

UK Renewable Energy Investment Opportunity: Creating Industries & Jobs

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Editorial Letter

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The coalition government inherited ambitious emission reduction and renewable energy mandates from the previous government, including a target to achieve 15% of overall energy from renewables by 2020, requiring 30% of power, 12% of heat and 10% of transport fuels to be derived from renewable sources to achieve the overall target. Key coalition energy ministers have demonstrated that they are serious about meeting these commitments. The October, 2010 Treasury Comprehensive Spending Review did not impose the draconian measures on the clean energy sector that had been feared. Rather, it reaffirmed the coalition government's commitment to a low-carbon economy by funding renewable technologies, upholding the feed-in tariff (FiT) and the ground-breaking Renewable Heat Incentive (RHI) schemes implemented by the former government as well as maintaining support for larger scale renewables through the Renewable Obligation and supporting the establishment of a Green Investment Bank.

In the consultations on policy that will now follow, there are opportunities to review and improve these incentive measures to ensure that they unlock sufficient capital to meet the UK's renewable targets.

Successes and opportunities:

- The UK has some of the best renewable energy resources in the world for power generation, especially for offshore wind and marine energy. Potentially offshore wind could add as much as 50 GW of capacity in the UK, according to the Crown Estate. This would equate to 65-70% of current UK power generation.
- There is also a large untapped market opportunity to develop a new renewable heat industry with huge potential environmental and economic gains from biomethane injection. A National Grid Study found that if all UK waste biomass were used to produce biogas and subsequently upgraded to biomethane then this could substitute for 48% of residential heat demand by 2020.
- The scaling up of renewable energy manufacturing and production in the UK has the potential to create thousands of jobs and simultaneously represents a significant opportunity to rejuvenate parts of the country historically known for manufacturing and industry. Job estimates for offshore wind range from 23,000 to 70,000 by 2020 depending on capacity installed and the biomass/bioenergy sector could employ in the region of 40,000 people by 2020. The UK government and Scottish government have allocated a total of £130 million for upgrades at port facilities. This level of funding is a strong recognition by the new government of the importance of port redevelopment in scaling up the UK's offshore power industry.
- The UK has already attracted interest from six of the largest international wind turbine manufacturers in 2010 expressing plans to set up renewable manufacturing plants, sending a positive signal to the market about future renewable industry growth prospects, job creation and regional development.
- What is vital is that the policy landscape enables the investment case for renewable energy to be made in the UK. Before private investors will commit large amounts of capital to the renewable sector there must be **transparent, long-term and certain regulations ('TLC')**. UK policy has increasingly demonstrated TLC but needs stability in coming years without major changes.
- The introduction of the feed-in tariff (FiT) in the UK in April, 2010 and the confirmed introduction of a Renewable Heat Incentive (RHI) have greatly improved the investment environment for renewable energy technologies and ensures that policies are in place to support the UK's renewable market through 2013.
- The RHI is a ground-breaking initiative and the coalition government has taken care by funding the initial phase of the scheme through to 2014, so as not to place additional costs on the energy bills of the poorest in society. At this time there are no specific proposals as to what will happen post 2014.
- Solar PV installations have seen significant growth as a result of the introduction of the FiT with 16 MW of capacity being installed in the first 6 months of the scheme, in line with the Department of Energy and Climate Change's 'take off' projections and not highlighting any unsustainable industry deployment as a result of the scheme.

Editorial Letter

Key challenges:

