

Wind turbines: Large wind turbines are one of the most mature and cost effective renewable energy technologies. Turbine output increases dramatically with size, for example, a single medium-sized turbine (76m tip height) might generate the same as fifty or more 'school size' (25m height) turbines, owing to the larger swept area of the rotor and the better wind resource available at that height.

From a technical perspective wind turbines are best located in exposed upland areas. However there are a large number of constraints on the sites used that mean wind turbines are only appropriate for small pockets of land, if at all. Common constraints include; environmental designations, site access, noise, proximity to a grid connection and the cumulative impact of other wind turbines. Areas of unconstrained land for wind turbines may have been explored via GIS constraints mapping in Planning Policy Statement 22 renewable energy studies, commonly carried out by councils in the last decade. Onshore wind is currently facing

8 Extensive details available on council website: www.telford.gov.uk/info/20222/solar_farm

9 www.link4life.org/news/2243-council-shows-flair-over-solar-farm-build

10 Based on a FiT rates available for stand-alone PV 1 April-30 September 2015 of 4.44p/kWh, export tariff of 4.85p/kWh and assumed O&M costs of 0.5p/kWh giving a net operating revenue of 8.8p/kWh.

an uncertain future following the removal of Renewable Obligation Subsidies in 2016 and a pending review of associated Feed-in Tariffs in late 2015.

Project examples:

- Avonmouth, Bristol City Council (2013): Two 2.5MW turbines[11].
- Oakdale Wind Energy Park, Caerphilly Council (2012): Two 2MW turbines installed on council land by a private developer. The project was financed by the developer. The project provides land rent to the council and a £10,000/year payment into a community fund[12].
- Rochdale Council wind pilot project, former Hill Top School, approximately 15kW.

The performance of small scale turbines has proven to be highly variable. This has usually been caused by poor turbine siting and the technical immaturity of some products. Trials of building-mounted turbines have not been successful due to inherent turbulent airflow around buildings.

Hydro power uses water dropping through a height ('the head') to turn a turbine connected to a generator. Small hydro projects are generally complex to develop, with many technical and legal issues to consider, including fisheries, flood risk, river laws and the engineering solution itself. They can be viable however, where the right geographical conditions exist.

Anaerobic Digestion: Anaerobic digestion (AD) facilities break down biodegradable organic matter to produce biogas, which can be used in a variety of ways: exported to the gas grid, converted to transport fuel or used to generate electricity and/or heat. Municipal food waste can be used as feedstock for AD plants. However AD plants require approximately 60,000 tonnes of feedstock per year to be viable and therefore are likely to require waste streams from a number of councils and other sources to be viable. As a result, anaerobic digestion plants are normally owned and operated by waste and water companies, dedicated AD developers, and private companies with suitable feedstock, such as farms and food manufacturers.

Councils can potentially take a stake in projects and/or facilitating projects to derive most value for the community. For example, councils can potentially encourage AD developers to specific locations where the electricity and heat generated can be used locally eg connected to district heating. Councils can also offer food waste as feedstock and avoid landfill taxes, if their waste collection and disposal arrangements permit.

There are currently no council-owned and operated anaerobic digestion plants in England. Shropshire Council ran a small (5,000 tonnes/year, 200kWe) demonstration project with grant funding support between 2005 and 2012. This is now operated by the charity Cwm Harry.

Costs and benefits of standalone renewable energy projects

It is important to note that the financial performance of renewable energy projects is highly location-specific and the policy and incentive framework is subject to frequent changes. This section thus provides an 'order of magnitude' indication of the financial parameters based on technology costs and subsidies available, July-September 2015. The capital costs are exclusive of land costs.

