July 2010

Friends of the Earth

Revised Briefing

Pathways to 40% CO_2 cuts

Introduction

This briefing explains the main findings of research carried out by Carbon Descent for Friends of the Earth. The research carried out in 2009 examined a mix of exemplar policy measures to enable local authorities to reach at least 40% cuts in carbon dioxide emissions by 2020, using three different local authority case studies. It included an assessment of the Net Present Value (a measure of the extent to which the measures would pay for themselves over the time) for the three scenarios. In May 2010, following the introduction in April 2010 of Feed-in Tariffs ("Clean Energy Cashback") and the consultation on the proposed Renewable Heat Incentive, the Net Present Value of the original scenarios were re-modelled to bring them up to date.

This makes a significant difference to the results, especially for Hampshire.

Friends of the Earth, 26-28 Underwood Street, London N1 7JQ
Tel: 020 7490 1555 Fax: 020 7490 0881 Web: www.foe.co.uk

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1. Background to the research

Two hundred thousand people backed Friends of the Earth's pioneering climate change campaign, The Big Ask, as a result of which the UK passed the world's first law which commits it to cutting carbon emissions by 80 percent by 2050.

What matters now is seeing this transformed into action. Friends of the Earth's Get Serious About CO_2 campaign recognises the key role that local councils must play in reducing emissions in their area. It aims to deliver a step change in local authority action by calling on individual councils to cut CO_2 emissions by at least 40% by 2020, and at the same time to put in place a statutory mechanism that will require all local authorities to act with similar levels of ambition. We think that the best way to achieve this is through a system of local carbon budgets, mirroring the national carbon budgets set by the Committee on Climate Change under the Climate Change Act.

Local government has a crucial role to play in driving the changes that will create real benefits for local people while helping keep our climate safe. Councils have a major influence on how we heat and power our homes and how we travel locally. They also have influence over businesses, and have a key role as community leaders.

Each local authority must find the package of measures that best delivers in its communities. Reductions must be made across the sectors of housing, energy and transport - three of the biggest contributors of carbon dioxide emissions in the UK. Friends of the Earth's publication 'Getting Serious about Climate

Change' sets out six example policy measures to illustrate how a local authority could reduce CO_2 across these sectors.

To show the extent to which these policies could deliver big carbon cuts for local authorities, Friends of the Earth commissioned research from independent consultants Carbon Descent. Their report, 'Pathways to 40% Carbon Reductions by 2020' modelled the impact of our policies in the three very different authorities of Middlesbrough, Hampshire and Tower Hamlets. It explored whether the policies can combine to cut emissions by 40% by 2020 in the three authorities, as well as the cost-effectiveness of the different policy scenarios it outlines. Its conclusion was that these reductions are entirely possible in all three authorities, given sufficient will.

Carbon Descent is an independent social enterprise and environmental trust. It creates strategies and delivers solutions that measurably reduce carbon footprints. It aims to create a sustainable and equitable future for all. See more at www.carbondescent.org.uk.

In April 2010 Feed-in Tariffs (FITs – known officially as "Clean Energy Cashback" came into operation for small scale renewable electricity production – following a campaign led by Friends of the Earth. This pays producers of small-scale (sub-50MW) renewable energy a fixed income for every unit of electricity they generate – with an additional payment for every unused unit that they sell back to the national grid.

The Government also announced its proposals for the Renewable Heat Incentive (RHI) which is due to come into effect in April 2011, and which will provide a similar additional income for renewably generated heat.

As these measures would significantly affect the economic viability of renewable energy technologies, we asked Carbon Descent to revisit their three scenarios, modelling the impact of both the existing FITs and the proposed RHI. This briefing summarises the conclusions of the original piece of research and this subsequent review.

The three example local authorities:

Three local authorities with differing characteristics were chosen as examples to paint a picture of the possibilities for CO_2 reduction in a range of local authorities across the country.

Tower Hamlets
Inner city London borough
High indicators of deprivation

Middlesbrough
Unitary authority in the North East
High indicators of deprivation
Industrial

Hampshire
Rural county council in the South East
Low levels of deprivation

From the results demonstrated by modelling emissions reductions in these three councils, we may extrapolate potential reductions achievable for other councils across the country.