- Despite unrivalled renewable resource potential and policy ambitions, in 2009 the UK derived just 3.1% of its energy from renewable sources, far short of the 15% target. Just 7% of the UK's overall power and only 1% of heat demand was sourced from renewable sources in 2009, figures that are recognized by government as being some of the lowest in Europe.
- Low renewable installation levels have been partly attributed to financing difficulties, especially at the pre-construction phase for offshore wind, as well as lengthy planning delays.
- The Green Investment Bank Commission has estimated that £550 billion worth of investment could be needed to meet the UK's renewable energy and emission targets by 2020.
- Grid infrastructure and grid connection availability has long been one of the main challenges to renewable energy scale-up in the UK.
- The upcoming replacement of the Infrastructure Planning Commission with a Major Infrastructure Unit for energy planning decisions has created some confusion and caution in the industry, slowing the pace of infrastructure projects.
- Despite the success of the FiT for solar PV, the tariffs and rates of return on offer for some technologies, including anaerobic digestion tariffs and larger wind projects, have been challenged by industry for not being high enough to attract sufficient levels of investment.
- The coalition government's manifesto document detailed support for a full system of FiTs. Currently there is no FiT for offshore wind, which could be advantageous for several reasons: it would cut the bureaucracy surrounding the Renewable Obligation and allow much greater transparency.
- A scheduled review of the tariffs in 2013, or earlier if deployment rates of technologies are higher than expected or thresholds are exceeded, aims to refocus on the most 'cost-effective technologies.'
- Recent concerns that huge areas of land in southern England could be covered with solar panels could be minimized by the introduction of a building integrated solar PV tariff to focus support for systems that are incorporated into the build environment.
- Low levels of ambition through, in effect, caps will not lead to the UK achieving its 2020 goals in the longer-term,
- At the time of writing this paper no further details of the mechanism of the FiT review are available. If DECC intends to move towards 'thresholds' rather than periodic reviews in its FiT revision process it should also take the opportunity to raise the UK's ambition level. The UK needs a strong 'take off' period to establish a domestic base to its renewable sector and there is considerable scope for expanding the UK renewable sector without risk of overheating.
- In the interest of investor certainty, the key focus should be on the end-goal of meeting the UK's 2020 renewable mandates, rather than on the scale of technology take-up rates. In this way, investment, innovation and employment opportunities would not be undermined.
- The current proposed tariff structure of the RHI, formulated by the former government, has also been challenged for not going far enough to remove perverse incentives and recognize the added benefits of some technologies, notably for biomethane injection.
- Upcoming reviews of the RHI structure by the coalition government before the end of 2010 will need to re-evaluate the merits of individual technologies, especially biomethane injection, and adapt tariffs accordingly to ensure the UK renewable heat target is met. The opportunity exists for future consultations to clarify and re-engineer the scheme.
- The Renewable Heat Incentive was scheduled to start on April 1, 2011, but is now set to start in June, 2011. The importance of no further delays to the schemes start date must be emphasized if the UK is to meet its 2020 renewable heat target.

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Executive Summary

The transformation from a fossil fuel dominated energy supply to a more sustainable renewable energy supply is an essential component in reducing greenhouse gas (GHG) emissions in the UK. The UK's energy policy is at a crossroads owing to a combination of ageing energy infrastructure, emissions targets and the transition from being a net exporter to a net importer of oil and gas. This has created a need for investment from the private sector in energy systems. The October, 2010 Treasury Spending Review reaffirmed the coalition government's commitment to a low-carbon economy by upholding the feed-in tariff (FIT) and the ground-breaking Renewable Heat Incentive (RHI) schemes implemented by the former government and supporting the establishment of a Green Investment Bank. In the consultations on policy that will follow, there are opportunities to review and improve incentive measures to ensure that they unlock sufficient capital to meet the UK's renewable targets.

There is an opportunity to both fill the gap created by retiring existing energy plant and enhance energy security by investing heavily in new renewable sources of energy. But the renewable policy landscape has to enable the investment case to be made in the UK, and there is evidence that the new coalition government is serious about doing this:

