2015

REVIEW

RENEWABLE ENERGY VIEW

THE AUTHORITATIVE ANNUAL REPORT ON THE UK RENEWABLE ENERGY SECTOR

INNOVAS

pwc

A RENEWABLE ENERGY ASSOCIATION PUBLICATION

REA
RENEWABLE ENERGY ASSOCIATION

Foreword Dr Nina Skorupska
Chief Executive, REA

Rebuilding consensus – creating new partnerships to deliver the renewable energy economy

Renewable energy is growing to be a major player in the energy sector here in the UK. Despite the last year's political uncertainty and leading up to the 2015 General Election, it remains a business opportunity for the UK. Clean energy is one of the fastest growing industries in the world, and significant work is needed to upgrade our energy infrastructure for the challenges of the 21st century.

The 2015 Renewable Energy View (REview) builds on our 2014 report. Once again, we have teamed up with Innovas to produce robust employment data, broken down by technology and region. We've also collated official deployment figures and compared them to the Government's 2020 projections. Each technology chapter is brought to life with case studies and articles from industry practitioners. PwC have joined us again to share their views on historic and projected investment trends – vital to giving a clue to future growth.

The feedback from last year's report told us that this report is the most complete assessment to date of the UK renewable energy market.

So what has changed since the last report? We've found that the private sector has invested over £11billion in renewable electricity, heating and transport fuels, growing the industry to over 112,000 jobs and supplying the UK with 19.2% of its power in 2014, 2.8% of its heat in 2013 and 4.4% transport fuels in 2014.

This is excellent progress, but there's a long way to go to meet the 2020 targets and tackle climate change. The necessary expansion of clean energy is both possible and affordable, as we have seen with the dramatic decreases in the cost of solar. The Government has laid a path for renewable energy deployment with the electricity market reform (EMR) seeing its first set of auctions for both Contracts for Difference (CfD) and the Capacity Market. The new Government must reconsider how much emphasis it places on technologies such as nuclear if it truly wishes to address the trilemma of energy security, affordability and sustainability. We see renewable energy, along with energy storage, as the way to deliver all three in a balanced way. We hope the new Government is open to debate about both the costs and the (often overlooked) benefits of renewables, including the new jobs being created. As we said last year, this not just a new generation of highly skilled engineers, but the biochemists, the legal and financial service providers and the installers and construction workers across the whole of Britain.

'The message remains clear: supportive, stable policies are vital. The stronger the policies, the greater the growth, and the faster the costs come down – as we're seeing right now with onshore wind and solar power.'

To read *REview* online, please visit: www.r-e-a.net/resources/rea-publications

Europe is committed to leading the world on a low carbon future – with this given an added impetus by the ongoing crisis in Ukraine. Whilst the UK should benefit from increased interconnectivity, we are blessed with excellent renewable resources such as wind, water, sunshine, underground hot rocks and energy from waste. Then there are sustainable bio-based fuels, which offer flexible heat, power and transport fuel when and where we need them. We can grow some of these ourselves and also buy them from trusted trade partners in the USA and Europe. Renewable energy puts us firmly in control of our energy security.

The UK currently looks to be on track for its 2020 renewable electricity ambitions and its renewable heat policies are truly pioneering. The lack of support for renewable transport, however, has seen this sector continue to stagnate. Where there has been uncertainty or drastic changes in policy, the results have been hugely damaging.

The message remains clear: supportive, stable policies are vital. The stronger the policies, the greater the growth, and the faster the costs come down – as we're seeing right now with onshore wind and solar power.

Several other technologies are progressing too, but still need work to unlock their full potential. So whilst there continue to be challenges ahead and outstanding issues to tackle, we will face these head on with the support of our members. The opportunities outweigh the challenges by far. Investment in UK renewable energy is the clearest way to building the UK economy. This investment creates jobs, brings down costs, improves our energy security and helps us preserve a safe environment.

N. M. Skorupska

Dr Nina Skorupska Chief Executive, REA

SUPPORTED BY:

IMAGE: ROBERT GRESHOFF

Welcome to the second edition of *REview* – the authoritative annual report on the UK renewable energy sector.

The UK looks to be on course to meet its commitments on energy and climate by 2020. According to the Office of National Statistics 15% of the UK's energy came from renewable sources in 2013. The last 12 months have shown a significant investment by the private sector in renewables, leading to new jobs and hopefully increasing this percentage as a result.

In this issue of *REview* we examine each sector individually, with articles and thought leadership from key industry figures. Experts at the REA take a look at the RHI, CfDs, the future of biofuels and the policy overview, identifying successes and weaknesses and where improvements can be made.

The REA data pages give a clear picture of the context and size of each sector, encompassing employment data from Innovas, as well as government data and projections. PwC has once again produced an executive report on investment and projected trends.

As a result, REview is a must read for anyone involved in the renewables sector and I hope you find its pages inspiring and thought-provoking.

We are always happy to hear from you, so do get in touch with your comments for future discussion.

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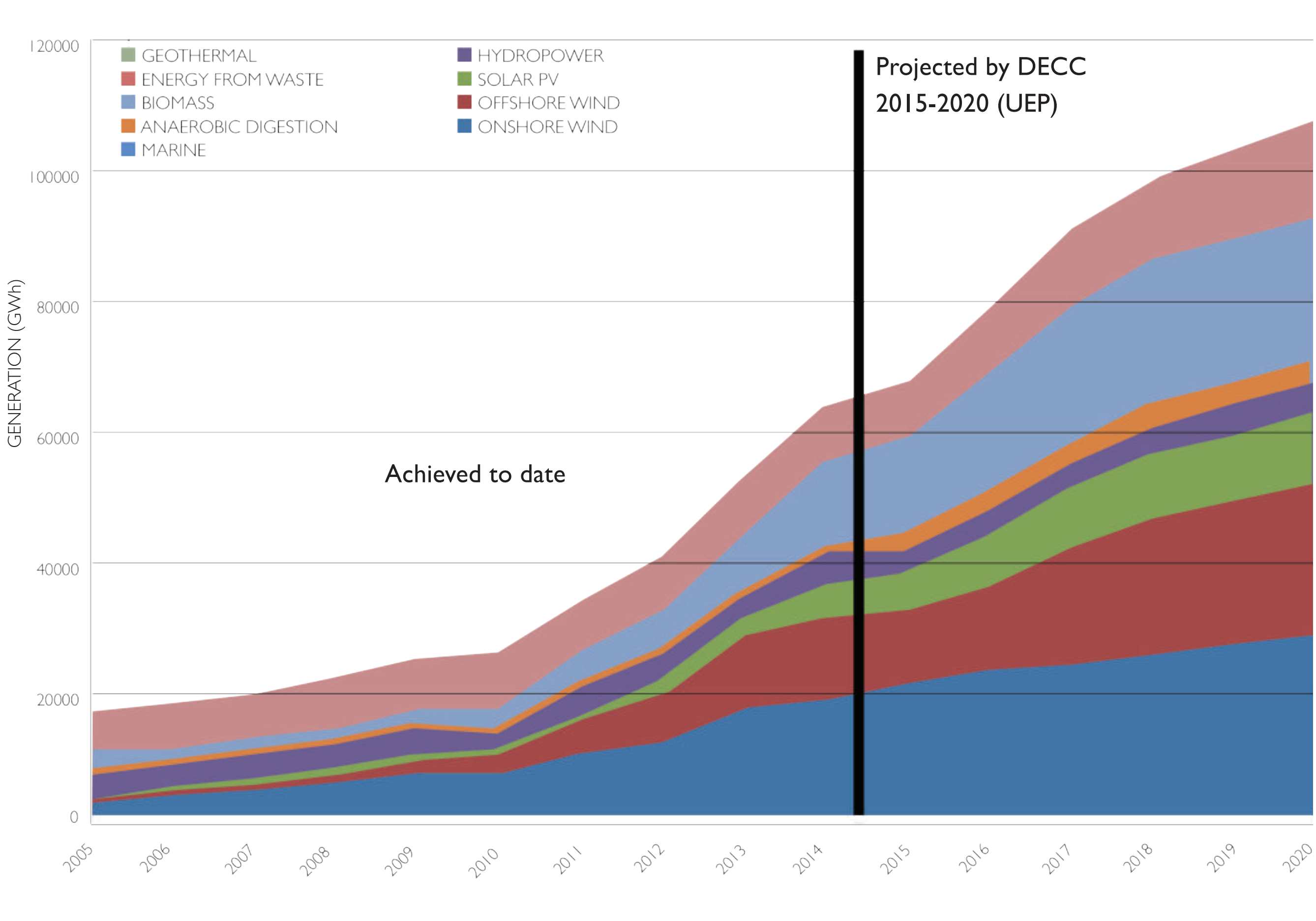
Executive Summary

Renewable energy should continue to grow strongly if the policy environment is supportive

RENEWABLE ELECTRICITY GENERATION

ACHIEVED TO 2014 AND PROJECTED BY DECC TO 2020



Overall, the UK has made considerable recent progress towards meeting its renewable objectives. Arguably, the UK is on track to meet the Renewable Energy Directive target of 15% of energy being renewable by 2020. Nevertheless, the growth rate required for the next five years remains very steep – and one of the highest for any EU Member State. The overall figures mask stark differences between sectors and individual technologies.

Renewable electricity generation (supported by the Renewables Obligation and Feed-in Tariff) has grown steadily, increasing on average by 25.9% year-on-year between 2009 and 2014. This sector has the strongest claim to being on track for 2020. Major uncertainties remain, with the Renewables Obligation due to close to new entrants from 2017 and the first Contracts for Difference having only just been awarded.

Renewable heat generation has also grown steadily, increasing on average by 13.4% year-on-year between 2009 and 2013 (the last full year for which data are available). Although only a small portion of the whole, the Renewable Heat Incentive has expanded rapidly over that time.

The non-domestic policy is dominated by biomass boilers and biomethane injection to the grid, while the domestic policy has seen 7,106 installations spread more evenly across biomass boilers, heat pumps and solar thermal. Despite this growth, the sector is a long way short of the estimated contribution required for 2020.

Biofuel consumption has increased on average by 3.9% between 2009 and 2014, although a final EU agreement on indirect effects of biofuels is likely to lead to the UK formally scaling back its ambitions.

Investment in renewables is growing, but much more is needed

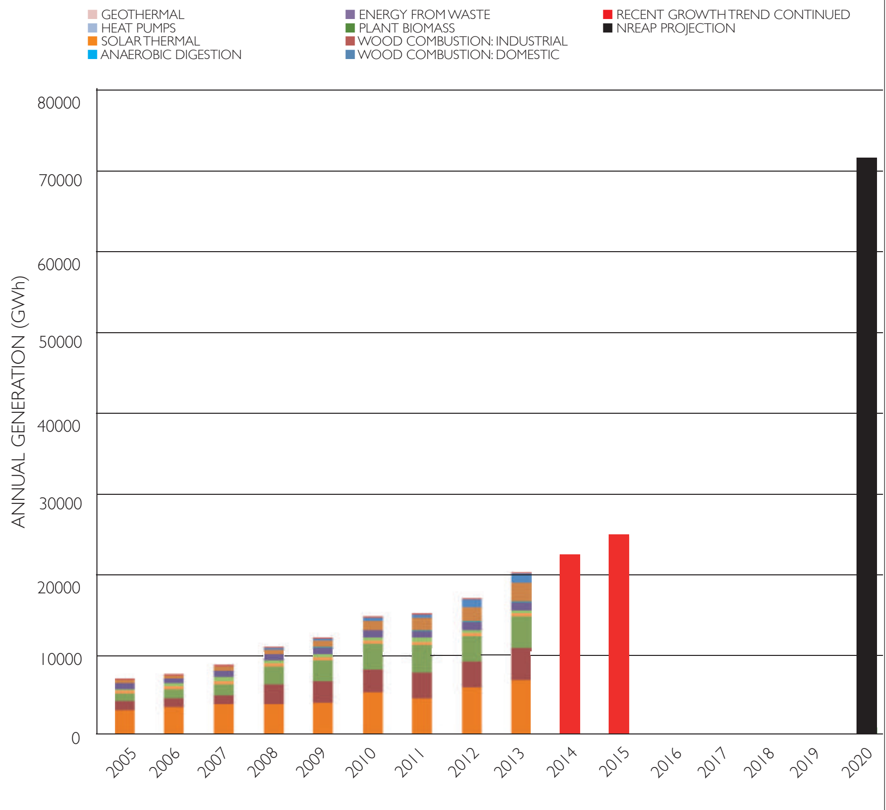
Data provided by PwC

£10 billion was invested in UK renewable electricity generation in 2014, with an estimated further £42billion required to 2020. Heat saw £2billion invested in 2013, with the vast majority going to biomass boilers and biomethane. A further £6.5billion is estimated to be needed by 2020. There were no new investments identified in transport biofuels in 2014. Any plausible projection of future investment in the industry would require a far more supportive policy environment than at present.

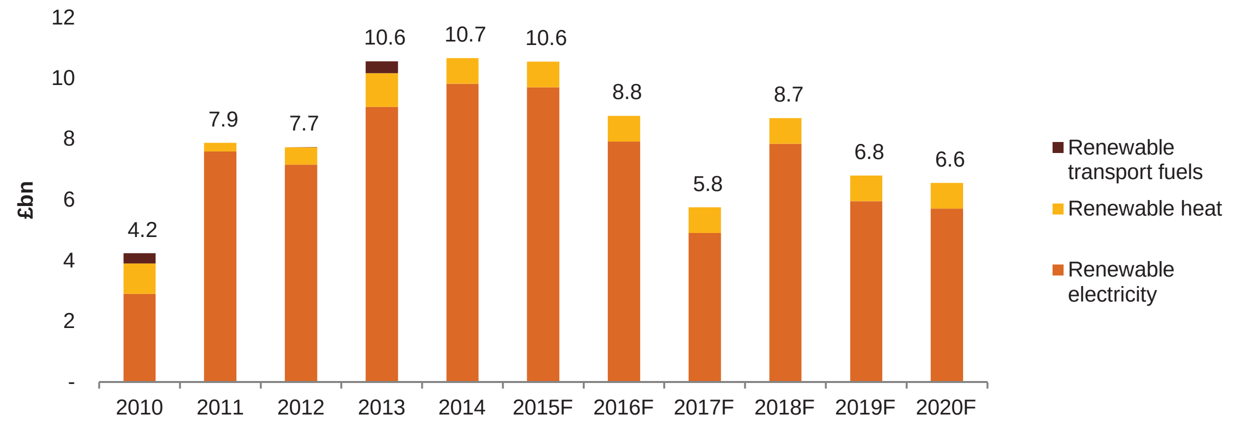
The renewables targets are interlinked. With the electricity sector the only one that might be able to exceed its targets, any under-performance in heat and transport would have significant implications for additional renewable electricity. This highlights the need for a coordinated approach to targets that is not obvious from current policy.

RENEWABLE HEAT PRODUCTION

ACHIEVED TO 2013, RECENT GROWTH EXTRAPOLATED TO 2015 AND NREAP PROJECTION BY DECC FOR 2020

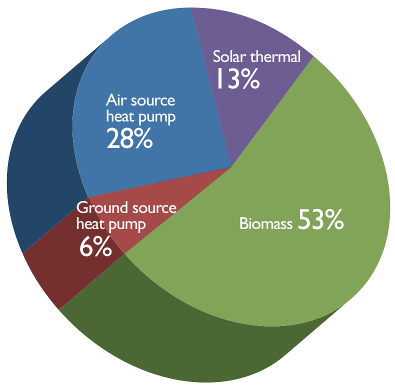


HISTORICAL AND FORECAST INVESTMENT IN RENEWABLES (2010-20)



Executive Summary

NUMBER OF DOMESTIC RHI INSTALLATIONS SINCE APRIL 2014



Jobs and market value continue to grow

Data provided by Innovas

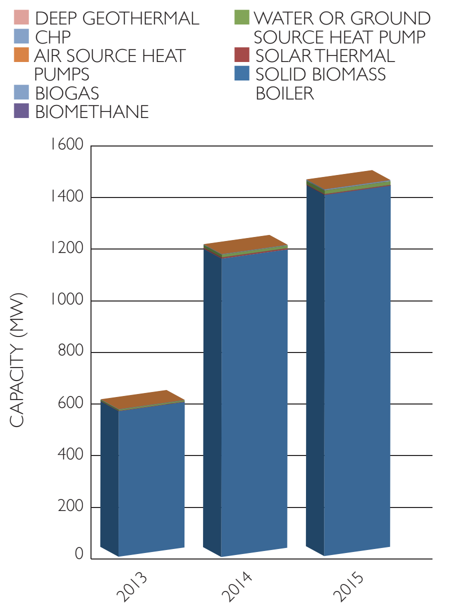
112,000 people were employed across the UK renewable energy value chain in 2013/14, an increase of 8.7% on the previous year. The industry's market value has increased over that time by 6.1% to £14.9billion. The analysis forecasts this increasing to £22billion by 2019/20. If employment numbers increase at a similar rate to market value over that time, this would imply an additional 55,000 people employed.

Conclusions

The industry has come a long way in recent years and can continue to grow strongly. For individual technologies, there is a strong correlation between Government policy and deployment. Where this is stable and supportive, there have been considerable successes. Where the opposite is true, technologies have stalled or gone backwards.

A key driver of this growth has been the targets contained in the EU's Renewable Energy Directive. This has given investors confidence that major policies will be introduced, even when the details of them were not yet clear. The nature of the EU's 2030 climate change package will therefore be critical for future success. Both in what it says on paper and the extent to which project developers and investors are confident that it will lead to decisive action.

CAPACITY OF ACCREDITED NON-DOMESTIC RHI INSTALLATIONS (MW)



EMPLOYMENT AND TURNOVER SUMMARY FOR RENEWABLE ENERGY SECTORS 2013/14

Renewable Energy Sub Sectors	*2013/14 Turnover £'millions*	*2013/14 Employment Numbers*	*2013/14 Company Numbers*
Air & Ground Source Heat Pumps	1,097	8,315	417
Anaerobic Digestion	340	2,828	148
Biofuels	522	3,829	211
Biomass Boilers	684	5,379	244
Biomass CHP	356	2,389	146
Biomass Dedicated Power	546	3,830	187
Energy from Waste	866	7,109	363
Hydro	595	5,390	276
Offshore Wind	2,693	19,478	913
Onshore Wind	2,493	18,191	844
Solar PV	2,307	16,103	2,088
Solar Thermal	1,008	8,639	372
Wave & Tidal	103	635	36
Production of biomass including wood for fuel	1,322	9,913	567
Totals	**14,931**	**112,028**	**6,812**

Policy Overview

Renewables Obligation (RO)

The RO is the oldest of the current UK financial incentives, having started in 2002. It obliges electricity suppliers to source a proportion of their electricity from renewable sources. Renewables Obligation Certificates (ROCs) are awarded to renewable generators, who then sell them to suppliers. Support lasts for 20 years, but the actual value of ROCs depends on the outcome of commercial negotiations rather than being fixed by the policy.

When introduced, all renewable electricity received the same level of subsidy, regardless of the technology used. This changed in 2009, when 'banding' was introduced – meaning that support varies depending on the cost of the technology.

The RO will close to new participants in 2017.

Electricity Market Reform (EMR)/ Contracts for Difference (CfDs)

EMR covers a package of measures including a carbon floor price, an emissions performance standard to rule out new coal generation and a capacity mechanism to try to ensure the system has sufficient back up capacity. Contracts for Difference are the new mechanism to replace the RO – although they will also be available for nuclear and carbon capture and storage.

Most policies give a more or less fixed income to renewable generators but leave them free to sell the power itself on commercial terms. One drawback of this is that, if market prices go up then the total income for the generator will be higher than expected and they may be over-rewarded – and therefore the impact on consumer bills will be higher than it should be. By the same token, falling power prices would see generator income and consumer bills being lower than expected.

CfDs seek to address this by setting a figure for the total income for a project – i.e. both the renewables subsidy and the value of the electricity. This total figure is called the 'strike price'. The Government caps the maximum price it is prepared to give to each technology, with the actual strike prices set by auctions. Government will also take a market average for the power price, known as the 'reference price'. Rather than being a fixed price, the subsidy paid to the generator will be the difference between the strike price and the reference price.

In theory, this gives the best of both worlds, as the generator has certainty over total income and the subsidy – and therefore the impact on consumers – is no higher than necessary. Lower risks to generators should result in reduced costs of financing, and therefore improve the value for money of the electricity delivered.

> 'The Government caps the maximum price it is prepared to give to each technology, with the actual strike prices set by auctions. Government will also take a market average for the power price, known as the 'reference price.'

The first auction was run in early 2015 and there are a number of concerns over the way this works for the full range of technologies and business models. Deciding how to shape this policy further will be a key set of decisions for the next government.

Feed-in Tariff (FIT)

The FIT started in April 2010. It supports anerobic digestion, wind, hydro and solar PV up to 5MW, as well as small scale fossil CHP.

Building on successful policies elsewhere, the FIT aims to be much simpler for the end user than policies such as the RO. It pays a fixed income on all generation with no need to enter into complex commercial negotiations. The FIT also gives a guaranteed minimum income for electricity not used on site – although projects are free to seek better prices elsewhere.

In 2011/12 solar PV was the major beneficiary, overshooting the estimated budget by a large margin. Cost control mechanisms have been introduced for both the FIT and the RHI for all technologies, in which tariffs reduce for new entrants to a scheme if deployment reaches particular levels. Although the PV market is more stable, tariff reductions for the other technologies happened for the first time in 2014, and are likely to lead to severe market disruption.

Renewable Heat Incentive (RHI)

The RHI builds on a similar approach to the FIT, although it is available at all scales. Unlike electricity, excess heat generation cannot usually be exported onto a grid, so the policy aims to ensure that only useful heat is supported.

The RHI opened in November 2011, initially only for ground source heat pumps, biomass, solar thermal, small-scale biogas and injection of biomethane to the gas grid. Single domestic installations were not included. To date, the vast majority of deployment has been biomass boilers and biomethane injected to the grid. Rapid growth has seen reductions in tariffs, and further reductions are likely in 2015.

A number of tariffs and technologies were either adjusted or included for the first time in 2014. These include a sister scheme for individual households.

Unlike the renewable electricity policies - which are funded by consumer bills - the RHI is paid for out of general taxation. The budget is fixed to the end of March 2016, with further funding to be set after the general election.

Renewable Transport Fuel Obligation (RTFO)

The RTFO was introduced in April 2008. It is similar in principle to the RO, in that it obliges fuel suppliers to replace a proportion of supply with renewable fuels.

Targets were scaled back in 2009. The Government has yet to set out a trajectory for meeting the binding 2020 targets contained in the Renewable Energy Directive, and has made this conditional on EU-level resolution of controversy over sustainability. This has severely undermined confidence in the sector. This is particularly frustrating as UK-produced fuels have an excellent sustainability record, significantly exceeding expectations in environmental protection and greenhouse gas savings.

Renewable Energy
MADE IN BRITAIN

Employment and turnover by region and technology 2013/14

REA
RENEWABLE ENERGY ASSOCIATION

Made in Britain Map - employment and turnover by region 2013/14 as published in REA's REview 2015. Report by the REA, data by Innovas.

"REview: Renewable Energy View, The Authoritative Annual Report On The UK Renewable Energy Sector." Jobs, deployment & investment, by technology.

May 2015

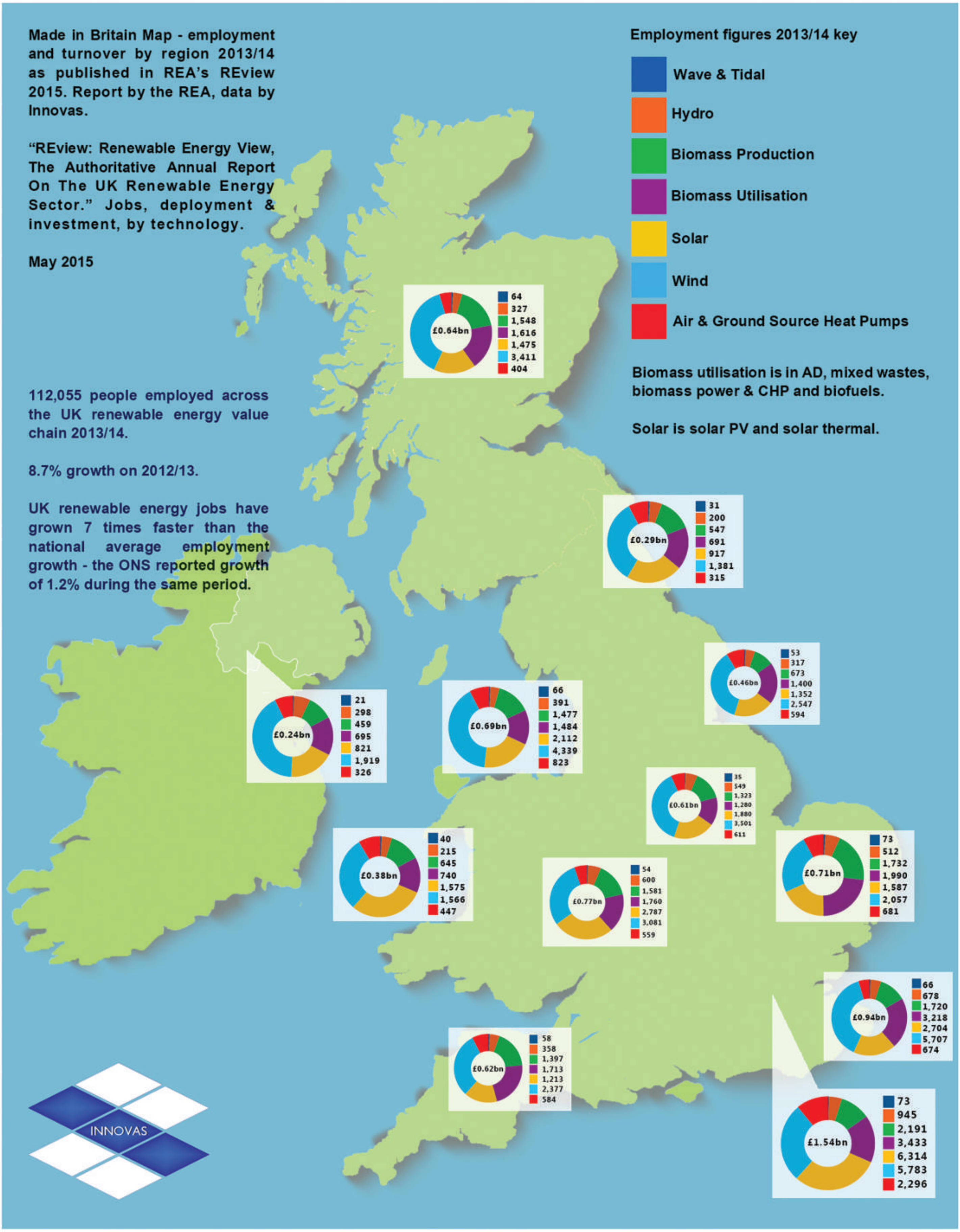
112,055 people employed across the UK renewable energy value chain 2013/14.

8.7% growth on 2012/13.

UK renewable energy jobs have grown 7 times faster than the national average employment growth - the ONS reported growth of 1.2% during the same period.

Biomass utilisation is in AD, mixed wastes, biomass power & CHP and biofuels.

Solar is solar PV and solar thermal.



Green jobs, outperforming the UK jobs miracle

One of the strongest elements of the renewables sector is the impact it has on UK plc in terms of jobs, an often overlooked positive we have seen in the past 5 years.

In the economy as a whole we have enjoyed a fall in unemployment - which fell to below 6% for the first time in six years, from 7.1% the previous year - coupled with a 1% growth in employment.

Yet renewable jobs increased by over 8%, jumping from 102,987 to 112,055. This underlines the fact that, where there is a stable policy framework, jobs and investment follow.

REA appointed Innovas to provide statistics and information on employment in the renewable energy supply chain. The growth this data shows in green jobs is all the more impressive when you look at the regional distribution, with all areas of the UK having a strong foundation to build on.

The much acclaimed Northern powerhouse is already one of the best performing regions, with 10,693 jobs, something that should be jumped upon by the politicians in that area who are about to receive unprecedented powers and autonomy to promote and attract investment.

The Midlands is also an area that has benefited greatly, with over 20,000 jobs in the combined West (10,420) and East (9,178) regions.

These jobs cover a range of demographics, from the academic, skilled, semi-skilled and non-skilled. At the top end they provide high quality engineering jobs, leading the way in sustainable intellectual property as well as in science and technology.

In manufacturing, we are beginning to see the growth of companies investing in our skilled workforce and ease of access to a dependable market, with over 53,900 jobs now. This is due to grow further, with companies like Siemens opening their new factory in the Hull area.

Put into the wider energy policy context, renewables are now firmly the growth area for employment. Whilst the oil and gas industries still dominate the sector with just under 240,000 direct and supply-chain jobs, these jobs are dependent on global volatility and the long term need to move away from fossil fuels.

The figures for renewables also provide context for other technologies that are often talked about. Hinkley Point C is claimed to support 1,000 permanent jobs, for example. On shale, an EY report showed that the maximum capability of that industry is to deliver 64,000 jobs - nearly half of what the renewables industry already supplies.

2013-14 was a good year for renewables, with growth and employment outperforming the rest of the economy. The Government should take note and ensure the stable investment environment that is needed for this sector is to continue to grow and realise the potential the UK needs.

The future of renewable liquid biofuels

Last year, a new government task force was set up to investigate biofuel policy, try and break past deadlocks, and attract investors in low carbon transport fuels back to the UK. But has it succeeded?

The UK's Renewable Transport Fuel Obligation (RTFO), which implements the transport elements of the EU Renewable Energy Directive (RED), came into effect in April 2008. Almost immediately the policy came under fire because it was alleged that some biofuels were worse than fossil fuels because of potential indirect effects. These were things that occurred not during the production of the fuel, but as a knock-on effect. These are by definition difficult to measure with accuracy, and a great deal of time and money has been spent at UK and EU level without firm agreed conclusions being reached.

In response, the government commissioned the Gallagher Review, which came out in July 2008 and recommended a dramatic slowdown in the RTFO. This had an almost immediate effect on the nascent UK biofuels industry, with many companies exiting the business or turning their attention to other countries.

Industry stagnation

In 2010, the coalition government decided that the UK's target could not exceed 4.75 percent (by volume, which is about 3.8 percent by energy) until these effects had been adequately dealt with in EU legislation. This policy position effectively condemned the UK industry to stagnation, as current investment sought to limit the damage caused and future investment was choked off. The European Commission (EC) put forward a set of proposals in October 2012, which included applying estimates of these indirect effects to reporting mechanisms under the directive, and requiring that crop-based biofuels make up no more than half the 2020 target.

These proposals set off a further storm of controversy as the EU biofuels industry and the non-governmental organisation (NGO) community attempted to persuade decision makers in the European Parliament and the Council to support, strengthen, destroy or water down the proposals, depending on their particular point of view. Debates were heated and votes always very close. Industry after industry in the EU followed the UK in going into 'hold' mode until the future became clearer.

A new beginning

The UK coalition government is no more, and the UK has a new Conservative government. It has become increasingly clear that the continued stagnation in biofuels policy, and the negative effect this has been having on UK industry, and potential investments in advanced biofuels, is untenable. Spurred on by industry, including the REA, the Department for Transport set up a Transport Energy Task Force in September 2014, with the remit to "formulate and examine options for how the UK should set about meeting the 2020 RED renewable transport target, and how low carbon fuels could help reduce transport greenhouse gas emissions in the UK economy to 2030 and beyond." This remit recognises that liquid fuels will still be dominant in the transport sector to at least 2030. The task force included the fossil fuel, biofuel, aviation and agricultural industries, motor manufacturers, environmental NGOs and government departments. The aim of the

> 'It has become increasingly clear that the continued stagnation in biofuels policy, and the negative effect this has been having on UK industry, and potential investments in advanced biofuels, is untenable.'

task force was to seek as much consensus as possible on the way forward for biofuel policy in the hope that the deadlock of the past could be broken, and investors in low carbon transport fuels could look at the UK once again with confidence.

The task force has largely succeeded in these ambitions and its report, which has been signed off by all task force members, can be found on the Low CVP website, www.lowcvp.org.uk.

The report sets out the pathway to the de-carbonisation of transport to 2030, as well as looking at how best to achieve the 2020 target in a way that is compatible with the longer term objectives. It recognises that all options to 2020 have their advantages and disadvantages but the issues are now much clearer, and in the words of the Chairman of the Task Force: "There is now a need for political leadership, to capture the momentum and alignment created by the Task Force."

Looking to the future

In the meantime, the decisions being taken in Brussels will need to be implemented in the UK by the new government. Key amongst these is the level at which the UK will set any limits on crop-based biofuels. The EU institutions are likely to agree a seven per cent cap, and it is crucial that the UK government implements this figure – and no less – to ensure that the UK industry can remain competitive with its European neighbours. There has been talk of the UK setting a much lower figure, perhaps even as low as 1.5 per cent, which would be a disaster, in particular for the UK bioethanol industry which has invested around £800 million and supports about 3,500 jobs in some of the most disadvantaged regions in the UK.

If this industry is allowed to go under, it will send shock waves through the investing community and it will be highly unlikely that future investment in advanced biofuels will be forthcoming. The new government has a real chance to make a genuine difference to de-carbonising liquid transport fuels now and in the longer term. It must not mess this up.

Liquid Biofuels
(Transport)

Patterns in consumption of biofuels – including the relative proportions of bioethanol and biodiesel – have changed rapidly, in response to government policy and other external factors. Since biofuels are traded globally, there is not necessarily a correlation between production and consumption of biofuels in the UK. Locally-produced fuels made up 19 percent of UK consumption. A more favourable policy environment would enable the UK to have a significantly increased proportion of its consumption from UK production, thereby maximising the economic benefits. The Department for Transport has constituted a multi-stakeholder task force to report on options for UK renewable transport policy to 2020 and beyond, with the hope that this will enable policy to move forward after the election.

- PwC estimate that £741m was invested in the sector between 2010 – 2013, limited to 3 major projects
- In 2014, PwC state that there was no significant investment
- Over the period 2015 – 2020, PwC forecast that further investment in the sector is unlikely unless there is a commitment to meet the 10% EU target

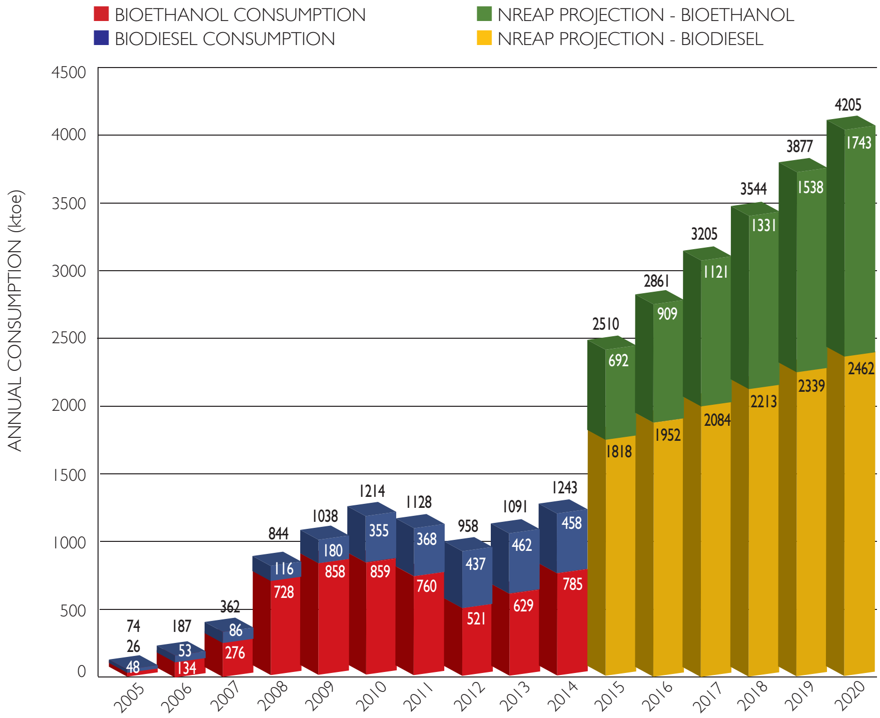
(£m, Real 2012)

LIQUID BIOFUELS CONTEXT

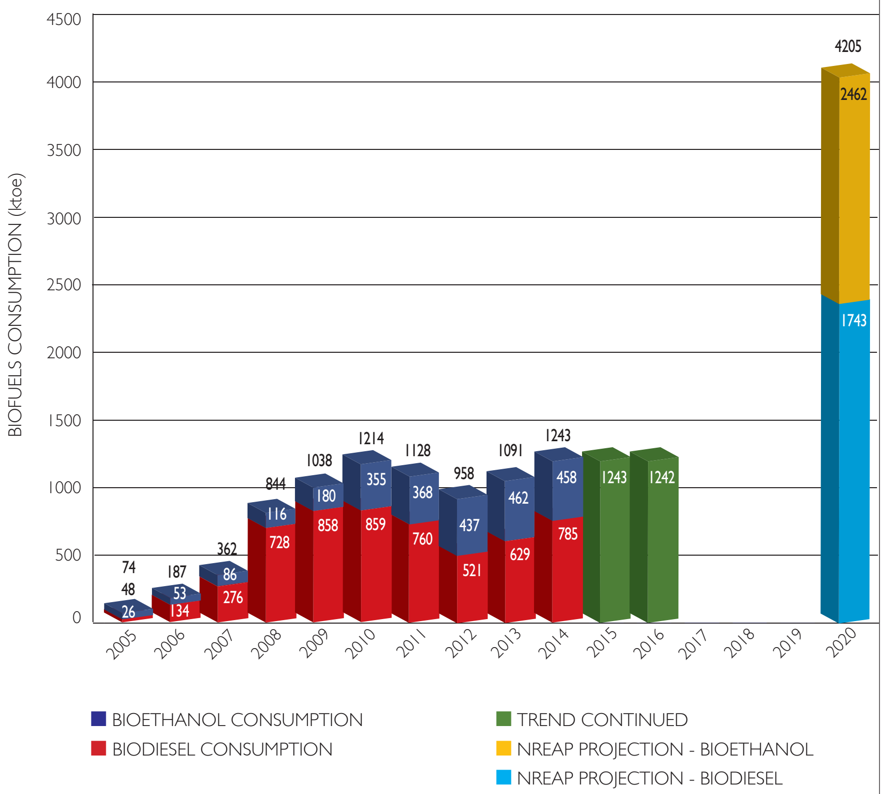
- Renewable Energy Directive imposes sector-specific requirement for 10% of energy used in land transport to be renewable by 2020. In practice this will be met by renewable liquid biofuels
- UK has not set out how it will meet target, pending EU resolution of indirect land use change, which has proven very controversial
- Biofuels are traded globally, unlike power and heat which can only be transported shorter distances. Therefore consumption in the UK is no guarantee of economic benefits to the UK. These will only occur if there is confidence in UK market and policy supporting this
- UK-produced fuels have an excellent sustainability record, significantly exceeding expectations in environmental protection and greenhouse gas savings. Average saving of fuels supplied was 70%
- UK wishes to support 'advanced' biofuels, although this will require far more supportive policy environment than at present

UK BIOETHANOL & BIODIESEL CONSUMPTION

TO DATE AND PROJECTED BY DECC



UK BIOETHANOL & BIODIESEL CONSUMPTION AND PROJECTED GROWTH



SIZE OF THE UK LIQUID BIOFUELS SECTOR

	2011 -2012	2012 -2013	2013 -2014
Sector Turnover (£'millions)	485	530	522
No. of people employed across UK supply chain	3,500	3,510	3,829
No. of UK companies across supply chain	200	200	211

JOBS IN LIQUID BIOFUELS

DESIGN AND DEVELOPMENT
Design engineer; Project manager; Economist; Electrical systems designer; Environmental engineer; Biotechnologist; Chemist; Agriculturalist; Environmental consultant; Feed-stock handling systems designer.