11 A case study is available on the LGA website: www.local.gov.uk/web/guest/home/-/journal_content/56/10180/3511241/ARTICLE

12 www.planningresource.co.uk/article/1305142/it-winning-approval-wind-energy-scheme

Figure 5: Typical costs and benefits of standalone renewable energy technologies

	Stand-alone technologies				
Technology	5 MW Solar PV farm	500kW medium sized wind turbine	15kW small wind turbine	50kW Small Hydro	2MW Anaerobic Digestion
					
Capital cost (excluding land cost)	£3.75m	£1.6m	£75k	£300k	£9.5m
Annual revenue potential	£390k	£170k	£5.5k	£35k	£790k
Return on investment (per cent)	9	11	7	12	8
Development complexity	Medium	High	Low	High	High
Performance risk	Low	Low	High	Low	Medium

Key: High Medium Low

Technology options – building integrated technologies

A variety of renewable energy technologies can be integrated into buildings. They are most effectively integrated at the design stage, but some can also be retro-fitted where conditions allow. For electricity generating technologies, any mismatch between generation and demand can be absorbed by grid import or export. Renewable heat technologies in contrast need to be carefully matched to the heat demand of the site, potentially in tandem with a conventional heating system to supplement the supply.

Roof mounted solar PV panels: These are suitable for most types of council buildings, but particularly buildings with large flat or pitched roofs such as schools, leisure centres, depots and offices. An advantage over ground-mounted PV is that the electricity generated can be used on site, which helps the business case by displacing grid electricity consumption at retail prices. The main constraints to their deployment are: available roof area, roof orientation, over shading by trees or other buildings, planning in conservation areas and the ownership of buildings. Since April 2015, installations of up to 1MW on non-domestic buildings are 'permitted development' in planning terms.

The capital cost of roof mounted solar is currently £800-£1,500 per kW installed, depending on variables such as scale, suitability of roof structure and ease of access.

- Keynsham Civic Centre, Bath and North East Somerset Council (2014), 243kW, council-owned and operated, installed as part of a new build civic centre.[13]
- Northacre Resource Recovery Centre in Westbury, Wiltshire Council (2014) 318kW, council owned and operated[14].
- Heywood Sports Village, Rochdale Council (2014), a 100kW array retro-fitted to an existing leisure complex.
- Solar Schools Project is a crowd funding scheme run by the charity 10:10 which helps schools raise finance for solar PV installations[15].

Solar Hot Water (SHW) panels: SHW panels collect solar energy to heat water and are typically mounted on building roofs. Their application to council buildings and schools is limited to niche applications, owing to the relatively small domestic hot water demand in these buildings and the difficulty of integrating SHW with existing hot water systems. SHW may also compete for roof space with solar PV panels. Open air swimming pools (lidos) may present a good application. The privately-owned Bristol Lido has installed 80m2 of solar collectors for the 24m pool which supplies up to 70 per cent of the annual hot water needs[16].

Biomass boilers: Biomass boilers use wood pellets, wood chips or occasionally logs as fuel that is burned to produce heat, in a similar way to a standard boiler. They are available from domestic to commercial scale.

Biomass boilers are best suited to buildings with a constant heat load, such as leisure centres or within communal heating systems. This is because they take time to heat up and do not work well when operated at part load. They are most cost-effective in off-gas areas as an alternative to oil, LPG or electric heating.

There are a range of issues to consider when investigating potential for biomass boilers, such as: having sufficient space for installation, careful boiler sizing, matching the fuel to the boiler, fuel delivery and storage arrangements, maintenance requirements and air quality. The market for biomass is more local than fossil fuels; biomass can be more expensive than the fossil fuel alternative, depending on local supply chains and quality of fuel. The RHI income is designed to provide a certain return on investment including fuel costs.

Biomass boilers have commonly been installed as a relatively low (capital) cost method to meet sustainability targets in new public buildings. Some of these have proved a poor match to the building and have fallen into disuse. This highlights the need for careful consideration of the whole life cost of ownership and operation, including fuel supply and maintenance costs.

Ground source heat pumps (GSHPs): GSHPs use buried pipes to extract heat from the ground for domestic hot water and space heating via radiators or underfloor heating. A 'ground loop' used to absorb low grade heat from the ground can either be installed in horizontal loops in trenches or in vertical boreholes in more constrained sites. Heat can also be extracted from water sources such as lakes, rivers and canals17. In some areas it may be possible to directly extract and re-inject water from an aquifer, known as an 'open-loop' system, subject to Environment Agency approval.