David Cameron – UK Prime Minister	"The potential for Britain to lead this (offshore wind) industry is immense. We don't just have wind; we have the first-class research capability and a wealth of experience across the aerospace, engineering and energy sectors. We need thousands of offshore turbines in the next decade and beyond. And manufacturing these needs large factories which have to be on the coast. Yet neither the factories nor these large port sites currently exist. So we're stepping in. To help secure private sector investment in this technology, we're providing £60 million to meet the needs of offshore wind infrastructure at our ports. It's a triple win. It will help secure our energy supplies, protect our planet and the Carbon Trust says it could create 70,000 jobs. And it's a clear demonstration of the coalition's approach – alert to those sectors that are strong but could be stronger." <i>CBI Annual Conference, October 25, 2010.</i>
Chris Huhne – Energy and Climate Change Secretary	"We are committed to achieving the 2020 renewable energy target, which is a European Union legislative goal. The Coalition programme for government commits us to the establishment of a full feed-in tariff, with the aim of securing significant increase in investment in renewables while maintaining a banded renewable obligation and not changing the ground rules for existing investments. We are also strongly committed to action on renewable heat." <i>House of Commons, September 16, 2010.</i>
Greg Barker - Minister of State for Energy and Climate Change	Talking about the Spending Review, Greg Barker said "We have come through with a very strong position from which to deliver our core low carbon objectives. It is a real display of the fact that when we talk about being the greenest government ever, we mean it...Green businesses can now invest in confidence and look to this government as a partner in helping them to deliver growth." <i>Interview with Business Green, October 21, 2010.</i> "Our ambitions are clear, we want the UK to move to low carbon society, and we intend for Britain to be a world leader in the move to a green economy. We're committed to a game-changing agenda and a radical overhaul to our climate change programme...Investors need certainty in the environment they are investing in. We must look to build a new kind of economy, to ensure competitiveness, and protect ourselves from price shocks. It is something I like to call TLC. Transparency; Longevity; and Certainty." <i>European Future Energy Forum, October 20, 2010.</i>
Charles Hendry Minister of State for Energy and Climate Change	"Potential renewable energy is in abundance, but so far the UK has not realised its potential. We are the 2nd worst performer in the EU, but we have the resources – over 40% of the EU's wind resource is in the UK, and we have the largest tidal resources in Europe. We need more on and offshore wind, a massive increase in energy from waste, and faster development in marine energy, such as wave and tidal, if they are to develop in 10-15 years time. Again, the UK should be leading the world in these new technologies." <i>Chatham House, June, 8, 2010.</i>
Vince Cable – Business Secretary	"The government's approach to growth and investment is the right one. Renewable technology is a priority for this government, and I am delighted that foreign investors are also recognising our commitment to environmentally sustainable growth." <i>CBI Annual Conference, October 25, 2010.</i>

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Under the EU Directive¹, the UK is committed to achieving 15% of its overall energy from renewable sources by 2020, up from 3.1% in 2009. To achieve this target 30% of power generation, 12% of heat use and 10% of transport fuels need to come from renewable sources by 2020. And whilst the UK is a participant in the European Emissions Trading Scheme, what drives renewable energy growth has more to do with complimentary policies within the renewable energy sector.

DBCCA have always argued that **before private investors will commit large amounts of capital to the renewable sector there must be transparent, long-term and certain regulations** governing carbon emissions, renewable energy and energy efficiency. Investors need 'TLC' - Transparency, Longevity and Certainty². In the absence of a global agreement on climate change coming out of the UNFCCC's Copenhagen summit at the end of 2009, investors need to focus, for the foreseeable future, on the quality of policy support provided by individual countries as much disparity exists between countries in the degree of regulatory TLC they provide. Countries that offer a high level of TLC in their renewable policy will attract more investment and will build new industries, technologies and create jobs faster. Investment capital will seek the best returns, wherever they are and countries that do not provide them will fall behind those that do. It is particularly encouraging to note that the UK Minister of State for Energy and Climate Change, Greg Barker, has mentioned this same mantra, telling the Confederation of British Industry that the concept of 'TLC' will become the touchstone of all DECC policies.

In the coalition government's manifesto document, the new government signaled a continued commitment to a variety of renewable schemes inherited by the former government³ and the October 20 Treasury Spending Review reiterated the coalition government's continued support for a low carbon UK economy. Commitments include £1 billion worth of investment for a CCS demonstration project in the UK; £200 million of funding for low carbon technologies, manufacturing and port facilities; and the establishment of a Green Investment Bank with an initial injection of £1 billion from the government. The coalition government also promised to revise and create some new incentive policies for renewable energy in its manifesto including increasing the UK's target for energy from renewable sources under the EU Directive; establishing a full system of feed-in tariffs while grandfathering current incentives; introducing measures to encourage marine energy; and reforming energy markets to deliver security of supply and investment in low carbon energy and reforming energy markets. The Spending Review also confirmed that the coalition government will proceed with a planned Renewable Heat Incentive in June, 2011 and will uphold the current feed-in tariff structure until a scheduled review of tariffs in 2013, unless markets experience such deployment growth that an earlier review is needed, ensuring that policies are in place for at least the next 3 years to drive the UK's low-carbon economy.