MANUFACTURING
Design engineer; Project manager; Welder; Sheet metal worker; Chemist; Agricultural specialist; Microbiologist; Biochemist; Electrical engineer; Mechanical engineer.

CONSTRUCTION AND INSTALLATION
Planning consultant; Environmental consultant; Project management and construction workers; Electrical engineer; Power generation engineer; Project manager; Health and safety manager; Pipefitter; Welder; Electrician; Service engineer.

FEED-STOCK PRODUCTION
Farmer; Agricultural operative; Waste operative; Civil engineer; Water engineer; Irrigation engineer; Process engineer; Chemical engineer; Electrical engineer; Field technician; Tanker driver; Warehouse manager.

OPERATIONS AND MAINTENANCE
Chemist; QC Laboratory staff; Electrical engineer; Power generation engineer; Energy trader; Boiler engineer; Pipefitter; Welder; Electrician; Service engineer; Construction worker; Electrical/electronic technician; Plant operator; Mechanic; Project manager, Fuel and ash supervisor; Labourer; Maintenance manager.

DISTRIBUTION
Distribution manager; Tanker driver; Blend operative; Forecourt operative.

Anaerobic Digestion - Biogas

(Power, Transport, Biomethane Injection, CHP)

Particular caution should be used when projecting forward on recent growth rates, as the industry is starting from a low base. Deployment correlates closely (with an 18-24 months lag) with changes in government financial incentives, such as the introduction of increased Renewables Obligation (RO) support in 2009, and uncertainty over both the RO and Feed-in Tariffs in 2012. This would suggest that significant reductions in tariffs in 2014 will have a similar impact over time. Although growth has been good, generation is still lagging behind the government's projections.

- PwC estimate that £576m was invested in the sector between 2010 – 2013
- In 2014, PwC calculate that an additional £122m was invested
- Over the period 2015 – 2020, PwC forecast a further £1,919m could be invested in the sector

(£m, Real 2012)

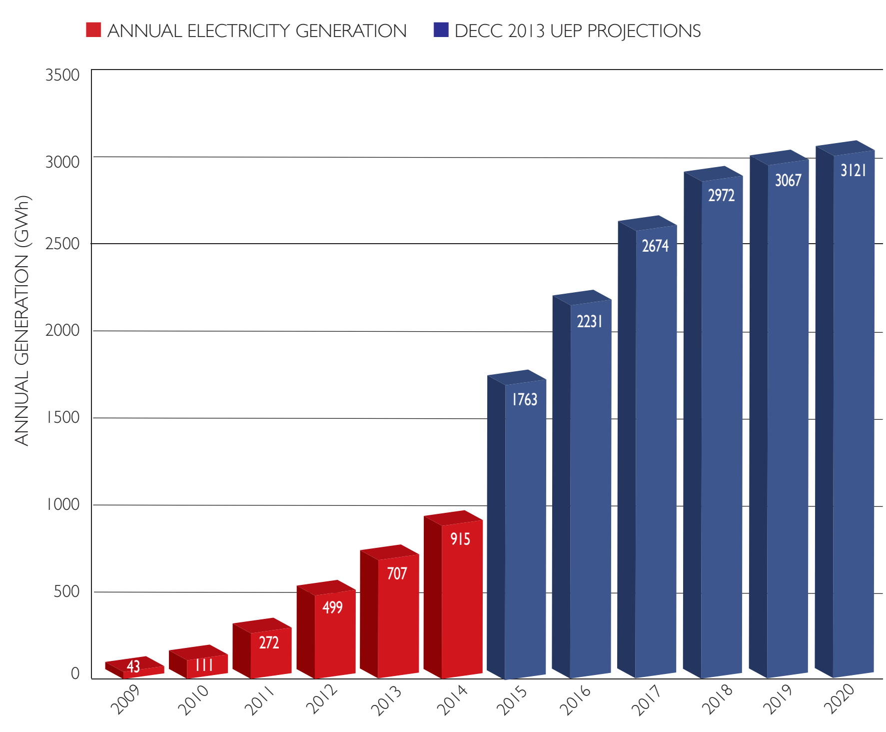
ANAEROBIC DIGESTION CONTEXT

- Unique in that eligible for all the financial incentives for power, heat and transport fuel
- Biogas can also be cleaned up and injected into the gas grid as 'biomethane'. Green Gas Certification Scheme tracks sales of the gas to support green claims by end users
- Can use food waste, animal manures and slurries, residues from food processing and crops
- Solid outputs ('digestate') can replace mineral fertiliser, providing nutrients and improving soil fertility. Biofertiliser Certification Scheme certifies digestate so farmers can be confident in quality and safety
- Feed-in-Tariff is seeing dramatic reductions in support, particularly hurting smaller-scale developers

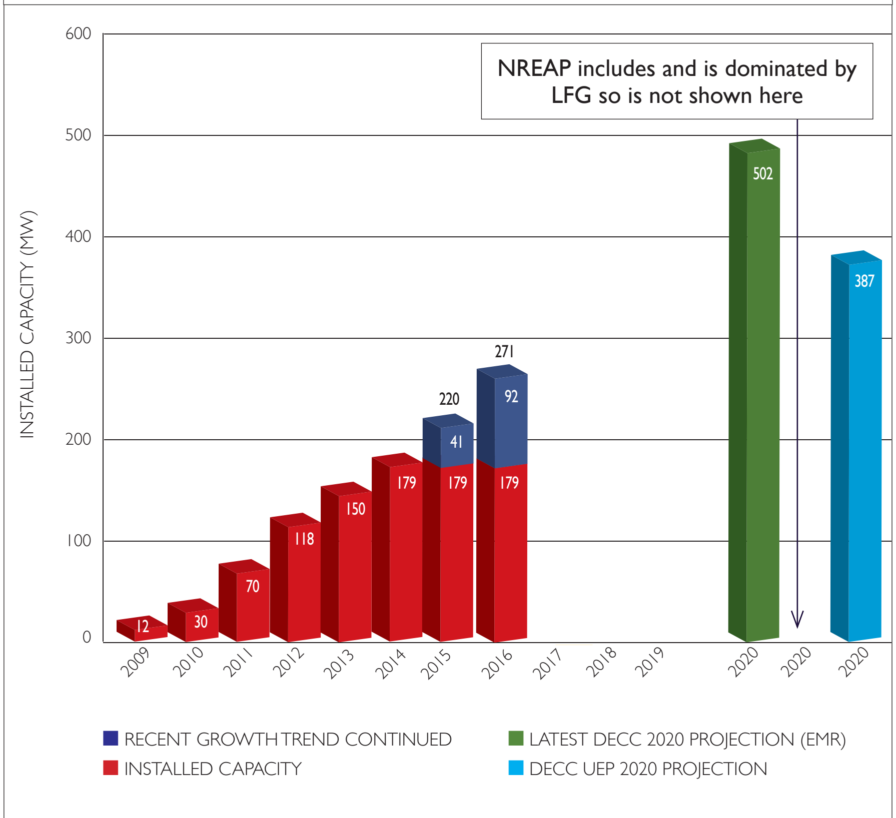
For full explanation of terms, methodology and growth projections see pages 96-97

ANAEROBIC DIGESTION ELECTRICITY GENERATION

TO DATE AND PROJECTED BY DECC



ANAEROBIC DIGESTION INSTALLED CAPACITY AND PROJECTED GROWTH TREND



SIZE OF THE UK ANAEROBIC DIGESTION SECTOR

	2011 -2012	2012 -2013	2013 -2014
Sector Turnover (£'millions)	310	360	340
No. of people employed across UK supply chain	2,650	2,640	2,828
No. of UK companies across supply chain	140	140	148

JOBS IN ANAEROBIC DIGESTION

MANUFACTURING
Design engineer; Electrical systems designer; Environmental engineer; Environmental consultant; Power generation engineer; Electrical engineer; Welder; Metal worker; Machinist; Skilled assembler; Materials engineer; Mechanical engineer; Biochemist; Biologist.

CONSTRUCTION AND INSTALLATION
Planning and environmental consultant; Project manager; Construction worker; Electrical engineer; Mechanical engineer; Laboratory technician specialising in digestion and digestates; CHP technician.

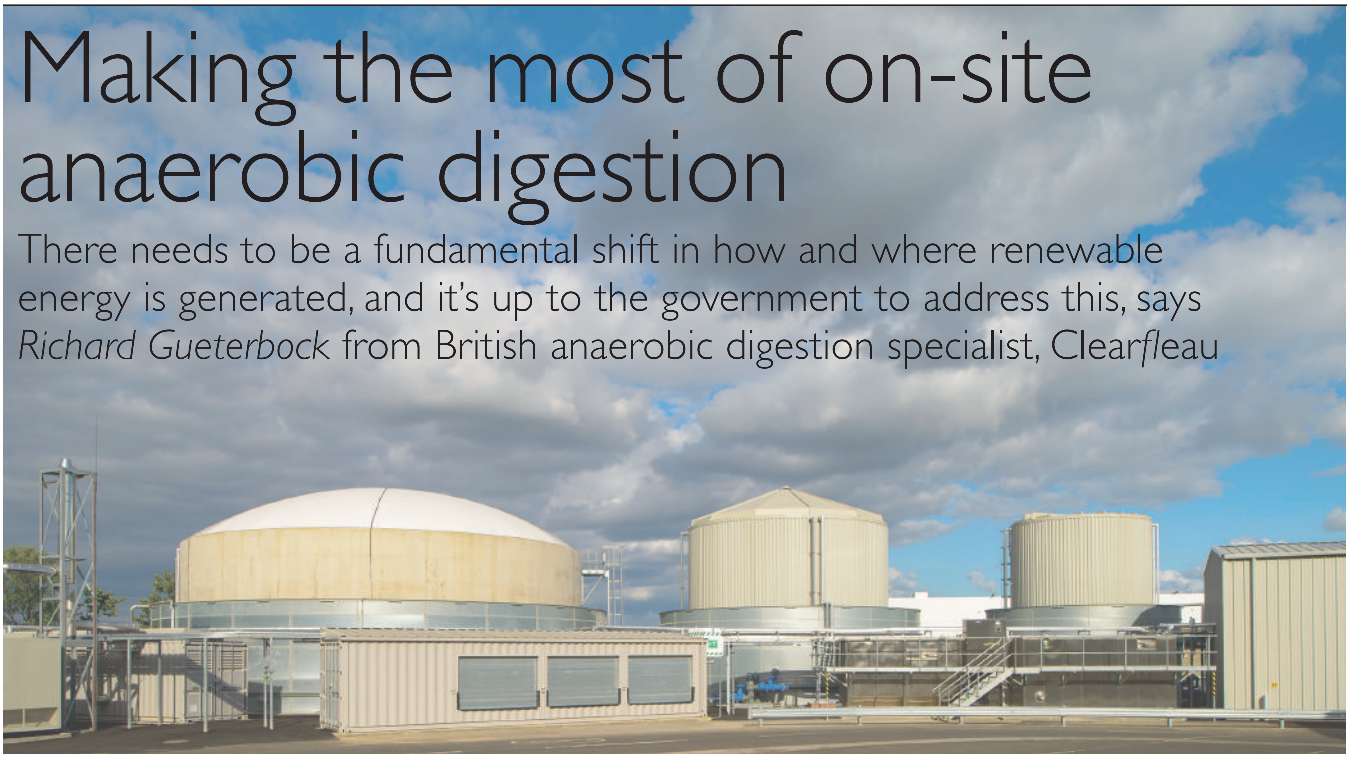
PLANT OPERATION
Waste collector; Farmer; Feedstock loader; Truck driver; Plant operator; Maintenance technician; Laboratory services; Quality assurance.

BIOGAS APPLICATIONS
Vehicle design and manufacture; Pump attendant at fuelling stations; Biomethane-injection plant construction and operation; CHP construction and operation; Digestate packaging and distribution.

Clearfleau

Making the most of on-site anaerobic digestion

There needs to be a fundamental shift in how and where renewable energy is generated, and it's up to the government to address this, says *Richard Gueterbock* from British anaerobic digestion specialist, Clearfleau



On-site anaerobic digestion (AD) can enhance the sustainability of the food and beverage sector by reducing fossil fuel use and cutting the carbon footprint on individual sites. However this opportunity has been undermined by the outgoing government's failure to deliver on its promises.

If more food industry sites were to replace energy intensive residue treatment systems with on-site digestion it would reduce the carbon footprint of our food supply. However Department of Energy and Climate Change (DECC) policy errors have restricted the development of the on-site AD sector.

The failure to support British businesses in the development of AD technology has inhibited efforts to boost decentralised renewable energy output. Three policy failings stand out:

Size is not everything Policy decisions are increasing the scale of AD plants, even though this is not always the best use of the technology. Concerns about larger merchant plants include feedstock transport and odour issues, operational effectiveness and digestate disposal.

The FIT Degression Mess The scale issue is compounded by DECC's mismanagement of the Feed-in Tariff (FIT) scheme that allows companies using the technology to be paid for the energy generated. Accelerated degression of the FIT rate for sub 500kW on-site AD plants for farms, rural communities and industrial sites has slowed the development of AD, hitting emerging British companies and restricting overall growth.

Overall Policy Inconsistency The two government departments involved – DEFRA and DECC – have contributed to policy inconsistency. For example, despite DEFRA's ethical and land use concerns about crop-based digesters, DECC has facilitated the development of this sector, with rapid degression undermining the viability of smaller manure digesters.

More can be done to encourage widespread deployment of smaller scale AD. In addition to more consistent policy, the government should encourage investment and innovation, and limit reliance on imported technology.

Suggestions for new government policies on renewable energy include:

Development of new technologies: Investment in innovative technology requires a consistent incentive regime that values decentralised energy generation at the point of use. Increased generation from new technologies and novel fuels, such as hydrogen, plus other innovation solutions will require investment and British engineering skills.

Consistent incentives for small scale: We need smaller heat or power based bio-energy systems for community, farm and industrial sites. Innovation for small scale on-site renewable energy requires better incentives to stimulate early stage investors. To match some of our EU counterparts, the UK urgently needs a sub 100kW FIT incentive for AD.

Regulatory burden on sustainability: Smaller scale generation for community, farm or factory sites, limits losses incurred in transmission and offers partial energy security. Regulators must be flexible over where plants are located and allow food residues from rural communities to be digested on farms.

Next generation of green engineers: More engineers are needed to design, build, operate and maintain renewable energy facilities, which means more training programmes focused on the renewables sector are essential. This could include a targeted apprentice scheme for renewables companies and provision for retraining engineers from other industrial sectors.

Promote the circular economy: If companies are to improve their resource utilisation embracing the circular economy, they need evidence that government ministers back this approach with more than words. By deploying its innovation and technical skills, the UK can cease to be a laggard and take the lead in developing new solutions.

The next government must back British low carbon, sustainable technologies, not only to meet carbon emissions targets, but also to create jobs and stimulate growth. There needs to be a fundamental shift in how and where renewable energy is generated, and a focus on resource optimisation as part of investment decisions across industrial sectors.

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Xergi

Pioneers of innovation

As pioneers of AD, Xergi has more than 25 years' experience working in the sector. The company's innovative approach has earned it an excellent track record building biogas plants in Europe and the USA, says *Jørgen Fink*, at Xergi

Back in the 1908s Danish farmers, engineers and inventors started to learn about anaerobic digestion (AD) the hard way from scratch. Out of this grew Xergi, created by two large industrial foundations, with the purpose of taking AD to a new level of innovation based on science, commercial strategy and strong finances.

Xergi has retained its pioneer spirit, and has a solid foundation of more than 25 years' experience working with AD, including building more than 60 biogas plants in Europe and USA.

Variety of feedstock

The Xergi plants are all individually designed and configured to meet the requirements and needs of the clients. Even though the set-up is customised, the input system retains a versatility that ensures the plant can manage changes in the availability of different types of biomasses. The Xergi plants are able to process almost any type of organic matter like animal slurry, deep litter, energy crops, vegetable waste, industrial and commercial waste as well as household waste.

Xergi has a unique feeding system, FlexFeed®, which ensures a precise feeding and flexibility. The Xergi design philosophy is to run the plants at the optimum temperature for the feedstock which can be any temperature between 37 and 52°C. The digester and agitation system is designed such that the content of the digester is fully mixed, which also reduces the risk of creating a floating layer and sedimentation. Furthermore, the design ensures a low operation cost with a minimum of energy.

- Staples Vegetables creates new value from surplus vegetables. The total capacity is 7 MW electricity, and the digestate is used as a valuable fertilizer.
- The Barkip plant digests food waste from households and supermarkets, but also industrial waste and manure.
- The Retford biogas plant is designed to digest large amounts of nitrogen rich poultry manure.

The SCADA system is a key element in Xergi's biogas plants. It is built in-house and based on many years of experience, and described as very user-friendly by customers.

Xergi plants in the UK

Xergi has delivered six operational plants in the UK, with a total power output of more than 14 MW. Two more are under construction and several more are in the planning and development stages.

The first plant was built for Staples Vegetables in Lincolnshire, and commissioned in 2010. This plant was originally constructed as a 1.4 MW plant but has since been expanded and the output is now 5 MW electricity. Furthermore, Xergi has built a new plant for Staples on a second site with 2MW output. The Staples plants mainly runs on surplus vegetables as well as maize silage.

Another Xergi plant is the Scottish and Southern Energy biogas plant at Barkip, close to Glasgow. This plant is mainly running on food waste from households, supermarkets and the like as well as industrial waste and some manure. The power output is 2.1 MW.

Xergi has also built a 0.5 MW plant for Bernard Matthews to process the waste from their turkey abattoir. Last year Xergi finished two plants for Tamar Energy, including Holbeach, a 1.5 MW plant processing potato and other vegetables wastes and maize silage, and a plant in Sutton Grange, Retford, which is at the final commissioning stage. The Retford plant with 3 MW power output includes Xergi's patented NiX®, technology which allows processing of large amounts of nitrogen rich poultry manure.

All the operating plants in the UK are combined heat and power (CHP). However, Xergi is now building biogas plants in Denmark and Sweden where the biogas is upgraded to bio-methane in order to replace the use of fossil natural gas in households, industry and vehicles.

FOR FURTHER INFORMATION

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ENER-G

How to gain finance for your on-farm AD project

For the right project, the overall return on investment on anaerobic digestion can be excellent, says *Ian Gadsby,* Managing Director of ENER-G Natural Power

New EU CAP rules for 2015, requiring greater crop diversification, are good news for farmers when it comes to ensuring bankability of anaerobic digestion (AD) schemes.

The 'greening rules' linked to payment of the new Basic Payment Scheme require some farms with more than 30 hectares (75 acres) of arable land to grow three different crops. By breaking crops with cereals, farmers can create a stable, long-term feedstock for an AD scheme, and attract higher value for that crop than would be traditionally achieved through the commodity markets.

Feeding the AD is critical

When we examine the viability of investing in AD projects without a reliable, minimum 10-year feedstock supply, the project will not stand up. Another key factor is the availability of a ready outlet for the digestate. We also seek opportunities to capture and utilise the heat output from AD, therefore qualifying for payments through the Renewable Heat Incentive (RHI).

In an era of Feed in Tariff digression and the uncertainty that surrounds this, it is increasingly important for the more marginal projects to make up any shortfall via the RHI, and the returns are highly attractive.

Accessing finance

For the right project, with heat and digestate demand and a robust feedstock pipeline, the overall return on investment on AD can be excellent. But accessing finance can be tricky, as evidenced by the high numbers of pre-accredited projects that are failing to launch.

As the AD market matures, it is essential that technology providers adjust their pricing to reflect the proven market and the government tariffs available. With ENER-G's experience of developing a total 170 MW of biogas generation projects, we are continually finding innovative new ways and economies of scale to drive costs down.

De-risking AD investment

Our wide AD experience and proven technologies gives us the confidence to provide a fully or partially funded AD model. This flexible AD ENER-G finance model is attractive to landowners and farming businesses. We offer the de-risking of projects for farmers that are not fully comfortable with investing, owning and operating their own AD facility. The flexibility of our model means we also welcome shared investment for those who want to split the benefits of the scheme directly, as well as offering to fully finance for those who want to host and supply the facility with feedstock without making any capital outlay.

Among those farms partnering with ENER-G, organic cheese maker Lye Cross Farm has agreed to a 15-year feedstock contract. This gives ENER-G the security to invest in the design, installation and operation of the complete AD facility.

This project will create renewable energy from lactose permeate and plant washings. The farm will take on responsibility for re-using the digestate – assisted by ENER-G, which is installing a system to separate solids and liquids – creating a valuable organic fertiliser from land spreading the solids. The liquid fraction will be recycled via an aeration system, with this treated water used to hydrate the farm's dairy herd.

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Clarke Energy

Maximising your CHP engine performance

There are many factors to consider when selecting a CHP engine provider to ensure high levels of equipment availability and maximise long-term revenues, says *Alex Marshall*, Group Marketing and Compliance Manager at Clarke Energy

If your biogas engine isn't operational then you are liable to be losing valuable revenues. Are you fully informed about the things you must consider when selecting your combined heat and power (CHP) engine provider? There are many different factors involved in ensuring high levels of equipment availability, and how to maximise long-term revenues.

Engine selection

There is only a small selection of gas engine brands that are designed to operate on biogas. Investigate the track record of the suppliers you are evaluating. How many engines do they have operating on biogas in the field? You must also investigate the quality of the 'balance of plant' supplied – supporting items of machinery that facilitate the CHP's performance. These include control systems, fans and radiators to dump excess heat, exhaust gas heat exchangers, dehumidifiers and gas boosters.

UK-specific regulations

UK regulations governing the installation of biogas units such as the Dangerous Substances and Explosive Atmospheres Regulations (DSEAR) are different from those in Europe. If injury results from incorrect installation of the CHP unit, you are potentially criminally liable. Select a CHP provider that understands UK regulation compliance and has in-house health and safety support.

Aftersales support

The first maintenance consideration is to understand the skill level of the CHP service engineers. Engineers need detailed understanding of mechanical and electrical engineering and engine control systems. Clarke Energy engineers are comprehensively trained on GE's Jenbacher gas engine product range and are Gas Safe certified. We are also able to offer training to third parties if requested.

Commissioning

The commissioning of the generator is an important element in ensuring your machinery is operational to your project schedule. Does your CHP supplier need to bring in specialists from the original equipment manufacturer (OEM), or do they have their own dedicated in-country resource? In addition to this consideration, are the commissioning engineers able to support with local grid synchronisation requirements such as G59 in the UK, and G10 in Ireland.

Maintenance agreements

Your CHP supplier may offer you a maintenance agreement. This is typically a good way to transfer risk from the owner of the facility to the CHP maintenance company. When you compare prices from suppliers, ask yourself if you're comparing apples with apples. Is the fee transparent or are there standing charges? If the company is providing an availability guarantee, what physical and financial substance is behind the organisation to back this up?

The cost of a maintenance agreement might include the following components:

Spare parts: This includes parts for scheduled maintenance, such as the parts that need to be changed at specific times as per manufacturers' guidelines. Also parts for non-scheduled maintenance, such as those that needed to be changed if something breaks down.

Labour: The physical resources to conduct the maintenance procedure.

Field service capabilities are important in ensuring that the intent of a maintenance contract is realised. So you need to ask how many service engineers the company has, how many consumable parts the service engineers hold in the field and their location? Are the engineers supported by remote monitoring? This enables a CHP service company to diagnose faults remotely and dispatch engineers to site if needed.

Oil: Gas engines consume significant amounts of oil to facilitate smooth operation. The oils are often highly advanced in composition tailored to the demands of a biogas engine.

Availability of parts

The CHP equipment company needs to have ready access to the required spare parts for the units. Investigate what levels of parts stockholding your CHP service company has. Also are the parts that are being supplied high quality OEM-approved components or are they lower quality non-approved spares? The latter will open you up to operational risks and expose you to lost revenues in the future.

In summary, to maximise equipment availability you need to ensure high quality components are used. This must be backed up by engineers that understand UK legislation and use a service organisation with comprehensive UK coverage, backed up by in-country parts stockholding.

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Edina

Offering incentives for energy savings

Planning an AD plant and applying for incentives like RHI is not for the faint-hearted. However, users are confident that when technology is more widely applied, the system will pay regardless of subsidy, says *Sarah Farr* of Edina

Renewable Heat Incentive (RHI) for biogas using combined heat and power (CHP) at a practical scale has been available for just over a year. It has aroused a considerable amount of enthusiasm by some, scepticism and disbelief by others and a degree of bravery by those being the first to tackle the scheme's red tape.

Although at first glance the financial reward for the installation of biomass or biogas-fuelled heating for commercial uses looks very attractive, in effect there are understandably very stringent rules to comply with, and potential loopholes that may be closed in subsequent rounds of RHI legislation.

Non-domestic RHI for commercial biomass and for biomethane injection into the grid has been available for several years. However financial support for heat use from a biogas CHP plant (referred to as biogas combustion) above 200kW thermal output has only been available since December 2013, and anaerobic digestion (AD) plants commissioned before this date are ineligible.

The RHI for biogas CHP is supported in three band rates, depending on the total heat recovered from the CHP installation. Below 200kW thermal the rate is 7.5p/kWh, between 200kW and 600kW the rate is 5.9p/kWh, and above 600kW the rate is 2.2p/kWh.

Useful applications

This has prompted serious consideration and implementation of schemes that give more thought to capturing heat and using it, and that makes possible greater advances in the research and development of drying digestate following the anaerobic digestion process. This then lends itself to further uses such as animal bedding, or fuel itself as pellet form, as well as reducing volume for land spreading. Another useful application is steam generation for use in maltings, or food processing industries. Also drying wood and grain is viable and is currently under final development stages on several sites.

As the first few projects receive accreditation, it is apparent that misleading information on the requirements of the scheme is commonplace and can have serious financial implications for those investing their time and money. One such example is the confusion regarding the heat meters. It is clear that a heat meter must measure the amount of heat that is used to attract the RHI payment.

What was not in the guidelines but is covered by law is that a separate meter or system is required to measure 'non-eligible' heat use. Without these two readings the payment will not be made. Even investors using professional companies to help with the paperwork can suffer, as Ofgem use a queuing date system for answering emails/queries rather than assigning cases on an individual basis. This has also been a frequent complaint from those seeking Feed-in Tariff (FIT) accreditation.

Strathendrick Biogas

One of the first projects with a CHP system from Edina to achieve RHI accreditation is Strathendrick Biogas. The plant has feedstock for the AD process on its doorstep from dairy farm cow slurry, distiller's draff and pot ale syrup from local whisky distilleries, and some grass silage. This produces enough biogas to fuel an engine from Edina, the TCG2016V12 model from MWM which has an output of 500 kWe and 500 kWth. The electricity powers the farm and plant with surplus exported to the grid, attracting the FIT. The heat from the engine is sufficient to heat the water for the dryer and to warm the tank, enabling a more efficient AD process.

The dryer is a NEWtainer from NEWeco-tec GmbH and is multi-purpose, potentially drying grain, wood or other materials; however Strathendrick Biogas uses it purely for drying digestate. Strathendrick Biogas uses all the waste from the farm, stores a proportion of the dry digestate for six months which means little odour is emitted when it is used as fertiliser, and the remainder of the digestate is suitable for cattle bedding. So far it has received a very favourable response from the farmer trialling it, who finds that it is absorbent, minimises odour and is more economic than purchasing and transporting straw. The RHI is paid on this aspect of the operation only.

The equipment was a sizeable investment and proceeding with the digestate drying would have been barely viable at this juncture without the RHI. Users are confident, however, that once the technology is more widely applied and demonstrably successful, the system will pay regardless of subsidy and over a shorter period of time.

Planning an AD plant and applying for the appropriate incentives is still not for the faint-hearted, and the seemingly inevitable delays make a good dialogue with your lender absolutely essential. For latest policy updates and advice contact the REA, ADBA, and The ADE.

FOR FURTHER INFORMATION
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The long and winding road

The Renewable Heat Incentive (RHI) isn't perfect, but the renewable energy sector has plenty of growth potential and there are many ways in which the policy could be improved under the new government

Sometimes it's easy to get so lost in day-to-day concerns that you forget how far you've already come. Here we are with a Renewable Heat Incentive (RHI) that is strongly stimulating the market and, at the same time, living with a complex bundle of hopes and fears of how it might change in future.

But step back a few years and all the talk from REA members was of disappointment and stoic attempts to hang on in the hope that things would improve. It had been such a long road since 2008, when the REA led the campaign to get the legal powers for the RHI, with so many struggles and delays along the way. Last year, plenty of people doubted the domestic scheme would ever happen, even when the regulations had been approved by Parliament. We fielded plenty of press calls asking if this was going to be 'another green deal'.

Cost control

Since 2011 we've had several tariffs added, while existing tariffs have been increased, reduced or restructured. We have air quality rules for biomass boilers, and binding sustainability criteria for all bioenergy will finally be introduced in October 2015. We've also seen a cost control mechanism introduced, which reduces tariffs for technologies deploying faster than intended.

Some technologies have done extremely well. Biomass boilers have deployed strongly, particularly at the smaller scale, and have also flourished in the domestic RHI. Biomethane is the other big success, creating a thriving UK industry from scratch. This brings in the cost control mechanism, and the risk that tariffs will end up being cut too far. As we've seen elsewhere, the first thing everyone does when they think a cut is imminent is to redouble their efforts to sell as much as they can as quickly as they can, and let tomorrow look after itself.

Other technologies have the opposite problem – all other technologies combined make up less than five percent of the RHI. The most obvious under-performance here is with heat pumps, which the Department of Energy and Climate Change (DECC) has always anticipated would have a major role to play.

There's a real danger that this leads to taking sides and partisans of one technology talking the other down. On a bad day, the renewables industry can resemble Monty Python's People's Liberation Front of Judea. Perhaps this is part of the journey from being a maverick lifestyle choice to a mainstream one.

2020 targets

Quite apart from the fact that we're not going to impress anyone by squabbling amongst ourselves, whether it's the media, politicians or our customers, there's another pressing reason to make common cause - we're going to need a major contribution from all the viable options in the years ahead.

Based on March 2015 data, the UK has furthest to go to hit its 2020 targets of any EU member state. We need a growth rate greater than 16 per cent across all renewables. As we report elsewhere, renewable electricity is on course, but transport has been deliberately neglected for six years and counting. On renewable heat, the government estimated we need around 12 per cent of heat in 2020 to be renewable. The most recent data available – 2013, admittedly – put us on 2.8 per cent.

It bears repeating that, although people talk a lot about electricity (and sometimes use the words 'energy' and 'electricity' interchangeably), the amount of energy involved in the power sector is far less than for heat. Heat accounts for just under half of both the UK's energy demand and greenhouse gas emissions, so it's pretty obvious we need to tackle it.

What next

There's a number of supporting measures that can and should be put in place now and in the longer term. Built environment policy has been a lot weaker than it should have been, and there's a general need across the sectors to send a stronger, more consistent signal on carbon prices. For now though,

these are just that – supporting measures. The big question is what happens next for the RHI?

Unlike the electricity policies, the RHI is paid for directly out of taxation. Overall this is a big plus, imagine the headlines if RHI participants were responsible for putting everyone else's heating bills up. The downside is that our fate now rests on the outcome of the secret negotiations over UK spending as a whole that will go on after the election.

Although supportive in principle, all the main parties have been nervous about tying themselves down. They all presumably have teams of people at party headquarters ready to pounce on any 'unfunded spending commitments' from the other side. We have to hope that the more measured conversations can resume afterwards and that, whatever it is, it produces a government confident enough to plan spending four years ahead rather than horse-trading its way through, one deal at a time.

Value for money

There's a very strong story to tell. The RHI isn't perfect, but would that every new government policy were as successful. There's plenty more growth to be had in the sector, and many ways in which the policy could be further improved. The industry is going to have to be mature in what it asks for, as well as getting its own house in order in terms of safety, quality and customer service.

Most importantly, the RHI is already very good value for money and should get better. It compares favourably in subsidy terms with much of large-scale power, and at the cheaper end we want as much as we can get of renewable energy that only needs 2p/kWh to make it happen. Given that money will be tight whoever's in government, we need to make sure that every penny of subsidy achieves as much as possible, and that the industry takes the lead in weaning itself off those subsidies as far and as fast as possible. Then we really will be here for good.

Biomass Boilers & Wood Stoves
(Heat)

- Following the introduction of the RHI in April 2014, investment is expected to continue to grow with the sector seeing a large rise in deployment in both the domestic and non-domestic markets

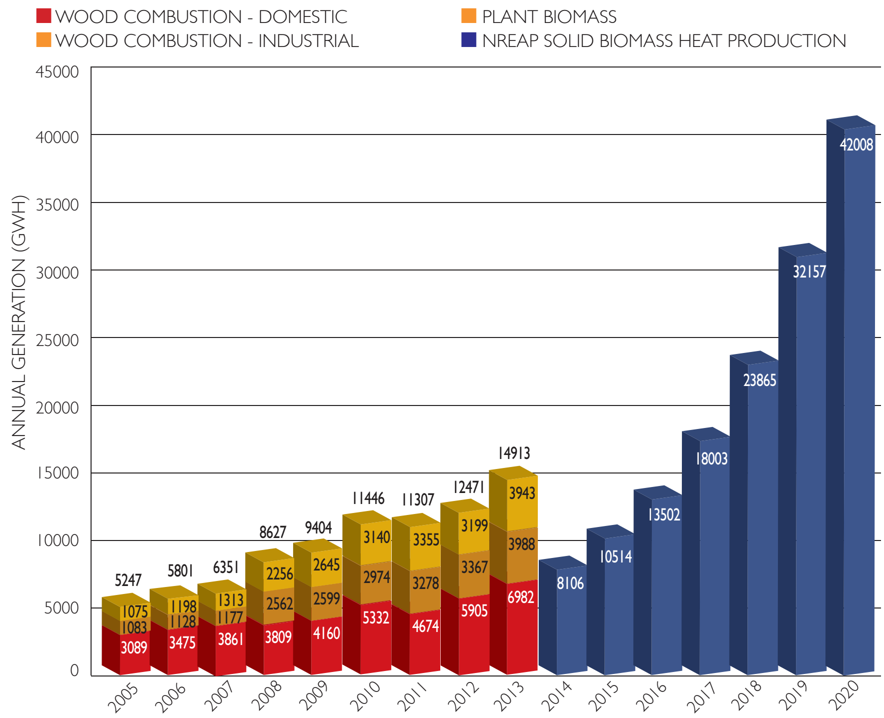
The published data is of limited value for understanding the current market as it dates from 2013. Although the Renewable Heat Incentive (RHI) had a slow start, it is now showing significant growth and there is no reason to believe this cannot continue if the policy remains supportive. It is also worth noting that this is already a highly cost effective technology, with further cost reductions possible as the UK supply chain matures.

BIOMASS BOILERS & WOOD STOVES CONTEXT

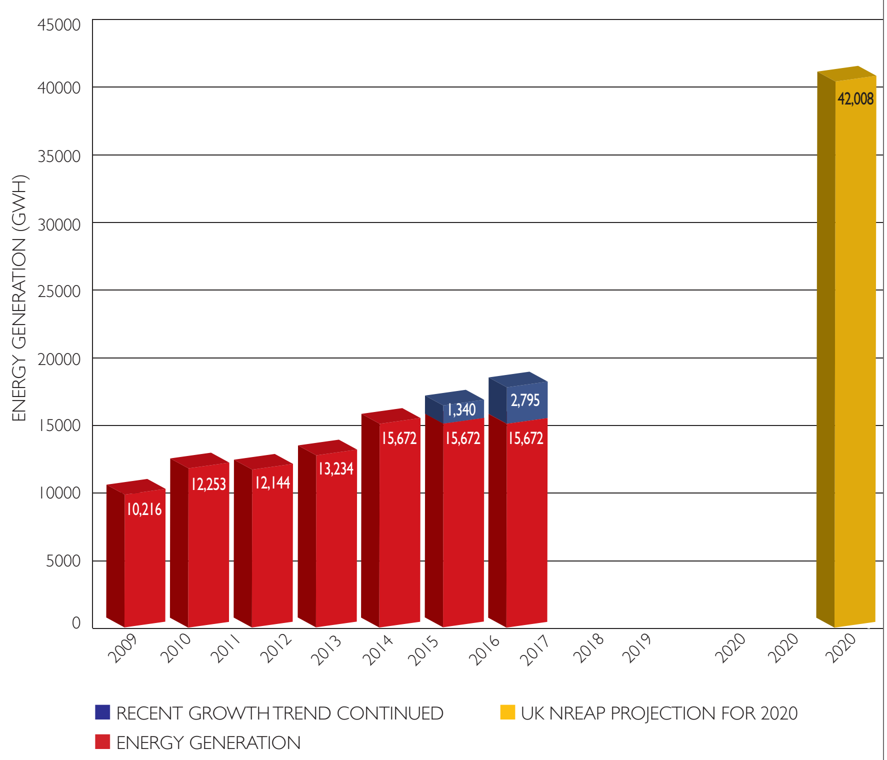
- Wood stoves already popular without subsidy, particularly off gas grid
- Very strong take up in Renewable Heat Incentive, particularly in the sub 200kWth market
- Stringent air quality controls introduced in September 2013
- Sustainability criteria to be introduced October 2015

BIOMASS BOILERS HEAT GENERATION

TO DATE AND PROJECTED BY DECC (NREAP)



BIOMASS HEAT GENERATION AND PROJECTED GROWTH TREND



SIZE OF THE UK BIOMASS BOILERS SECTOR

	2011 -2012	2012 -2013	2013 -2014
Sector Turnover (£'millions)	540	600	684
No. of people employed across UK supply chain	4,530	4,510	5,379
No. of UK companies across supply chain	210	210	244

JOBS IN BIOMASS BOILERS

MANUFACTURING

Design engineer; Boiler maker; Welder; Electrical engineer; Chemist; Agricultural specialist; Microbiologist; Biochemist, Building services engineer, Electrical engineer, Mechanical engineer; Quality assurance.

INSTALLATION AND MAINTENANCE

Project manager; Electrical engineer; Boiler engineer; Pipefitter; Welder; Electrician; Heating engineer; Service engineer; Construction worker; Electrical/electronic technician; Plant operator; Mechanic, Project manager, Technical sales manager; Service engineer; Chimney sweep.

Heating the NHS with biomass technology

The installation of a biomass boiler into the brand new £40 million NHS mental health facility in Blackpool has helped deliver a sustainable and low carbon building with a long lifespan, says *Paul Clark*, Managing Director at Rural Energy

Lancashire Care NHS Foundation Trust has chosen biomass technology supplied by Rural Energy to heat its new £40 million mental health facility, The Harbour in Blackpool.

The new biomass boiler has helped The Harbour project meet the high standards set by Building Research Establishment Environmental Assessment Methodology (BREEAM) to deliver a sustainable and low carbon building with a long lifespan. In addition, the Herz BioFire 600kW boiler will greatly reduce the facility's energy bills while also providing a significant income from the government's Renewable Heat Incentive (RHI) scheme.

This design and development process was led by principal contractor Integrated Health Projects (IHP), a joint venture between Sir Robert McAlpine and VINCI Construction UK.