13 www.solarsense-uk.com/news/latest-news-comment/posts/2014/solarsense-complete-keynsham-civic-centre-pv-system.aspx

14 www.solarsense-uk.com/media/104116/uks_largest_local_authority_rooftop_pv_system_installed_by_solarsense.pdf

15 www.solarschools.org.uk/

16 www.kingspansolar.ie/casestudies/bristol-lido.aspx

17 The Department for Energy and Climate Change has published a water source heat map to highlight the opportunities for deploying innovative heat pump technology: https://www.gov.uk/government/publications/water-source-heat-map-layer

GSHPs are most suitable in well-insulated buildings with underfloor heating and high hours of occupation, such as day care centres or residential homes. They typically need to be an inherent part of the design of a new building or major renovation, rather than retrofitted. They are also most suitable in off-gas areas as an alternative to oil, LPG or electric resistive heating. Heat pumps can also be used in reverse to provide cooling in summer months. This can improve the efficiency of the system, using the ground as a form of inter-seasonal heat store and avoiding the need for a separate air conditioning system.

Examples:

- **St Edmundsbury Borough Council, Suffolk (2009)**[18]. 463kW heating, 430kW cooling open loop GSHP installation providing all heating needs and 90 per cent of the cooling to a 6,430m^2 four-storey new build office block. Total cost was £435k.
- **Stoke Local Service Centre, Stoke on Trent Council (2009)**[19]. 90kW closed loop GSHP system providing heat to a 1,314m^2 new build extension with underfloor heating. Total cost was £149k. The contractor's defects and liabilities period was extended to include the first full heating season, meaning that during the extended handover, complications caused by further heating demands could be fixed.

Air source heat pumps (ASHPs): ASHPs are similar to GSHPs but absorb heat from the outside air rather from the ground (see above). ASHPs are typically less efficient than GSHPs (ie produce less heat than GSHPs for the same electrical consumption) but are cheaper to install, and do not require an area of land to be excavated or the drilling of vertical boreholes. ASHPs can have poor performance during the coldest periods of the year and require careful system integration and design.

18 Carbon Trust, CTG061: Down to earth, 2011, www.carbontrust.com/media/81349/ctg036-down-to-earth-ground-source-heat-pumps.pdf [Accessed 09/07/2015]

19 Carbon Trust, CTG061: Down to earth, 2011, www.carbontrust.com/media/81349/ctg036-down-to-earth-ground-source-heat-pumps.pdf [Accessed 09/07/2015]

Figure 6: Typical costs and benefits of building integrated renewable energy technologies

	Building-integrated technologies				
Technology	10kW roof mounted Solar PV	20kW solar hot water heating system	100kW biomass boiler	100kW ground source heat pumps system	100kW air source heat pump system
					
Capital cost	£13k	£25k	£60k	£125k	£100k
Annual revenue potential	£1.2k	£1.2k	£5.3k	£1.2k	£3.8k
Return on investment	10%	5%	9%	10%	4%
Development complexity	Low	Low	Medium	Medium	Low
Performance risk	Low	Low	High	Medium	High

Key: High Medium Low

Is renewable energy a mature industry?

Renewable energy is now the fastest growing source of energy worldwide supplying an estimated 19 per cent of global energy consumption. Its share is growing fastest in the production of electricity, where 59 per cent of the net additions to generating capacity in 2014 were from renewable sources, meeting an estimated 23 per cent of the global electricity demand20. Closer to home, renewables supplied 7 per cent of the UK energy needs and nearly a fifth of electricity needs in 2014[21].

Renewable energy is big business in the UK employing approximately 100,000 people[22]. However supply chain maturity varies by technology.