Primary conclusions

A 40% CO_2 cut on a 2006 baseline is feasible in all three local authority areas. There is a marked variation in the relative contribution of different measures to the overall savings across the three areas, affirming the principle that each local authority needs a tailored response to climate change. Achieving 40% depends significantly on the decarbonisation of the national grid which requires national action as well as local action to encourage renewables.

Thanks to the impact of FITs and the proposed RHI, in all three cases the scenarios have a positive Net Present Value – i.e. the package of measures proposed would as a whole more than pay for themselves over a 20 year time period. Middlesbrough sees a small increase in NPV by 2030 from £23 million to £35 million, Tower Hamlets sees a bigger increase from £702 million to £776 million, but the most dramatic change is in Hampshire where a negative NPV of almost £1.1 billion is changed to a positive one of £283 million.

The FIT for PV is the biggest factor, so if RHI was introduced at a significantly lower level the NPV would be reduced slightly but still be strongly positive.

Which policy measures did we test?

Friends of the Earth suggested six example policy measures that councils could implement towards delivering cuts of 40 per cent by 2020. It should be noted that the modelling has been limited to these six policies as examples of what local authorities could achieve by 2020. There is a range of other policies councils could implement in addition to these example measures which would allow the deeper cuts in CO_2 that will be necessary in the run up to 2050, and which may be more effective and appropriate in different local authorities.

The six example policies are:

1. Housing: Free loft and cavity-wall insulation.
2. Housing: Retrofitting for renewable energy systems.
3. Energy: Energy Service Companies
4. Energy: Renewable energy planning policy
5. Transport: Plan to meet an ambitious target to cut car journeys
6. Transport: Increase use of greener vehicles.

For more information on these policies see the report ‘Getting Serious About Climate Change’

Technologies that reflected these policies were then chosen to be incorporated in modelling.
They were:

- Domestic insulation
- Domestic renewable technology (including solar thermal)
- Photo voltaic (PV) panels
- Ground-source heat pumps;
- CHP including biomass CHP
- Other larger scale renewable energy
- Traffic reduction (including demand reduction, transfer to walking and cycling, transfer to bus and rail)
- Low carbon vehicle shift.

Commercial energy efficiency was included but not prioritised because it is currently less amenable to local authority influence.

2. Assumptions and Methodology

Energy, Housing and Transport assumptions

To enable them to be modelled, these policies were converted into sets of assumptions about measures adopted. Assumptions made across housing, energy and transport may be found in the main report (Pathways to 40% by 2020, see details in Further Reading 2009). Separate, indicative estimates were made about potential for larger-scale renewable energy in each area which can be found in Appendix 1 of this briefing.

Other assumptions

The grid factor
The assumed carbon intensity of electricity from the national grid in 2020 has a significant impact on the results. If less carbon is used to generate electricity, then less CO_2 is attributed to the end user – and therefore the local authority area modelled. It was assumed that, to meet its obligations under the European Renewable Energy Directive to generate 15% of all energy from renewable sources by 2020, the government will achieve a level of 38% renewable electricity generation by 2020. This would dramatically reduce the carbon associated with generating each kilowatt-hour of electricity and hence the CO_2 attributed to the end user. Where electricity consumption counts for a large part of the area's CO_2 emissions, this makes a huge contribution to achieving the overall 40% reduction. In our three modelled areas, it delivers CO_2 reductions of approximately 16% to 25%.

Where are emissions reductions from renewable energy technologies counted?
Local Authorities report on their carbon emissions under National Indicator 186, which measures the CO_2 emissions in the local area. Local renewable electricity generation fed into the grid is not currently attributable to individual local authorities under the accounting framework that NI 186 uses, so potential emissions savings from large scale renewables were calculated separately from other local CO_2 reduction measures.

It was assumed in the model that all electricity generated from non-domestic renewable technologies would be fed into the national grid. This means that, in the results section for each authority area, any local renewable electricity generation is assumed as already counted under decarbonisation of the grid, and is not counted again.

An exception was made for domestic scale PV panels as it was assumed all the electricity would be consumed on site, and therefore not fed into the grid.

Feed-in Tariffs and Renewable Heat Incentive
The values used in the research for FITs and RHI were the Government's published figures, and the capital and running costs of renewable technologies were taken from the advisory reports on which the Government based its estimates.

How does Carbon Descent's methodology work?