Advice and guidance

In alignment with the Trust's commitment to using low carbon technologies, Rural Energy has worked closely with NG Bailey, the mechanical and electrical (M&E) contractor on this project, to understand the Trust's scope and expectations. Providing expert advice and guidance since the beginning of the project, Rural Energy specified a bespoke biomass solution that included a Herz BioFire 600kW biomass boiler and a giant underground fuel store for the state-of-the-art facility.

In partnership with NG Bailey and Glosfume, the installation began in February 2014 and incorporates the largest fuel feed and store that Rural Energy has ever installed. The massive 157 square metre fuel store was specified as part of a complicated design process and will reduce the number of fuel deliveries needed, but more importantly, will also reduce potential disruption to residents of the facility.

The installation was further supported by filtration specialists Glosfume, who provided an advanced ceramic filtration system. Nigel Black, Technical Director at Glosfume, said

"The ceramic filtration system is extremely effective and will remove the particulates from the boiler emissions down to a level comparable with a gas boiler and improve the air quality of the surrounding area."

The Harbour, which has 154 bedrooms, is one of the largest facilities of its type in the North West and will provide high quality inpatient care to those recovering from mental health issues.

Bespoke renewable solution

Paul Clark, Managing Director at Rural Energy, said "This was a challenging project with tight timescales and significant space limitations on site but we are delighted with the finished result. Rural Energy has been involved with this project for a number of years, providing technical and logistical advice since the public consultation stage. We have journeyed with the Trust and provided a bespoke renewable solution that will provide low-cost heating long into the future."

David Hughes, Project Engineer at NG Bailey said "The project involved an incredible amount of upfront planning with regular design reviews, so it's great to see the work complete with the facility receiving its first delivery of wood chip just recently."

Both the physical size of the biomass plant and the layout of the site required expert planning from Rural Energy and its partners. The design of the fuel store was particularly complex with the three five-metre filling screws installed at a low level to fully utilise the storage space in the bunker for wood chip.

Alistair Rose, Project Director at Lancashire Care NHS Foundation Trust, said: "Finding the right renewable energy solution for this project was absolutely key. The highly cost-effective heating solution and the requirement to reduce fuel delivery frequencies and costs by using the largest vehicles possible, influenced the layout of the whole site and the location of the energy centre relative to the site circulation road. As a result, the details and benefits of the heating solution had to be understood at a very early design stage for the whole project to support and influence the project architects."

With over 12 years at the leading edge of biomass technology, Rural Energy is one of the UK's most experienced biomass distributors and installers, and is the sole UK supplier of the Austrian Herz brand of boiler. Rural Energy offers a full turnkey service from survey and design, through to installation and on-going maintenance.

Rural Energy
INSTALLING BIOMASS SINCE 2002

FOR FURTHER INFORMATION
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Email: info@ruralenergy.co.uk
www.ruralenergy.co.uk

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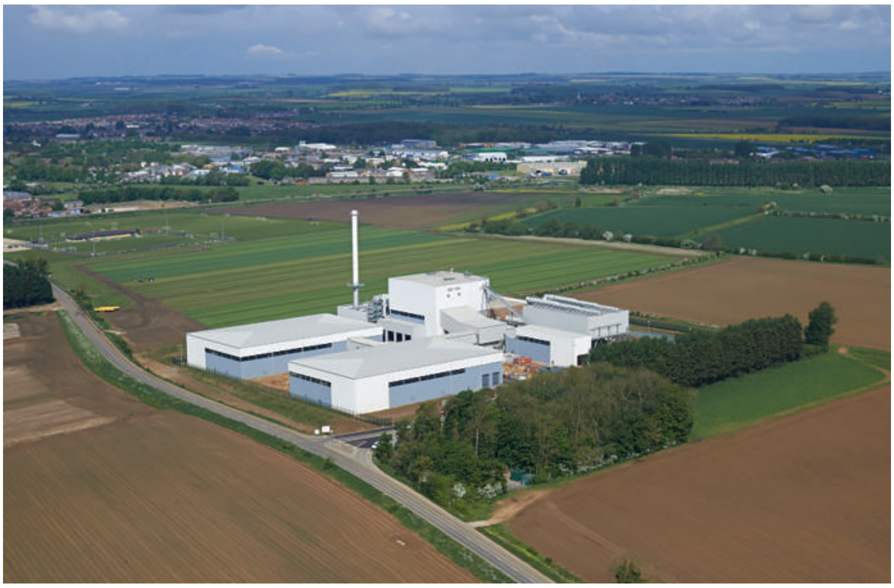
Biomass CHP

(Heat & Power)

For full explanation of terms, methodology and growth projections see pages 96-97



SIZE OF THE UK BIOMASS CHP SECTOR

	2011 -2012	2012 -2013	2013 -2014
Sector Turnover (£'millions)	331	370	356
No. of people employed across UK supply chain	2,190	2,180	2,389
No. of UK companies across supply chain	140	140	146

Combined heat and power (CHP) projects have generally been seen as electricity-led. They are therefore sensitive to the policy environment on power-only projects and tend to be more challenging to develop. As well as the straightforward costs there is the added need to ensure a long-term heat customer, both for direct income and to guarantee enhanced levels of Government support. The RHI has introduced a special tariff for CHP, which may be effective if there is sufficient policy stability.

BIOMASS CHP CONTEXT

- Combined Heat and Power can have significant energy savings compared to generating heat and power separately
- Financial support linked to demonstrating those savings, which can often be very complex
- Finding a customer for the heat is a big challenge – not just initially but for the lifetime of the project. Although eligible for Contracts for Difference, deployment unlikely to occur until this issue is addressed
- New tariff for Renewable Heat Incentive may prove effective

JOBS IN BIOMASS CHP

DESIGN AND DEVELOPMENT

Design engineer; Project manager; Materials engineer; Electrical systems designer; Mechanical engineer; Environmental engineer; Environmental consultant; Fuel handling systems designer; Heat network design engineer.

MANUFACTURING

Design engineer; Project manager; Welder; Labourer; Sheet metal worker; Chemist; Electrical engineer, Mechanical Engineer.

CONSTRUCTION AND INSTALLATION

Planning consultant; Rigger; Environmental consultant; Project management and construction workers; Electrical engineer; Power generation engineer; Heat network specialists; Health and Safety manager; Pipefitter; Welder; Electrician.

OPERATIONS AND MAINTENANCE

Agricultural specialist; Microbiologist; Biochemist; Fuel sourcing manager and negotiator; Electrical engineer; Power generation engineer; Heating engineer; Energy trader; Boiler engineer; Welder; Electrician; Service engineer; Electrical/electronic technician; Plant operator; Mechanic; Fuel and ash supervisor; Labourer; Maintenance manager.

Sweden's hottest biomass boilers – the perfect solution

Värmebaronen is the hottest thing to come out of Sweden since Abba, says *Romaine Furmston-Evans* from AC Gold

At AC Gold we have been getting more and more enquiries from domestic customers for biomass installation. As there was very little help for consumers, pre dRHI, affording the good quality but pricey products was challenging. This led us to search for a good quality and affordable solution. There were some cheap boilers available in the UK market, but none of them seemed up to the job. We didn't want to give our customers inferior products, regardless of price point. It was a saving we felt was not worth making as it came at too high of a price later on. Inefficiency, unreliability, flimsiness – and the list goes on – are all things that cause both the installer and the end user heartache and unnecessary expense. So we cast our net further afield to Sweden. Here we met Värmebaronen, an established and respected boiler manufacturer. The company was producing exactly what we were looking for in its pristine factory in Österslöv, a versatile range of reliable, good quality, well-engineered, efficient boilers, with outputs and designs aimed specifically at domestic use.

Biomass installation

Bringing Värmebaronen to market

AC Gold's background is in product installation and as such we have plenty of experience dealing with all types of suppliers. So we were perfectly positioned to bring Värmebaronen to the UK. We knew the market, knew our customers, and knew what they needed. We looked at all the things we wanted from a good supplier, and what training, technical support and customer service was required, and knew that we had everything it took to provide all of these services, along with world class boilers.

Swedish engineering at its best

Värmebaronen boilers define Swedish engineering at its pinnacle. There is a part for everything but nothing superfluous. The simple design means they are easy to clean, which helps maintain the 93 per cent efficiency, even between services. They are quick and easy to install and just as easy to service. With the clip-off pellet burner you can have a spare one ready to go, which means no down time for your customer while doing services or repairs. It can also be attached to the front of the log boilers to convert to pellet burning – it's the quickest, simplest, cheapest and least space consuming way of adapting a log boiler to pellets. There are few consumable parts, which mean low long term running costs for the customer – another great selling point. They have been designed to be user-friendly for both installers and end users, meaning everyone's a winner.


Vedolux log boilers

Current biomass market

With the RHI tariffs nose diving at an alarming rate, the need for affordable but reliable products is increasing. Our installer network is growing daily as installers realise the real benefits of the range. Because they are so simple to install, labour costs come down as well as the actual products being price competitive. This makes a real difference in terms of winning jobs and turning them over quickly. AC Gold is passionate about the importance of biomass in the industry's future, and knows this involves the efforts of more than one company. For this reason we are keen to empower other installers with the right products, training and support to help grow the industry as a whole. In a lot of respects we are all only as good as each other's reputation. If biomass gets a bad name with consumers then we all suffer – good and bad alike. AC Gold aims to be one of the driving forces behind biomass perfection.

FOR FURTHER INFORMATION
Tel: 01786 849 099
Email: Varmebaronen@acgoldenergy.co.uk
www.varmebaronen.org

Biomass Power

(Power)

Biomass power usually involves a small number of relatively large projects, so projecting future deployment from historic patterns is less meaningful. Significant expansion beyond conversion of existing coal powered stations is unlikely in the current policy environment. This is likely to be a significant missed opportunity for 2020 targets and longer-term carbon reductions as it is highly cost-effective. Given high load factors for bioenergy technologies, the actual generation is far greater than for an equivalent amount of installed capacity from wind or solar photovoltaics (PV).

- PwC estimate that £4,462m was invested in the sector between 2010 – 2013
- In 2014, PwC calculate that an additional £689m was invested
- Over the period 2015 – 2020, PwC forecast a further £3,416m could be invested in the sector

(£m, Real 2012)

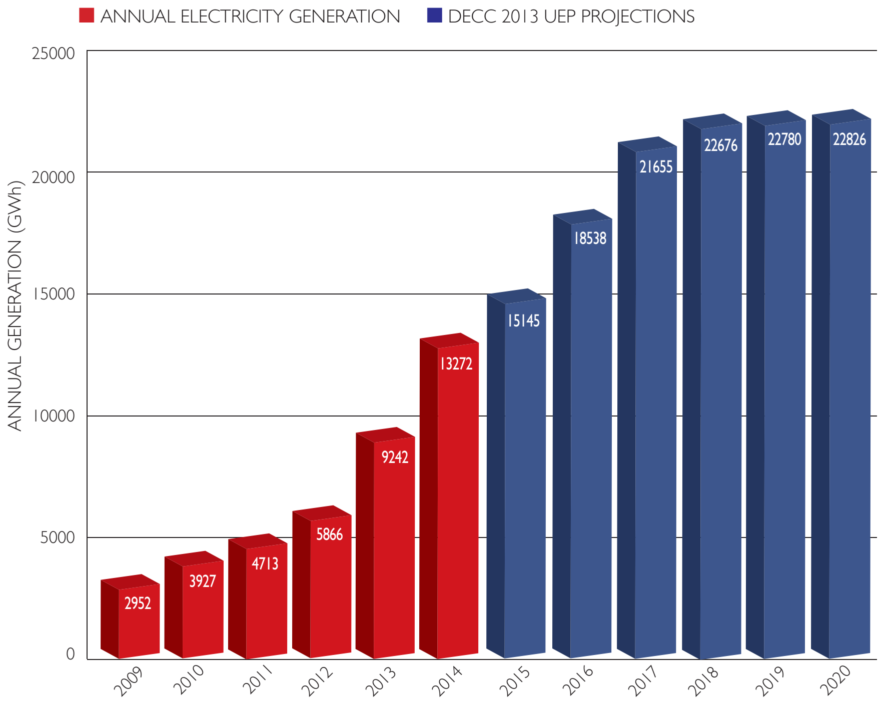
BIOMASS POWER CONTEXT

- Wide range of applications from small scale to conversions of existing coal-fired power stations
- Cost-effective compared to other options. Like other bioenergy technologies, provides power that can be delivered when needed – complementing technologies such as wind and solar
- Coal conversions supported by current policy, but Government has turned against stand-alone new projects. Support capped in the Renewables Obligation and not included at all in Contracts for Difference. Deployment likely to be far below potential in medium term
- Sustainability regulations to be introduced in October 2015. Many details still to be resolved, but should provide independent assurance to the public

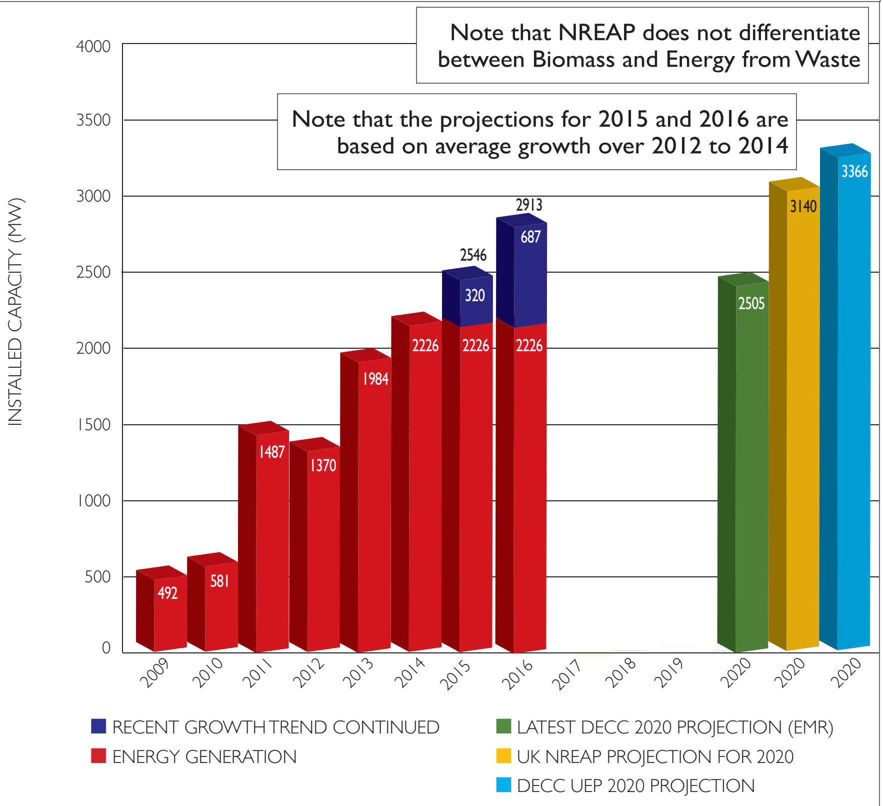
For full explanation of terms, methodology and growth projections see pages 96-97

BIOMASS POWER ELECTRICITY GENERATION

TO DATE AND PROJECTED BY DECC



BIOMASS POWER INSTALLED CAPACITY AND PROJECTED GROWTH TREND



SIZE OF THE UK BIOMASS POWER SECTOR

	2011 -2012	2012 -2013	2013 -2014
Sector Turnover (£'millions)	450	500	546
No. of people employed across UK supply chain	3,330	3,320	3,830
No. of UK companies across supply chain	170	170	187

JOBS IN BIOMASS POWER

DESIGN AND DEVELOPMENT
Design engineer; Project manager; Materials engineer; Electrical systems designer; Mechanical engineer; Environmental engineer; Environmental consultant; Fuel handling systems designer.

MANUFACTURING
Design engineer; Project manager; Welder; Labourer; Sheet metal worker; Chemist; Electrical engineer, Mechanical engineer.

CONSTRUCTION AND INSTALLATION
Planning consultant; Rigger; Environmental consultant; Project management and construction workers; Electrical engineer; Power generation engineer; Health and safety manager; Pipefitter; Welder; Electrician.

OPERATIONS AND MAINTENANCE
Agricultural specialist; Microbiologist; Biochemist; Fuel sourcing manager and negotiator; Electrical engineer; Power generation engineer; Energy trader; Boiler engineer; Welder; Electrician; Service engineer; Electrical/electronic technician; Plant operator; Mechanic; Fuel and ash supervisor; Labourer; Maintenance manager.

Deep Geothermal
(Heat & Power)

The graphs tell their own story. Commercial deployment for power is unlikely in the current policy environment. There are opportunities in the short to medium term for heat. These are dependent on relatively large heat loads such as industrial users or district heating schemes. The latter is particularly relevant, as both district heating and deep geothermal have high upfront costs but last a long time once built.

- PwC estimate that £576m was invested in the sector between 2010 – 2013
- In 2014, PwC calculate that an additional £120m was invested
- Over the period 2015 – 2020, PwC forecast a further 1,900m could be invested in the sector

(£m, Real 2012)

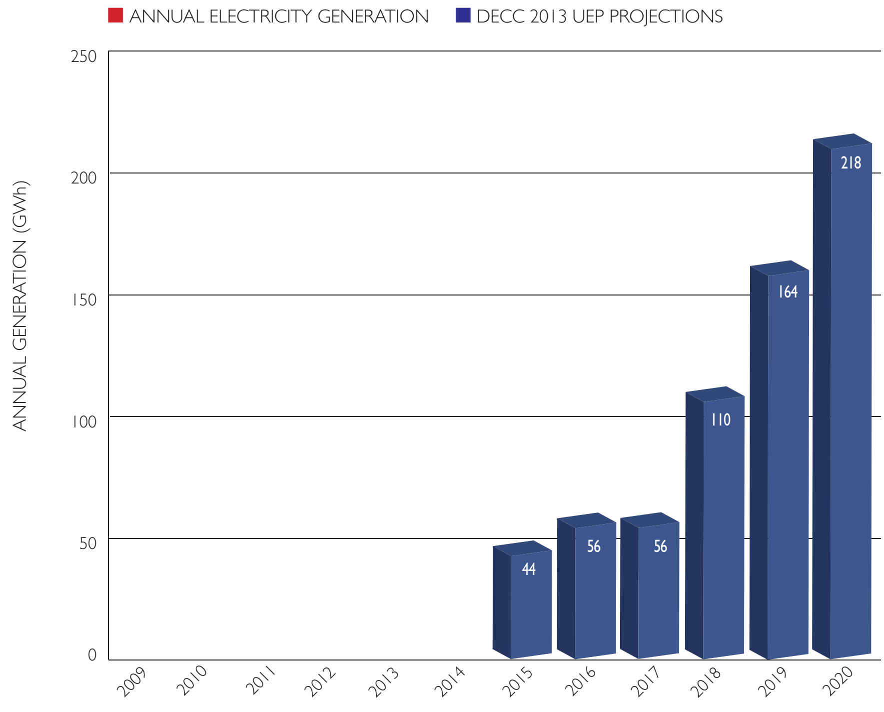
DEEP GEOTHERMAL CONTEXT

- Very limited experience in UK, although more widely used elsewhere in Europe
- Easier to deploy for heat only as electricity generation requires higher grade heat. Several projects being developed for heat, but deployment for power generation unlikely before 2020
- May be caught up with fracking in public and political perceptions

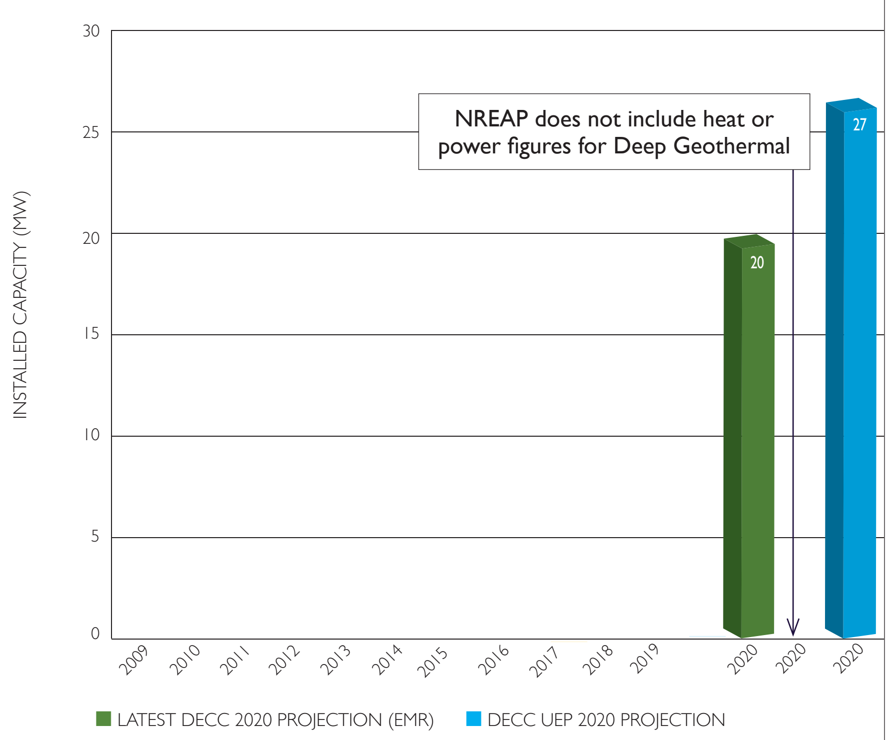
For full explanation of terms, methodology and growth projections see pages 96-97

DEEP GEOTHERMAL ELECTRICITY GENERATION

TO DATE AND PROJECTED BY DECC



DEEP GEOTHERMAL INSTALLED POWER CAPACITY AND PROJECTED GROWTH



SIZE OF THE UK DEEP GEOTHERMAL SECTOR

	2011 -2012	2012 -2013	2013 -2014
Sector Turnover (£'millions)	10	10	10
No. of people employed across UK supply chain	200	200	200
No. of UK companies across supply chain	<25	<25	<25

JOBS IN DEEP GEOTHERMAL

MANUFACTURE
Design engineer; Electrical engineer; Welder; Metal worker; Machinist; Skilled assembler; Test technician; Chemical engineer; Materials engineer; Mechanical engineer.

SCHEME DESIGN AND DEVELOPMENT
Project manager; Planner; Lawyer; Financial planner; Economist; Electrical systems designer; Physical engineer; Reservoir specialists; Geologist; Environmental engineer; Environmental consultant; Drilling engineer; Pump designer; Programmer; Modeller; Communications; Academic staff.

CONSTRUCTION AND INSTALLATION
Project manager; Construction workers; Drilling manager; Geologist; Drilling crew; Hydro geologist; Electrical engineer; Geophysicist; Power generation engineer; Drilling services manager; Drilling services staff; Generator engineer; Pump installer; Health and safety manager.

OPERATIONS AND MAINTENANCE
Heat and electrical engineer; Power generation engineer; Geologist; Hydro geologist; Academic staff; Service engineer.

Heat Pumps

(Air, Water & Ground Source Heat)

Not all the output from heat pumps is counted as renewable. Since they require electricity to operate, the Renewable Energy Directive essentially nets off this input electricity. This explains the reference to 'renewable heat' in the accompanying graphs and the reason these do not match the gross output figures used in the RHI. Recent deployment is a long way behind that originally envisaged for 2020. Although heat pumps have undoubtedly been held back by limitations in the RHI, it is questionable whether these ambitions are realistic – the RHI has certainly reduced its medium-term expectations for ground source heat pumps.

- PwC estimate that £187m was invested in the sector between 2010 – 2012
- In 2013, PwC calculate that an additional £70m was invested
- Over the period 2014 – 2020, PwC forecast a further £2,239m could be invested in the sector

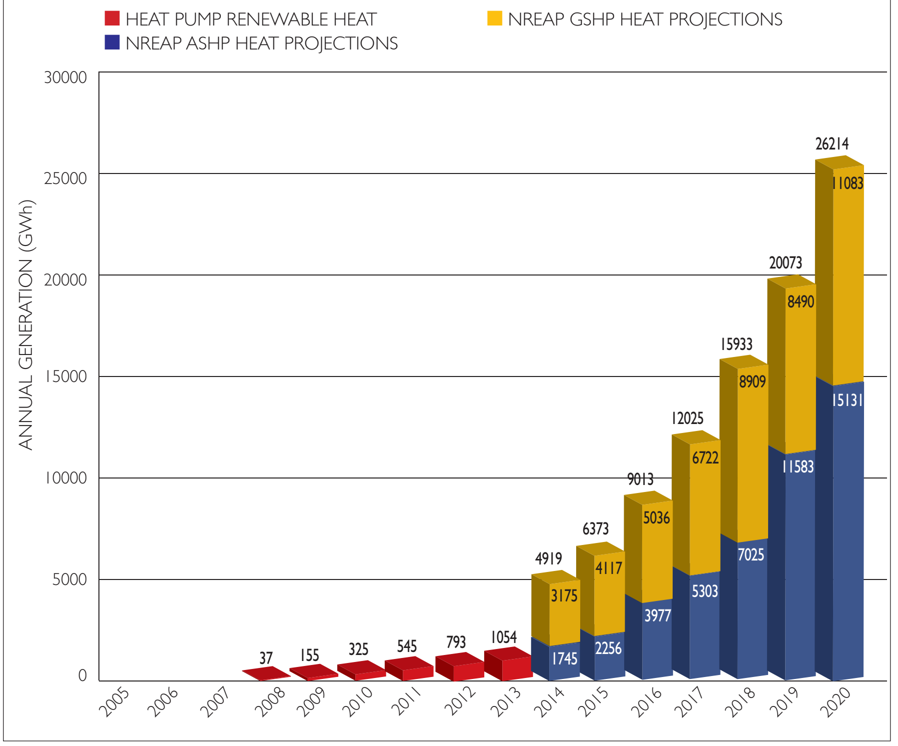
(£m, Real 2012)

HEAT PUMPS CONTEXT

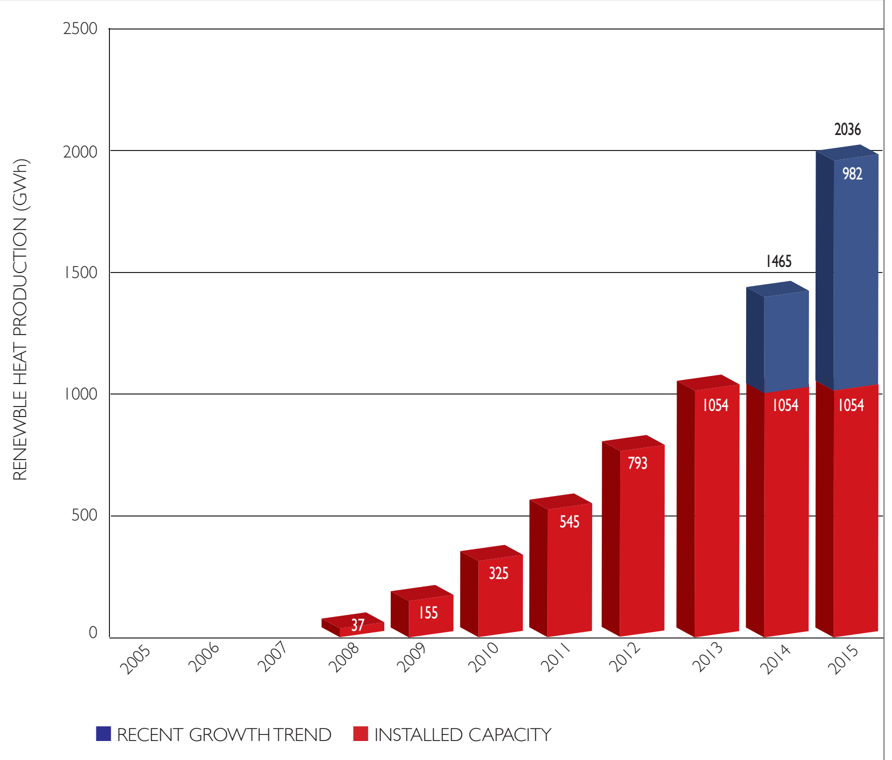
- Low deployment in Renewable Heat Incentive to date, with changes made in 2014 yet to show much improvement. Some deployment in domestic sector, although new build is excluded
- Some deployment to date, driven by policies to reduce costs and carbon emissions in buildings
- Installation requires sophisticated understanding of heat demands of building and existing heating systems. Without this, consumer electricity bills and GHG emissions will be far higher than expected.
- Renewable Energy Consumer Code and Microgeneration Certification Scheme working to ensure good practice in installers and equipment. Critical to long-term reputation

HEAT PUMPS GENERATION

TO DATE AND PROJECTED BY DECC (NREAP)



HEAT PUMPS - HEAT PRODUCTION AND PROJECTED GROWTH TRENDS



SIZE OF THE UK HEAT PUMPS SECTOR

	2011 -2012	2012 -2013	2013 -2014
Sector Turnover (£'millions)	935	1,060	1,097
No. of people employed across UK supply chain	7,320	7,340	8,315
No. of UK companies across supply chain	380	380	417

JOBS IN HEAT PUMPS

MANUFACTURE AND DESIGN

Design engineer; Heat pump engineer; Electrical engineer; Skilled and semi-skilled assembler; Welder; Machinist; Metal worker; Hydro geologist; Geologist; Mechanical engineer.

INSTALLATION AND MAINTENANCE

Project manager; Construction worker; Electrical engineer; Pipefitter; Electrician; Heating engineer; Electrical/electronic technician; Plant operator; Plumber; Drilling engineer; Drill rig operative; Operations maintenance engineer; Heating engineer; Pipefitter; Service engineer.

Hydropower
(Power)

As the graphs show, there is a substantial contribution from historic plant but recent growth rates have been very low, at less than one percent. Activity is focusing on smaller-scale schemes and the overall picture looks unlikely to change to 2020.

- PwC estimate that £237m was invested in the sector between 2010 – 2013
- In 2014, PwC calculate that an additional £94m was invested
- Over the period 2015 – 2020, PwC forecast a further £1,830m could be invested in the sector

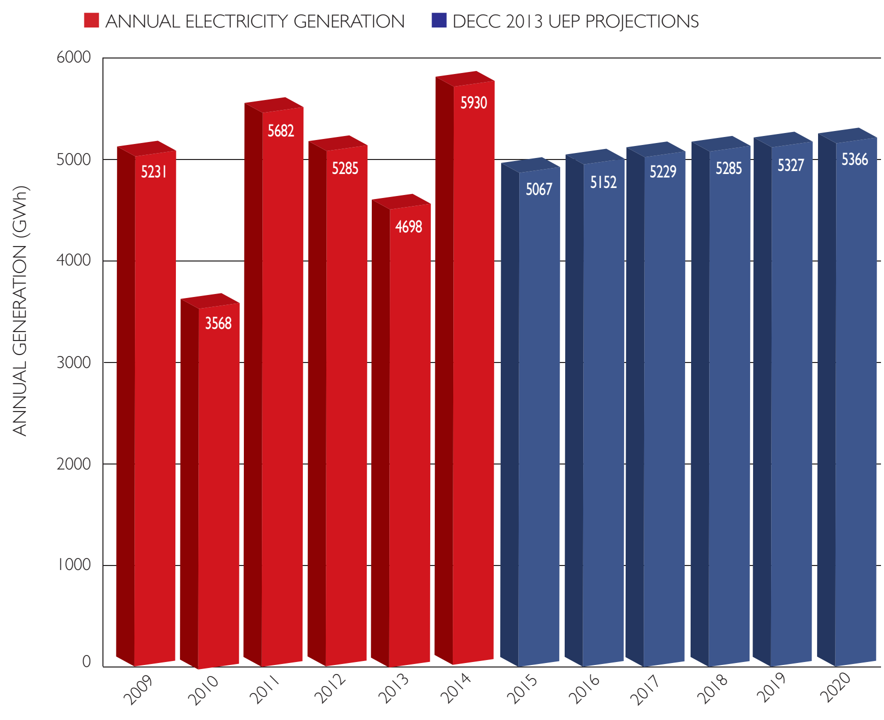
(£m, Real 2012)

HYDROPOWER CONTEXT

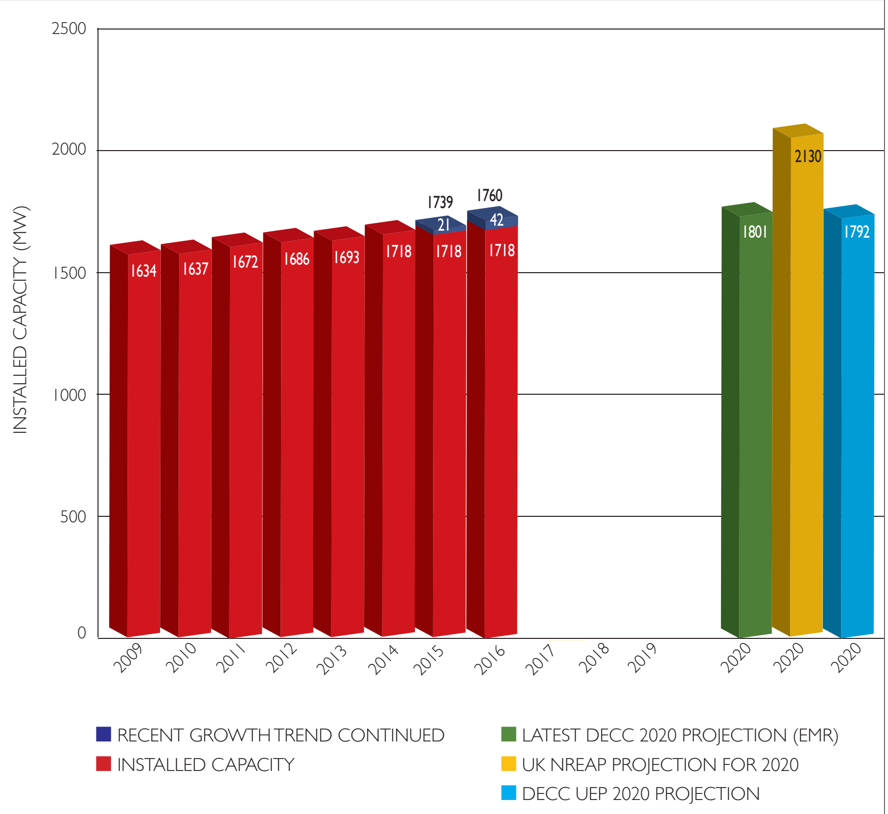
- Significant contribution from historic installations. New deployment mostly small-scale
- Limit to cost reductions that can be achieved as no two installations are identical

HYDROPOWER ELECTRICITY GENERATION

TO DATE AND PROJECTED BY DECC



HYDROPOWER INSTALLED CAPACITY AND PROJECTED GROWTH TREND



SIZE OF THE UK HYDROPOWER SECTOR

	2011 -2012	2012 -2013	2013 -2014
Sector Turnover (£'millions)	544	580	595
No. of people employed across UK supply chain	4,970	4,960	5,390
No. of UK companies across supply chain	260	260	276

JOBS IN HYDROPOWER

MANUFACTURE AND DESIGN

Design engineer; Hydro geologist; Marine biologist; Electrical engineer; Machinist; Welder; Metal worker; Structural engineer; Marine engineer; Reservoir engineer; Resource manager.

INSTALLATION AND MAINTENANCE

Planning and environmental consultant; Project management; Construction worker; Project manager; Electrical engineer; Power generation engineer; Maintenance engineer; Installation technician; Supervisor; Environmental and planning consultant; Environmental scientist; Ecologist; Service engineer.

Is the UK energy market ready to break with tradition?

New ways of doing business within the energy sector could alter the current status quo

Energy Industry experts know that the GB energy system was originally designed with a focus on a centralised electricity market, with large generators connecting to a transmission system and national system balancing. In both gas and electricity production, the sources are typically remote from where the energy is used. Under this system, arrangements are based on a "supplier-hub" business model, with national suppliers at the heart of the energy market, managing the consumers's relationship with the energy system.

Little changed with the introduction of New Electricity Trading Arrangements (NETA) in 2002, despite the intention of creating the most competitive electricity market in Europe. Vertically integrated companies can balance risks across volatile wholesale electricity prices with trading and longer term supply contracts. This is how the largest 6 players in the supply market operate as they also own 70 percent of the generation market. Government stressed the aim for the system to be secure, affordable and sustainable – often known as the energy 'trilemma'. There has been little progress on this, though: lack of investment decisions, little growth in competition to keep energy costs down, no effective "market driven" drive to a low carbon future. Any progress that has been made has happened from government intervention, deeper regulation and by a wave of new players in the energy market, operating to different business needs and value drivers. These are collectively referred to by OFGEM, the GB energy market regulator, as delivering energy via "non-traditional business models (NTBMs)[1].

There was considerable government intervention in the electricity market in 2014:

Awarding of the first Contracts for Difference for low-carbon electricity generation – see our article (on page 50 for more details)

> 'The pace of change may well quicken in the next few years, particularly as Government begins to wake up to the opportunities.'

The first capacity market auction to contract electricity generation and demand services – notionally to address electricity security concerns from deployment of variable renewable energy, but really to address lack of new investment in traditional fossil fuel generation

All of this is still framed in essentially a traditional view of how the UK energy system should work. But the system is changing in the meantime, meaning that many of the assumptions used are open to challenge. The pace of change may well quicken in the next few years, particularly as Government begins to wake up to the opportunities.

In 2014 DECC published the UK's first ever Community Energy Strategy. The government also instructed Ofgem to

conduct a series of reviews into whether the system as a whole is fit for purpose. There needs to be new grid connection and control strategies which use smart meters, smart energy balancing and energy storage in order to accommodate increasing volumes of renewable electricity. Unfortunately, we see that this has been too slow in some regions of the UK, where the grid is now effectively closed to new connections for the next 3-6 years.

Yet these reviews and discussions supporting them are still framed within a centralized energy delivery context and existing system rules:

- When the community energy strategy was published it was stated that take up will only lead to small growth in this business model across the UK in the next years.
- Even this strategy may need to be revised as we now see local authorities play "catch up" to the lead smaller communities have shown, as they set themselves up as energy suppliers, enabling them to deliver affordable energy to the local people and support the vulnerable.
- Novel demand management and energy storage deployment are now more likely to be constrained because of market rules rather than cost of the equipment itself

In addition, many cities are looking at cross-cutting approaches that combine low carbon supply with new infrastructure, such as renewable heat networks, smart buildings and low carbon transport. Ofgem are also looking to understand whether current regulation is standing in the way of these NTBMs. Their discussion paper published in February 2015 should act as a catalyst for further action.

REA view:
Whilst centralised energy will continue to play an important role, the wide range of renewable energy technologies and energy storage will be key to the transformation of the UK energy system. As a pan technology association, REA is uniquely placed to challenge the status quo. We are clear on the need to support the deployment of decentralised energy. We encourage all to contribute to the Ofgem discussion paper as a starting point for the strategic review of the grid we desperately need.

[1] *OFGEM Discussion paper: Non-traditional business models: supporting transformative change in the energy industry, 25th February 2015 https://www.ofgem.gov.uk/publications-and-updates/non-traditional-business-models-supporting-transformative-change-energy-market*

Mixed Energy From Waste

(Combustion, Pyrolysis, Gasification, Landfill Gas - CHP, Heat & Power)

Energy from waste includes a range of different technologies and feedstocks, with differing potential for deployment. The picture is further complicated as the technologies are, to some extent, in competition for the same raw material. Landfill gas continues to make a substantial contribution to renewable electricity generation, but is likely to decline rather than grow as policy has moved away from supporting new projects, and existing sites produce less gas over time. These technologies offer a range of benefits beyond electricity generation, including enhanced greenhouse gas savings from avoided methane emissions from landfill.