Solar PV and medium/large scale wind power are mature industries. From a financing point of view the technologies and supply chain are 'bankable' with substantial companies able to provide the obligations and warranties required by lenders of project finance. The industry is sufficiently large for healthy competition, meaning that procurement exercises can set tough criteria on price and post-sales support. Once developers (including councils) have got a scheme to the point of financial close, they can have a high degree of confidence that it will operate as intended. Hydro power and solar hot water heating are also well established and mature industries, though the market in the UK and average project size are much smaller.

Other technologies (small wind, biomass, heat pumps, and anaerobic digestion) are smaller industries and there is a higher level of technology, procurement and operational risk. Renewable heat technologies have the added complexity of needing to integrate into a building's heating system, and in the case of biomass, require a reliable fuel supply matching the type of boiler installed. Nonetheless several thousand new biomass boilers have been installed in the UK since the introduction of the RHI, helping the industry to mature. Heat pumps have yet to see the same level of uptake.

What level of income might renewables bring to a council?

To estimate the potential revenue streams from renewable energy, we have considered a portfolio of renewable energy investments for each of the generic example councils. This is for illustrative purposes only. Many combinations of renewable energy deployment could be considered depending on local circumstances. It is based on the market conditions and subsidies available in late 2015 and focuses on what could be achieved in the short to medium term.

We have assumed a small number of standalone projects in each council type and building integrated renewables in 5-10 per cent of council buildings including schools. The portfolio includes the following:

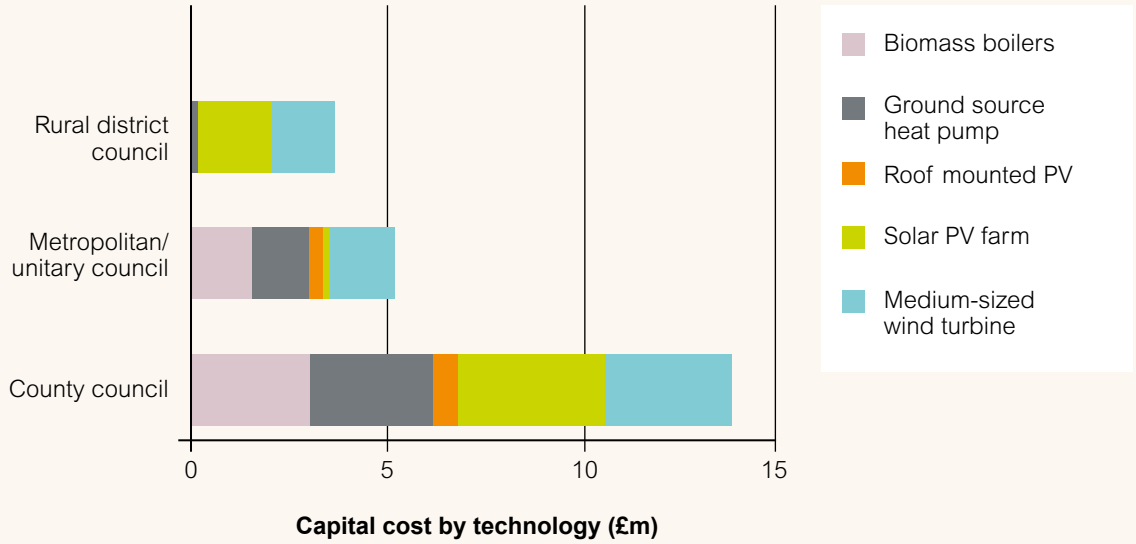
- one solar farm, with the size depending on the council type
- one or two medium sized turbine (2 for a country council, 1 for metropolitain borough/unitary and rural district councils)
- ten per cent of buildings with 10kW PV roof
- ten per cent of buildings with a 100kW biomass boiler
- five per cent of buildings with a 50kW ground source heat pump.

20 Page 18 of REN 15 Renewables 2015 global status report. www.ren21.net/status-of-renewables/global-status-report/

21 Department of Energy and Climate Change, Renewable energy in 2014: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/437937/Renewable_energy_in_2014.pdf

22 Renewable Energy View 2015, published by the Renewable Energy Association: www.r-e-a.net/resources/rea-publications

Figure 7: Example renewable portfolio – capital investment



We have chosen to exclude small wind turbines, hydro power, air source heat pumps and solar hot water heating as these technologies provide less income generation potential for councils than other options.