Carbon Descent modelled the chosen scenarios using VantagePoint, a software system that has been

developed for this purpose and which has been used by a number of local authorities, such as the London Borough of Camden. The Energy Saving Trust and Carbon Descent are now working together to make this modelling available to all local authorities in the future.

Data used

VantagePoint contains data about CO_2 emissions from domestic and commercial buildings and land transport in every local authority area, supplied by DEFRA. It is derived primarily from post-coded consumption data from gas and electric companies; and traffic data extrapolated downwards from national figures. This allocates CO_2 emissions from power stations and gas consumption to the end-user. This data is used by local authorities to report on National Indicator 186, which measures CO_2 emissions from the local authority area.

VantagePoint contains a list of possible carbon reduction measures and technologies including energy efficiency, renewable energy and traffic reduction, with figures for how much carbon these measures would save, the cost of these measures, and the saving in fuel bills over time.

It is conservative in that it assumes – unless directed otherwise – that there is no significant behaviour change by people in their use of energy at home and work, and that savings in these areas are only delivered by installing physical measures.

For each local authority area modelled, the following data are used:

- The number of homes, the expected amount of population growth, demolition and new build.
- The number of homes with inadequate loft insulation and unfilled cavity walls.
- The amount (by square metres of floor space) of industry (excluding heavy industry in the European Trading Scheme), offices, retail and warehousing.
- Traffic data.
- Any existing plans for insulation, renewable energy installation and traffic reduction.
- Any existing plans for reducing emissions from the council's own estate and activities.
- Assumption about the carbon intensity of the electricity supply as detailed above.
- Assumptions about the price of fuel (gas, electricity, road fuel)

The technologies and measures listed above (see page four) were modelled using the data above for each scenario. For example, the number of cavity wall treatments is limited by the number of unfilled cavity walls present in the area. The software then calculates the CO_2 reductions that each measure will deliver and the total reduction.

Additional factors measured

The software also calculates the total capital cost of installation for each measure and the expected saving in energy bills. This allows it to assess whether the investment will pay for itself over time, referred to as the Net Present Value. A positive value indicates that the initial investment has been more than recouped.

3. Results

Pathways to 40% carbon emissions cuts.

The table below details the most cost effective way the three local authority areas modelled can reach a 40% cut in CO_2 emissions, measured on a 2006 baseline, using the illustrative policy measures. This part of the analysis was conducted before the impact of FITs and the RHI was understood and we have not revisited it, although it is the case that the existence of the new incentives may change the prioritised list of

measures to get to 40 per cent reductions.

It should be noted that there are a range of other policy measures out with the six tested that could take the other two authorities modelled to deeper levels of emissions cuts.

Table 3: Pathways to 40% - percentage reductions in CO_2 from each measure

Area/ Measure	Domestic energy efficiency	Domestic renewables	Traffic reduction/ eco-driving	Improved vehicle efficiency	Conversion of district heating schemes to CHP including biomass (e.g. through ESCOs)	Overall de-carbonisation of the electricity grid (including more local approval of renewable energy)	More efficient commer-cial lighting	**Total reduc-tion in CO_2 (%)**
Tower Hamlets	2.9	0.15	1.6	2.7	7.5	24.3	1	40.1
Middles-brough	5.6	0	2.4	7.0	2.9	22.2	0	40.1
Hamp-shire	6.2	1.5	5.0	7.2	3.7	16.5	0	40.1

(For example basic domestic energy efficiency measures in Tower Hamlets would reduce total emissions from the borough by 2.9%)

Local Authority areas

The table shows that Middlesbrough and Hampshire can reach a 40% CO_2 cut using the policies set out, and that Tower Hamlets can with the addition of more efficient commercial lighting.

Differing results of measures in areas modelled

The results showed that the same measures can deliver a lesser or greater CO_2 depending on the make-up of the local authority area. Some of these effects are detailed below.

Why does the effect on CO_2 of decarbonising the national grid vary?

In areas with denser housing, gas consumption tends to be lower, and therefore electricity contributes to a higher proportion of emissions. Reduction of carbon intensity of the grid through renewable energy programmes delivers a bigger CO_2 reduction in those areas than others.

Why does the effect on CO_2 of domestic energy efficiency vary?

Where housing is detached or semi-detached the same scale of insulation measures can have a greater impact on reducing emissions.