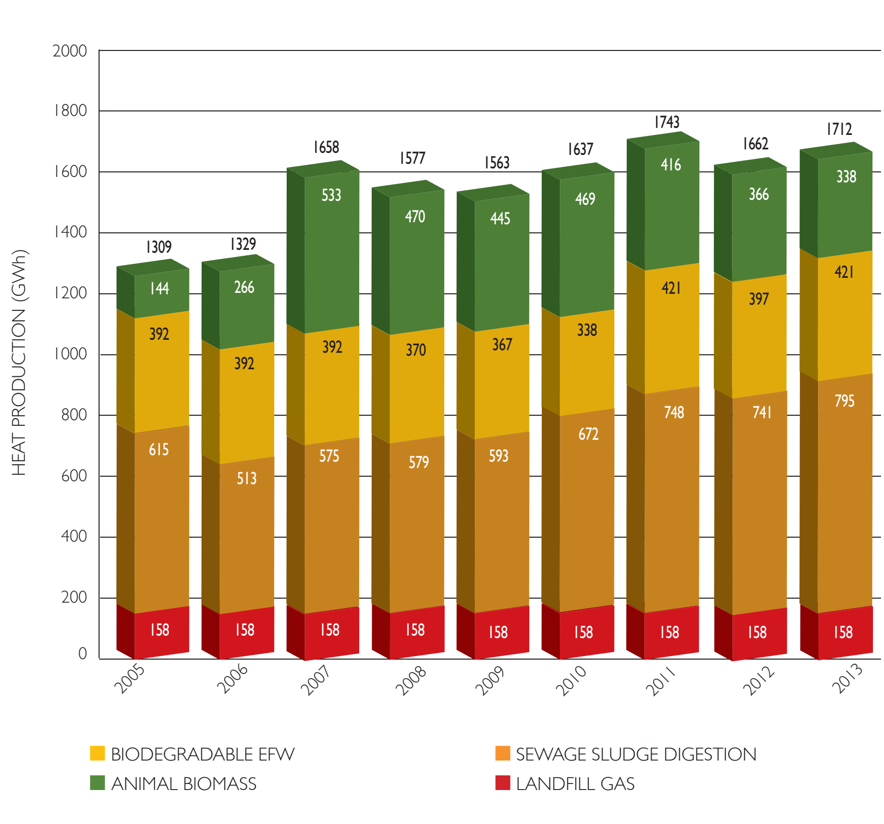
MIXED WASTE TO ENERGY CONTEXT

- Includes landfill and sewage gas, conventional incineration and advanced treatments such as gasification
- Planning issues remain a significant barrier
- Availability of feedstock an issue, with concerns over impact of exports of UK waste to Europe
- Financial incentives for renewables pay on the renewable content of waste. Difficult to demonstrate for solid waste without being overly burdensome

- PwC estimate that £1,366m was invested in the sector between 2010 – 2013
- In 2014, PwC calculate that an additional £824m was invested
- Over the period 2015 – 2020, PwC forecast a further £4,695m could be invested in the sector

(£m, Real 2012)

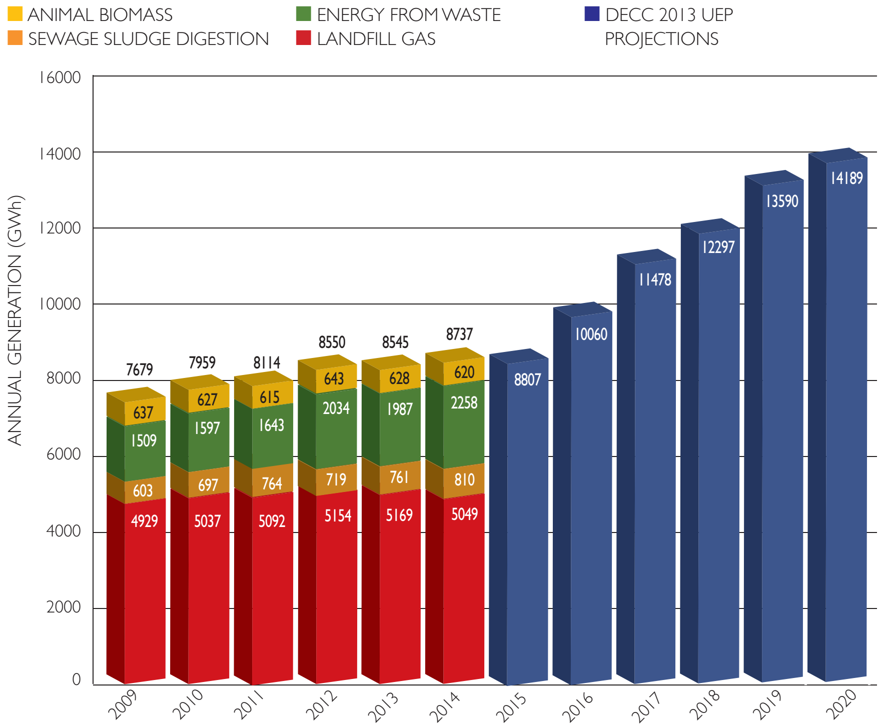
ENERGY FROM WASTE - HEAT PRODUCTION



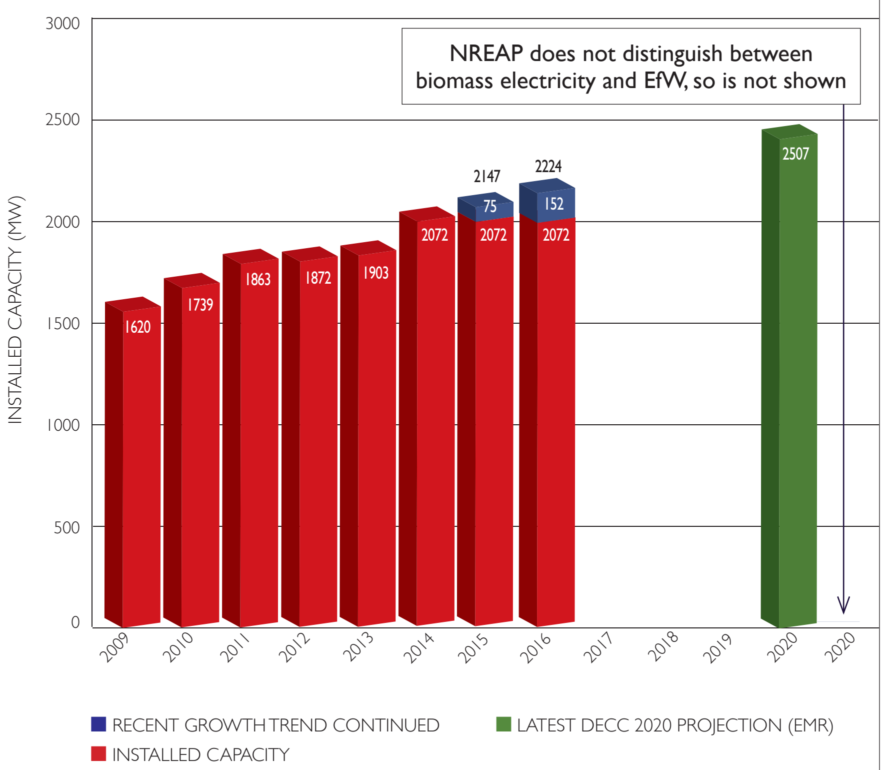
For full explanation of terms, methodology and growth projections see pages 96-97

ENERGY FROM WASTE ELECTRICITY GENERATION

TO DATE AND PROJECTED BY DECC



ENERGY FROM WASTE INSTALLED POWER CAPACITY AND PROJECTED GROWTH TREND



SIZE OF THE UK ENERGY FROM WASTE SECTOR

	2011 -2012	2012 -2013	2013 -2014
Sector Turnover (£'millions)	786	830	866
No. of people employed across UK supply chain	6,020	6,550	7,109
No. of UK companies across supply chain	330	340	363

JOBS IN ENERGY FROM WASTE

MANUFACTURING
Design engineer; Boiler engineer; Welder; Electrical engineer; Metal worker; Quality assurance; Chemist.

INSTALLATION AND MAINTENANCE
Planning consultant; Environmental consultant; Project manager; Construction worker; Electrical engineer; Boiler engineer; Pipefitter; Welder; Electrician; Heating engineer; Electrical/electronic technician; Plant operator; Mechanic; Waste collection operative; Ash supervisor; Site supervisor.

Energia


1MWe equivalent gasifier

Energy sustainability comes to the fore

Continuous process fast gasifier technology that produces minimal effluent, ash and slag has been a Holy Grail to the Energy from Waste industry. The search is now over, says *Richard Newman*, Technical Director at Energia Ltd

Energy from Waste (EfW) companies have been seeking a "continuous process" fast gasifier technology, that produces minimal effluent, ash and slag. To the industry it has become like finding the "Holy Grail". The wait is now over, because a technology that was developed initially to use peat as a fuel, has developed to be able to use firstly virgin wood and now waste wood.

The fuel has to be dried, de-mettaled and made into a sawdust before being pelletised for use in this technology. Even sewage sludge pellets can be mixed in. Careful fuel preparation is key to reliability and an uptime of >8,000 hrs/annum. Further R&D will see SRF, RDF and WDF's being used as fuel sources.

Low-cost technology

Problems with batch gasifiers have now been eradicated using this continuous process fast gasifier. The process makes a clean, tar free syn gas for use in gas engine generators. Long chain carbon molecules normally associated with tars, are destroyed in the high temperatures encountered in the process. The result is a technology that costs approximately half of that as for standard combustion / steam EfW technology solutions. It is a modular system in sizes from 1 to 10MWe and now has proven operational running hours exporting to a grid of >50,000 Hrs. The R&D plant was initially based on a 500kWe size plant. Plants from and in module sizes of 1MWe up to 10MWe are financially viable.

Any ammonia produced is cleaned in the process using a flash exaporator and condenser.

The first two commercial plants have been commissioned in the UK, one in the West Midlands and the other in Brighouse, Yorkshire. Both plants operate on waste wood with one mixing in sewage sludge pellets.

RHI subsidy

Waste heat from the gasifier is used to dry the fuels, and can earn an RHI subsidy. Using CfD's and RHI a simple payback of <4 years is achieve able. For instance, a 3MWe system using Caterpillar engine generators costs approx. £13m and uses 26,000 tpa of fuel.

A typical SCADA process controller is employed to undertake the monitoring and control of the system, with a button to start and a button to stop the process.

Roughly every two weeks the gasifier has to be shut down for 2 to 3 hours to remove a build up of slag between the primary and secondary chambers. Some solid carbon carryover is created and captured as biochar, to be sold as a soil conditioner, or mixed back into the pellet fuel production.

It really is the Holy Grail for the Energy from Waste industry. The plants can be small enough for community schemes, 1MWe, up to small EfW plant size of 10MWe. Build times of six months are anticipated, with commissioning taking weeks not months. The next phase of R&D is to trial SRF, RDF and WDF pellets. Site visits are limited to concerns that have already got sites with planning permission, grid connections and access to fuel sources.

FOR FURTHER INFORMATION

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ENERGIA

Training future green workers

As the domestic renewable heat market begins to really take off, training becomes more important than ever in ensuring growth and future success says *Simon Butcher*, Training Manager at Innasol, the UK's market-leading renewable heating company

What courses does Innasol Academy offer?
At Innasol, we offer product specific courses and some more general nationally recognised qualifications which have been developed by BPEC, to meet national occupational standards. Our product courses include specific ETA biomass, IDM heat pumps and Lovato heating accessories training, of which Innasol is the UK sole distributor.

To help our partner businesses, we also offer a range of supporting BPEC qualifications. These include Energy Efficiency, Awareness of Renewable Technologies and Heat Metering to name a few.

How does Innasol's training academy differ from others in the industry?
The Innasol Academy is unique in several ways. In addition to supporting our customers, we have a strong sense of corporate responsibility to help develop the renewables market. We make sure that our training is led by our own technical engineers, making it relevant and experiential for those attending. We also create training packages to meet the needs of industry and If this means that a bespoke course is required, then that is what we will deliver.

INNASOL
Innovative Alternative Energy Solutions

Why is training so important in the renewable heating sector?
Soon oil and perhaps gas as forms of heating will become a thing of the past. So it is really important that our base of installers in the UK is equipped with the necessary skills to negotiate this change.

Training is also vital in promoting growth. Renewable heat will become popular only if the customer can see that it is cheaper, greener and more convenient for them. If we can train our designers, installers and service engineers to deliver perfect service and equipment day in, day out, then growth will follow. We must ensure that we deliver problem free installations and excellent customer service. For a new industry, consumer confidence is key.

The training facility will soon be available to the professional public. What does this mean?

To date we have trained 2,000 engineers. Initially when we started the training it was only available to our partner network of 200 companies. We are keen to extend this, and from April 2015 it will be open to the professional market. This means that engineers from our immediate area and beyond will be able to benefit from our various BPEC courses. We are also in the process of developing CPD courses for specifiers, architects, system designers and building managers, which will be delivered at our academy and across the country.

FOR FURTHER INFORMATION
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Electricity Market Reform (EMR) in action.

The outcomes of the first Contracts for Difference (CfDs) allocation round are now known, and the next one won't take place for another six months, so now is an excellent time to take stock of where we are

CfDs: Where are we now?

The auction process resulted in contracts being offered at lower prices than would otherwise have been the case, which could save £110million over the lifetime of the contracts, making pleasing headlines for the Department of Energy and Climate Change (DECC). But look beyond the headlines and there is at least one glaring issue. The auction process is at risk of unintended consequences when very few projects bid into one delivery year. We saw this in the outcomes for two solar projects commissioning in 2015/16, which secured contracts, but at a price (£50/MWh, or below the predicted wholesale electricity price for that year) that most of the industry see as unsustainable. Indeed, these contracts were not signed and the projects will now be barred from reapplying for 13 months. So how did this come about?

What is clear is that those projects bid in a way that maximised their chances of gaining a contract, but were caught out by miscalculating the likelihood of other bids that did not subsequently materialise. This is a result of the way the auction is structured. Bidders make sealed bids, and contracts are awarded based on funds available, starting with the cheapest bids. The winners will therefore have bid a range of prices. The question is what price should the winners be granted? The obvious answer would be that every winner should get what they bid. However this was rejected as it gives a major advantage to those with reliable market intelligence on what everyone else is doing. Instead, the policy gives all the projects the price bid by the most expensive winner.

In theory, this allows everyone to ignore what the rest of the market is doing, and just bid the best price they can for their projects. In practice, it encourages some to bid £0.01/kWh and hope that not too many people will do the same. If they gamble correctly, they get a contract at everyone else's sensible price. If they're wrong, they would most likely be unable to bid in the subsequent round, but solar developers may have felt they had little to lose if they'd already missed the boat on the Renewables Obligation (RO).

Review meetings

DECC have commissioned a review of the CfDs scheme, and the REA are actively participating in this, holding meetings for our renewable power, waste to energy, marine and solar groups to feedback and submitting online responses directly. It is a bit early for the summer sales, but our 'shopping list' is already well developed.

> 'We are also calling for an increase in the overall budget and improvements to the logistics of contract management, that risk contract terminations before there is an opportunity to put things right.'

Our list includes more frequent allocation rounds as a priority, perhaps splitting the timetable for the different pots, which we believe should be on a six-monthly basis as a minimum; re-examining qualification criteria in the context of the high costs involved in meeting these; streamlining the appeals process so that delays to the allocation process are reduced; a rolling five-year horizon of strike prices and minima (reserved capacity) in the auction for more emerging technologies.

The contract terms should also be amended so that solar can benefit from a level playing field. At present it is one of only two technologies that does not have 12 months in which to commission and the milestone requirements don't reflect the way the sector operates. We are also calling for an increase in the overall budget and improvements to the logistics of contract management, that risk contract terminations before there is an opportunity to put things right. As a simple day to day improvement, there should be a single portal for all information and documents required to enter the CfDs process, to aid understanding and transparency. Please feel free to send us your views on these issues if you have not already done so.

The DECC is keen to stress that any changes to the policy cannot be implemented before the next allocation round in October 2015, due to the election and necessary consultation periods, and would be most likely for the one after that (currently scheduled for October 2016). Like so much else, the outcome of the election will be crucial, but the last thing the industry needs is another set of wholesale changes and prolonged uncertainty.

Finance schemes driving growth in renewable energy

Finance schemes are driving the adoption of renewable energy by allowing customers to choose the best solution for their energy needs, says *Darren Riva,* Head of Sales, Green Finance at Siemens Financial Services, UK

Since the implementation of the EU Renewable Energy Directive in 2009, the UK has made substantial progress against the initiative's target to achieve 15 per cent of its energy consumption from renewable sources by 2020. Significant headway has been made in promoting renewable energy, with both public and private sector investment flourishing, particularly in Scotland where renewable power surpassed nuclear as the main source of electricity at the end of last year. The overall UK generation of electricity from renewable sources increased from 13.6 percent in 2013 Q3, to 17.8 per cent in 2014 Q3.

Government support has propelled the development of a range of alternative energy sources and technologies. An example of one of such alternative approaches is biomass. Between July 2012 and June 2013 biomass electricity saw an increase of 1.6 GW, with total installed capacity reaching 4.9 GW. Meanwhile generation rose to 17.3 TWh for the year July 2012 to June 2013, increasing by 3.1 TWh compared to the previous period.

The introduction of the Renewable Heat Incentive (RHI) scheme has also played a crucial role in driving biomass heating. As at 31 March 2014, installations on the RHI scheme had provisionally generated 909GWh of heat, 94 percent of which has been generated from biomass boilers. According to a 2015 study published by the EurObserv'ER Consortium, the consumption of solid biomass energy increased by 3.3 percent in the EU in 2013, predominantly driven by the UK and France.

Energy Efficiency Financing

Energy saving assessment by CARBON TRUST

Financial Services provided by SIEMENS

Solar PV technology

Another renewable energy source receiving great attention from the UK government is solar PV. A 2013 survey indicated that solar is the most popular of all renewable energy technologies among the public. Solar projects are particularly favourable to businesses looking to subsidise their own electricity consumption given the ease of installation and the predictability of power generation. The implementation process is quick and scalable and the 'fuel' (solar radiation) is, of course, entirely free. Although solar PV is currently used predominantly in the domestic environment, its applications extend effortlessly to the industrial and commercial sectors.

In 2014, solar PV capacity increased by 1.9 gigawatts, making it the largest contributor to the UK's heightened consumption of renewable energy compared to the previous year. To encourage take up of solar PV technologies, the government has implemented the Feed-in Tariff (FIT) scheme which, much like the RHI, allows companies using the technology to be paid for the energy generated.

Although government policy will continue to prove instrumental in further uptake of renewable energy, the driver for further expansion should not depend entirely on government endorsement. With specialist technical expertise and equipment knowledge, renewable technology suppliers are well positioned to promote the monetary and environmental benefits of adopting clean energy to businesses, and to help them successfully implement the technologies.

Nevertheless equipment suppliers are often struggling with customers who do not have the budget to make the investment. However specialist financing schemes such as the Energy Efficiency Financing (EEF) scheme, are now available in the market, with which equipment suppliers can help their customers overcome their budget constraints.

Joint initiative

The EEF scheme is a joint initiative between Siemens Financial Services Limited (SFS) and the Carbon Trust. It provides finance for energy-efficient and renewable energy equipment for businesses, where the expected savings in energy costs and/or income from energy generation offset the monthly equipment finance costs, thereby removing the need for initial capital outlay. The EEF scheme covers a wide range of renewable technologies, ranging from solar photovoltaic, biomass heating, ground/air source heat pump to wind turbines and micro combined heat and power, making the deployment of many renewable technologies affordable and accessible.

Equipment suppliers can apply to become a Recognised Supplier of the scheme, which will allow them to integrate the EEF financing offer into their overall sales proposition, and help customers make the desired investment

in their chosen technology without having to raise or borrow capital for the acquisition. Unlike traditional bank loans, the EEF scheme does not demand a deposit or guarantees.

As a large capital outlay is no longer a prerequisite for investment, equipment suppliers can focus their efforts on providing the best technological solution that is suited for the individual business requirements. This one-stop-shop experience combining technology and finance makes suppliers' proposals and quotes more compelling to their customers, and helps them win more deals and close those deals faster. An independent energy savings/earnings assessment is conducted by the energy specialists at the Carbon Trust for each application, giving businesses the assurance that the expected carbon reduction/FIT or RHI earnings, and hence financial savings over time, will match or exceed the finance payments.

> 'Renewable technology suppliers are well positioned to promote the monetary and environmental benefits of adopting clean energy to businesses, and to help them successfully implement the technologies.'

Growing market

Environmental concerns, fluctuations in energy prices and government policy mean that renewable energy will continue to gain importance in the decades to come. Forward-looking companies adopting renewable technologies will not only yield considerable financial savings, but also contribute to a low carbon economy. Renewable equipment suppliers can and should drive forward the deployment of renewables by keeping abreast of the funding and financing options available to them and their potential customers. With the support of available financing schemes such as the EEF, they are now given the tool they need to do just that.

FOR FURTHER INFORMATION
Tel: 01753 434 476
www.energyefficiencyfinancing.co.uk

Storage and solar technologies could be the solution to some of the biggest problems facing the UK's energy system

A future is bright (and flexible) with storage and solar

Here at the REA we are excited about energy storage, and even more so when combined with solar power and other renewables. Together the technologies can help address some of the biggest problems facing the UK's energy system, and enable renewables to meet their potential as the number one source of power in the country.

Energy storage allows the UK to balance out variable power generation and avoid costly reinforcement of the electricity grid, two issues that could be a serious brake to renewables.

Domestic and business users can benefit from increased self-consumption and therefore keep energy bills down. But what is really exciting is when renewables, including solar photovoltaics (PV), are combined with energy storage.

Such a combination offers lots of advantages, including stable, balanced energy supplies that reduce strain on the network and therefore lower balancing system charges for generators and suppliers, and also help regulate frequency and voltage rises on the network.

In a DECC-funded pilot project, UK Power Networks recently installed a 5MW battery system in the Midlands as an alternative to upgrading the overhead line, which would have otherwise been necessary. Costs have reduced by around 25 per cent since the battery was first installed, meaning that this could be a cheaper way of strengthening the grid within the next few years.

Reduced costs

Costs of domestic systems have reduced dramatically in the past two years as module manufacturers start to package storage units alongside PV panels. Anecdotally, this has seen a 75 per cent reduction in costs in the space of two years, one reason why the storage industry has been compared to the solar PV industry 15 years ago. Germany has introduced a form of upfront support for storage and the market is developing fast there, while some US states have required their grid operators to install large amounts of storage capacity. Many have seen the benefits and decided to go much further than required to by the legislation.

In the UK, the government unfortunately still positions energy storage in the 'research

and development (R&D)' bracket. Indeed, the Department of Energy and Climate Change's (DECC) very small team for storage includes responsibility for five other technologies known as the 'Future Networks' office – the name says it all in terms of government perception!

That, and the reasons above, explains why the REA has officially launched UK Energy Storage, a pan-technology group for energy storage in the UK. The REA will seek to use our experience in campaigning for renewables support to further the energy storage industry, at a crucial time for the sector's development.

Solar energy

In parallel, we have also launched UK Solar, a new group for the solar industry in the UK. This group aims to become the trusted voice for solar in the UK and use the REA's breadth of activities, including energy storage, to make the case for solar energy in a holistic, joined-up way. The REA has been involved in solar for many years and has an experienced team to back up our work, including industry stalwart Ray Noble, our grid networks expert Bob Weaver, and Stuart Pocock, who many will know from his previous spell leading the REA's work on solar.

Membership of these groups is open to existing members and new joiners. Just tell us you would like to be involved and you will receive the relevant information to keep up to speed with these exciting areas.

> 'Domestic and business users can benefit from increased self-consumption and therefore keep energy bills down. But what is really exciting is when renewables, including solar photovoltaics (PV), are combined with energy storage.'

Solar Photovoltaics
(Power)

Of all the technologies featured, solar photovoltaics (PV) is the most dramatic case of exceeding expectations. Much of the current growth is driven by larger-scale projects. The government has responded to this by closing the RO to projects above 5MW from April 2015. There are serious concerns about whether Contracts for Difference will be viable for solar PV, at least in the medium term. Plotting a course for reducing subsidies in line with costs is a key challenge. There is also a need to unlock deployment on buildings in the commercial sector. For comparison purposes, it is always worth looking at the generation figures rather than installed capacity, as load factors for solar PV are far lower than for other non-baseload technologies, such as wind.

- PwC estimate that £5,708m was invested in the sector between 2010 – 2013
- In 2014, PwC calculate that an additional £4,554m was invested
- Over the period 2015 – 2020, PwC forecast a further £5,580m could be invested in the sector

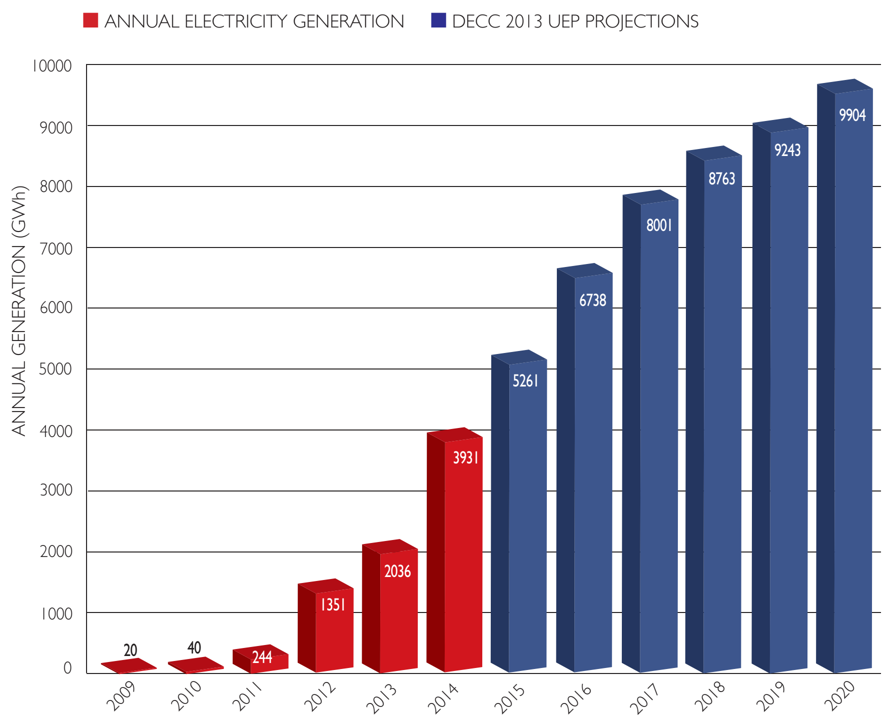
(£m, Real 2012)

SOLAR PHOTOVOLTAICS CONTEXT

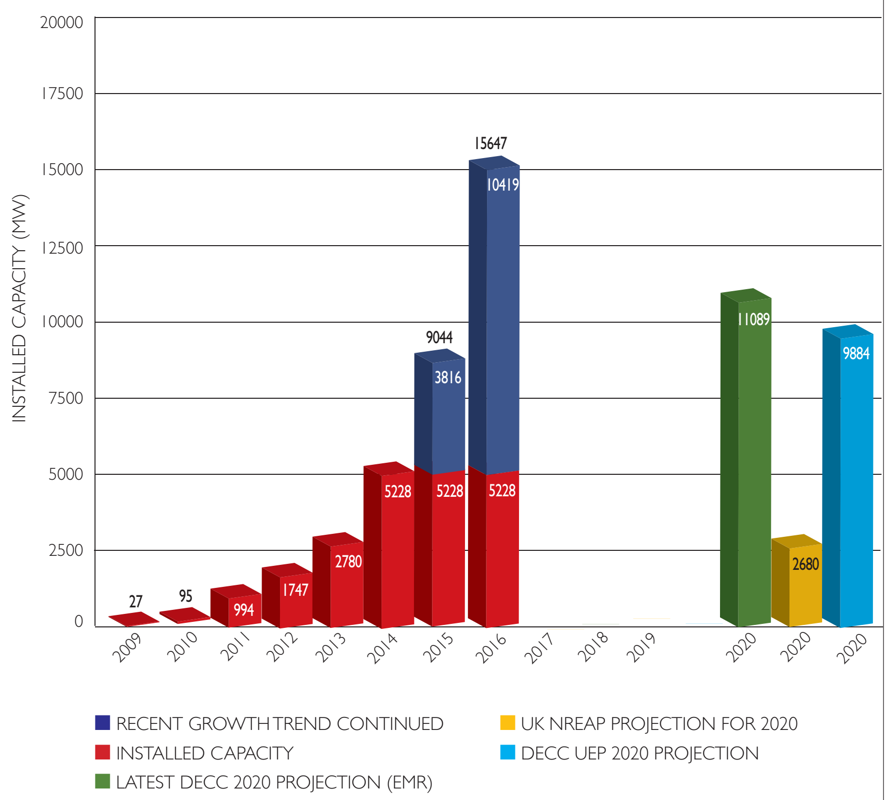
- Huge beneficiary of Feed in Tariff, growth of nearly 1000% in 2011
- Dramatic recent cost reductions. Large scale forecast to be competitive with onshore wind by 2018. Likely to require little or no subsidy after 2020
- EU has imposed additional duties on Chinese panels on grounds of unfair competition – pushing up deployment costs to end 2015
- Popular on buildings but 'solar farms' considered controversial by Government. Industry has developed codes of practice, community engagement and biodiversity guides

SOLAR PV ELECTRICITY GENERATION

TO DATE AND PROJECTED BY DECC (NREAP)



SOLAR PV INSTALLED CAPACITY AND PROJECTED GROWTH TREND



SIZE OF THE UK SOLAR PV SECTOR

	2011 -2012	2012 -2013	2013 -2014
Sector Turnover (£'millions)	1,800	2,200	2,307
No. of people employed across UK supply chain	15,650	15,620	16,103
No. of UK companies across supply chain	2,200	2,180	2,088

JOBS IN SOLAR PV

MANUFACTURING AND DESIGN

Design engineer; Systems engineer; Production manager; Production supervisor; Electrical engineer; Laboratory technician; Quality assurance; Assembler line personnel; Chemist; Surveyor; Materials scientist; Warehousing/logistics personnel.

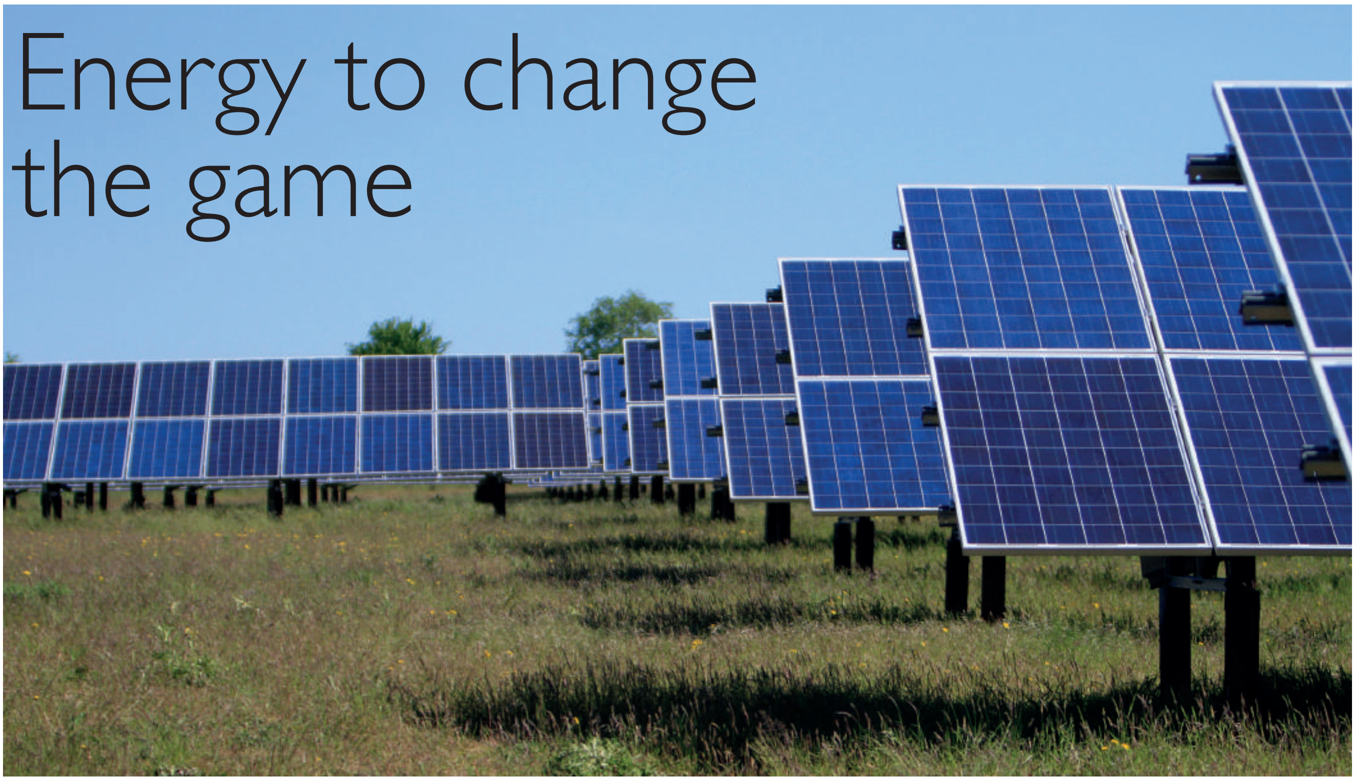
INSTALLATION AND MAINTENANCE

Planning and environmental consultant (ground mounted schemes); Roofer; Electrician; Instrumentation engineer; Controls and electrical systems technician; Installation engineers; Installation supervisor; Scaffolder; Service engineers; Panel cleaners; Security.

GENERAL MANAGEMENT, SALES & ADMIN

Sales/purchase administrators; Sales and business development team; Logistics - drivers, packers, warehouse staff; Marketing team.

British Solar Renewables



Energy to change the game

With the development of solar farms and rooftop arrays, solar power is transforming the way energy is produced and distributed, says *Marcus Dixon* from British Solar Renewables

Solar power has the potential to become a game changer in the energy market. It takes daylight and turns it into money; it creates clean, home grown energy that's good for the environment; it is passive technology that's powering a brighter future.

British Solar Renewables (BSR) is the UK's leading integrated developer and operator of solar farms and rooftop arrays. Established in 2010, we generate energy from solar photovoltaic (PV) farms and rooftop arrays on commercial buildings and carpark canopies.

We have a strong track record of delivering at every life-stage of a solar project: from design, planning, financing and development; to construction, connection and operation and maintenance. Through this unique structure BSR is able to continually improve efficiencies and drive down costs, the benefits of which we pass on to our stakeholders and customers.

British Solar Renewables

Farming interests

Our unique holistic approach means we can take an everyday field, brownfield site or building, and equip it for green power generation quickly and efficiently. It's an approach that has already delivered up to 330MW of 'clean' electricity, and we have a solid pipeline of projects including green field, brown field, land fill and roof top.

We don't just generate renewable energy because the country requires it, but also because farming interests are at the heart of BSR. We offer crucial diversification options for the farming community, with sensitive use of rural land and consideration for conservation and ecology. We pride ourselves on our product, which enjoys an outstanding reputation with structural integrity, and excellence of quality engineered in from the start.

Solar power is transforming the way energy is produced and distributed, and in doing so it provides home-grown, clean energy which reduces our dependence on imports, as well as our vulnerability to political uncertainty and price spikes. The UK currently has around 5.5GW of solar PV capacity, and by the end of March 2015 this is likely to reach 8GW, offering the fastest and cheapest way to replace the UK's ageing power stations generation infrastructure.

Global developments

Within the energy sector there has been news of falling oil and gas prices, but solar power is on the up. Developments in USA, China and India, as well as the UK, have been increasing both solar technology's efficiency and its affordability. This is why sector analysts are increasingly indicating that solar is a disruptive technology, the growth of which could well see it becoming the pre-eminent source of energy in the not-too-distant future.

Last year BSR entered into a joint partnership with Siem Industries Inc., a diversified company providing services to the energy sector. The companies are working together to deliver utility scale renewable power projects in the UK and worldwide. British Solar Renewables is an innovative, dynamic cleantech company positioned to be a significant player in this rapidly emerging global market.

FOR FURTHER INFORMATION
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Livos Energy

Green expertise

Livos Energy specialises in onshore wind and solar PV development. Through years of experience we have developed a process to give each individual project the best possible chance of success. Our team of professionals look at projects at every stage of the development process, from initial site identification and feasibility, through to working with other developers on projects with planning in place.

1 Feasibility:

Livos Energy has developed a process to assess the suitability of sites quickly and efficiently. We use desk based GIS (Geographic Information System) studies to check sites for the basic requirements. With a positive outcome from these initial checks, we complete a further more detailed feasibility review, including writing to the relevant statutory bodies and reviewing local planning policy. With the increased competition for available grid capacity, and a cap on the size of solar PV projects eligible under the Renewables Obligation incentive scheme, many potential projects are no longer viable, increasing the importance of initial feasibility checks.

2 Legal agreements:

With the recent shift in industry focus towards rooftop solar PV projects and community shared ownership schemes, whilst they are exciting new opportunities, they have added an extra layer complexity to the legal process. We work with landowners and other third parties to resolve any legal issues. Once we have a feasible project we meet all the relevant parties to discuss the heads of terms which details our financial and legal offer to enable the project to proceed.

3 Planning and community engagement:

Planning approval rates for renewable energy technologies are decreasing every year. Livos Energy has an experienced team of planners with an enviable track record in renewable energy development, having achieved consents for 290MW of projects across both wind and solar technologies. Our team will oversee the whole planning process from initial contact with the local authority and community groups, responding to any additional concerns and information requests during the consultation process.

4 Construction through to commissioning:

Once planning permission is obtained the next stage in the development process can begin. This includes finalising an EPC contract, securing your grid connection, negotiating a Power Purchase Agreement (PPA) and, if necessary, securing finance for your project.

5 Operation & maintenance:

Once commissioned, a project is continuously monitored and maintained to ensure optimum performance and return.

FOR FURTHER INFORMATION
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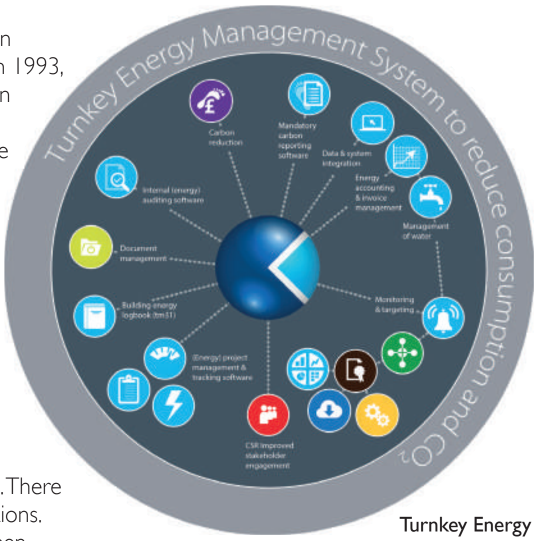
Email: info@livosenergy.co.uk
www.livosenergy.co.uk

MWA Technology

Getting it right with energy management software

Energy prices don't generally go down, so effective energy management is definitely the way forward. With the UK government incentivising us to comply with initiatives and taxing us if we don't, becoming greener and more carbon neutral has to be on your agenda says *Mark Brown* from MWA Technology



Turnkey Energy Management System

MWA Technology is the largest independent meter distribution business in the UK. Founded in 1993, the company is an established leader in the metering solutions marketplace.