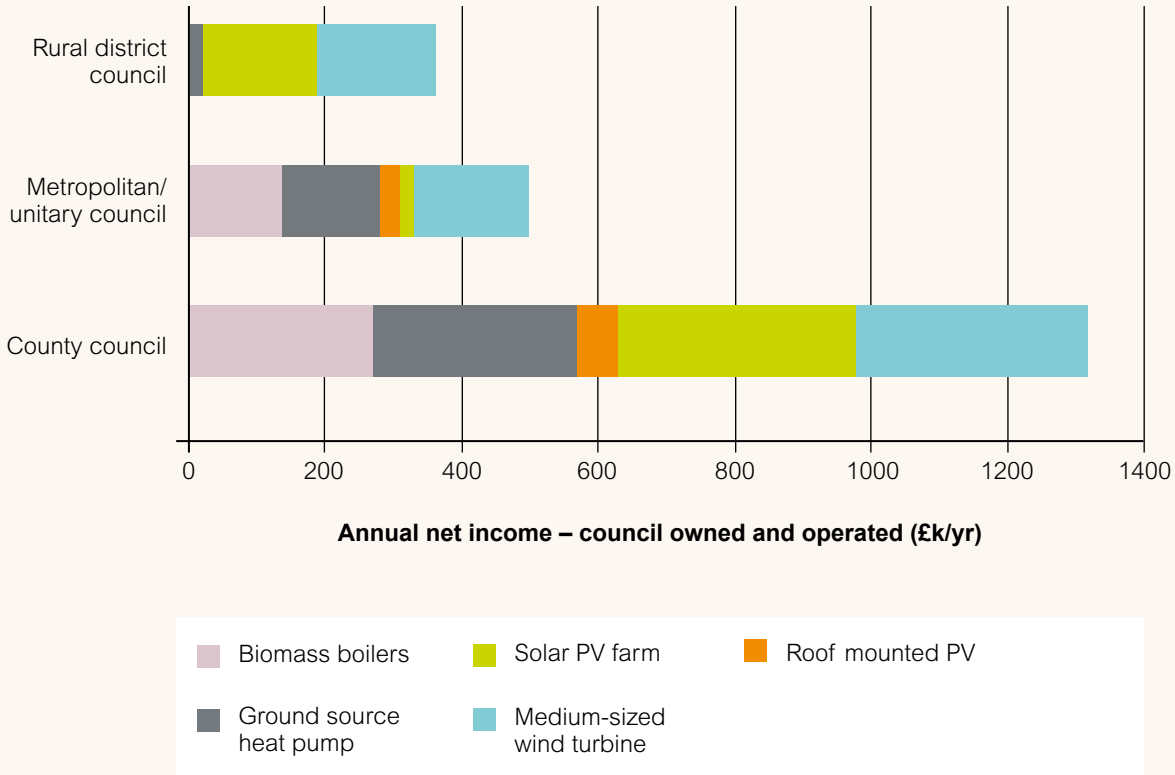
It is recognised that air source heat pumps and solar hot water heating in particular have a large market potential, but they are not currently stimulated by the RHI-subsidy to the same extent as other technologies. Anaerobic digestion is excluded owing to the lack of precedents of council-owned projects.

Figure 7 above shows the breakdown of total capital expenditure for the chosen scenario. The large standalone projects account for the majority of the capital spend. The cumulative expenditure of biomass and GSHPs is also significant in the case of metropolitan and county councils owing to the larger building stock in comparison to rural district councils.

Figure 8 overleaf shows the annual net income of the portfolio[23] (income minus operational costs, not including financing costs). The payback period of projects is typically circa 10 years, therefore financing would have to be structured to provide an income in the short-term. The potential income is strongly dependent on subsidies which are subject to frequent change.