The UK Opportunity

The UK is well positioned in many respects to develop a low carbon economy.

Summary of the key opportunities in the UK renewable energy sector:

Resource opportunity

- The UK has some of the best renewable resources in the world, especially regarding offshore wind. The most scalable technology to meet the 2020 targets for renewable power generation is considered to be offshore wind, and in September 2010 the UK reached a landmark 1.34 GW of installed offshore wind capacity, more than the installed capacity of the rest of the world combined, which stands at 1.1 GW⁴.
- The Crown Estate estimates that there is 50 GW of generating capacity sites suitable for offshore wind development, which would represent around 65-70% of UK total power generating capacity in 2010.⁷⁷
- The UK has an abundant biomass resource, from waste including sewage, manure, food waste and other biomass energy crops which can be used in anaerobic digestion systems to produce biogas which can be used to produce heat or electricity, and subsequently upgraded to biomethane to be injected into the natural gas grid as an alternative to heat source. Industry calculations suggest that if all UK waste biomass resources were used to produce biogas and subsequently biomethane then this could substitute for 48% of residential gas demand⁵.

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	The UK is considered to be at the forefront of the marine renewable energy industry through its research and development (R&D) programs, test facilities and marine and offshore experience gained from working with the oil and gas industries. The winners of the world's first commercial wave and tidal leasing round were announced by the UK Crown Estate in March, 2010. The leases are for ten sites in Scotland's Pentland Firth and Orkney waters and will generate 1.2 GW of power by 2020. Although marine technologies are still very much in their infancy, the announcement marks a milestone in the trajectory towards commercialization.
Manufacturing Hubs	- The offshore wind industry is bullish on growth prospects in the UK and sees the number of international investors, such as Siemens, General Electric and Mitsubishi, interested in the market and the key multi-national players expressing interest in setting up offshore wind manufacturing factories in the UK as positive market signals⁶. - There are various disused port facilities in the UK that are available to be redeveloped into offshore wind turbine manufacturing sites and hubs for offshore vessels.
Regional Development	- Scaling up renewable energy power generating capacity and renewable heat technologies can also tie into the government's regional development policies. - Office of National Statistics figures show that in April, 2010 there were 2,500,000 people unemployed in the UK, with the North-east and South Wales having the highest unemployment rates. These former coastal manufacturing centers could be regenerated by renewable scale-up.
Job creation potential	- There is a huge potential for the creation of domestic employment opportunities by scaling up renewable industries. The offshore wind sector can learn from an oil and gas industry that can offer a range of services covering offshore work. - Estimates for jobs created in the offshore wind sector range from 23,000 to 70,000 by 2020 depending on capacity deployed. Unlocking this potential will necessitate addressing a shortage of skilled workers at all levels of the renewable energy production chain from technicians through to chartered engineers.⁶ However the new coalition government has already allocated £150 million deployed from savings to create a further 50,000 apprenticeships, many in the low carbon sector. - In other renewable industries there is high potential for job creation especially at the installation and operation and maintenance stages of the production chain. This has already been demonstrated by a large increase in employees in the solar PV sector since the introduction of the UK feed-in tariff in April made small systems more attractive to household investors. - The Anaerobic Digestion and Biogas Association finds that the biomass/bioenergy sector could potentially employ around 40,000 people by 2020.

In terms of policy, DBCCA views the UK as a leader in current and proposed schemes as detailed in the next table.