MWA products include an extensive range of meters and ancillary equipment for energy, electric, heat, water, gas, oil, and steam. Customers include end users, consultants and hard and soft facilities management in the UK, Europe, East, West and South Africa, Australia, Malta, UAE and the Far East.

Every aspect of each project is carefully considered against the specification, and supported through ISO90001 and 14001 TQM processes. There is no 'one size fits all' in metering solutions.

Over the past few years we have been repeatedly asked to provide a means to visualise and measure data with specific requests for energy management software. After all, the meters we provide are measuring instruments which provide important information, some with more complex functionality than the average laptop.

Downloading data to Excel is one way to achieve this, but to have data flowing through a system that provides active visualisation in reports and dashboards, with powerful applications to dice and slice the data, delivers real energy savings.

Choosing the right software system

The challenge when selecting an energy management software system is matching your needs to what's available, and peering through the smoke and mirrors to get to the actual functionality. There are so many providers all claiming to offer a panacea when, in my experience, some are little more than data visualisation. Others promote functionality which doesn't exist, doesn't work, or is so complicated that it becomes quicker to use spreadsheets, negating the reason for using it in the first place.

Some of the more established systems are more energy accounting than energy management, and can be clunky, inflexible and expensive. Then there are the innovations with add-ons which are fantastic, but very specifically driven by gamification in order to work with the latest smart phone. There's nothing wrong with these systems, but in my opinion they're more advertising agency then environment agency.

Energy management software must be fit for purpose, and everybody's needs are intrinsically different. Not just by industry, vertical or application, but by the level of competency within the business. It also needs to be accessible to the entire organisation in order to achieve more.

Range of applications

Whether single or multi-site, it should have the ability to capture data from meters at meter, asset or building level, as well as a range of standard energy management reports and outputs that are customisable with the option of bespoke reports and interfaces for a reasonable cost.

Look for a solution that includes a range of applications within the licence that you can turn on if you need them. The most significant for a large company is legislatory compliance, again search for one that offers a centralised energy data repository. This saves you time producing reports, complying with legislation, and tracking your energy projects automatically.

A project management application should provide visibility of active, planned and completed projects. Enterprise level systems use standard PM methodology and the best have a wizard to guide you through a process which is very useful. Dashboards and interfaces support stakeholder engagement, and if the management team are engaged you will almost certainly reduce consumption and carbon dioxide.

Applications are vital for effective energy management and widely used apps include CRC, DECs and benchmarking, invoice management and validation, project management and verification, solar and water management, asset management and tenant billing and recharge.

Turnkey solution

Once you've ticked these boxes, the most important factor is the support you receive. It's critical to have a provider who will help you through the early stages as you tune the system to your requirements. The best will wrap their software around your processes, making it instantly familiar to you from day one.

FOR FURTHER INFORMATION

If you require advice or further information before selecting software please get in touch.

Tel: +44 (0) 121 327 7771

Email: info@mwatechnology.com

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We also offer a turnkey solution comprising of hardware, software and installation, including commissioning to the cloud.


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SHIFTING THE LIMITS
Fronius
FRONIUS PRIMO

Setting the standards for self-consumption

The government's vision to end subsidies for solar power before 2020 has caused industry outrage. However, this may be exactly what's needed to make green energy a viable alternative to fossil fuels, says *Jodi Huggett*, Innovation Director at 4eco

With utility prices rising, concern over carbon emissions and ever-increasing government pressure to lower energy usage, balancing costs and minimising reliance on non-renewable resources is now a key national priority.

To tackle this crisis and protect the future of our energy landscape, huge investment has been placed in renewable technologies to provide a more sustainable long-term solution. From biomass boilers and air source heat pumps to solar thermal technology and photovoltaic setups, there is now a wide range of energy alternatives to alleviate demand on national grid supply.

These technologies require minimal initial investment and can provide a high volume of cost-effective renewable energy, while helping to meet environmental targets and reduce utility costs. What's more, in many cases, they are now on par with fossil fuels when it comes to end-user costs.

To boost the widespread uptake of these technologies, green initiatives and subsidies have always been available as a financial sweetener. From increased funding for efficient systems to calculating offsetting strategies, these incentives have made renewables a highly attractive option. On the surface, therefore, it seems that moving to zero subsidies and removing this support will surely impact the rise in renewables. However, there is a much stronger solution to outweigh the requirement for subsidies and make renewable energy more cost-effective than ever before – microgeneration self-consumption.

Making the most of renewable energy

Much has been learned about renewable technology over the past few years and, for householders boasting PV setups in particular, a key draw-back is the fact that the peak daytime hours when panels generate the most energy are, more often than not, the times when domestic power consumption is at its lowest. PV owners then often find themselves having to buy back electricity from the grid in the evenings at a higher rate per kilowatt hour (kwh) in order to heat their houses or hot water tanks. Put simply, there isn't wide scale capability for renewable storage so when the sun sets, no energy is being produced. This makes homeowners still highly reliant on grid power.

Self-consumption, a relatively new term in the renewables industry, is the name given to maximising the personal use of this generated green energy by effectively utilising it within the home. This is typically achieved by using microgen diversion devices - a massive progression in environmental capability that fully automate the diversion of surplus volumes.

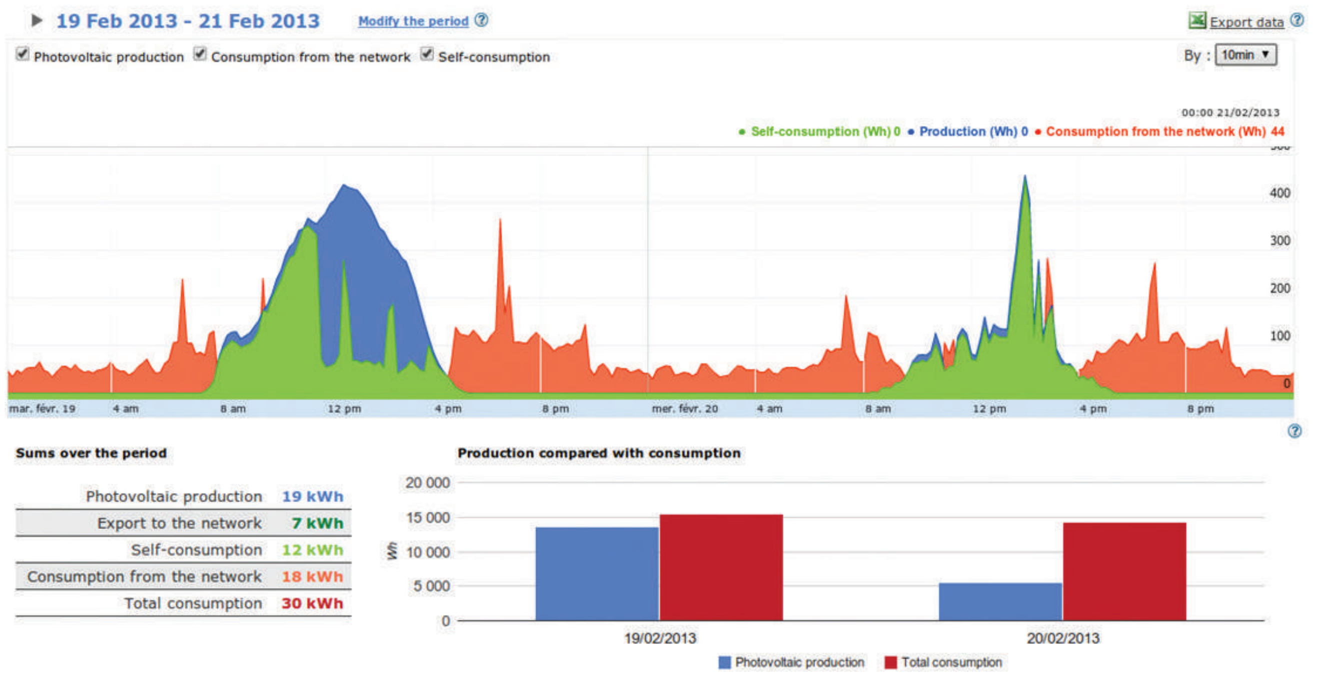
By directing green energy to heating and hot water systems at peak generation times, diversion devices effectively 'store' renewable energy. This helps to reduce reliance on the grid and ensures that energy is used around the clock – even when generation conditions don't permit. In most instances, whether in a small or large-scale scenario, 100 per cent of self-generated supply can be effectively utilised.

Self-generated supply

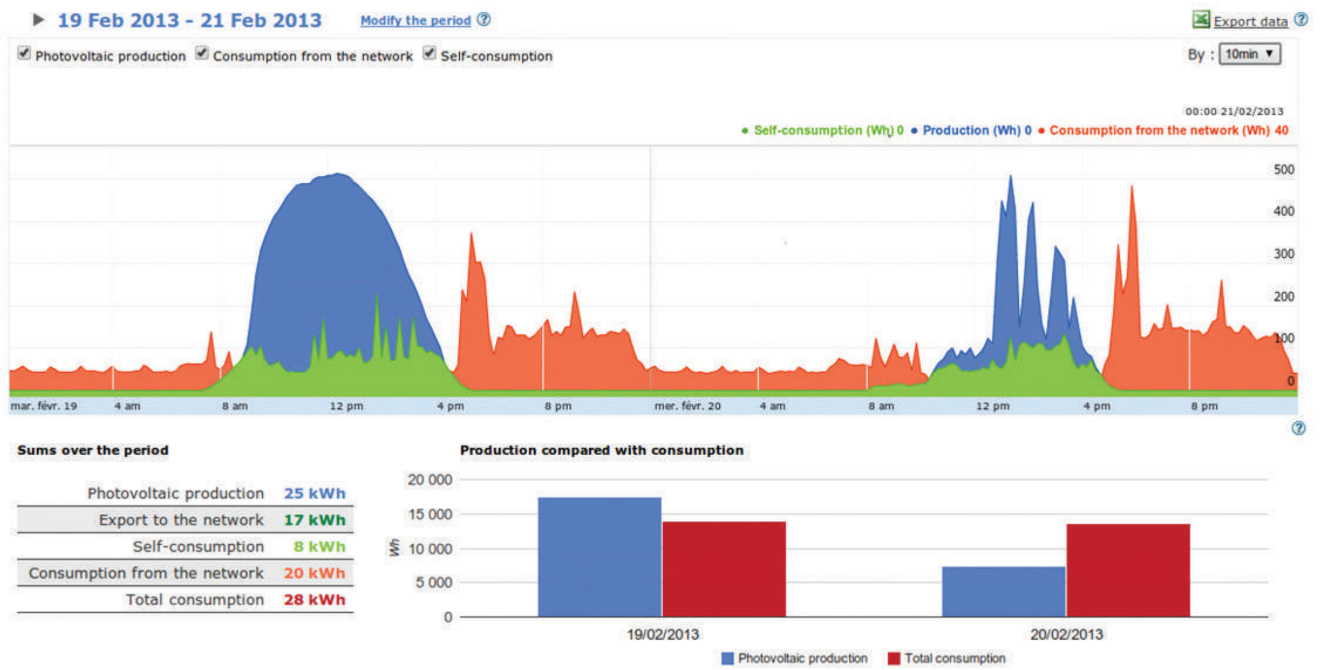
4Eco's immerSUN is the market-leading energy diversion device. Working in tandem with microgeneration technologies such as PV panels and wind turbines, the immerSUN diverts green energy directly to an immersion heater, storage heater, and/or electric underfloor heating. This prevents renewable energy from being exported to the national grid and can therefore reduce an average energy bill by over £250 annually, as well as maximising the benefits of self-generated supply.

Using truSINE power control technology, the immerSUN diverts self-generated renewable energy via width modulation (PWM), which ensures the power is delivered to the load as a true sine wave. This highly effective control method means the immerSUN complies with all applicable parts of the EMC directive 2004/108/EC, including EN 61000-3-2, the harmonised standard for regulating levels of harmonic emissions. This cannot be achieved using more traditional power control methods, which makes the

AN INSTALLATION WITH IMMERSUN



AN INSTALLATION WITHOUT IMMERSUN



immerSUN unique in the energy marketplace.

Eliminating the requirement for government-driven incentives, immerSUN users quote huge energy saving statistics, as well as saving hundreds of pounds on their energy bills. Making the initial green investment highly attractive, the self-consumption of green energy really is the solution to achieving zero subsides.

Driving sustainability forward

As we work towards zero subsidies, promoting the financial benefits of self-generation must be a major tactic to continue the rise in renewables. By looking towards effective diversion systems, such as the immerSUN, it is possible to further increase the country's commitment to green, hitting the highest echelons of international targets and future-proofing our energy landscape, all the while saving money and making the switch to green still financially viable.

Although great while they last, these environmental subsidies obviously won't last forever. What's more, 4eco would argue that they are an unnecessary drain on stretched government funds. We need to start looking towards tandem technologies as a driver to increase sustainable performance. This will not only contribute to shorter pay-back periods on original investment, but also drive long-term, year-on-year savings, regardless of the volatile incentives regimes.

FOR FURTHER INFORMATION

Email sales@4ecoltd.co.uk or ring 01472 398 838

Solar Thermal
(Heat)

- PwC estimate that £170m was invested in the sector between 2010 – 2012
- In 2013, PwC calculate that an additional £37m was invested
- Over the period 2014 – 2020, PwC forecast a further £100m could be invested in the sector

(£m, Real 2012)

Solar thermal provides another check to over-confidence in the reliability of modelling projections. Analysis for the RHI has consistently predicted minimal deployment, yet moderate deployment has continued. Broadly, the market for solar thermal has become less favourable as solar PV has become increasingly attractive. Despite this, the published figures may not tell the whole story. For example, it cannot be explained why the estimate for 2020 (published 2010) is lower than the actual generation in 2007.

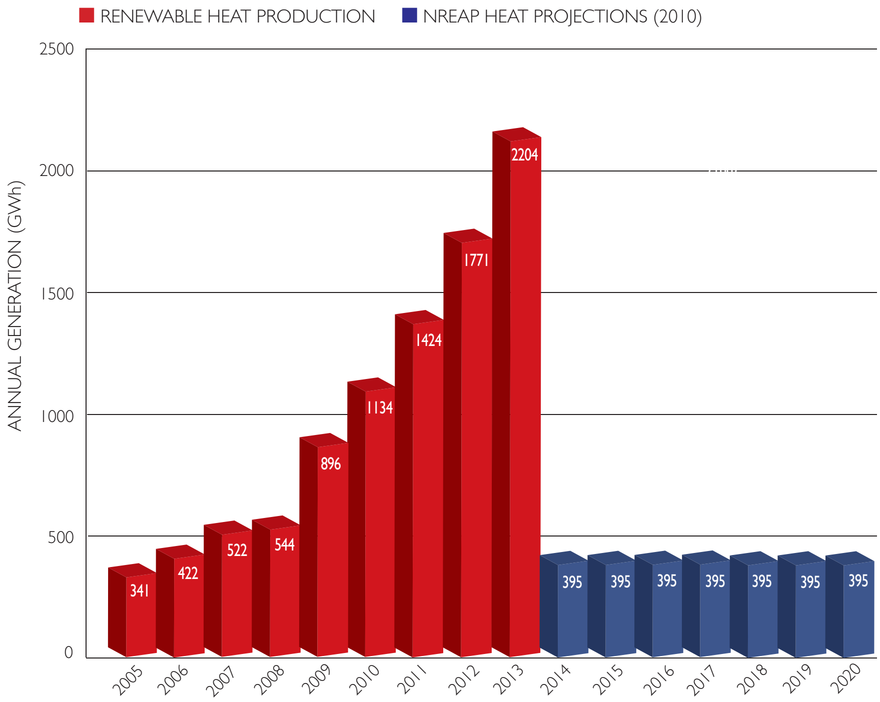
SOLAR THERMAL CONTEXT

- Deployed in the UK for many years, but growth slowed since 2010, although domestic Renewable Heat Incentive is making some difference
- Main UK market likely to be domestic, but has been used in other countries at larger scale

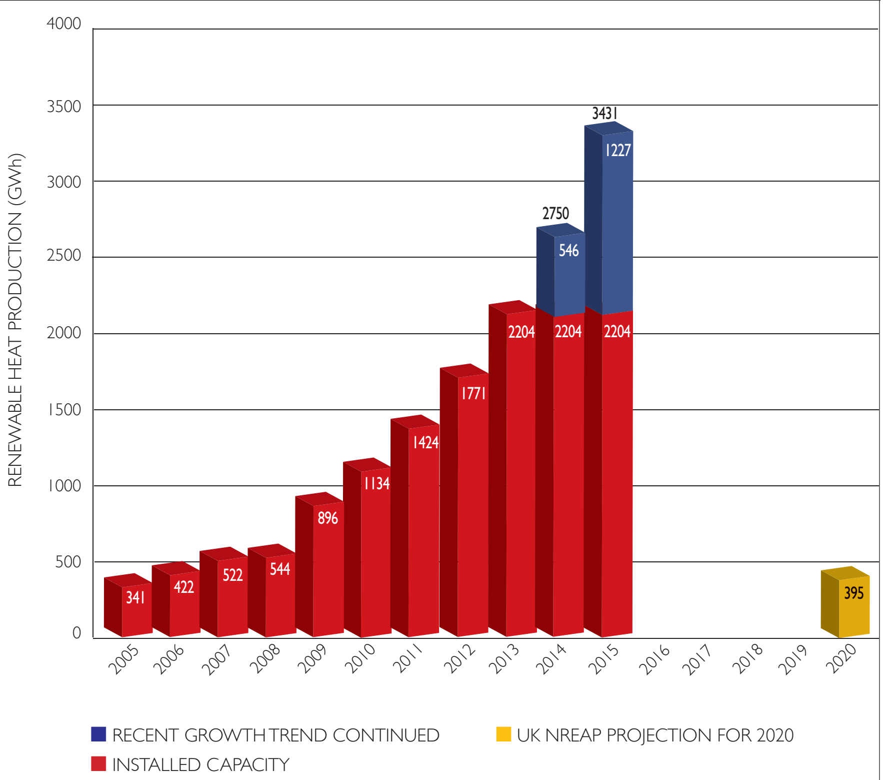
For full explanation of terms, methodology and growth projections see pages 96-97

SOLAR THERMAL HEAT GENERATION

TO DATE AND PROJECTED BY DECC



SOLAR THERMAL - HEAT GENERATION AND PROJECTED GROWTH TREND



SIZE OF THE UK SOLAR THERMAL SECTOR

	2011 -2012	2012 -2013	2013 -2014
Sector Turnover (£'millions)	830	940	1,008
No. of people employed across UK supply chain	7,550	7,530	8,639
No. of UK companies across supply chain	340	340	372

JOBS IN SOLAR THERMAL

MANUFACTURING AND DESIGN

Component manufacture; Solar energy systems designers; Systems engineer; Electrical engineer; Laboratory technician; Quality control technician; Collector assembly worker; Chemist; Surveyor; Materials scientist.

INSTALLATION AND MAINTENANCE

Roofer; Electrician; Plumber; Instrumentation, controls and electrical systems technician; Scaffolder; Installation engineer; Installation supervisor; Service engineer; Semi-skilled labourer for cleaning collectors.

LOGISTICS

Driver; Packer; Warehouse staff.

New Solar iBoost+ also gets a Buddy!

Solar iBoost has already proven itself with householders and pv installers as a truly innovative way to divert excess pv solar energy generated to heat water for free.

Now the arrival of the next generation is eagerly anticipated, the new "plus" version offers enhanced functionality and the capability of connecting wirelessly with a home energy monitor. This Solar iBoost+ Buddy works intuitively for the homeowner, glowing green when excess energy is available and red when grid power is being used. Its display duplicates the built-in display of Solar iBoost+ and also remotely controls it so that the boost function can be operated from the kitchen.

System owners can use the Solar iBoost+ Buddy to view daily, weekly, monthly and total savings to date enabling them to adjust heating settings and cut gas, oil or electricity costs for water heating.

The new products from Marlec will be displayed at Intersolar in Munich in June and be available in the UK market from July 2015.

Solar iBoost products are available from Marlec Eng Co Ltd based in Corby and selected electrical & PV wholesalers. Log onto www.solariboost.co.uk or call 01536 201588

Offshore Wind
(Power)

As with onshore wind, there is good recent growth, although from a lower base. Continued support is dependent on further cost reductions being achieved, with a number of government/industry initiatives to remove barriers and drive improvements across the supply chain. It may be significant that the government's more recent projections scale back anticipated deployment compared to the original 2020 National Renewable Energy Action Plan.

- PwC estimate that £7,248m was invested in the sector between 2010 – 2013
- In 2014, PwC calculate that an additional £2,113m was invested
- Over the period 2015 – 2020, PwC forecast a further £12,412m could be invested in the sector

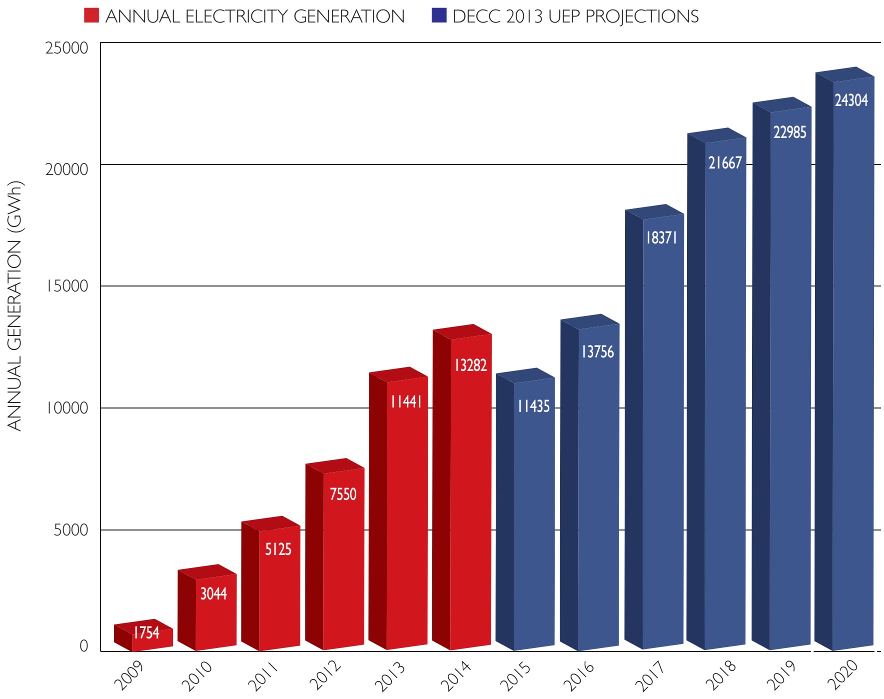
(£m, Real 2012)

OFFSHORE WIND CONTEXT

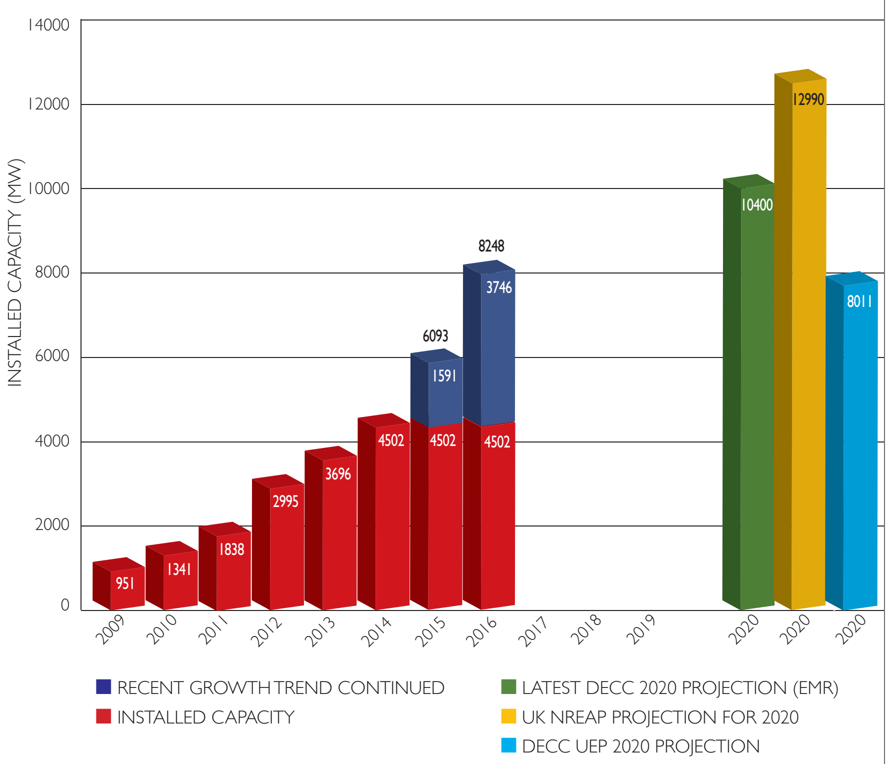
- Strategic industrial priority, given opportunity to build UK leadership
- Requires far higher subsidy than many other options. Industry committed to significant cost reductions in medium term
- Contracts for Difference mechanism vital to delivering intended deployment and cost reductions

OFFSHORE WIND ELECTRICITY GENERATION

TO DATE AND PROJECTED BY DECC



OFFSHORE WIND INSTALLED CAPACITY AND PROJECTED GROWTH TREND



SIZE OF THE UK OFFSHORE WIND SECTOR

	2011 -2012	2012 -2013	2013 -2014
Sector Turnover (£'millions)	2,100	2,500	2,693
No. of people employed across UK supply chain	16,200	18,280	19,478
No. of UK companies across supply chain	790	790	913

JOBS IN OFFSHORE WIND

DESIGN AND DEVELOPMENT
Planner; Lawyer; Financial planner; Economist; Electrical systems designer; Physical engineer; Project manager; Environmental engineer; Meteorologist; Programmer and modeller; Aeronautical engineer; Communications expert.

MANUFACTURE
Design engineer; Electrical engineer; Welder; Metal worker; Machinist; Skilled assembler; Semi and non-skilled worker; Test technician; Chemical engineer; Materials engineer; Mechanical engineer; Quality assurance.

CONSTRUCTION AND INSTALLATION
Planning and environmental consultant; Underwater diver; Project management and construction worker; Marine engineer; Electrical engineer; Power generation engineer; Turbine specialist engineer; Tower erector; Crane operator; Health and safety manager; Specialist shipping and port personnel.

OPERATIONS AND MAINTENANCE
Electrical engineer; Sea and air transport personnel; Power generation engineer; Energy trader.

Onshore Wind
(Power)

Onshore wind has grown well over several years. The geographical spread is not even, with a strong concentration in Scotland. If recent trends were continued, it would be well on course for the 2020 deployment anticipated by the government. This is by no means certain, as growth has slowed recently: rates of planning consent have fallen significantly and the full impact of increased requirements on community engagement, including increased payments to local residents, has yet to be seen.

Onshore wind is one of the cheapest technologies for generating renewable electricity. So the implication of attempts to reduce future deployment is that other more expensive technologies will be needed to meet renewable and climate change targets.

- PwC estimate that £7,125m was invested in the sector between 2010 – 2013
- In 2014, PwC calculate that an additional £1,427m was invested
- Over the period 2015 – 2020, PwC forecast a further £11,682m could be invested in the sector

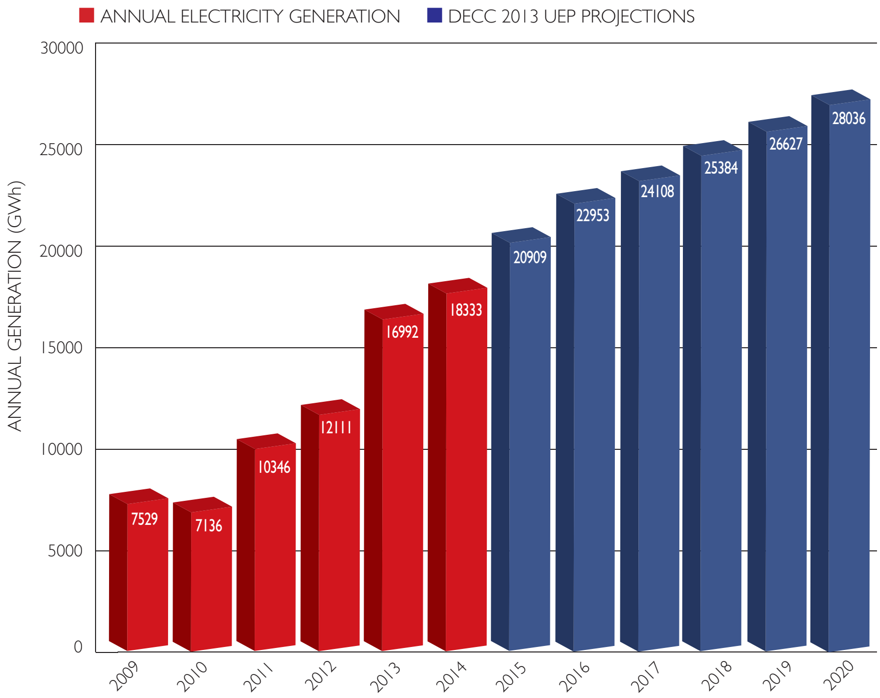
(£m, Real 2012)

ONSHORE WIND CONTEXT

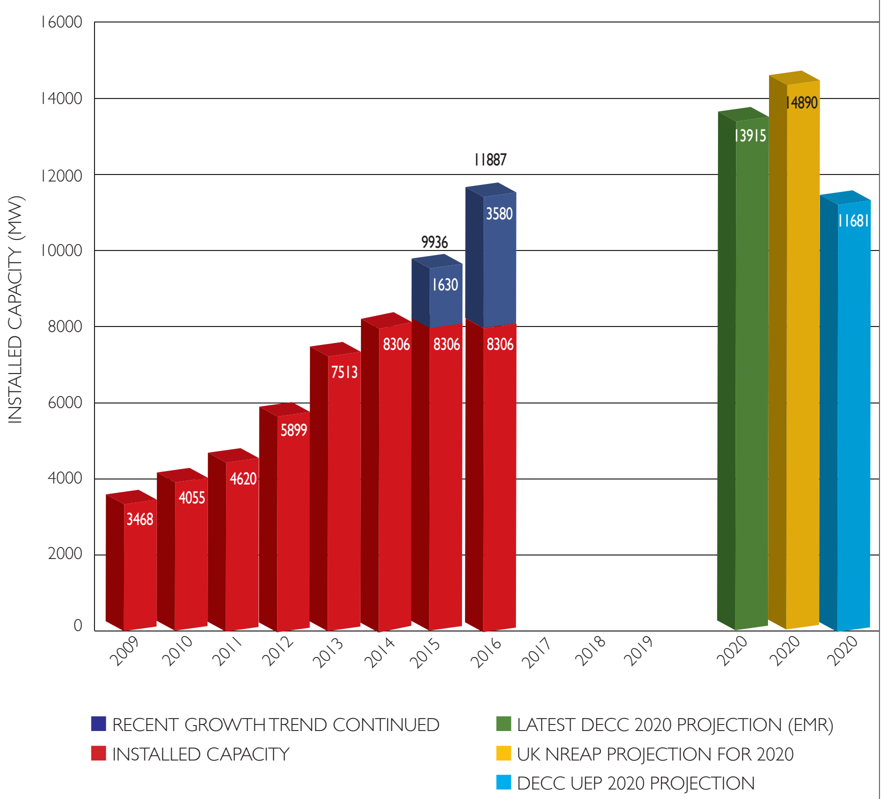
- Cost-effective technology, should continue to play key role with policy focussed on value for money
- Significant contributor to Renewables Obligation and Contracts for Difference. Also supported in Feed-in-Tariff
- Politically controversial. Focus of sustained criticism in media and Parliament. Industry seeking to address through community engagement and sharing economic benefits of developments

ONSHORE WIND ELECTRICITY GENERATION

TO DATE AND PROJECTED BY DECC



ONSHORE WIND INSTALLED CAPACITY AND PROJECTED GROWTH TREND



SIZE OF THE UK ONSHORE WIND SECTOR

	2011 -2012	2012 -2013	2013 -2014
Sector Turnover (£'millions)	2,000	2,300	2,493
No. of people employed across UK supply chain	15,200	17,070	18,191
No. of UK companies across supply chain	730	730	844

JOBS IN ONSHORE WIND

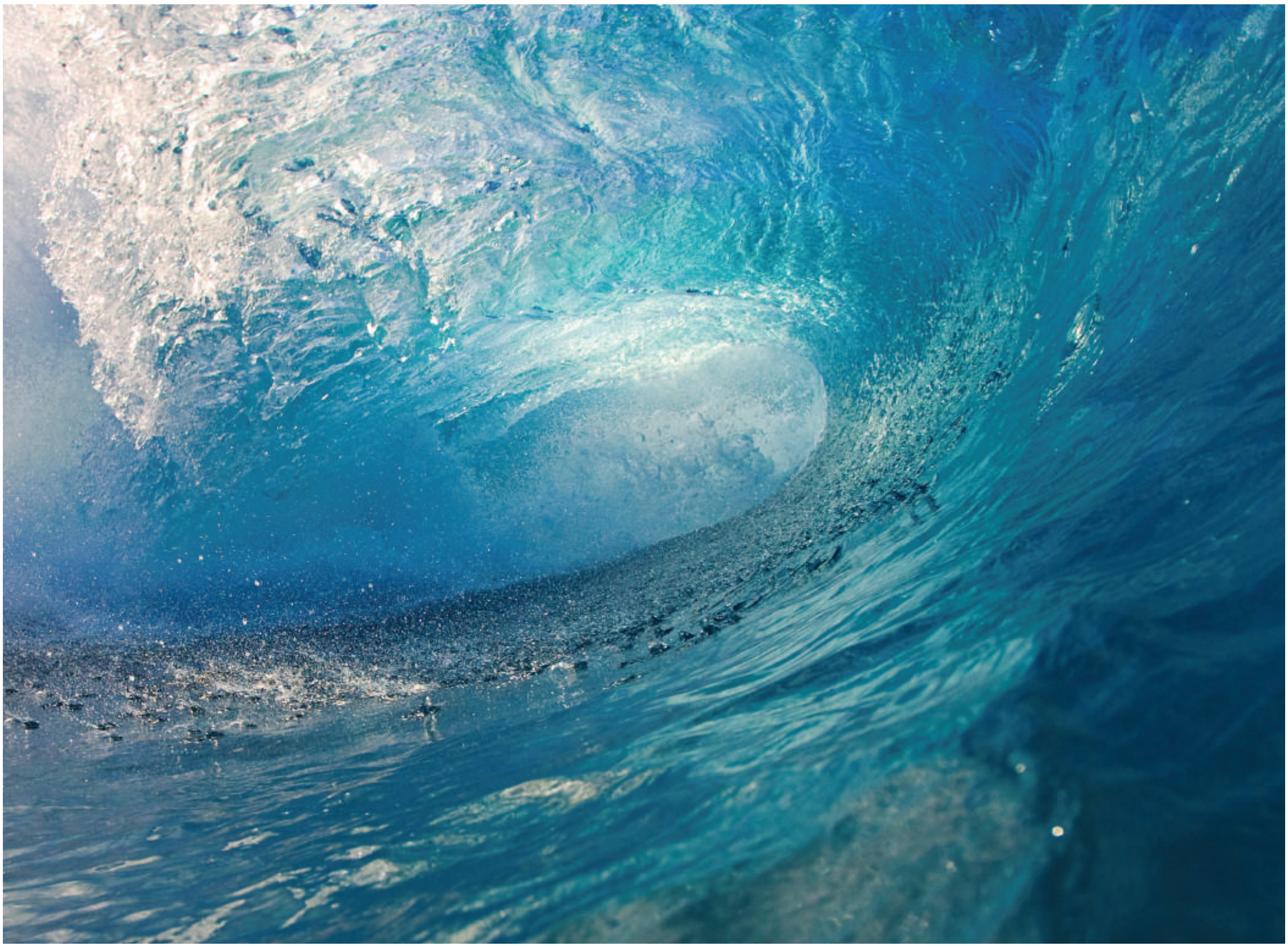
DESIGN AND DEVELOPMENT
Design engineer; Lawyer; Project manager; Financial planner; Economists; Electrical systems designer; Physics engineer; Environmental engineer; Environmental consultant; Meteorologist; Programmers and modellers; Aeronautical engineer; Communications expert.

MANUFACTURE
Electrical engineer; Welder; Metal worker; Machinist; Skilled assembler; Test technician; Quality controller; Chemical engineer; Materials engineer; Mechanical engineer; Semi and non skilled workers.

CONSTRUCTION AND INSTALLATION
Planning and environmental consultants; Project management and construction workers; Electrical engineer; Power generation engineer; Project manager; Turbine specialist engineer; Tower erector - crane operator; Health and safety manager.

OPERATIONS AND MAINTENANCE
Electrical engineer; Power generation engineer; Energy traders.

Wave & Tidal
(Power)



- PwC estimate that £13m was invested in the sector between 2010 – 2013
- In 2014, PwC calculate that an additional £5m was invested
- Over the period 2015 – 2020, PwC forecast a further £546m could be invested in the sector

(£m, Real 2012)

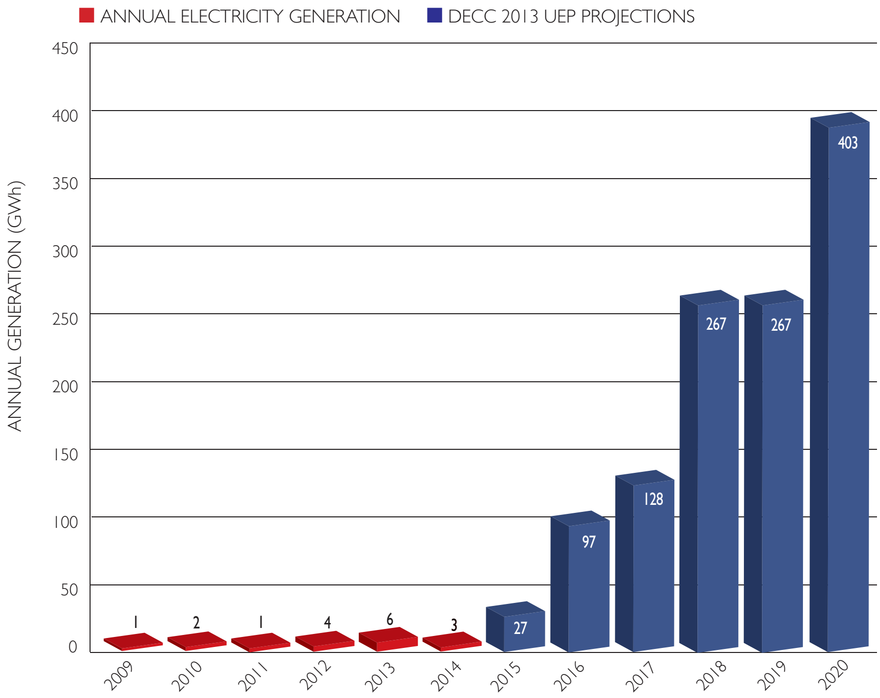
The industry is moving from technology development to deployment. Much of the government's support has been directed at funding innovation, with progress in commercial-scale deployment not being as rapid as the government anticipated. Some major players have reduced their involvement or stepped away from the industry altogether, and it is clear that a fresh look at policy will be needed after the election if this sector is to achieve its potential.