23 The figures are based on the prevailing rates as of July 2015.

Figure 8: Example renewable portfolio – annual net income



Development options

Councils have the opportunity to use development options which share the risk and reward with third party developers, such as commercial or community energy developers. This option is not applicable to all technologies in present market conditions and in this example, is assumed to be available only to solar PV and medium-scale wind turbine projects, reflecting the activity of the large majority of commercial renewable energy developers.

For the purposes of quantifying the approximate revenue potential, three options are shown in Figure 9:

- **Option 1: Council owned and operated**, as per Figure 8, but for solar PV and medium-scale wind turbine projects only.
- **Option 2: Part financed by council**, where a council provides debt finance to a project developed by a third party, such as a community energy developer. In this example we have assumed that the council provides a loan to projects, covering 25 per cent of the capital cost and makes a 2 per cent return on capital invested[24].
- **Option 3: Land rent and concessions**. In this option the council receives a land rent for the solar farm and wind turbine, and benefits from free electricity from the solar PV roofs, of which it uses 50 per cent of the generation. Business rates are also included for the solar PV farms and wind turbine[25].

Note that option 2 and 3 are not mutually exclusive and could be applied to the same project. A breakdown of the revenue potential by technology is shown in the appendix.

24 For example, a loan is offered to a community project at 6.5 per cent return and the council borrows at 4.5 per cent from the Public Works Loan Board. If the council lends from its own reserves then higher rates of return are possible.

25 Business rates amount to £19,000 and £3,400 a year for the 5MW solar and 500kW wind projects respectively in this example. This may not be additional if displacing another rateable activity on the land in question.

Figure 9: Income generation potential of a portfolio of solar and medium wind

Benefit to the council	County council (£k/yr)	Metropolitan council (£k/yr)	Rural district council (£k/yr)
Option 1: Council owned and operated	750	218	346
Option 2: Income from 25% PWLB loan to third party developer	38	11	17
Option 3: Land rent and business rates from third party owned	97	28	38

Council owned and operated projects have a dramatically greater income potential for the council. However, the upfront cost and risk to a council is substantial. Development costs for stand-alone renewable projects can run into hundreds of thousands of pounds with no guarantee of success or residual value to a failed project.

Key questions for councillors and senior officers to consider

There are a number of financial solutions to fund projects. The greater challenge is often identifying and developing projects with a strong business case. By understanding the value of their assets from an energy perspective, councils will be better placed to form a rational strategy and where relevant, obtain the most benefit from partnerships with third parties. The key questions below provide areas for exploration to draw together the key information councils should hold to build a strong business case for energy efficiency or renewable energy projects.

Foundation steps

- Do you know how your energy expenditure breaks down across assets and operations?
- Have you reviewed your internal capacity to manage energy, for example using an energy management self-assessment tool[26]?

Developing strategy

- Have your assets and operations been mapped from an energy perspective to identify the main areas of opportunity for energy saving and renewable energy generation?
- Has the geographical area of the council been mapped from an energy perspective, ie renewable resources, heat mapping, strategic projects and energy infrastructure?
- Do you have a strategy for extracting maximum value from them for the council and the local community?

Business cases

- Is there a close working relationship between your finance and operational teams when developing business cases for energy efficiency and renewables?
- Do you consider the internal rate of return of energy projects as well as the simple payback when evaluating business cases? Are all co-benefits considered? (see section 1)
- Are you aware of the various sources of finance available?
- Are you aware of what an Energy Performance Contract (EPC) is? Do you understand the advantages and disadvantages and how these apply to the specific situation of your council?
- Is there an opportunity to aggregate projects and programmes either across the council or with partners to achieve economies of scale and share risk?

Wider engagement

- Do you know what your local public sector partners are doing in this area? Is there potential to collaborate (for example, knowledge share, joint studies and procurement frameworks)?
- Are you aware of community energy groups in your area and do you have a forum to communicate with them? Do you have a strategy of how to work with them towards mutual goals?

26 Such as www.carbontrust.com/resources/tools/energy-management-self-assessment-tool or benchmarking information via http://laenergyindex.co.uk

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