Summary of the key strengths in UK Energy Policy:

High UK mandates	- The coalition government inherited ambitious emission reduction and renewable energy targets from its predecessors and has maintained that it is determined to maintain these targets. - The coalition government is indeed pushing the EU to demonstrate leadership in tackling international climate change, including an increase in the EU emission reduction target to 30% by 2020. - Scotland's government recently increased its individual renewable power generation target to 80% by 2020.
Renewable Obligation	- The main mechanism to support renewable energy to date has been the Renewable Obligation (RO), and this has had some success in stimulating the growth of a number of larger scale technologies. - The coalition government has so far pledged to maintain a banded system of the RO alongside the new feed-in tariff policies, although there is the possibility of moving to a full system of feed-in tariffs.
Feed-in Tariff Policy	The former UK government put in place a feed-in tariff (FiT) scheme which came into effect on April 1, 2010 offering tariffs for a wide array of renewable power generating technologies below 5 MW in size, which had previously experienced underinvestment owing to the immaturity of the small-scale renewable market in the UK, high project risk associated with new technologies and the complexity of the RO policy⁷.

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	Industry analysis has shown that there is a greatly improved investment environment for most small-scale renewable energy technologies as a result of the FiT policy⁷ with one of the key successes so far being a large increase in solar PV household installations, in line with DECC's 'take-off' projections.⁸
Renewable Heat Incentive	- In the absence of clear policies and incentives, renewable sources of heat have so far struggled to reach just 1% of heat supply in the UK. - However the confirmed Renewable Heat Incentive (RHI), introduced by the former government, is seen as a vital step in spurring the market and help catch up with other European countries, such as Germany, Austria and the Czech Republic, who already have mature markets for renewable heat technologies. - Industry analysis has shown that the RHI has the potential to encourage a raft of non-traditional investors, such as farmers, households and community programs, to install renewable heating systems⁷. - The coalition government has committed £861 million pa from general taxation to back the RHI. Bringing the RHI into direct government expenditure, rather than funding it through a levy on heat suppliers and consumers, avoids any issues about how to distribute costs between heat providers and reduces the financial burden on the fuel poor. - Treasury funding in the first phase of the RHI through to 2014. At this stage, there are no details on what will happen regarding funding after this time.
Green Investment Bank	- The coalition government's manifesto document maintained the former government's pledge to create a Green Investment Bank (GIB) to help fund the shift to a low-carbon economy and could make it commercially independent. - There have been various consultations on the GIB and early clues as to how the bank will operate were released in a report by the Green Investment Bank Commission in June, 2010. - There is still debate over the scale of the bank and its precise role, but a positive signal came in September, 2010 when Greg Barker announced at a Confederation of British Industry conference that the coalition government was in the process of studying a wide range of options for the Green Investment Bank, including the possibility of it being commercially independent. - The government committed £1 billion as initial funding for the GIB in the October Spending Review and committed to selling government assets to raise more funds for the GIB. - A final decision on the scale and scope of the Green Investment Bank needs to be made quickly as such credit enhancement could substantially bridge some of the present financing barriers.
Long-term energy market planning	- In July, 2010 Chris Huhne delivered the UK's first ever Annual Energy Statement to Parliament⁹. The Statement outlined various consultations on aspects of government policy including a consultation followed by a White Paper next Spring on electricity market reform; a review of Ofgem's role as energy regulator; and overhaul of planning for major infrastructure projects; and a new transitional regime for offshore wind farms already operating or being constructed with the promise of an enduring offshore transmission regime. - These consultations demonstrate that the coalition government is clearly aware of the changes needed to the UK's transmission and grid infrastructure and electricity market structure.
Direct Public Funding	The coalition government has allocated £200 million to low carbon technologies, notably offshore wind and port facilities needed for turbine manufacturing; the Scottish government has also set aside £70 million for the redevelopment of port facilities for the offshore renewable industry; the coalition has pledged to create a new Green Deal program to give financial help to over 14 million households to improve insulation; and the coalition has launched the Deep Geothermal Energy Fund to offer finance to companies seeking to generate energy from geothermal sources.