WAVE & TIDAL CONTEXT

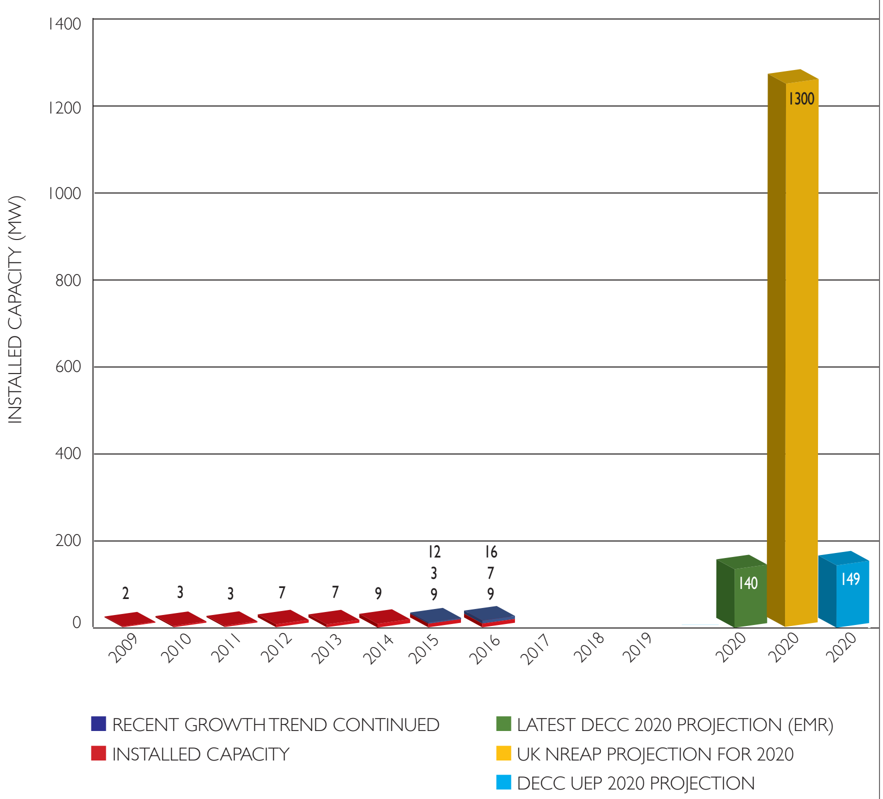
- Still at an early stage of deployment
- Relatively high levels of support in Renewables Obligation and Contracts for Difference, but needs clear policy beyond 2020
- Major challenges in creating Government policy that enables the industry to deploy at scale

WAVE & TIDAL ELECTRICITY GENERATION

TO DATE AND PROJECTED BY DECC



WAVE & TIDAL STREAM INSTALLED CAPACITY AND PROJECTED GROWTH TREND



SIZE OF THE UK WAVE & TIDAL SECTOR

	2011 -2012	2012 -2013	2013 -2014
Sector Turnover (£'millions)	86	100	103
No. of people employed across UK supply chain	570	570	635
No. of UK companies across supply chain	33	30	36

JOBS IN WAVE & TIDAL

PLANNING AND DEVELOPMENT
Environmental and planning consultant; Marine biologist; Marine surveyor; Subsea engineer.

DESIGN AND MANUFACTURE (INCLUDING TECHNOLOGY R&D)
Design engineer; Electrical systems designer; Project manager; Environmental engineer; Environmental consultant; Oceanographer; Programmer and modeller; Fluid dynamics specialist; Communications and control engineer; Electrical engineer; Power generation engineer; Marine engineer; Electrical engineer; Welder; Metal worker; Machinist; Skilled assembler; Test technician; Materials engineer; Mechanical engineer.

CONSTRUCTION AND INSTALLATION
Planning and environmental consultants; Project management and construction workers; Marine engineer; Electrical engineer; Power generation engineer; Quantity surveyor; Turbine specialist engineer; Health and safety manager; Specialist shipping and port personnel; Divers; Controls engineer; Project manager; Marine installation crew; Health and safety manager.

SUPPORT SERVICES AND OTHER
Device maintenance crew; Electrical engineer; Marine engineer; Power generation engineer; Energy sales people; Divers.

State of the renewables industry

Investments in renewable electricity, heat and transport

1. EXECUTIVE SUMMARY

In order to meet 2020 carbon reduction targets, all EU member countries have been set targets for the level of renewable energy as a proportion of total energy consumption. The UK target of 15% of final energy consumption is binding, as is the 10% contribution from transport, however electricity and heating targets are a matter of UK policy.

The UK Government has enacted a series of policies to support the development of a portfolio of renewable technologies, provided a regulatory framework and a support mechanism that encourages investment. As the renewable energy industry matures, Government has sought to adjust policy so that the overarching targets are met in the most affordable way, which in practice may see the policy for individual sectors (electricity, transport and heating) change as technology costs and deployment rates change.

This report explores the recent (2014/15) developments in the renewable energy industry and their impact on the level of investment, recognising the interactions between policy, targets and level of investment. We also present an updated estimate of capital expenditure required to reach UK 2020 targets, following on from the first REview in 2014.

The analysis estimates £40bn has been spent between since 2010 across the three sectors[1] and a further £48bn is required to deliver against targets.[2]

Renewable electricity

2014 saw the greatest investment in renewable electricity generation to date, at £10bn. This level of investment exceeded expectations for the year, which were forecast to lie at £8.7bn, based on 2013 projections. Offshore wind and solar PV attracted the largest share of this record investment in a year that witnessed a number of important developments in the renewable electricity sector.

One of the most notable investments during 2014 was the Green Investment Bank (GIB) investment in the 210MW Westermost Rough offshore wind project. This marks the first time GIB has taken construction risk in offshore wind, and the bank's involvement facilitated additional investment from Marubeni Corporation, also sharing construction risk. It is expected that through facilitating further such deals involving new types of investors, GIB will help both developers to recycle their capital more effectively and bridge the funding gap for construction stage projects.

Alongside record levels of investment, the industry also witnessed the first competitive CfD auction which concluded in February 2015. With the exception of energy from waste, all technologies cleared below their respective administrative strike prices. This was seen by Government as testament to the benefits of competitive allocation and a positive outcome for consumers. Two solar projects drew particular attention by clearing at £50/MWh for delivery in 2015/16 and subsequently withdrawing, highlighting some of the flaws in the allocation process. Three further solar PV projects cleared at £79/MWh in 2016/17 together with one onshore wind project. Mainstream's Naert offshore wind development, which cleared at £114/MWh in 2017/18, demonstrated good progress towards the target LCOE of £100/MWh in 2020.

While lower than expected CfD clearing prices will allow more capacity to be delivered within the Levy Control Framework (LCF) envelope, higher than expected investment in solar PV seen since 2013 has led DECC to announce the closure of the RO to large (>5MW) solar PV from 1st April 2015 in a bid to protect the LCF budget. The announcement led to a push from developers to commission ahead of April 2015 under the more favourable RO regime, to avoid having to bid for CfD support against other 'well-established' technologies in Pot 1, including onshore wind.

Renewable heat

The renewable heat sector saw an estimated £1.1bn of investment during 2013, delivering a capacity addition of 1.5GW. The majority of investment was in bioenergy technologies (£1bn, 1.4GW net additions), followed by heat pumps (£70m, 57MW) and solar thermal (£37m, 24MW).

Renewable transport

No capacity additions were identified in 2014. The primary regulatory instrument for biofuels, the Renewable Transport Fuel Obligation (RTFO), has reached the maximum obligation level of 4.75%. Without a clear trajectory towards the target of 10% by 2020 there is a weak business case for investment in additional capacity in the UK. Evidence from DECC shows that the majority (77%) of

FIGURE 1 **HISTORICAL AND FORECAST INVESTMENT IN RENEWABLES (2010-20)**

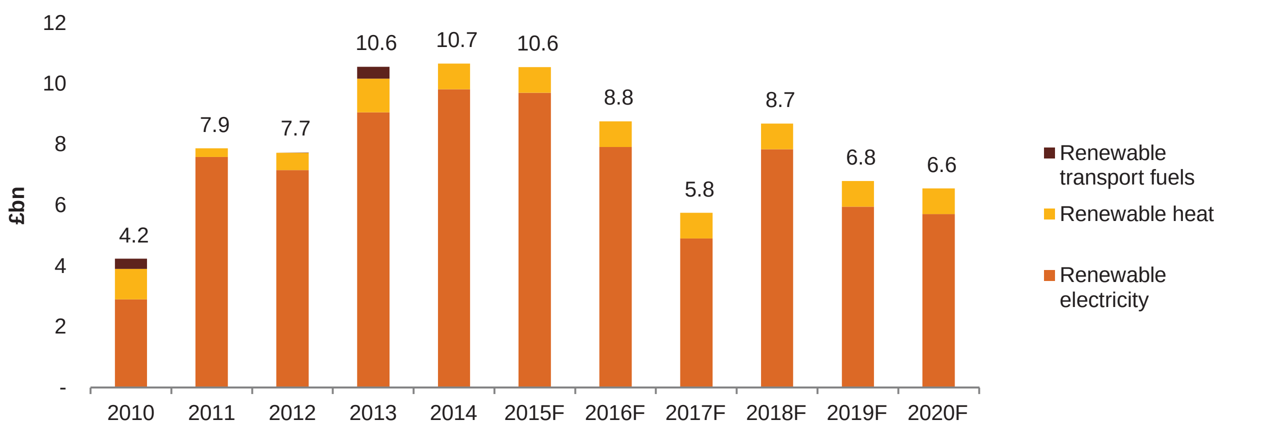
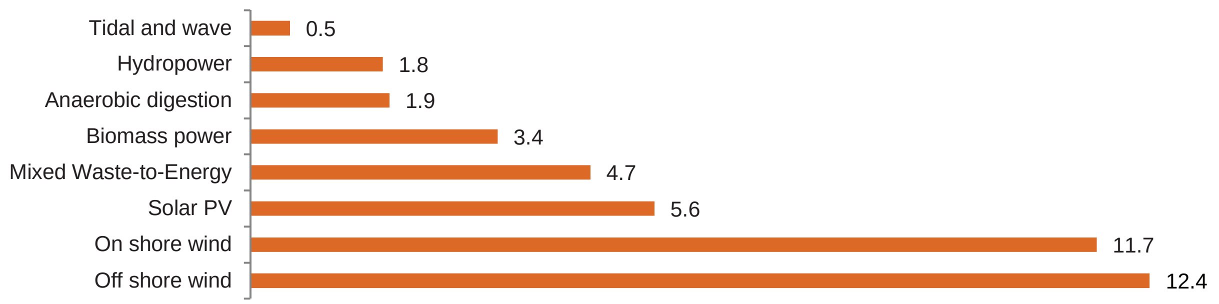


FIGURE 2 **ELECTRICITY GENERATION FORECAST INVESTMENT BY TECHNOLOGY, 2015-20 (£bn)**



fuel obligation is being met through imports, suggesting suppliers are seeking to meet their volume obligations from lower cost imported biofuels.

Future investment

When considering the investment required to deliver the UK's 2020 targets, electricity generation is expected to continue to require the greatest share of capital. Indeed the capital required to deliver Government's 2020 generation targets increased during 2014 as a result of the volume of low load factor capacity (e.g. solar PV) being deployed. This has seen DECC increase the 2020 capacity targets by 7GW in order to deliver the existing generation target.

This rise in target capacity brought the total estimated investment required in electricity to £42bn to reach 2020 targets. Offshore wind and solar PV will continue to dominate investment in electricity capacity, although the announcement that the RO will close to large solar PV will see developers competing for CfDs two years sooner than originally expected.

Technology costs remain one of the greatest areas of uncertainty for industry. There are indications that costs are falling rapidly for some technologies, as evidenced by solar PV clearing at £79/MWh for delivery in 2016/17. Offshore wind continues to track the progress towards a LCOE of £100/MWh in 2020, as analysed by the Offshore Renewable Energy Catapult's Cost Reduction Measurement Framework (CRMF). The CRMF study showed that industry is broadly 'on target', with all finance indicators (e.g. cost of debt, availability of capital) showing scores of 'on target' or 'ahead of target', suggesting that the target cost reduction is on track to be delivered.

For renewable heat, if the UK is to meet the 2020 energy target set out in the National Renewable Energy Actions Plan (NREAP) of 72TWh, an estimated investment of £5.9bn is required across bioenergy, heat pumps and solar thermal between 2014-20.[3] The NREAP assumes that the investment will be primarily into bioenergy and heat pumps. However, historical investment has favoured bioenergy, with considerably less investment into high-efficiency heat pumps. This poses a risk to achieving the 2020 targets, as a fixed investment volume will deliver less renewable generation if historical investment trends continue. Figure 3 shows the investment required to achieve NREAP targets and the historical investment share attracted by each technology.

Investment in renewable transport has not been estimated due to uncertainty around whether targets will be met through domestic or imported biofuels.

Achieving 2020 renewable energy targets

It is important to recognise the interaction between individual technology targets in meeting the overall energy basis target. Figure 4 illustrates the relationship between the level of renewable contribution from individual areas, in order to meet the overarching target of 15%. DECC's base case assumption is 30% power, 12% heat and 10% transport. The highlighted values show current contributions from transport and heat, which would require a 52% contribution from renewable electricity

FIGURE 3 **FORECAST INVESTMENT IN RENEWABLE HEAT BY TECHNOLOGY TO REACH NREAP, 2014-2020[4]**

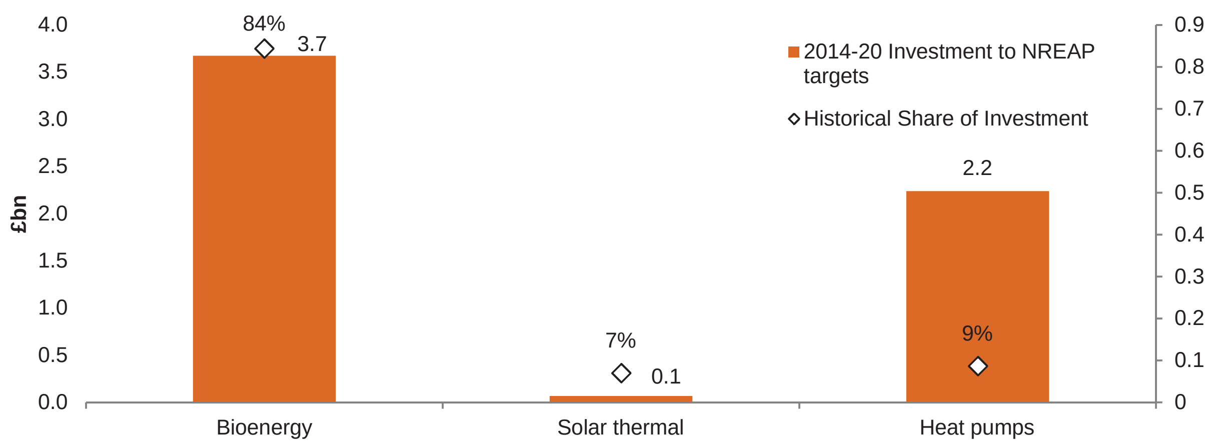


FIGURE 4 **RELATIONSHIP BETWEEN POWER, HEAT AND TRANSPORT TARGETS**[5]

	Surface Transport								
Heat	**10%**	**9%**	**8%**	**7%**	**6%**	**5%**	**4%**	**3%**	**2%**
12%	30%	32%	33%	34%	36%	37%	38%	39%	41%
11%	32%	33%	35%	36%	37%	38%	40%	41%	42%
10%	34%	35%	36%	37%	39%	40%	41%	42%	44%
9%	35%	36%	38%	39%	40%	41%	43%	44%	45%
8%	37%	38%	39%	40%	42%	43%	44%	46%	47%
7%	38%	39%	41%	42%	43%	45%	46%	47%	48%
6%	40%	41%	42%	44%	45%	46%	47%	49%	50%
5%	41%	43%	44%	45%	46%	48%	49%	50%	51%
4%	43%	44%	45%	47%	48%	49%	50%	52%	53%
3%	44%	46%	47%	48%	50%	51%	52%	53%	55%
2%	46%	47%	49%	50%	51%	52%	54%	55%	56%

generation. What this shows is that a shortfall against heat or transport targets requires a significant increase in renewable power contribution.

Current investment and capacity deployments suggest that power is the only area in which an outperformance of the existing DECC targets for renewable energy generation is likely, even if only marginally.

Policy clarity

The challenge of meeting targets across power, heat and transport highlights the need for a coordinated approach that is not obvious from current policy.

- Renewable electricity developers are facing a challenge to appropriately manage their development pipeline in the absence of clear guidance about volume requirements beyond the end of the LCF in March 2021.
- RHI funding needs to be confirmed beyond 2016 or overall generation targets are put at risk.
- Progress in renewable transport is particularly concerning, where the lack of a clear trajectory to reaching the 2020 target is seeing the sector fall short of even the more modest targets currently in place (4.75%), with little expectation of reaching 10%.

Without a baseline level of certainty across all sectors, investment decisions and therefore progress towards meeting targets in 2020 and beyond are in jeopardy. Policymakers must be mindful of industry's need for sufficient long term certainty to support the investment decisions necessary to maintain an appropriate balance between security of supply, decarbonisation and affordability.

2. MEETING THE UK'S RENEWABLE TARGETS

With just five years remaining for the EU to deliver on its 2020 renewable energy targets, designed to take carbon emissions to 20% below the 1990 levels, it is useful to reflect on how the UK's contribution to their target of 15% of final energy consumption from renewable sources is likely to be reached.

Although the UK 2020 target of 15% of final energy consumption is a binding target, the mix of renewable energy used to deliver this target has been devolved to UK Government (except in transport, where a 10% minimum is binding). Existing policy has indicated that this would be achieved through 10% of transport energy, 12% heat of energy and 30% power from renewable sources; progress however, has not been balanced across these three areas. It follows that progress above the base case assumptions in one area may allow a relaxation of targets in another area, or vice versa, while still delivering the requisite 15% across the three sectors.

The most recent data available indicates renewables share of power generation reached 19.2% in 2014 (2013: 14.9%), heat 2.8% in 2013 (2012: 2.3%) and transport 4.4% in 2013 (2012: 3.7%).[6] Based on current deployment rates, power is the only sector in which an outperformance of the existing DECC targets for renewable energy generation is likely, and even here, any outperformance may only be marginal. So what might this trade-off look like in practice?

The figure (next page) illustrates the impact of increasing the proportion of renewable power from DECC's base case assumption of 30% (i.e. 12% renewable heat and 10% renewable transport). The values shown in the table indicate the proportion of power that must be generated from renewable sources, at a given contribution from both transport and heat. What this shows is that a shortfall against either the heat or transport targets requires a significant increase in renewable power contribution. Under the 2015 forecasts prepared by DECC, renewable electricity is expected to reach a 34% share of demand by 2020. This would allow for a 3% reduction in transport targets, providing heat reached 10%.

This highlights the need for a coordinated approach to targets that is not obvious from current policy.

3. INVESTMENTS IN RENEWABLE ELECTRICITY

In our analysis, the absolute amount of investment in renewable electricity in any year is measured by the technology specific investment cost and the amount of additional capacity deployed in that year. The relative attractiveness of one technology over another is driven by a number of factors, but particularly by the support mechanisms put in place by Government to enact climate change policy (in order to meet renewable energy targets). The primary support mechanisms for power generation are the Renewables Obligation (RO), Contracts for Difference (CfDs) and, in the case of small scale generation, Feed in Tariffs (FiTs).

3.1. Investment costs

Calculating the investment required to deliver the DECC capacity build targets relies on robust assumptions about the cost of individual technologies. Our approach to 2015

FIGURE 5 **RELATIONSHIP BETWEEN POWER, HEAT AND TRANSPORT TARGETS**[7]

Heat \ Surface Transport	10%	9%	8%	7%	6%	5%	4%	3%	2%
12%	30%	32%	33%	34%	36%	37%	38%	39%	41%
11%	32%	33%	35%	36%	37%	38%	40%	41%	42%
10%	34%	35%	36%	37%	39%	40%	41%	42%	44%
9%	35%	36%	38%	39%	40%	41%	43%	44%	45%
8%	37%	38%	39%	40%	42%	43%	44%	46%	47%
7%	38%	39%	41%	42%	43%	45%	46%	47%	48%
6%	40%	41%	42%	44%	45%	46%	47%	49%	50%
5%	41%	43%	44%	45%	46%	48%	49%	50%	51%
4%	43%	44%	45%	47%	48%	49%	50%	52%	53%
3%	44%	46%	47%	48%	50%	51%	52%	53%	55%
2%	46%	47%	49%	50%	51%	52%	54%	55%	56%

investment costs has been to apply existing factors where no new evidence suggesting a shift beyond the assumed cost reduction trajectory has been identified.

Our reference point for these estimates has been the ARUP derived capital cost factors applied in the 2014 report[8]. These capital cost factors include:

- Pre-development costs
- Construction costs (turbines, foundations, civils)
- Grid costs
- Other infrastructure

The ARUP capital cost factors include learning and efficiency effects, based on the International Energy Association's learning rate of 7%.

3.1.1. Input costs

The cost factors used do not include exchange rate movements, due to the uncertainty of such movements. It is important to recognise the impact that exchange rates can have on overall costs of securing large CAPEX items, for example turbines, with developers entering into purchase agreements outside their country of origin exposed to greater risk. For consistency our approach has been to exclude the exchange rate fluctuations as these remain uncertain and challenging to accurately forecast.

Commodity prices are also important to the cost of individual technologies; for example, rising steel prices are expected to be the main contributor to price inflation for wind energy up to 2025.

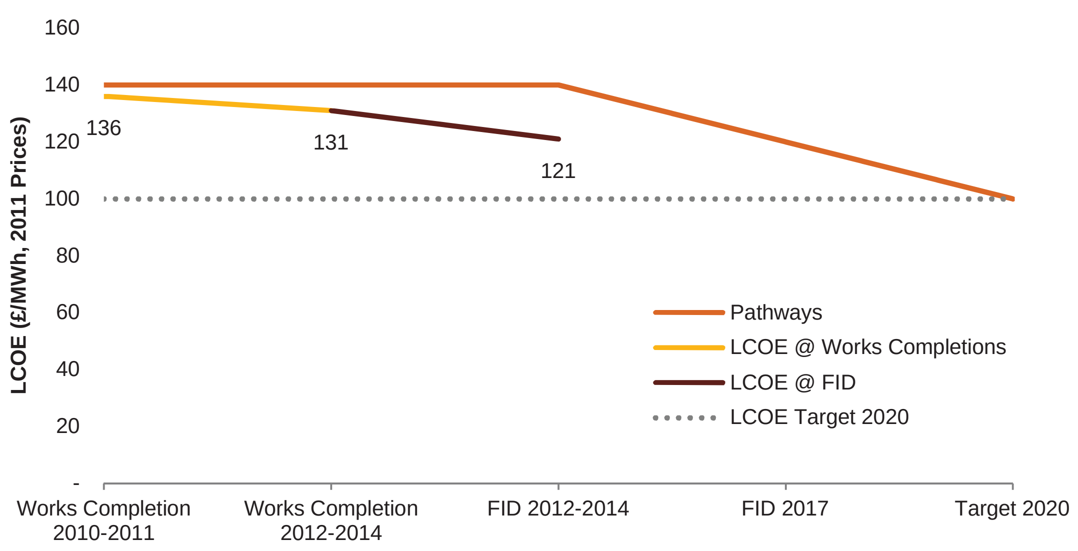
One commodity that has been the subject of the greatest change in price during 2014 was crude oil. The collapse of oil market prices dominated headlines during the latter months of 2014, but to what extent does this impact investment in renewable electricity generation?

3.1.2. Technology costs

When considering technology specific costs, there are two technologies where the evidence suggests costs have fallen below the assumptions used in last year's report: offshore wind and solar PV.

The new evidence which points to a fall in offshore wind is the Offshore Renewable Energy Catapult (OREC) Cost Reduction

FIGURE 6 **OFFSHORE WIND LCOE COMPARED TO PATHWAYS STUDY (TECHNOLOGY ACCELERATION)**[10]



IMPACT OF LOWER CRUDE PRICE ON INVESTMENT IN RENEWABLES

The last 12 months have seen some astonishing volatility in oil prices; falling to below $50 per barrel from highs of $115 per barrel last summer, the impact is starting to be felt across the UK oil and gas sector. Medium term capital budgets are being slashed, (e.g. BP -20% and BG -30%) while the value of assets are being written down. It has also driven a new round of M&A activity, as evidenced by Shells bid for BG Group.

The knock-on effect is being felt in the utilities sector, with wholesale gas and power prices falling. The outlook for power prices is also influenced by a benign carbon market and a coal market that has experienced even greater relative price falls than the oil market. The net effect of falling gas prices is that these reductions are slowly making their way through to end consumers with falls in the prices consumers pay (although the big suppliers have not yet passed on any power price reductions).

So what does this all mean for investment in the UK renewable energy sector? Does it make renewable investments more or less attractive?

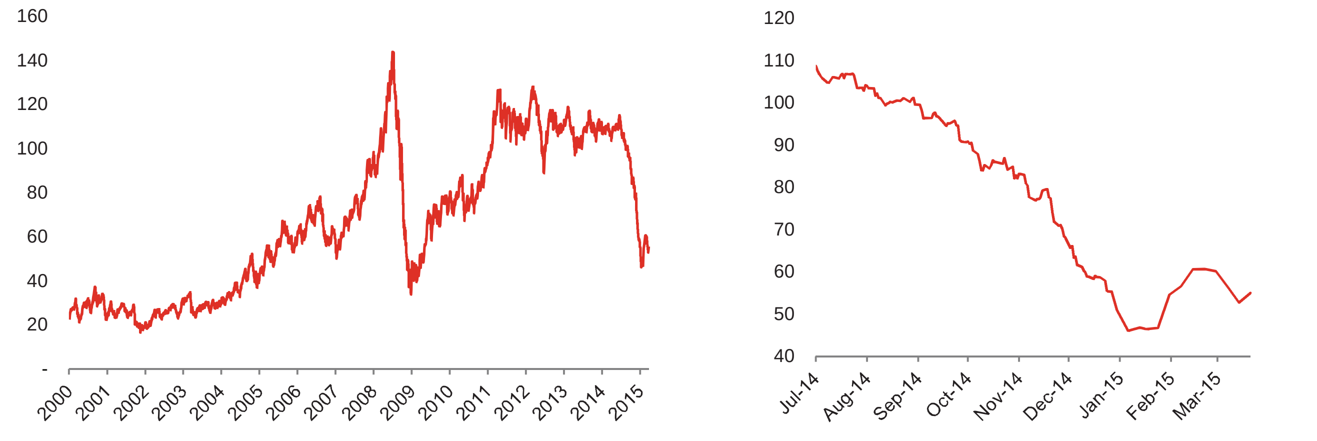
There is some evidence on the correlation between key input variables and the costs of technologies such as offshore wind which suggests that currency fluctuations and commodity prices have the greatest impact on the levelised cost of offshore wind. However, it is worth adding that as most of this manufacturing is outside the UK, international commodity prices will have a greater bearing on technology costs. Another key cost is bunker fuel prices which have fallen significantly on the back of lower oil prices. This should feed through to the transportation costs of both wind turbines and biomass. There is a timing issue around the lag between commodity price falls and how this feeds through to technology specific costs which will depend on contractual terms through the supply chain.

In principle, falling commodity prices will have the effect of making the relative cost of supporting renewables look more expensive. This situation is exacerbated by the newly introduced CfD support scheme for low carbon generation. As the energy policy debate has played out over the past 18 months, what has become more evident is the importance of the overall level of energy price (the price we pay as consumers). The irony of low commodity prices is that it makes renewables under a CfD look expensive, but overall consumer prices should be lower.

In summary, at a macro level lower commodity prices should not materially impact on the economics of renewable energy projects in a CfD world and should make consumers less focussed on the cost of renewables if overall energy prices are falling. We have concerns however, that the nature of the LCF mechanism could act as a constraint that reduces the total capacity of renewable projects that can be funded from a fixed pot and that issue needs to be addressed.

**Federal Reserve Economic Data*

FIGURE 7 **HISTORIC OIL PRICE (Brent $/bbl)***



Measurement Framework (CRMF) report. The CRMF assesses cost reduction in the offshore industry annually against the trajectory required to deliver an LCOE of £100/MWh in 2020. The findings of the January 2015 assessment suggest the industry is in fact ahead of the benchmark pathway, although the CRMF assessment is calculated over a 25 year period (contrasted with a 15 year CfD).[9]

Levelised Cost of Energy (LCOE) is the calculated cost to produce electricity over the life of the asset (typically 20-25 years), based on expected power output (MWh). LCOE includes all of the assets lifetime costs, such as construction, financing, fuel, maintenance, tax and insurance. Some costs are excluded, such as costs of selling power (due to Power Purchase Agreement discounts or fees) and working capital costs.

Figure 7 shows the assumed LCOE trajectory set out in the CRMF required to reach £100/MWh in 2020, along with the estimated LCOE based on the most recent data collected. The falling LCOE of offshore wind supports the cost reduction assumption which has been applied in the investment factors

It could be argued that equivalent cost savings would be expected for onshore wind, given the technology similarities (WTGs, financing, supply chain). However, onshore wind is impacted by fundamentally different planning conditions, which act as a barrier to the scale of onshore developments which would be required to realise many of the cost saving opportunities that have allowed offshore to reduce its LCOE. Turbine size, for example, has not increased at the same rate as onshore (offshore projects reaching FID 2012-14 are dominated by 6MW WTGs), where turbine size is a significant determinant of LCOE. Onshore wind is not able to achieve the same direct economies of scale that arise from greater efficiency or indirect economies of scale from fewer installations

PwC

LESSONS FROM THE FIRST CFD ALLOCATION ROUND

The past 12 months have also seen two batches of CfDs awarded to renewable projects, starting with FID enabling (FIDe) followed by the first competitive CfD auction, which was finalised in February 2015. With two sets of CfD now allocated, it is possible to comment on the relative levels of the subsidies awarded across the contracts and also the relative competitiveness of technologies.

February's announcement of the results of the first CfD allocation round made for interesting reading; with the exception of Energy from Waste, all other technologies offered CfDs cleared well below the administered strike price.

The results were seized upon by Government as a testament to the benefits of competitive allocation and a good thing for consumers and the environment, as the process demonstrated that you could buy more renewable energy for the same pot of money. But what were the key lessons?

Solar at grid parity?

Solar has also shown signs of strong cost reduction with the most recent reference point coming from the first competitive CfD auction. The clearing price for solar in 2015/16 at £50/MWh highlighted some of the flaws in the allocation system. With these developers bidding below the true cost of the project, in anticipation that the price would clear at a higher level, they were left with projects that could not stack up economically and have decided not to progress these projects. A more credible reference point for solar might be the clearing price of £79.23/MWh for delivery in 2016/17, matching onshore wind. This still represented a very significant discount to the headline strike price of £120 /MWh.

Where next for onshore wind?

With a significantly higher clearing price in 2016/17 at 79.2 £/MWh, three solar projects cleared the mature technology pot along with one onshore wind project. The 626MW of onshore wind that cleared the 2018/19 auction at 82.50 £/MWh, suggests no competition from solar in that year with a few notable winners; Banks Renewables with 3 projects (180MW) and Infinergy with the 177MW Dorenell wind farm. Although there was some competitive tension between onshore wind and solar in 2016/17, for future auctions it feels hard to see how onshore will compete successfully with solar which continues to demonstrate aggressive cost reduction potential.

Offshore wind – glass half full or glass half empty?

Perhaps the biggest surprise is the clearing price achieved for the two offshore windfarms – Mainstreams 'Neart' project cleared in 2017/18 at 114.4 £/MWh while the East Anglia round 3 project cleared at 119.9 £/MWh. While some may wonder at the ability to deliver projects at these prices, on the positive side, this demonstrates a level of cost reduction for offshore wind that is in line with the Government and industry's ambition of 100 £/MWh by 2020.

These clearing prices need to be put in the context of the strike prices offered to the five Final Investment Decision (FID) enabled CfD projects – 150 £/MWh for the projects due to commence operations from 2017 and 140 £/MWh for the projects commencing operations from 2018. In total, FIDe contracts were awarded to 3.2GW of offshore wind projects.

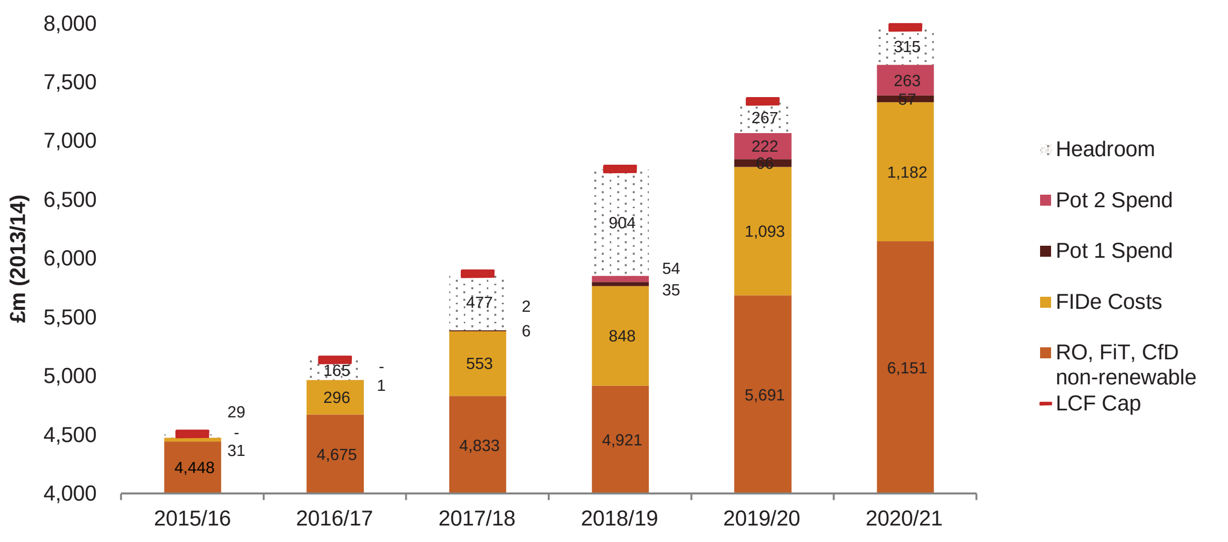
Invariably the Government will have to deal with further challenges to the FID enabling decision given the outcome of this competitive allocation round. In a hypothetical scenario where the FID projects had been held back to compete in this first CfD round and all offshore cleared at 120 £/MWh, this would have freed up c. £300m of Levy Control funding or c. 1.3GW of additional offshore projects.

This scenario demonstrates the importance of the LCF in determining the total capacity which can be deployed. The CfD budget available for each technology 'pot' is already known, as is the spend based on the CfDs allocated to date. This allows that for the latter years of the LCF at least, the CfD budget is largely allocated for both pot 1 and pot 2 technologies, although there is still considerable CfD budget available for FID before 2019 (c. £1bn). Therefore, although the technology CAPEX is certainly decisive in

TABLE 1 **CFD ALLOCATION ROUND ONE OUTCOME (REAL 2012)**

Technology		Admin. Strike Price	2015/ 2016	2016/ 2017	2017/ 2018	2018/ 2019
Advanced Conversion	£/MWh	155-140			119.89	114.39
	MW				36	26
Energy from Waste (EfW)	£/MWh	80				80
	MW					94.75
Offshore Wind	£/MWh	155-140			119.89	114.39
	MW				714	448
Onshore Wind	£/MWh	95-90		79.23	79.99	82.5
	MW			45	77.5	626.05
Solar PV	£/MWh	120-100	50[1]	79.23		
	MW		32.88	38.67		

FIGURE 8 **FORECAST LCF SPEND BY SUPPORT MECHANISM (£m)**



setting the total investment volume, the CfD budgets act to create a ceiling on the capacity deployed and therefore the capital required.

Also clear from the limited number of projects bidding for CfDs for delivery before 2018 is the industry preference for existing support mechanism (RO) where available. Only c. £8m of budget is required to fund all successful CfDs in the three years leading to the closure of the RO, compared to £87m in the first full year where the RO is not available (2018/19). There is a risk that the cost of funding the RO could increase significantly if a number of projects, for example those unsuccessful in the FIDe process, aim to commission before the closure of the RO in April 2017. In this scenario the headroom within the LCF to support future CfD rounds would come under increasing pressure.

Inevitably, comparisons will be made with the strike price of £92.5/MWh (real 2012) being offered to nuclear new build. However, the CfD agreed with Hinckley has been negotiated bilaterally and it will be bespoke in its terms, not least the 35 year tenor and risk sharing mechanism, meaning direct comparisons should be made with caution.

In summary, while these announcements will not reduce future consumer bills, as the lower than expected strike prices just mean we get more renewables for the same amount of money, the direction of travel for the costs of both solar and offshore wind is good news. For project developers, it is time to take stock and rationalise portfolios, including dropping less attractive projects that cannot compete in this new auction world and focus on further cost reduction potential for their better projects. For policy makers, the outcome is a clear endorsement of the Electricity Market Reform programme, although no doubt there will be lingering questions on the FID enabling process.

Results from the competitive auction certainly draw attention to the apparent generosity of the FIDe contracts, while Government has been vocal in recognising the success of the competitive auction in terms of securing investment at an affordable level for consumers, who will ultimately bear the price risk removed from generators. It is important to recognise the discussion between affordability within the context of the LCF budget (which serves to limit the regulatory support that can be recovered from consumers) and the capital affordability of the projects themselves.

Sources: Contracts for Difference allocation round one outcome, DECC, February 2015

CfD administrator confirms no PV projects for 2015/16, Solar Power Portal, 7th April 2015

Notes: The LCC has confirmed that Wick Farm and Royston Solar Farm, both of whom secured a strike price of £50/MWh, will not proceed

Sources: Early contracts for renewable electricity, NAO, June 2014

Assumes FIDe projects achieve an average load factor of 45% or 12.4TWh across five successful projects and foundations per MW or capacity as have been seen in offshore projects. The assumed capex factor applied to onshore wind has remained flat from 2013.

3.2. Capacity deployment

DECC publishes data tracking the deployment of renewable electricity generating capacity by technology type. Figure 9 shows the growth of capacity in the UK, which reached 24.2GW at the end of 2014 (2013: 19.7GW), following record capacity additions of 4.5GW during 2014, equivalent to 23% growth in a single year.

Figure 10 shows the capacity deployment during 2014 by technology. Two technologies stand out for their outperformance against previous forecasts: solar PV and offshore wind. Solar PV has not only deployed significantly more capacity in 2014 than onshore and offshore wind combined, but also more than doubled the 2013 solar PV capacity addition of 1GW. Offshore wind, while reaching a lower absolute deployment, exceeds the existing forecasts by c. 60%.

This shift in the mix of capacity being deployed is significant because it affects the output of renewable electricity, since all technologies have different load factors.[13] Solar PV has one of the lowest load factors of any renewable power generating technology (c. 10%), meaning that a large addition of solar capacity will not lead to as large an increase in output as would be the case from other technologies.

The last 12 months have also been positive for biomass, with Drax's Unit II conversion unit entering operations, adding to the unit commissioned in 2013.[14] In January 2015 the FIDe contract awarded to MGT's 300MW Combined Heat and Power (CHP) plant in Teesside formally cleared EU state aid approval.[15] This marked the first biomass plant to be approved under the CfD regime.

Another important observation is the extent to which the total capacity additions exceeded the forecasts made by DECC in 2013. The outturn capacity additions amounted to 129% of the 2013 forecast for 2014.