Why does the effect on CO_2 of traffic reduction vary?

In areas with a greater proportion of journeys by car, or where car journeys are longer, the same measure of traffic reduction delivers a greater impact on CO_2.

Additional summary conclusions

In addition to the primary conclusions listed on page 4, the following conclusions can be made:

In two of the areas modelled - Middlesbrough and Tower Hamlets - the measures easily pay for themselves by 2030. The scenarios included relatively small numbers of renewable energy installations. These benefit from FITs and RHI. Middlesbrough sees a small increase in NPV by 2030 from £23 million to £35 million, Tower Hamlets sees a bigger increase from £702 million to £776 million, but the most dramatic change is in Hampshire where a negative NPV of almost £1.1 billion is changed to a positive one of £283 million.

In the third, Hampshire, the scenario includes a large number of domestic renewables and efficiency measures on hard-to-treat properties. These are labour intensive and expensive. This means that a large number (3,567) of jobs would be created from basic measures. In the original research it also led to a significant negative NPV. The introduction of FITs and RHI turns this into a positive NPV of £283,647,000 by 2030.

The most appropriate mix of measures varies greatly between local authority types:

In denser urban areas, traffic reduction and large-scale CHP are able to deliver greater benefits, while in rural areas with more detached houses and longer journeys, domestic scale renewables play a larger part in achieving a 40% CO_2 cut.

In all scenarios, improved vehicle efficiency has a significant role to play. Combined Heat and Power (CHP), domestic energy efficiency and local transport measures contribute more than a quarter of the 40% carbon savings in all three areas.

Reducing CO_2 by 40% has a mixed effect on fuel poverty. For some of those in fuel poverty (defined as spending more than 10% of income on heating) with very energy inefficient homes the energy efficiency measures modelled would be enough to lift them from fuel poverty. However, others would need additional measures such as domestic renewable energy technologies. For more information on fuel poverty and energy efficiency see the Friends of the Earth report, Home Truths.

4. A note on cost effectiveness

Does reducing carbon pay for itself ?

The Net Present Value (NPV) is calculated for each measure to create an overall NPV for each scenario – this tells us whether cutting CO_2 by 40% pays for itself over time.

NPV takes into account the time value of money. It is calculated in the following way

$$\sum_{t=1}^{T} \frac{C(t)}{(1+d)^t}$$

Where *t* is the time in years, *C(t)* is the cash flow in year *t, T* is the year for which the NPV is being calculated and *d* is the discount rate. For the purpose of this work the discount rate has been assumed to be 3%. If a technology has a positive NPV, it contributes value and could be considered economically

viable. In this modelling, the NPVs have been calculated to 2030. This is to take better account the lifetime of the installed technologies.

Cost effectiveness of renewables

The introduction of Feed-In Tariffs from April 2010 has made renewable energy more cost effective. A Feed-In Tariff allows people (including households, businesses and other organisations) who generate their own renewable energy to be paid a set rte, above market rate price, for the energy they generate and export to the grid. The rate is guaranteed for a period of time (usually 20 years) to allow security of investment.

The original scenarios were based on the situation at that time, i.e. without FITs or RHI. The measures chosen in the *Pathways to 40%* modelling were based on the most cost effective measures at the time. For example, no domestic renewables were used in the Middlesbrough scenario because a combination of other policies reached a 40% carbon reduction more cost-effectively. If the same research was conducted now, the mix of measures chosen to achieve 40% would probably differ significantly from those used here. It is likely, however, that reprioritising on the basis of the impact of FITs and RHI on scenario cost-effectiveness would only serve to further improve the NPV of the scenarios.

It should also be noted that, even if renewable technologies in some situations are not the most cost effective way of meeting 40%, they will be necessary to meet the 80% CO_2 cuts required by 2050. Cost effectiveness to 2050 can be achieved by encouraging take-up now, especially in new developments and refurbishments. There are also potential synergies; for example if scaffolding is being erected for other measures, such as to fit external wall insulation, costs can be saved by fitting renewables at the same time.

5. Funding

The research does not address the issue of funding for the measures, or distribution of benefits (such as lower fuel bills). The fact that the three overall Net Present Values are positive in all three scenarios suggests that the chosen measures would pay for themselves over time. However this headline figure obscures differences between measures – some are very strongly positive while others – large scale CHP, solar thermal and some domestic insulation measures – are still negative by 2030. This underlines the importance of considering funding in terms of packages of investment – using income streams from measures such as road pricing, FITs and the savings from energy efficiency measures to counterbalance the more costly measures that may be needed.