The UK Challenge

Yet despite the UK's unrivalled renewable resource potential and policy ambitions, by the end of 2009 only 7% of power generation was derived from renewable sources and the new coalition government has acknowledged that the UK is one of the worst countries in Europe in terms of renewable deployment. In response to this, the Minister for Energy and Climate

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Change has vowed to turn that around and make the UK the most improving country in renewable energy deployment over the next five years¹⁰.

Many reasons for a poor track record in renewable scale-up stem from underinvestment in the low-carbon sector by the former UK government relative to their renewable deployment ambitions. The coalition government has shown strong commitment to addressing these issues through market reform and renewable policy. Upcoming consultations on renewable policy must further ensure that the schemes have 'TLC' to stimulate a market response.

Summary of the key challenges in UK Energy Policy:

Historical achievement to date on targets	• The UK derived just 3.1% of its energy needs from renewables in 2009, a long way from its 15% target by 2020. • Just 7% of its overall power from renewable sources in 2009, the third lowest in the whole of Europe. • Despite having the largest offshore wind capacity installed in the world, the annual capacity installations of offshore wind in 2009 were 300 MW, far short of the estimated 1.1 GW needed to meet the trajectory to the 2020 power generation target¹¹. • The UK generates just 1% of heat from renewable sources, so growth to meet 12% heat from renewables by 2020 will be from a very low base with little preceding experience in the sector.
Scale of investment needed	• Low renewable installation levels to date have been partly attributed to financing difficulties at the pre-construction phase, as well as lengthy planning delays and technology risks associated with some renewable technologies. • £200 billion of investment is needed in energy infrastructure by 2020 and as much as £30 billion of capital could be needed in offshore wind farms to meet UK renewable power targets, far exceeding the current £8 billion level of investment for all utilities and National Grid combined¹¹. • The Green Investment Bank Commission estimated that around £550 billion worth of investment could be needed to meet the UK's renewable energy and emission targets by 2020¹².
Policy uncertainty & design of FiT	• Despite the success in solar PV, industry reaction on the FiTs allocated for some other technologies and the rates of returns on offer have been challenged. • Industry reaction to the tariffs shows that the anaerobic digestion (AD) tariffs and tariffs for larger wind projects, which have a high potential to contribute towards the UK's 2020 renewable target may not attract commercial investors. • Furthermore, the lack of any FiT for less advanced marine technologies to help them transition from research and early development stages through to commercial-scale deployment is seen as a flaw to the system^{13,14,15,16}. • There could be a gap in the rate of returns targeted by the FiT scheme relative to an investor's required minimum return which means that the tariffs for some technologies are not attractive enough for investors as currently structured as discussed further in Section III. • The new coalition government has agreed to the establishment of FiTs as well as the maintenance of banded ROCs. Little further detail has been provided on this by the coalition government since it took office. • Currently offshore wind projects are supported by the Renewable Obligation and are not covered by the FiT. A decision over retaining the RO or replacing it completely with the FiT is still to be decided. However industry fears that such a move could create uncertainty for offshore wind projects in Round 3 developments unless a decision is made soon. • FiTs for offshore wind, as a replacement for RO payments could be advantageous for several reasons: introducing the notion of double ROCs has already made the procedure more of a hybrid that edges towards FiTs; a shift to FiTs would involve a large cut in the bureaucracy surrounding the RO and make procedures more transparent. • There have been concerns that huge areas of land in southern England could become covered with solar panels. A possible solution to this would be the entry of a building integrated PV tariff. This would focus stronger support for systems that are incorporated into the built environment, rather than seeing subsidies going more into rural