3.3. Renewable electricity investments in 2014

In order to estimate cost of deploying this capacity the technology specific capital costs in a given year is multiplied by the capacity addition.

2014 saw the greatest investment in renewable electricity capacity to date, with the in-year investment of £9.8bn (2013: £9.1bn) taking the total since 2010 to £36.3bn. Solar PV attracted the greatest investment during 2014 (£4.6bn), followed by offshore (£2.1bn) and onshore wind (£1.4bn). Mixed waste-to-energy showed the greatest year on year increase, with investment rising almost six-fold to £0.8bn in 2014.

This level of investment has translated to greater than expected capacity additions during the year. When compared to 2013 forecasts made by DECC, the 2014 out turn capacity additions have exceeded expectations by 1GW (c. 30% greater in year deployment than 2013 forecast).

The capacity outperformance during 2014 has come primarily from the two technologies: solar photovoltaics (1GW or c.75% above forecasts) and offshore wind (0.3GW or 75% above forecast).

The reason for this outperformance is considered to be partly due to be an effort by solar and offshore wind industries to commission projects under the existing support mechanism, before these close to new capacity.

The headline change anticipated by developers is the closure of the RO to all capacity in April 2017. Although support will continue to be available under the CfD regime, the risk profile of the CfD mechanism is fundamentally different due to the competitive auction process, which introduces allocation risk to developments. By commissioning projects ahead of 2017 under the RO, developers are guaranteed regulatory support (subject to no further ROC re-banding) for the full 'grandfathering' period or 20 years from COD, without the risk of failing to secure a CfD.

Although the RO regime will remain open for new capacity until 2017, DECC has taken steps to limit the volume of large (>5MW) solar PV technology able to access support under the RO from April 2015. The amendment reflects the more aggressive deployment of large scale solar and DECC's concern about the impact this has on the LCF budget. The announcement is credited with leading to a push by developers to commission projects before the April 2015 deadline; as with wind, this is seen as a lower risk option than attempting to secure a CfD at auction.

This change in policy is an example of policy change in response to a maturing renewable market, where Government is attempting to maintain support for a wide range of renewable electricity generating technologies.

Onshore wind attracted an impressive £1.4bn during 2014, with a strong pipeline of projects in development (1.3GW in construction, 5.2GW consented and 5.7GW

FIGURE 9 **CUMULATIVE DEPLOYMENT OF RENEWABLE ELECTRICITY CAPACITY (GW)**[11]

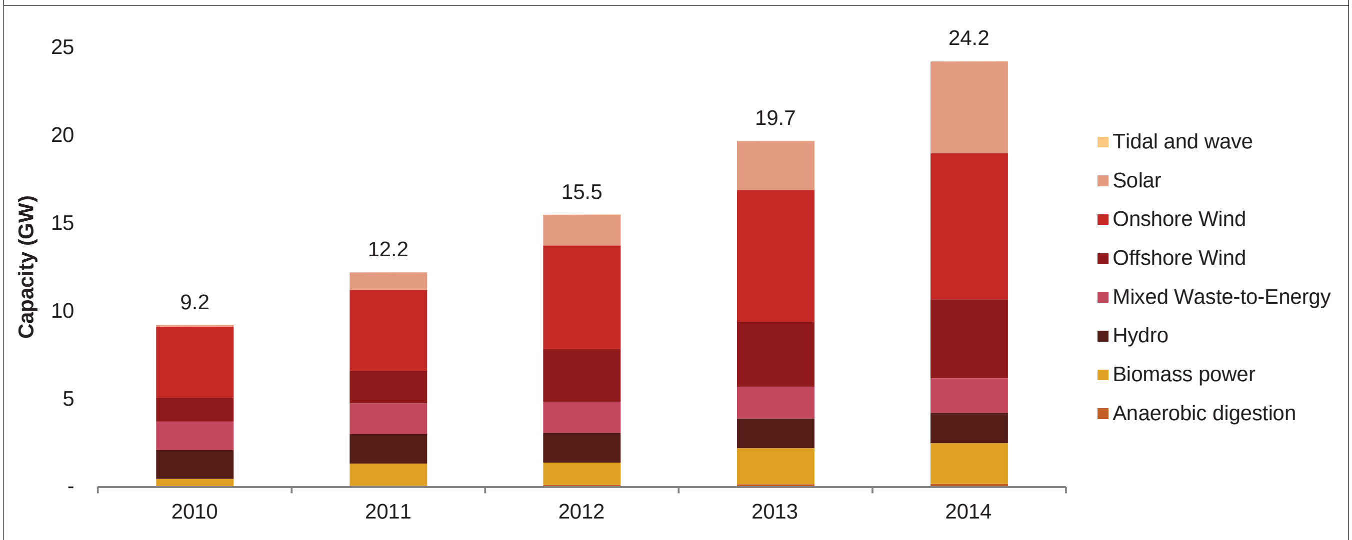
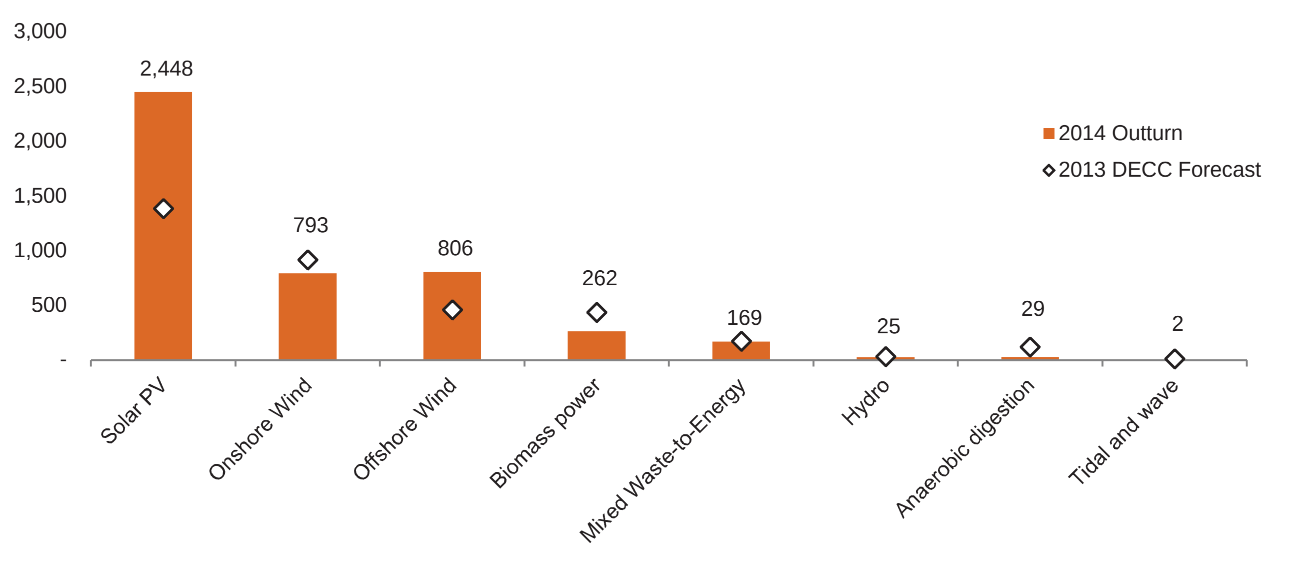


FIGURE 10 **CAPACITY ADDITIONS DURING 2014 AGAINST 2013 FORECASTS (MW)[12]**



submitted).[16] 2014 saw further evidence of the role institutional investors play in allowing developers to recycle their capital for use in future projects. For example, EDF Energy Renewables announced the sale of the majority stake in three of its onshore developments (Green Rigg, Rusholme and Glass Moor II) to China General Nuclear Power Corporation (CGN) in December 2014.[17]

Onshore wind received a further boost in 2014, when the creation of a £200m debt fund was announced to support community scale renewables (anticipated to be mainly wind and small scale hydro). The lending programme will be provided address a funding gap at the community scale.[18]

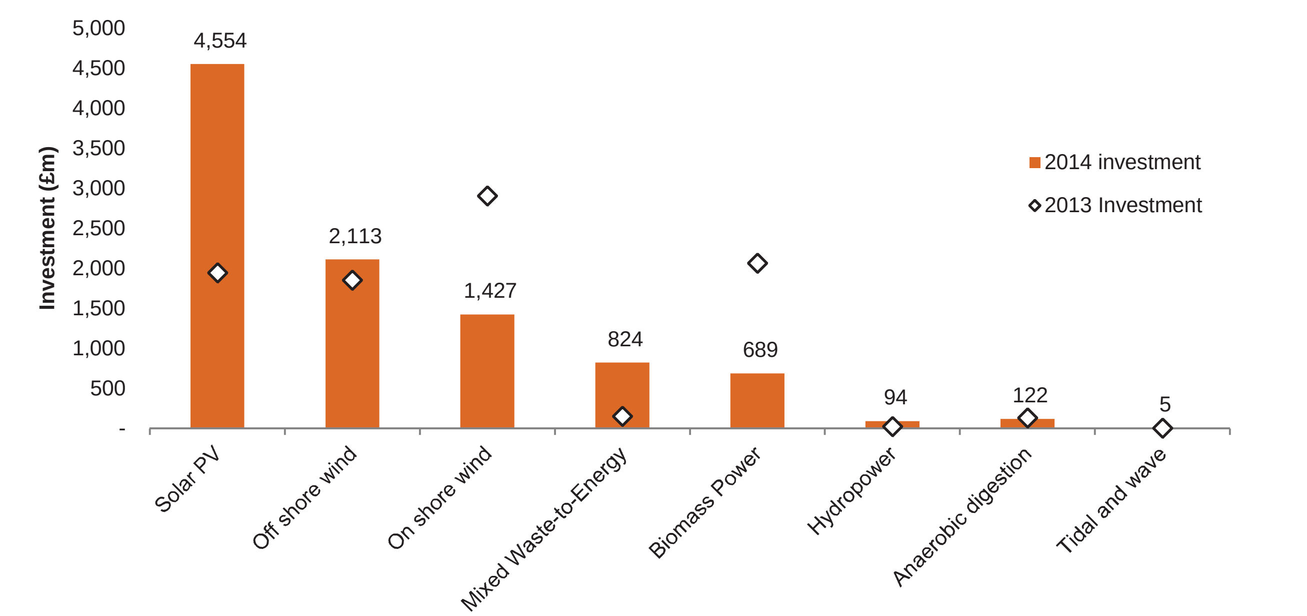
3.4. Renewable electricity investments 2015-2020

Given the developments during 2014 in terms of market reform and the resulting record investment and capacity additions, what are the implications for investment in renewable electricity generation from 2015-20?

The capacity investment outperformance during 2014 certainly appears positive in the context of achieving 2020 targets; however, this apparent benefit may be misleading.

One of the most notable effects of this outperformance is that DECC has increased its forecast for 2020 renewable electricity capacity by almost 7 GW to 44.6GW in 2020. This increase in the forecast capacity largely reflects the boom in low load factor generation during 2014. The increase in

FIGURE 11 **INVESTMENT IN RENEWABLE ELECTRICITY GENERATION DURING 2014 (£m)**



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GROWING SOLAR INVESTMENT HAS TRIGGERED AN END TO RO SUPPORT FOR LARGE (>5MW) INSTALLATIONS

In late 2014, DECC announced that the Renewables Obligation (RO) will close to new solar installations with a capacity above 5MW (or additions taking TIC above 5MW) from 1st April 2015, following Government's consultation on the level of support.

The decision to curtail the support available to large scale solar comes in response to faster than anticipated deployment of the technology, with Government aiming to protect the Levy Control Framework (LCF) budget from future development. In their own words, DECC "considers it necessary to take action to control the cost of large-scale solar PV to ensure it is affordable in the context of the RO and the EMR". So what options does this leave solar developers?

Reduce output to qualify for <5MW ROC

DECC have confirmed the RO will remain open to <5MW installations, although DECC will presumably be vigilant of developers splitting larger sites into a number of small sites.

Grace periods

Projects which fail to commission before the 31st March 2015 cut-off may be able to accredit under regulatory 'grace periods'. Under the terms of the grace period, applicants must be able to evidence that a number of milestones have been reached before the 13th May 2015, including an accepted grid connection offer; confirmation of ownership, lease agreement or option to purchase the land, and confirmation that planning applications has been received. Where all of these conditions are met, the prevailing banding will be awarded (1.3 ROCs/MWh for ground mounted and 1.6 ROCs/MWh for building mounted) .

Apply for a CfD

As an 'established technology', developers of solar PV are able to apply for a CfD in competitive auctions which started in October 2014 (the next auctions scheduled for October 2015). The total funding available to Pot 1 ('established technologies') is £50m for delivery in 15/16, rising to £65m in subsequent delivery years. There was some criticism from the solar industry over the classification as an 'established technology', which sees solar PV compete for subsidy support with onshore wind, which cleared at £79/MWh (16/17 delivery).

Aside from the technology level competition, the risk profile of CfDs is fundamentally different to the RO. Where the certainty of accrediting under the RO justified the necessary DEVEX (e.g. grid connection costs), a developer is no longer guaranteed a CfD at auctions, introducing allocation risk. This allocation risk may reduce the availability of equity or debt funding for CfD sponsored solar projects.

The result of this risk is a substantial incentive for developers to commission large scale solar in advance of 31st March 2015. Some analysts have suggesting the planned ROC closure for >5MW could trigger as much as 4GW of capacity additions in the 12 months to 1st April 2015.

TIC: Total Installed Capacity
Sources: Berwin, Leighton, Paisner Renewables update: RO to close to large-scale solar, October 2014

capacity is not mirrored by an equivalent increase in generation or total demand. Put another way, the share of renewable power expected in 2020 has not moved as a result of this increase in capacity (rising 1 percentage point only, to 34%). The increase in capacity is simply a function of the need for a greater volume of low load factor renewable capacity to meet the existing decarbonisation target. Indeed, the increase in forecast capacity will lead to a greater requirement for capital investment in order to deliver the now higher capacity.

One effect which will not yet be reflected in DECC's September 2014 capacity forecasts is the increased affordability of projects securing CfDs in DECC's first round auction held in late 2014. As already identified, several large projects cleared considerably below the administrative strike price, meaning that under the limited LCF budget, a larger volume of renewable capacity can be supported. The extent to which this is the case remains to be seen following updated projections, however, the implication will be that more capital will be required to finance the developments.

Estimating the capital requiremenet to deliver this increased capacity target requires a view of the mix of technology that will be deployed. However, DECC no longer provide

FIGURE 12 **DECC CAPACITY DEPLOYMENT FORECAST (GW)** [19, 20]

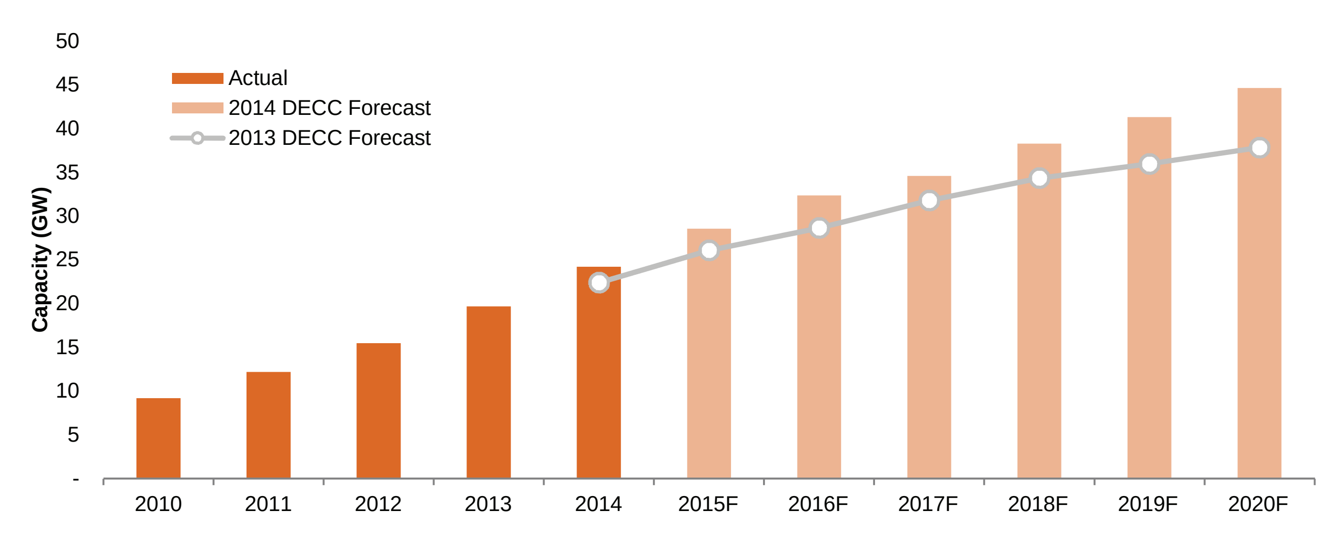
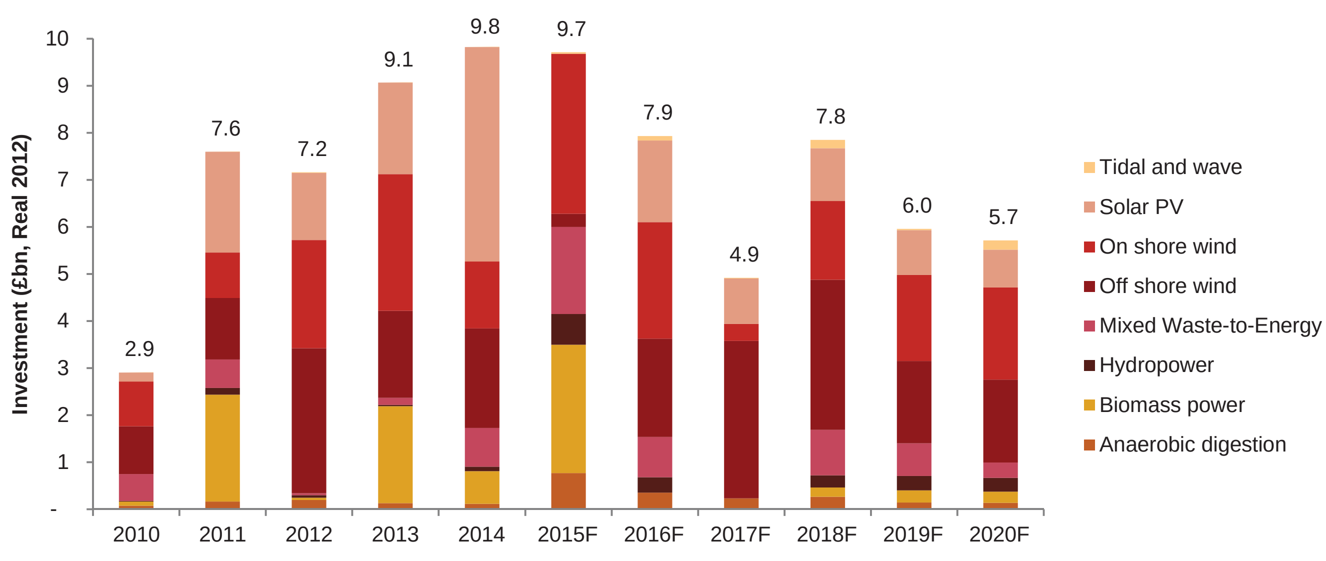


FIGURE 13 **HISTORICAL AND FORECAST INVESTMENT IN RENEWABLE ELECTRICITY 2010-2020 BASED ON FIG 12 DATA**



No solar PV forecast for 2015 as 2014 saw a volume exceeding the combined 2014 and 2015 trajectory, meaning no capacity additions were assumed for this year.

a forecast of capacity split by technology, instead, only the total deployment is reported, by year. Therefore the most recent split by technology, which was published in the 2013 DECC Updated Energy Projections (UEPs), has been used as a basis for determining the generation mix, as in the 2014 report.

Investment in renewable electricity from 2015 to 2020 will continue to be driven by the support mechanisms in place, whether RO and CfD in the near term or CfD alone from 2017. Figure 13 shows the annual investment by technology, based on the updated DECC forecast. The chart shows a total of £42.1bn investment is required in the next five years to reach the 2020 targets.

This increase to capacity targets will require an additional investment of c. £9bn between 2015-20 compared to the 2013 DECC forecast.

One of the observations about investment in renewables is that it is volatile from year to year, as project commissioning reacts to technology specific regulatory milestones or exclusions. A strong example for this is the dip in forecast investment in 2017, the year in which the RO is closed to new capacity.

3.5. Capital availability

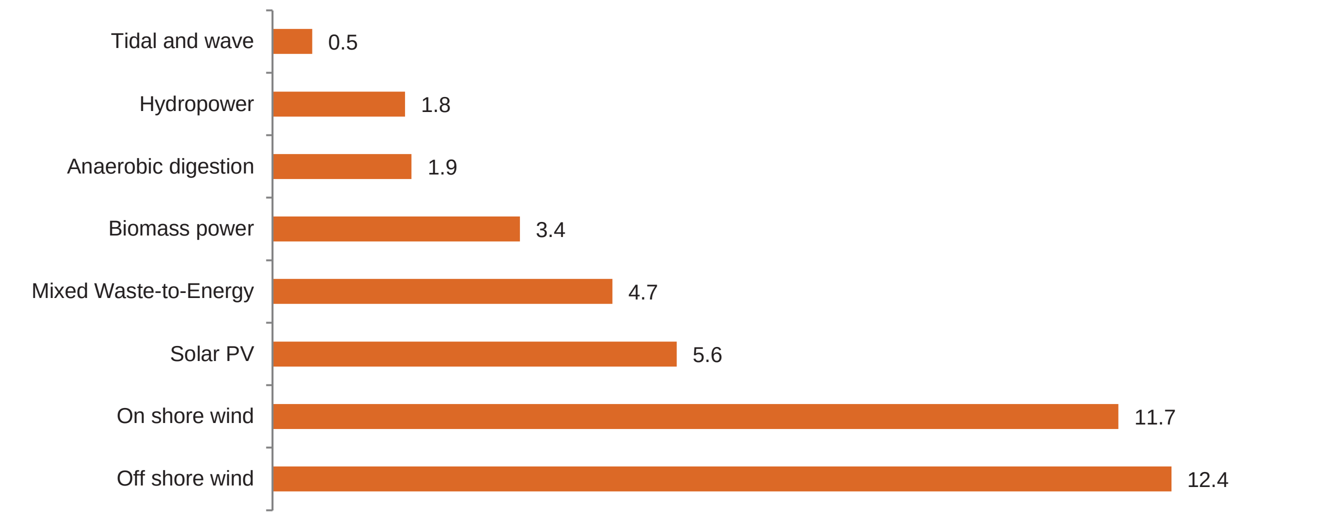
This increase in capital required to deliver the updated capacity targets draws attention to the distinction between the capital required to fund developments and affordability of support mechanisms for consumers under the LCF.

As already noted, Government will be pleased with the clearing prices of the first round CfD auctions, since these fell below the administrative prices in almost all cases. Lower strike prices allow a greater volume of renewable generation to be supported for a given budget – leading to better affordability for consumers.

However, more affordable support for renewable generation leads to more capacity being deployed for a given support budget – leading to greater capital requirements. This need for sufficient capital is equally important if we are to meet our 2020 targets.

When considering the technologies which require the greatest share of investment according to the current forecasts, we see that it is wind energy (on- and off-shore). Taken together, these two technologies are

FIGURE 14 **TOTAL INVESTMENT BY TECHNOLOGY, 2015-20 (£bn, Real 2012)**



expected to require £24bn of investment to reach the forecast 2020 capacity (57% of total investment in renewable power to 2020).

Accordingly, enabling investment in wind energy is paramount to achieving capacity targets. An interesting development in this regard during 2014 was the Green Investment Bank (GIB) investment in the 210MW Westermost Rough project. This marked the first time GIB was willing to take construction risk, and the bank's involvement allowed additional investment from Marubeni Corporation, who is also sharing construction risk. This change in approach will be welcomed by large utilities who have seen considerable pressure on their generation business during recent years, limiting their ability to fund large offshore projects on their own balance sheets.

Evidence suggests that the outlook for capital availability for other technologies is broadly positive, with confidence from developers in the availability of debt and equity alike.

Solar PV is increasingly succeeding in attracting growing volumes of institutional investment by delivering a suitable risk return profile to investors seeking to diversify their renewable portfolios. Fund managers credit the increasing awareness among institutional investors of the low volatility and index linked yields that solar PV can provide for the growth in appetite for the technology.[21] Allianz Capital Partners, for example, assert that by investing in solar PV they are able to hedge against the high volatility their wind energy portfolio, since solar output typically only deviates 3-5% annually compared to wind energy's 25%.[22]

3.6. Current challenges to securing investment in offshore wind

OREC's CRMF study consists of a number of indicators, which are grouped into three areas: technology, supply chain and finance. 2015 findings suggested that all finance indicators were either 'ahead' or 'on target', in the context of reaching a LCOE of £100/MWh. Evidence to support the finance indicator levels (cost of equity, cost of debt and cost of insurance) came from interviews with stakeholders spanning investors (equity and debt), developers and insurers. This coverage of stakeholders led to consensus about a number of themes influencing investment in offshore wind energy in the UK.

Target deployment volumes are unclear beyond the tenor of the Levy Control Framework (LCF)

The investment case for renewables is unclear beyond the end of the current LCF in March 2021. The lack of clear guidance is challenging for developers, who rely on capacity targets to appropriately manage their pipeline and equally to the supply chain, which requires confidence in the post-2021 market to justify investment.

Contracts for Difference provide certainty to winners but risk to all

The budgetary constraint applied to the CfD mechanism via the limited LCF budget is reported to have increased the risk of developers failing to secure a CfD at auction. This level of allocation risk is creating a barrier to developers, who must sink considerable development costs without certainty of securing a contract. Investors in turn are reluctant to engage with project developers who have not yet secured a CfD. It is too early to say whether this change in risk profile is sufficient to force developers (particularly for technologies with higher development costs) to stop developing projects.

Technology innovation aimed at reducing costs is increasing risk to investors

In a bid to reduce costs, industry has delivered strong technological innovation. However, the unproven nature of the new technology is viewed by investors as an unwelcome risk, preventing a fall in the cost of capital (by increasing the construction and operation phase risk premia). The report identifies investor's preference for proven processes and components and suggests there must be greater awareness of the implications of innovation on financing costs

Potential equity pinch point as developers push to construct and accredit under the RO

The report identifies the potential for an increased demand for equity in response to the large number of projects which are likely to target FID before the support scheme closes to new capacity.

WESTERMOST ROUGH CONSTRUCTION RISK SHARING

2014 saw a notable investment in offshore wind, with the Green Investment Bank (GIB) and Marubeni Corporation jointly investing c. £500m to purchase a 50% stake in Dong Energy's 210MW Westermost Rough project.

Dong Energy's Westermost Rough wind farm is located c. 8km off the Holderness coast and consists of 35 Siemens 6MW turbines expected to generate 800GWh of renewable electricity annually once commissioned in H2 2015.

The Westermost Rough project was at the early stages of construction off the Yorkshire coast at the time of investment and will be the first commercial scale project in the UK to deploy Siemens' 6MW direct drive turbine. The project marks the first case of the GIB taking construction risk in an investment.

This landmark risk sharing approach signals a shift from GIB's traditional role of investing in operational assets to facilitate capital recycling (e.g. Sheringham Shoal, Walney, Rhyl Flats and London Array). It forms part of GIB's strategy to mobilise capital into the UK offshore wind industry by helping developers to refinance part of their investment in developed projects, thereby supporting them in delivering the next round of new projects.

"We have been able to enter into a shared construction risk partnership and at the same time we have locked-in significant value creation from the transaction," explained Sam Leopold, executive VP of Dong Wind Power, "today's agreement enables us to free up capital to continue our investment programme and meet our 2020 target."

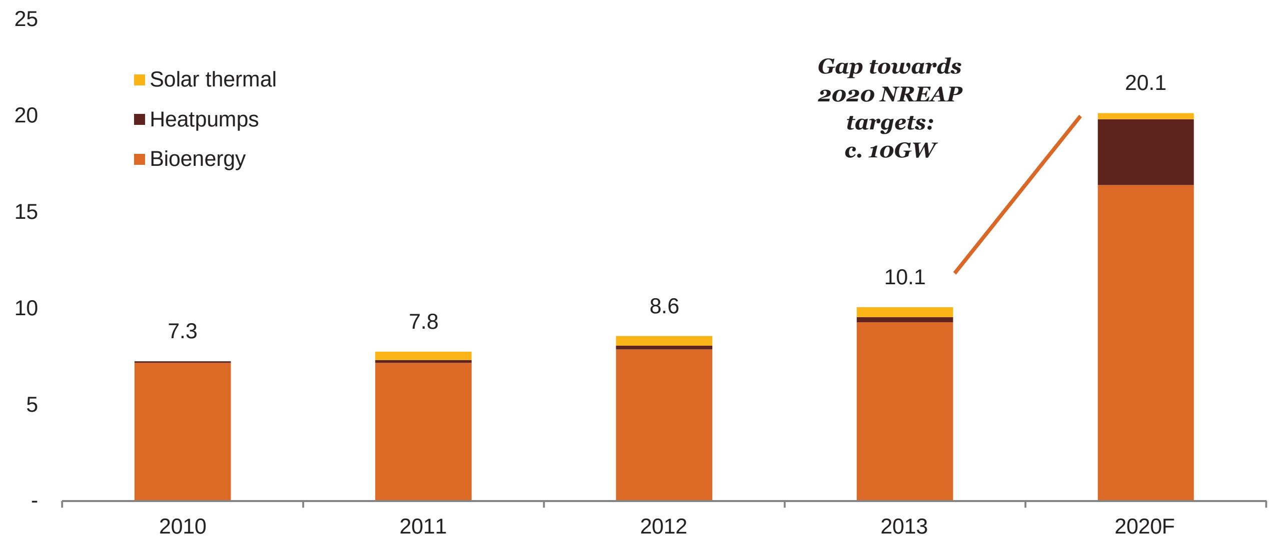
By making these investments on fully commercial terms, GIB hopes to finance the expansion of the sector and create a demonstration effect that other investors can follow. This demonstration effect is seen to have contributed to Marubeni Corporation's decision to provide £259m towards the transaction.

The Westermost Rough investment decision was accompanied by agreement for GIB to acquire a 10% stake in Gwynt y Môr from RWE Innogy for £220m. The £2bn Gwynt y Môr project has an installed capacity of 576MW and was in the late stages of construction at the time of investment.

The implications for industry are positive. By creating conditions that allow new types of investors to provide capital for offshore development, GIB is able to free up developer's capital at the same time as sharing risks. The demonstration effect also supports the industry's efforts to reduce costs, by investing in innovative technologies which would typically be associated with higher investment risk.

Sources: UK GIB invests £461m in the UK offshore wind sector, Press release, March 2014

FIGURE 15 **CUMULATIVE DEPLOYMENT OF RENEWABLE HEAT CAPACITY AND GAP TOWARDS 2020 TARGETS (GW)**



Investors generally shy away from construction risk
The report discusses the challenges faced by developers seeking an investor willing to assume construction risk, a challenge which is exacerbated by the pace of technical innovation. The recommendation is for increased activity from key equity investors, such as the European Investment Bank (EIB) and Green Investment Bank (GIB) who can attract new equity investors into construction phase projects.

Conclusions
Although set within the context of progress towards cost savings, the findings of the CRMF provide insights into the current areas of challenge for investment in renewable energy: the upcoming policy (and potentially Government) changes are proving harmful to overall investor confidence, as is the lack of long term capacity targets, while an industry striving to reach a more competitive LCOE increases the overall risk profile to investors.

4. INVESTMENTS IN RENEWABLE HEAT

New investment in renewable heat has in part been driven by the Renewable Heat Incentive (RHI), a Government scheme designed to incentivise investment in renewable and low carbon heating systems such as solar thermal panels, biomass boilers and ground- or air-source heat pumps. The scheme, which sees participants receive a support payment for each kilowatt hour of heat produced, was launched in 2011 for the non-domestic sector, including industry, businesses and public sector organisations, with roll-out of a domestic scheme commencing in spring 2014. Since 2011, the domestic sector has been supported through the Renewable Heat Premium Payment (RHPP), which offered home-owners a one-off grant towards the costs of installing renewable heat systems in their home, but ended in March 2014 with the launch of the domestic RHI.

There is currently limited available data on the state of the UK's renewable heat sector. Unlike for renewable electricity, the UK Government does not currently publish data on the capacity of renewable heat deployment. However, it does publish data on renewable heat generation (the latest data are for 2013; data for 2014 will be published in July 2015). The deployment of the installed capacity of renewable heat in this report has therefore been estimated using the available data on renewable heat generation. The unmetered nature of some renewable heat technologies leads to challenges in creating robust estimates of the capacity being deployed (e.g. domestic wood use).

Total installed capacity of renewable heat is estimated to have reached c. 10GW in 2013, although approximately 5.9GW of this capacity was installed before 2010. Bioenergy technologies represent 90% of the capacity added between 2010-13, with the remaining capacity provided by heat pumps (5%) and solar thermal installations (5%).[23] Capacity growth during 2013 was broadly consistent with historic technology splits.

Unlike with renewable electricity generation, DECC does not currently provide updated annual projections of potential deployment scenarios of renewable heat capacity through to 2020 and beyond. Projections of potential required capacity additions have therefore been estimated by referring to the UK's 2010 National Renewable Energy Plan ("NREAP").[24] On the basis of the data contained in the NREAP, it is estimated that an additional 10GW of renewable heat capacity would be required (from 2013 capacity) to meet NREAP's forecasts of renewable heat generation in 2020.

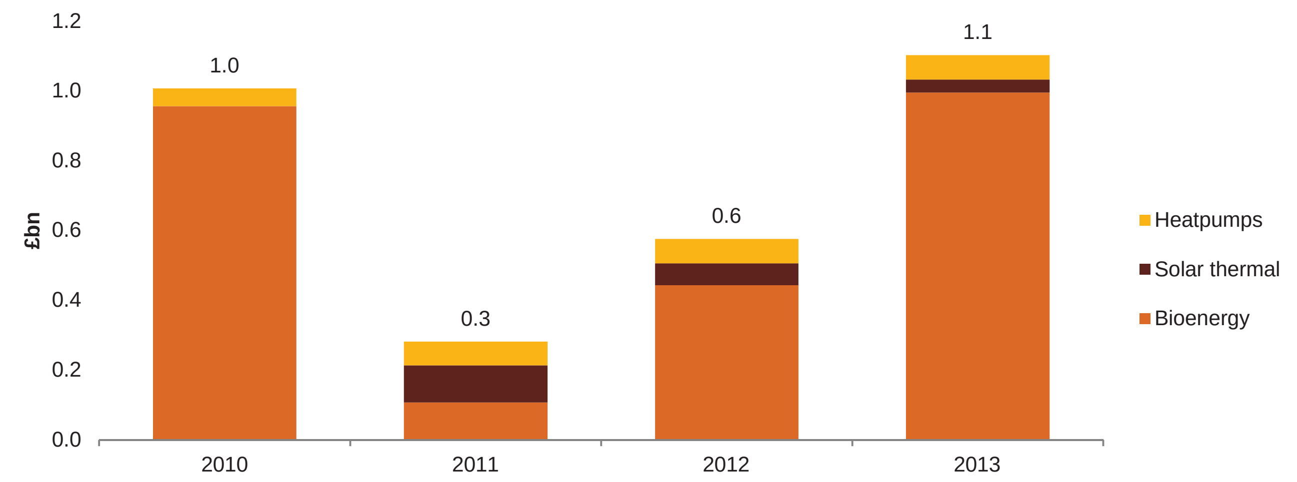
4.1. Historical investment 2010-2013

Based on the deployment of additional heat capacity over the period 2010-13, estimated total investment across different renewable heat technologies is summarised in Figure 16. Over the period 2010 to 2013, c. £3.6bn has been invested in UK renewable heat capacity: £3bn in bioenergy heat, £360m in solar thermal and £260m in heat pumps.[26] Investment during 2013 showed strong growth on 2012 figures, equalling those seen in 2011.

As already noted, some technologies present challenges to accurate data collection and analysis, domestic wood combustion being one of the areas DECC considers to be 'notoriously difficult to assess'.[27] 2011 DECC data showed a drop in the domestic wood combustion heat energy consumed, as reported in DUKES (2011: 402 ktoe, 2010: 458ktoe). This fall in energy consumption has been reflected in nil capacity investment for the technology in 2011, causing the bioenergy sector to register low investment in 2011.

Similarly, solar thermal deployment figures used in this report are based only on RHI applicable systems, excluding solar thermal systems used to heat swimming pools. The estimated size of this market is unknown.

FIGURE 16 **HISTORICAL INVESTMENTS IN RENEWABLE HEAT**[25]



4.2. Degression thresholds triggered

DECC has put in place a mechanism of 'degression', or gradual reductions in incentive payments, to manage the total budget available for renewable heat support under the RHI. The degression mechanism applies tariff reduction to new applications when technologies absorb more of the total budget than anticipated. This means that degression can react to different rates of renewable heat technology (c.f. the RO for renewable electricity).