Funding these policy measures in the future

Local authorities must be given more powers and freedoms to raise their own funds to support local programmes. The Government must bring in a wide range of flexibilities as part of its promised review of local government finance – such as allowing local authorities to vary National Non Domestic Rates (NNDR) to provide an incentive to businesses to make low-carbon investments, greater freedom to incur capital expenditure through borrowing for low-carbon investment, new charges – of which the Local Government Association are supportive, Tax Increment Financing (TIF) schemes - borrowing against future increase in tax-take due to investment, and green bonds.

National programmes of investment.

The scale of action needed to increase energy efficiency in homes and businesses, increase in the generation and use of renewable power and heat, and overhaul public transport networks, suggests

significant private investment will be needed. There must be a central role for the new Green Investment Bank to channel funds to both nationally- and locally-led schemes to cut emissions.

These measures, including the funding for them, should be delivered through local authorities as they are best placed to deliver such programmes in a way that fits local circumstances.

6. Conclusion

Local government has a crucial role to play in driving the changes that will create real benefits for local people while helping keep our climate safe. Councils have a major influence on how we heat and power our homes and how we travel locally. They also have influence over businesses, and have a key role as community leaders.

This research suggests that both urban and rural authorities can reach a 40% CO_2 reduction target by 2020, and that a package of measures to achieve this can more than pay for itself over time. This is bolstered by the Feed-in Tariff and would be further enhanced by the Renewable Heat Incentive, but even if the RHI is introduced at lower rates than currently proposed, there would still be a positive NPV. In large part they will be responsible for leading emissions reductions but this also underlines that they need Government help. In particular this research shows that achieving 40% hinges on grid decarbonisation.

However, there must be a mutually supportive role between national and local government, where the support of local authorities to push Government to play their part is crucial. This will require clear evidence of local authorities leading by example and doing all they can with current powers and funding to cut their emissions.

The research shows the most appropriate package of measures varies between local authorities. While councils must implement measures in all three areas of housing, transport and energy (and in non-domestic buildings too) they must also tailor the package to suit their needs based on a strong evidence base of where their emissions are coming from locally, and what can best be done to reduce them. Action on climate change is vital for the future of the planet but is also makes good business, social and political sense. Local communities should be at the heart of building a low-carbon economy that offers a fair and sustainable life for all.

This research shows that the vision of a low-carbon community is not a long-term aspiration but a real and pragmatic solution to existing problems available now. Realising this vision is no longer a matter of technical barriers; it is a matter of personal and political will to deliver change.

Some local authorities are displaying such will, but too many are still doing far too little. Friends of the Earth believes that the introduction of Local Carbon Budgets is the best way to ensure all local authorities are doing all they can to reduce CO_2 emissions from their areas.

7. Further Reading

Full 2009 Report:
Pathways to 40% reductions in CO_2 by 2020, Carbon Descent
www.foe.co.uk/resource/reports/pathways_to_40_percent_report.pdf

Revised report:

Pathways to 40% Carbon Reductions by 2020: The impact of Feed-in Tariffs and the Renewable Heat Incentive on the economic performance of eligible technologies, Carbon Descent 2010

Supporting reports and briefings by Friends of the Earth:

Getting Serious About Climate Change: How local government can cut carbon, create jobs and save cash
http://www.foe.co.uk/resource/reports/getting_serious_about_climate_change.pdf
Local Carbon Budgets
http://www.foe.co.uk/resource/briefings/local_carbon_budgets.pdf

8. Appendix 1: Assumed renewable energy potential per area

The research made assumptions on the potential for larger, non domestic renewable electricity generation. Wind power estimates are based on existing studies of potential, which are themselves derived with reference to current regional and sub regional targets contained in Regional Spatial Strategies.

Study Area	**Potential for large scale wind (MW)**	**Share of national wind[7] (%)**	**CO_2 savings from wind (ktpa)**	**NPV of large wind to 2030 (£k)**
Hampshire	49	0.35	56	95,424
Middlesbrough	21	0.15	24	40,896
Tower Hamlets	1	0.01	1	1,947