Installations of non-domestic biomass boilers are running ahead of DECC's forecast, and small biomass has accordingly seen tariffs degressed by 10% in January 2015 and a further 15% from April 2015. Should this trend continue, the July 2015 degressions would take small boiler tariffs below the rate payable for medium boilers for the first time. Other technologies, including solar thermal and ground source heat pumps, are not currently at risk of degression.[28]

The domestic biomass scheme, which began in April 2014, has seen deployment of domestic biomass exceed recent DECC forecasts. As a result domestic degression has also taken place; 10% in January 2015, followed by 20% in of the same year. The figure below shows the forecast (domestic heat is not metered) expenditure, as calculated by DECC. Figure 17 shows the expenditure threshold breached in December 2014 and January 2015. [29]

Given the deployment of a technology above the forecast rates, it is possible to draw parallels with the growth of large scale solar PV. Just as the solar PV subsidies (in the form of the RO) consumed LCF budget above what was expected by DECC leading to a change in the level of support available, so the domestic biomass support costs (in the

FIGURE 17 **DOMESTIC BIOMASS FORECAST EXPENDITURE**[30]

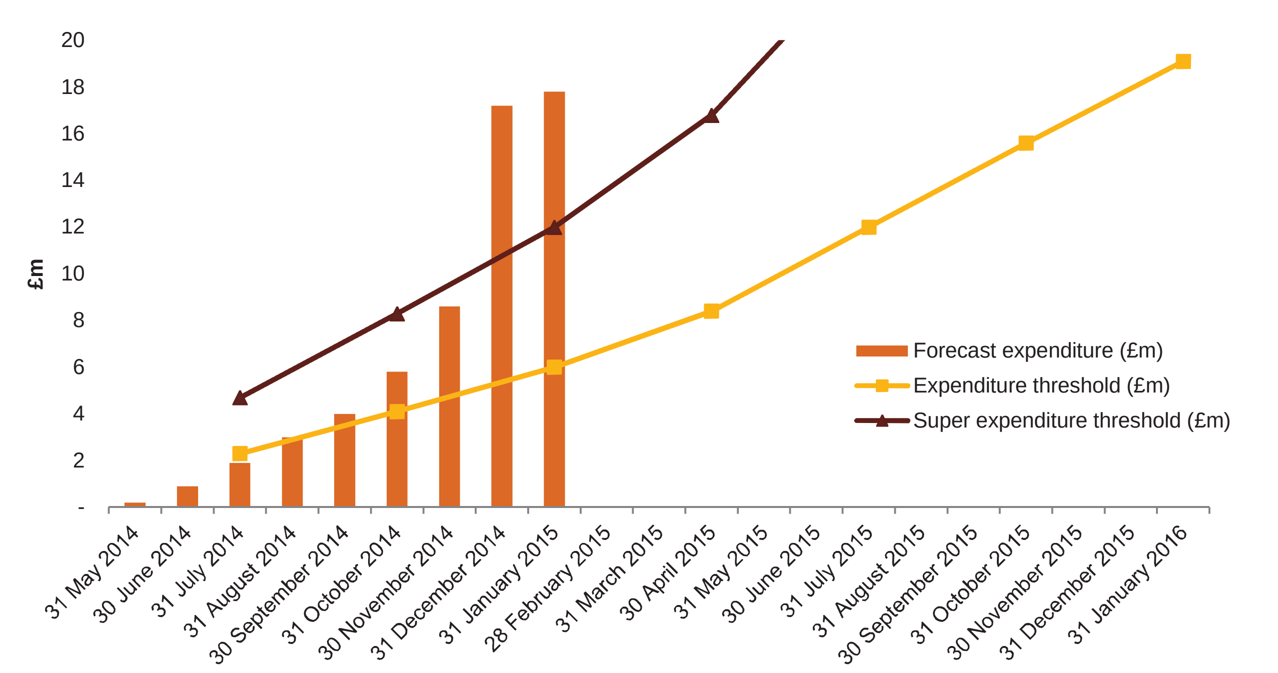
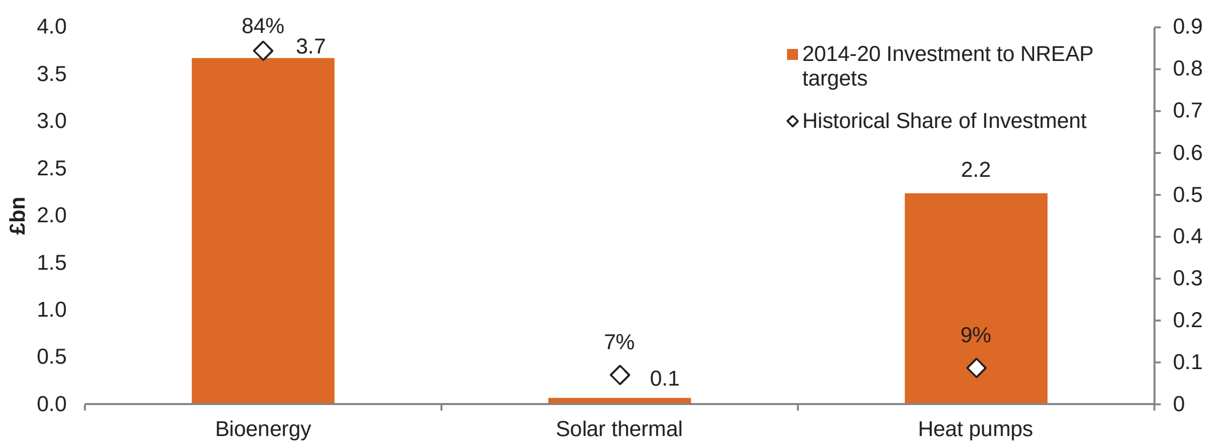


FIGURE 18 **FORECAST INVESTMENT IN RENEWABLE HEAT BY TECHNOLOGY, 2014-2020**[33]



form of RHI payments) are consuming RHI budget rapidly. Despite the similarities, the RHI mechanism is seen as more robust to overspend in given technology areas, given the feedback mechanism in place (degression). Although there is not yet sufficient data to comment reliably on the impact of degression, January 2015 deployments suggest a cooling off of installations; as such, it is seen as unlikely that biomass will see a solar PV-like boom.

4.3. Future investments 2014–2020

Looking ahead at potential renewable heat deployment in 2020, the UK's 2010 NREAP projects a total of 6,199ktoe (or 72TWh) of final energy consumption coming from a range of renewable heat sources in 2020. By applying DECC's estimates of load and efficiency factors as set out in its 2013 RHI Impact Assessment[31], this report estimates total required renewable heat capacity of 20.1GW, an increase of c. 10GW over the estimated 2013 installed capacity. By applying the cost assumptions as also set out in the Impact Assessment, an estimated £5.9bn of investment would be required.[32] It is important to note that this investment represents one mix of technologies that can be deployed to reach the total renewable energy requirement. Figure 18 summarises this required investment in the bioenergy, solar thermal and heat pumps sectors.

As indicated in the chart, the majority of investment (£3.7bn) is assumed in the NREAP to be undertaken in the bioenergy sectors, followed by the heatpump sector (ground and air-source), while investment in solar thermal is assumed to be minimal.

Also shown in the chart is the historic (2010-2013) share of investment by technology, demonstrating investors' technology appetite has not mirrored the required mix of technology investment well. This is seen most strongly with the share of investment required in heatpumps (37%), against a more modest historical share of investment (9%).

This poses a risk for the overall renewable heat targets insofar that each of the three core technologies have varying capital costs and technical characteristics (e.g. load factor, efficiency). If the NREAP is to be achieved, investment must be coordinated in such a way that delivers the necessary energy output in the most capital efficient way. The combination of cost and efficiency variances means that under fixed investment volumes to 2020, the impact on generation of applying historic technology splits (where interest in heat pumps is low and bioenergy high), is a reduction in output from investment. Achieving the NREAP technology mix, and by extension the renewable heat targets, will therefore require a change in investor behaviour.

It is important to note that compared to the renewable electricity sector, renewable heat is less mature. There is therefore significant uncertainty in relation to both current and future volumes of installed renewable heat capacity and the level of investment required to support future capacity additions. With the launch of both the non-domestic RHI (and more recently the domestic RHI) schemes, the total volume and relative share of future installations by technology group could therefore be significantly different to that set out in the NREAP.

5. RENEWABLE TRANSPORTATION FUELS

5.1. Consumption and supply of renewable fuel

Consumption of renewable transport fuels in the UK is primarily driven by the Renewable Transportation Fuel Obligation (RTFO). The RTFO requires transport fuel suppliers delivering above 450,000 litres annually to produce evidence showing that a percentage of fuels for road transport supplied in the UK comes from renewable sources and is sustainable, or that a substitute amount of money is paid.

The RFTO sets out the percentage required in each year of the obligation. Under the current regulatory framework, the annual increase to the target has reached the maximum at 4.75%.

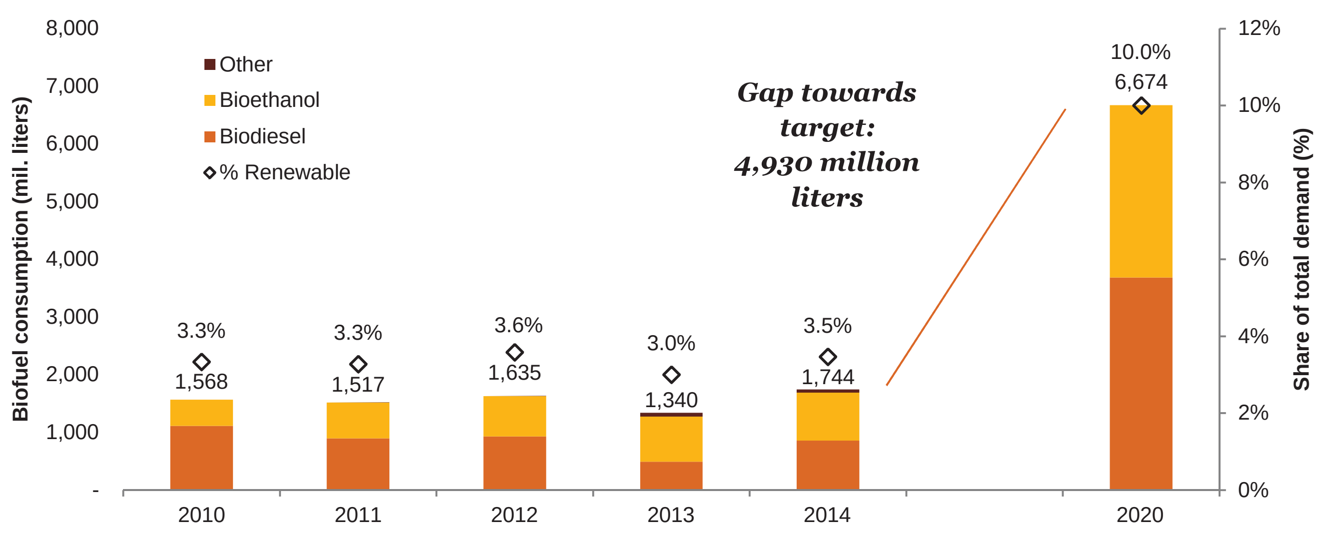
The RTFO targets (below) fails to set out how the RTFO obligation will rise towards the 10% target for renewable transport fuels in 2020 as set out in the EU's Renewable Energy Directive (RED).

Without a clear policy framework in place, consumption of renewable transport fuels has been relatively stable at c. 3-3.5% by volume from 2010-14, with blending rates steady at

TABLE 2 **CURRENT RTFO BIOFUEL TARGETS**[34]

Year	2008	2009	2010	2011	2012	2013+
Target Share (% Vol.)	2.50	3.25	3.50	4.00	4.50	4.75

FIGURE 19 **CONSUMPTION OF BIOFUELS (MILLION LITERS, LHS) AND SHARE OF TOTAL DEMAND (%, RHS)**



approximately the 2010/11 obligation period target. Given the stalled progress towards the 2020 targets, the shortfall against 2020 targets is currently c. 5,000m litres/year.

5.2. Investments in biofuels

As with other renewable energy, investment in renewable transport fuel capacity is driven by the policy framework.

The RTFO places an obligation on fuel suppliers to meet their volume targets, irrespective of the source of fuels. This creates the opportunity for fuel suppliers to meet their obligation using imported fuels. The economics of biofuels are such that it has generally been more economical for fuel suppliers to meet their obligations through imports (e.g. from Brazil or Ukraine) than through investing in UK production capacity. This is evidenced by the modest share of domestically produced biofuels, 23% in 2014 (2013: 21%)[35]. Demand for biofuel refining capacity, and therefore investment, is weakened by the availability of low cost imports.

The dominance of imported biofuels is compounded by the current lack of clarity as to how biofuel targets will increase to 2020, leading to a weak case for investment in UK biofuel capacity. Vireol's planned Grimsby bioethanol plant offers a good example of a facility ultimately being deployed in the US after Vireol unsuccessfully attempted to secure finance in the UK for two years, as policy uncertainty unsettled investors.[36]

Historical investment in biofuels have to date been limited to a small number of refinery investments. In the period analyzed, investment is limited to three projects[37]. Figure 20 shows the size of the investments during 2010-2014. No Major investments have been identified in 2014.

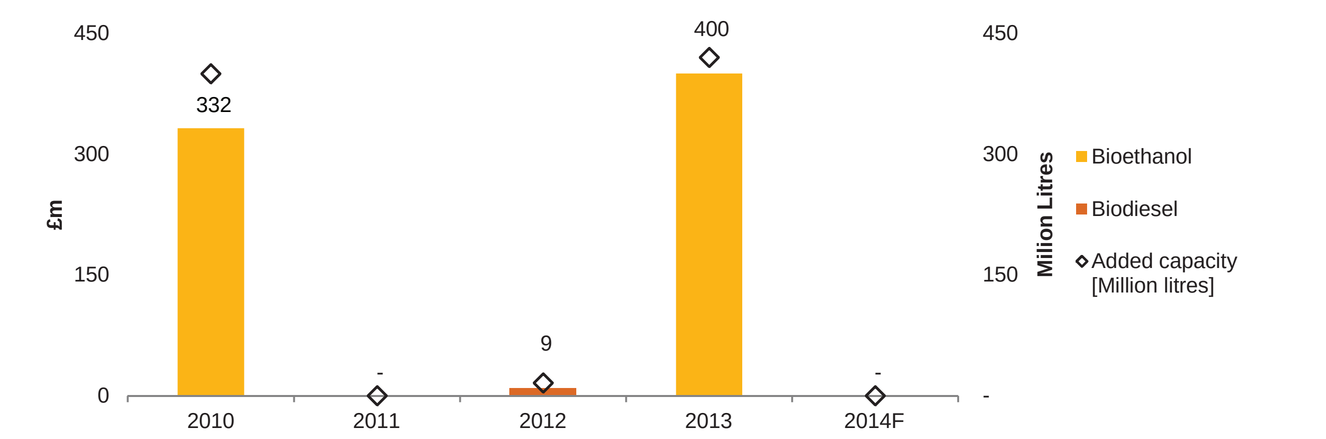
On balance the outlook for investment in biofuels in the UK is not positive. There are no signs that demand will increase towards the 10% EU level target in the near term and supply of low cost bioethanol imports provides an economical solution to meeting existing regulatory targets.

APPENDIX A. - METHODOLOGY

Installed capacity and additions

Capacity figures for the period 2009 to 2014 have been obtained primarily from 'Chapter 6: Renewable Sources of Energy' of the 'Digest of United Kingdom energy statistics' (DUKES) published by DECC (2014[38]) with 2014 data from Energy Trends, February 2015[39]. Supporting data has been estimated by applying a number of sources as summarised below. Capacity additions are allocated to the year in which the project is commissioned.

FIGURE 20 **HISTORICAL AND FUTURE ESTIMATED INVESTMENT IN BIOFUELS (£m)**



Electricity capacity
Forward looking projections of electricity capacity were obtained by applying yearly breakdowns from 2014 report to the latest yearly total figure from 'electricity related renewables projections' table 2010 to 2020 in the 'Updated Energy Projections' (UEP) also published by DECC (2014)[40]. The 'reference' scenario has been applied in this report.

Heat capacity
Historic and current levels of renewable heat capacity have been estimated as follows:

• Bioenergy: has estimated from DUKES, table 6.6. DUKES includes landfill gas, sewage sludge digestions, domestic & industrial wood combustion animal biomass, anaerobic digestion, plant biomass and energy from waste the following technologies in the category of 'Bioenergy'.

• Heat pumps: has been estimated from DUKES, table 6.6.

• Solar Thermal: estimates of installed capacity have been taken from the European Solar Thermal Industry Federation (ESTIF) 2014 report[41].

Projections of renewable heat capacity have been estimated from projections of heat generation provided in the UK's 2010 National Renewable Action Plan ("NREAP"). Capacity additions have been estimated by applying central Load and Efficiency Factors as set out in DECC's 2013 RHI Impact Assessment .These are summarised in Table 3.

TABLE 3 **POWER LOAD FACTOR ASSUMPTIONS**

	Load Factor	Efficiency Factor
Small Biomass	15%	83%
Medium Biomass	16%	83%
Large Biomass	23%	83%
GSHPs	19%	350%
Solar Thermal	8%	100%
Small Biogas	68%	85%
Biomethane	93%	100%
Medium Biogas	46%	85%
Large Biogas	46%	85%

TABLE 4 **INVESTMENT COST ASSUMPTIONS BY TECHNOLOGY 2010 – 2020 (£K/MW, 2012)**

	2010	2011	2012	2013	2014	2015
Anaerobic digestion	4221	4200	4180	4160	4140	4080
Bioliquids	952	0	0	0	0	0
Biomass power	2790	2718	2646	2636	2626	2596
Geothermal	6034	5462	4890	4844	4798	4660
Hydropower	4729	4215	3702	3702	3702	3702
Mixed Waste-to-Energy	4791	4846	4901	4893	4885	4861
Off shore wind	2599	2630	2660	2640	2620	2560
On shore wind	1621	1710	1800	1800	1800	1800
Small scale solar	2860	2380	1900	1880	1860	1800
Large scale solar	3523	2262	1000	1000	1000	1000
Tidal and wave	2902	2826	2750	2750	2750	2750

	2016	2017	2018	2019	2020
Anaerobic digestion	4080	4080	4080	4080	4080
Bioliquids	0	0	0	0	0
Biomass power	2591	2586	2581	2576	2571
Geothermal	4600	4540	4480	4420	4360
Hydropower	3729	3755	3782	3808	3835
Mixed Waste-to-Energy	4843	4825	4807	4789	4771
Off shore wind	2540	2520	2500	2480	2460
On shore wind	1790	1780	1770	1760	1750
Small scale solar	1760	1720	1680	1640	1600
Large scale solar	980	960	940	920	900
Tidal and wave	2750	2750	2750	2750	2750

PwC

	Cost (£k/MW)	Source of Cost assumptions
Small Biomass	577	Sweett
Medium Biomass	550	Market Intelligence
Large Biomass	357	Market Intelligence
GSHPs	1,295	Sweett
Solar Thermal	1,308	Sweett
Small Biogas	2,000	SKM Enviros
Biomethane	3,300	SKM Enviros
Medium Biogas	2,000	SKM Enviros
Large Biogas	2,733	SKM Enviros
CHP	2,644	Ricardo AEA
ATWHPs	877	Sweett

Transport capacity

Estimates of consumption of liquid renewable fuels has been estimated from Ricardo-AEA "UK Production of Biofuels for road transport"[44] and the DfT's "Renewable Transport Fuel Obligation statistics"[45].

Investment costs

For simplicity investment costs have been allocated to the year in which capacity additions took place.

Renewable Electricity

For 2010 historical investment costs, individual technology cost data has been estimated by applying the estimates provided in DECC's Review of the Generation Costs and Deployment Potential of Renewable Electricity Technologies in the UK (2011)[46].

For 2012 historical investment costs, individual technology cost data has been estimated by applying the estimates provided in DECC's Electricity Generation Costs (2013)[47]

For 2011 historical investment costs, individual technology costs data has been estimated by finding the midpoint of 2010 and 2012 costs.

Projections of costs have been estimated by applying DECC's forecasts as published in its 'Electricity Generation Costs' (December 2013)[48], which high, central, low figures were used for 2012, 2015, and 2020 costs respectively.

For those years in which there are no specific cost estimates or forecasts (for example 2013, 2014, 2016, 2017, 2018, or 2019), a straight line reducing average calculation has been applied.

Estimates have been adjusted for inflation (using the non-housing Resource Cost Index (RCI) inflation index) in order to express investment values in 2010 money.

Table 4 provides a summary of the cost assumptions applied in this report.

Renewable heat

Investment costs, load and efficiency factors for renewable heat have been estimated by applying the assumptions as set out in DECC's 2013 RHI Impact Assessment[49,50,51] These are summarised in the table above:

Renewable transport

Historic investment costs have been derived from the data provided by Ecofys in its 2013 report "UK biofuel industry overview"[52]. No projections of forecast investment have been made due to a lack of industry data.

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[1] *Historic investment includes electricity 2010-14, heat 2010-13 and transport 2010-13 only; future investment includes 2014 for heat and transport*
[2] *Real 2012*
[3] *Forecast heat investment period 2014-2020*
[4] *The bioenergy data includes burning wood and logs in open fire places*
[5] *Renewable Energy Strategy, PwC analysis*
[6] *DUKES 6, February 2014 & March 2015*
[7] *Renewable Energy Strategy, PwC analysis*
[8] *Review of the generation costs and deployment potential of renewable electricity technologies in the UK, ARUP, 2011*
[9] *Report available at https://ore.catapult.org.uk/ore-catapult-reports*
[10] *Cost Reduction Measurement Framework Summary Report, Offshore Renewable Energy Catapult, 2015*
[11] *DUKES 6, DECC, March 2015*
[12] *DUKES 6, DECC, March 2015*
[13] *The load factor describes the ratio of actual output to the nameplate capacity over a given period*
[14] *Renewable Energy Public Database, DECC, March 2015*
[15] *State aid: commission authorises UK aid for Teesside biomass CHP plant, EC, January 2015*
[16] *Delivering the UK energy investment : Low carbon energy, DECC, March*
[17] *EDF energy renewables sells stake in three UK wind farms to CGN, EDF Press, December 2014*
[18] *£200m of new funding available for community scale renewables, GIB press release, November 2014*
[19] *Updated Energy Projections, DECC, 2014*
[20] *Updated Energy Projections, DECC, 2013*
[21] *Solar energy investment coming of age and attracting institutional investors, Blue & Green, August 201*
[22] *Investors look to combine PV and wind assets, Wind energy update, May 2014*
[23] *DECC DUKES includes the following technologies in the category 'Bioenergy': landfill gas, sewage sludge digestions, domestic & industrial wood combustion animal biomass, anaerobic digestion, plant biomass and energy from waste.*
[24] *National Renewable Energy Action Plan for the UK, DECC*
[25] *DUKES 6.6, DECC*
[26] *DECC reported energy consumption data for 'wood combustion – domestic' has been amended retrospectively, investment and capacity figures have been updated for historical years.*
[27] *Renewable energy statistics, data sources and methodologies, DECC*
[28] *Quarterly non-domestic degression, DECC, January 2015*
[29] *Quarterly domestic degression, DECC, January 2015*
[30] *Quarterly domestic degression, DECC, January 2015*
[31] *RHI Tariff Review, DECC, September 2013*
[32] *Totals may not sum due to rounding*
[33] *The bioenergy data includes burning wood and logs in open fire places.*
[34] *Renewable Transport Fuel Obligation, Draft Post-implementation Review, DfT, December 2013*
[35] *Renewable Transport Fuel Obligation Statistics, 2014/15 Report, DfT, November 2014*
[36] *Vireol opens new US biofuel plant after struggling for UK finance, Business Green, April 2014*
[37] *https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/266090/ecofys-uk-biofuel-industry-overview-v1.5.pdf*
[38] *DUKES6, DECC, 2012*
[39] *DUKES Trends, DECC, Feb 2015*
[40] *Updated Energy Projections, DECC, 2014*
[41] *Solar thermal markets in Europe, ESTIF, June 2014*
[42] *National Renewable Energy Action Plan for the UK, DECC, 2009*
[43] *Review of the Generation Costs and Deployment Potential of Renewable Electricity Technologies in the UK, DECC, 2011*
[44] *UK Biofuel Production, DECC, 2011*
[45] *Renewable Transport Fuel Obligation statistics, DfT, 2010*
[46] *Government response to the consultation on proposals for the levels of banded support under the Renewables Obligation for the period 2013-17 and the Renewables Obligation Order 2012, DECC, July 2012*
[47] *Electricity Generation Costs, DECC, December 2013*
[48] *Electricity Generation Costs, DECC, December 2013*
[49] *RHI Tariff Review, Scheme Extensions and Budget Management, DECC, September 2013*
[50] *Research on the Costs and Performance of Heating and Cooling Technologies, DECC, February 2013*
[51] *Analysis of Characteristics and Growth Assumptions Regarding AD Biogas Combustion for Heat, Electricity and Transport and Biomethane Production and Injection to the Grid, DECC, May 2011*
[52] *UK Biofuel Industry Overview, ECOFYS, November 2013*

working in partnership to maintain high standards of consumer protection

RECC RENEWABLE ENERGY CONSUMER CODE

www.recc.org.uk

The Renewable Energy Consumer Code sets and maintains high standards of consumer protection in the small-scale renewable generation sector. The Code is approved by Trading Standards Institute under the Consumer Codes Approval Scheme.

You may wonder what this all means in practice.

The Code is designed to mirror legislation and in some instances to go a little further. We try to make it easy for businesses in our sector to understand what the legislation means in practice for them. To do this we apply the legislation to situations these businesses confront on a day-to-day basis. We have also prepared model documents and guidance on the more complex issues.

We have a Primary Authority arrangement with Slough Borough Council to assist us in ensuring that the information we provide is accurate and reliable. We also have dedicated e-learning online for members and their staff. They can even test themselves with a short exam. We are rolling this out by means of webinar training sessions which our members find helpful.

Renewable technologies for the home

The technologies we deal with are, on the electricity side, solar photovoltaic (PV) systems and, on the heat side, solar thermal heating systems, ground and air source heat pumps and biomass boilers. These are all highly complex, expensive systems which are only suitable for certain homes and circumstances. It is essential that they are marketed in an open and honest way and that consumers have plenty of time to consider whether they are right for them before signing a contract.

High pressure selling in the home

The most common issues in the sector concern businesses who use high pressure selling techniques to convince consumers, who are often pensioners, to purchase expensive and unsuitable systems. These businesses frequently operate, or work with, call centres that target consumers in their homes even those on the Telephone Preference Service. Consumers are informed that a system will 'more than pay for itself' in less than five years, for example, when such claims are based on grossly inflated performance predictions.

Often, these occurrences are linked to the selling of finance packages.

In many cases, consumers are not even aware that they have signed a finance agreement, or that it is secured on their property. They have often been assured that they will receive money 'from the Government' and that this will more than cover their loan repayments. Others are told that the Government will pay money directly to the finance company and so the system is effectively free.

We have repeatedly explained to Government that aggressive cold calling and doorstep selling practices, such as those we regularly find in our sector, are quite inappropriate for marketing such complex and expensive technologies. Until these practices are banned outright, it seems that abuses such as the ones we find in our sector will continue, and the resulting consumer detriment will remain high.

Working in partnership to combat bad practice

We are grateful to many Trading Standards departments who work closely with us to target problem businesses. We also work closely with valued partners such as the Microgeneration Certification Scheme, Ofgem, Citizens Advice, Age UK, the Financial Conduct Authority, Companies Investigation Branch and the Serious Fraud Office.

Only by joining forces with others can we hope to combat high pressure, unfair and, in many cases, criminal selling practices. This way, we can all be winners, and honest businesses can be secure in the knowledge that they are not being unfairly disadvantaged by competitors who pursue selling practices such as these.

Methodology

METHODOLOGY – INNOVAS (JOBS DATA)

Standard industrialisation Codes (SIC) are used to classify businesses according to the type of their economic activity. New sectors such as renewables are not currently covered by the SIC categorisation in detail and this has led to a lack of robust data on jobs associated with the sector. Headline data on the low carbon sector has been produced by Innovas for Government, however a detailed breakdown of the renewables sector by technology or geographical area has not been published until now.

The REA produces an annual update of this analysis and data, although ideally ONS would be providing this information. We would welcome any feedback and comments on the data in this report. Please send any feedback to review2015@r-e-a.net.

Definition of sector

The research undertaken by Innovas is based upon a data methodology developed by Knowledge Matrix Ltd and used widely in the UK. This methodology uses a broader definition of the renewable sector than other studies, because it includes the contribution from supply and value chain companies. It relies on 'bottom up' data based on what companies actually do, rather than what they are classified as doing under the SIC system. Innovas's definitions are consistent with (but not limited by) SIC and NAICS codes and extend down to eight-digit code classifications which specify activities. Innovas's final data levels go beyond SIC code definitions.

Data sources

The study draws from over 700 sources. It includes activities undertaken by companies across the renewable supply chain including related network activity, commercial R&D[1] only, through manufacturing into distribution, retail, installation, and maintenance services. Companies are included in the supply chain where 20% of their turnover is supplied into the sector, but only the sales activity relating to the renewable sector is included in the analysis. In order to limit the risk and error the numbers are informed by multiple sources. Innovas carry out a sensitivity analysis with the aim to provide a confidence level of 80% within a range of +/- 20%.

Model

The full sector analysis model is a bottom up, multi-staged model that uses econometric techniques sources and methods (such as data triangulation[2]) to verify and enrich source data drawn from multiple sources. The approach uses data from actual, live and accumulated business cases and computes confidence levels for final reported numbers, based upon a rigorous assessment of the source data. The model also measures activity in the supply chain for each sub-sector, totals are aggregated from 2,300 discrete individual product group lines for the whole low carbon and environmental goods and services sector. Each of these lines uses specific data sources and can be analysed individually, unlike traditional studies which often group together data sources.

The methodology mitigates against double counting risks by checking and comparing the numbers over a period of years, with multiple validated and verified data sources.

'Key facts'

Employment is a measure of the estimated employment numbers across all aspects of the supply chain – these are direct full time equivalent jobs. national, regional and other economic data sources have been used to estimate current employment levels. Where employment information is scarce, or where Innovas are estimating employment for a proportion of a company's sales, they rely on comprehensive case study materials to provide sensible industry-specific ratios and benchmarks, or for some technologies REA's sector groups have contributed data (these are set out in additional adjustments).

Number of companies is a measure of the total number of companies in the region that match (or fit within) the activity headings for renewables sector. Due to the limitations of using SIC codes the methodology uses a unique analytical process to allocate companies to the renewables activity headings. The total number of companies in this report has been arrived at by a bottom-up analysis of company stock within the country/region using such sources as: Companies House, European credit agencies, British Telecom, institutional listings and UK credit agencies.

Sector turnover estimates are based upon where economic activity takes place i.e. the location of the business rather than the location of the income earner. In the calculation of turnover value Innovas consider: turnover by sub sector within postcode sets; capital asset adjustment by sub-sector within postcode sets; ONS GDP calculations; supply chain procurement value sub-sector by sub-sector by postcode sets; sub-sector specific sales reporting where available.

Global market value uses the same methodology as above for each of the main country markets with the largest 50 markets by market value being analysed to the same level of detail i.e. 2,300 discrete lines.

Regional data methodology: Having identified the total company stock in the region, product and service outputs have been identified and verified by accessing further databases that include: institutional data sets, Yellow Pages, proprietary databases, Euromonitor, Dun and Bradstreet and Thompson. The methodology measures where the economic activity actually occurs and is reported, rather than just at the headquarters or main facilities.

Consultation with stakeholders: The analysis and data were then sense checked with industry participants, these included some REA sector groups, REA sector heads, developers of certain technologies, and expert members.

Sector adjustments: The adjustments to the data following consultation with stakeholders, or where the Innovas methodology was not used were:

Deep geothermal: The REA's deep geothermal sector group provided the data for this technology using current industry knowledge and detailed analysis of deep geothermal employment for the US department of energy. Investors put $3.2 billion into geothermal in 2013, a 2 percent increase over the previous year[3].

Marine issues: The global definition used by Innovas includes schemes the industry would themselves classify as large hydro. The consequence is that the figure for the global share of the market would be much lower than existing estimates. The Innovas methodology only includes commercially funded R&D, however industry feel that publically funded R&D is very relevant for this sector. This study therefore now uses an alternative study for these estimates.

Solar power: There has been a surge in the growth of solar since the introduction of the small scale Feed-in tariff. The reviews of the scheme have resulted in an increased demand for solar systems, which means that the Innovas data is significantly out of date given 2011 growth. Hence up- to-date REA figures have been inserted in the relevant section.

Heat pumps: The REA has scrutinised the built environment link with heat pumps, where there is a complex overlap with the air conditioning and refrigeration industry. We are satisfied the figures are representative of full time employees.

Woodburning stoves: An area of concern for the industry is a lack of reliable data for the wood burning stove industry. It was not possible to separate this technologies data from the wider boilers data, but there is anecdotal evidence of strong growth in this sector, which is taking place outside the UK policy framework.

Onshore and offshore wind data: The supply chains in these two sectors are very closely linked and it is very difficult to separate the two. Innovas have provided their best estimate for 3 Key data lines.

[1] Government and European funded R&D is not included.
[2] The gathering of data through several sampling strategies in order to enhance confidence in results.
[3] http://www.bloomberg.com/slideshow/2014-04-07/where-clean-energy-dollars-went-in-2013.html#slide4.

METHODOLOGY – REA (DEPLOYMENT DATA & GROWTH PROJECTIONS)

The intention of this report is to present both historic data and forward projections for renewable energy capacity and generation from authoritative sources, so that the reader can judge progress to date as well as the government's view of the contribution that might be made in 2020, the year by which the Renewable Energy Directive (RED) requires the UK to have achieved a 15% contribution to energy consumption from renewables. The RED also has a sub-target for all Member States to achieve a 10% renewable energy contribution in the transport sector.

We have therefore chosen to draw on official government sources for the graphs in each technology section. The one exception to this is where the average annual capacity growth rate achieved since 2009[1] has been used to extrapolate what further growth would be achieved in the following two years if this average growth rate were to be maintained: a "trends continued" projection. It must be stressed that this extrapolation is for indicative purposes only – there is no suggestion that future performance will follow that of the recent past, but the purpose is to show what could be achieved if recent trends were to continue and to further allow comparison with DECC's various projections for 2020.

The Renewable Electricity Sector

Renewable electricity deployment statistics are published by DECC quarterly in Energy Trends and annually in its Digest of UK Energy Statistics (DUKES)[2]. The first full data for 2014 were published in Energy Trends on 26th March 2015 and were used to produce the graphs for historical capacity and generation from 2009, as shown below. For capacity deployment in 2015 and 2016 we have shown the 2014 deployment plus the additional capacity that would be deployed if the average annual growth rate over the period 2009 to 2014 was maintained.

In order to compare past performance with projections for 2020, we have drawn on three DECC sources, the first of which we consider to be the most authoritative:

1. As part of its Electricity Market Reform Delivery Plan, DECC published National Grid's EMR Analytical Report in December 2013[3]. The report provides modelled capacity and generation projections for 2020 for a number of scenarios – we have used the reference scenario (described as 'Scenario 1'). In order to present UK data by technology we undertook the following calculations: a) Data for Great Britain were combined with those reported separately for Northern Ireland to produce UK totals for 2020; b) We obtained from DECC a breakdown of the data classified as "Other renewables" and were therefore able to distribute the capacity and generation by technology. We consider these to be the most authoritative projections as they form the basis of forward planning under EMR.
2. Under the RED, each Member State was required to publish a National Renewable Energy Action Plan and the UK's was published by DECC in 2010[4]. Although somewhat dated now, it provides the Government's official statement of how it plans to fulfil the UK's obligations under the Directive. In particular Tables 10 – 12 provide year-by-year indicative projections of deployment, broken down by technology, from 2010 to 2020 for electricity, heat and transport.
3. Finally every year DECC publishes Updated Energy Projections (UEPs), analysing and projecting future energy use and greenhouse gas emissions in the UK, based on assumptions of future economic growth, fossil fuel prices, electricity generation costs, UK population and other key variables. Renewables are only one part of the UEP, indeed the technology breakdown for renewables was only published in November 2013 following a special request, two months after the initial publication[5]. We have included the UEP projections for comparative purposes. As for the EMR projections, a significant share of deployment is classified as 'Other renewables' and this has been broken down by technology using the same split as used for the EMR data.

DECC is keen to emphasise that none of its projections constitute targets and they should not be viewed as such. Nevertheless, particularly the most recent ones provide a useful view of how DECC envisages each technology contributing to deployment in 2020 and a benchmark against which to judge progress to date. It must be remembered that the 2020 renewables target is expressed as a percentage share of energy consumption, so the amount of renewable energy required in 2020 will vary according to changes in energy demand; at present DECC is projecting demand to fall between now and 2020.

The Renewable Heat Sector

Renewable heat consumption statistics are only published annually in DUKES (in July) so the latest year for which data exist is 2013[6]. There are no data currently published for capacity however these could be inferred by using average load factors. With the advent of the Renewable Heat Incentive DECC has started to publish monthly data on the capacity of accredited installations, however this still forms a very small share of the UK's total renewable heat capacity. Future annual updates of this report will seek to monitor progress of deployment under the RHI, as this will be the Government's main measure in support of achieving its ambitious goal of achieving around 72 TWh renewable heat in 2020 (up from 20 TWh in 2013). As renewable heat consumption data are only available to 2013, the two year 'trends continued' extrapolations only cover the years 2014 and 2015. We will need to wait until the data for 2014 are published in late July 2015 to see whether the RHI has had a noticeable impact on growth. However, it must be noted that renewable heat consumption is, like heat consumption generally, strongly dependent on seasonal and annual temperature variations. Annual fluctuations in demand will therefore be superimposed on any growth in uptake of renewable heat technologies.

In order to compare past performance with projections for 2020 there is only one source to draw on: the National Renewable Energy Action Plan published in 2010. The NREAP's heat projections to 2020 (Table 11) however, do not correlate well with DUKES for NREAP's year of publication (6.0 TWh in NREAP versus 13.6 TWh in DUKES for 2010) and there is no clear explanation given for the discrepancy. Equally, the renewable heat production in NREAP does rise to 72 TWh in 2020, equivalent to the 12% figure set out in the 2009 UK Renewable Energy Strategy. For the latest year (2013) DUKES suggests that with 20 TWh achieved, the UK is well ahead of the NREAP trajectory (9 TWh) but this comparison needs to be treated with great caution. We will continue to engage with DECC in the hope that an updated trajectory for renewable heat to 2020 can be provided.

The Renewable Transport Sector

Statistics on the UK consumption of liquid biofuels for transport are published quarterly by DECC as part of Energy Trends, drawing on HMRC's Hydrocarbon Oils Bulletin[7]. The data in Table 6.2 of Energy Trends published on 26 March 2015 include annual consumption data for bioethanol and biodiesel from 2005 to 2014. The Department for Transport in turn publishes quarterly reports under the Renewable Transport Fuel Obligation, including the national origin of the biofuels supplied under the Obligation[8], from which it can be seen that UK sourced biofuels have varied between 8% and 22% of the total supply since 2008.

Projections for 2020 again rely on the National Renewable Energy Action Plan published in 2010 (Table 12). Projected growth is based on achieving the RED's sub-target of a 10% renewable contribution to transport by 2020 and includes a small but growing contribution from renewable electricity.

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[1] 2009 was the year that the Renewable Energy Directive was implemented and the UK's Renewable Energy Strategy published.
[2] Energy Trends can be accessed at http://bit.ly/1EV9ihl and DUKES at http://bit.ly/1R0k6Um. Data in this report were taken from Table et6_1 of Energy Trends, published 26 March 2015. Data for the Biomass Power chapter are the sum of 'Plant Biomass' and 'Co-firing'. Data for the Mixed Waste to Energy chapter are the sum of 'Landfill gas', 'Sewage sludge digestion', 'Energy from waste' and 'Animal Biomass (non-AD)'.
[3] National Grid's report and other documents relating to the EMR Delivery Plan are available at http://bit.ly/1dhCdXH
[4] The UK's National Renewable Energy Action Plan is located at: http://bit.ly/1m6i9bd
[5] DECC's main 2013 UEP page is http://bit.ly/1LhtFLp and the renewable energy breakdown is published at: http://bit.ly/1Eho95v
[6] DUKES is located at http://bit.ly/1R0k6Um. Data in this report were taken from Table 6.6, published 31 July 2014. Data for the Biomass boilers chapter are the sum of 'Wood combustion - domestic', 'Wood combustion - industrial' and 'Plant biomass'. Data for the Mixed Waste to Energy chapter are the sum of 'Landfill gas', 'Sewage sludge digestion', 'Animal Biomass' and 'Biodegradable energy from waste'.
[7] The Bulletin is available at http://bit.ly/1IOnsad
[8] RTFO statistics are at http://bit.ly/1EV8YiV

REA Events

The REA run a variety of conferences, seminars and workshops throughout the year, attracting some of the biggest movers and shakers in the UK's renewable energy industry as speakers and attendees.

The conferences and parliamentary events REA run form part of the wider campaigning activity undertaken to influence decisions affecting the renewable deployment at the highest levels of UK and EU government.

Our workshops and seminars are geared towards helping our members to better understand the changing regulatory and policy landscape impacting the renewable energy industry.

The REA organises the annual British Renewable Energy Awards - celebrating and honouring the achievements of organisations and individuals that are dedicated to strengthening the UK's renewable energy industry.

All of the REA's events are open for sponsorship and those organisations that choose to support us in this way receive a number of great benefits in the process, from brand promotion and press coverage through to tailored speaking opportunities.

More information about the REA's events can be found at www.r-e-a.net/events

To learn more about sponsorship opportunities please email events@r-e-a.net