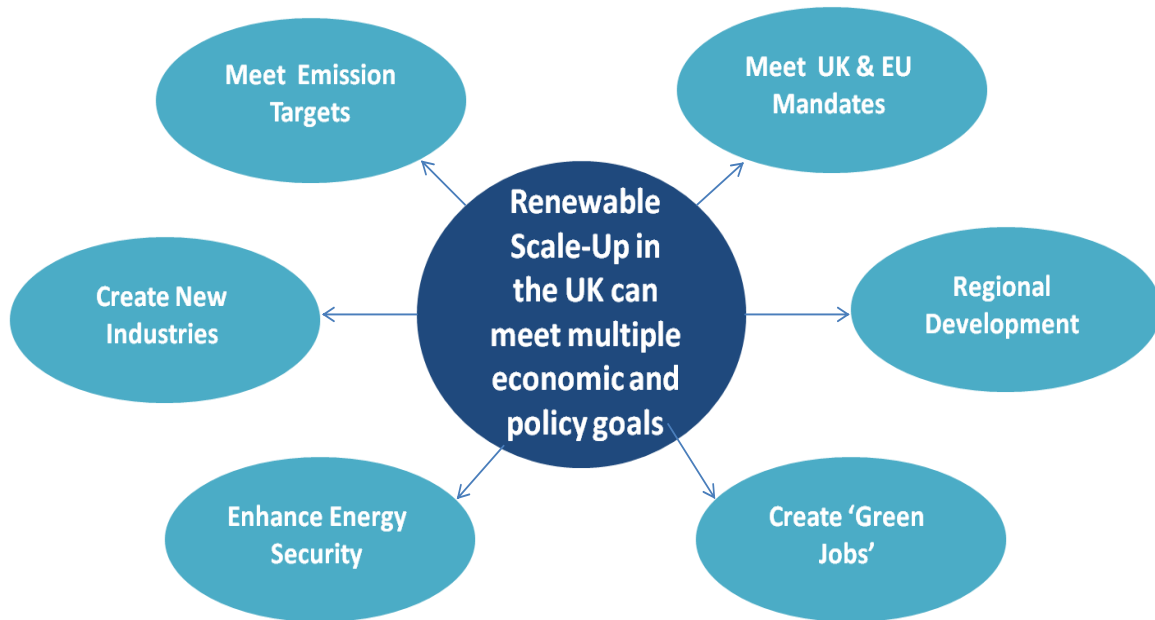
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	businesses carrying little public or political benefit. Such a tariff would also involve households and local communities in driving a shift into renewable energy. • Under the current scheme there is an imbalance in the payments made to those who installed renewable systems prior to 15th July, 2009 compared to after this date. The coalition government had said that it would look to remedy this when they came to power, but in September Chris Huhne acknowledged that any such move had been ruled out based on value for money analysis. • FiTs are paid for by electricity suppliers, rather than being paid for through direct budget spending. However, the Office of National Statistics considers the FiTs to be both government expenditure, because it is money allocated by government to a particular purpose, and a 'tax' because there is a compulsory payment levied on consumers. • The coalition government's October Spending Review confirmed that there will be no change to the FiTs ahead of the scheduled review in 2013, at which time the FiTs will be refocused on the most 'cost-effective technologies' to deliver a saving of £40 million by 2014-2015. • However it did stipulate that an early review could be carried out if there is higher-than-expected deployment of renewable systems as a result of the FiT scheme. • Low levels of ambition through, in effect, a cap will not lead to the UK achieving its 2020 renewable goals in the longer-term.
Policy uncertainty & design of RHI	• The current proposed RHI structure, developed by the former government, has been met with concern by the industry for not going far enough to stimulate uptake on the scale needed for renewable heat technologies to achieve 12% of heat use by 2020.¹⁴ • There are industry concerns about the proposed RHI tariffs for solar thermal technology and biomethane injection, stating that they are set too low to represent an attractive investment, discussed further in Section III. • There are calls to increase the 4p/kWh biomethane tariff to at least 6p/kWh to be on a par with the German market. Biomethane as a heat source is a far more efficient use of biogas than power generation. • Full details of the RHI tariffs and rates are under review by the coalition government and an opportunity exists to factor in the added benefits of technologies such as biomethane injection compared to other heat generating and indeed power generating technologies, as detailed in Section III. • The original scheme was scheduled to commence on April, 1, 2010. However an announcement in the Spending Review confirmed the intention for it to start in June, 2011. What is important is that there are no further implementation delays that could compromise the heat targets for 2020.
Electricity market reform and planning & infrastructure	• In the UK, grid infrastructure and grid connection availability has long been one of the most recognized challenges to renewable energy. • In addition, facility infrastructure upgrades, such as upgrading UK port space for offshore turbine maintenance and distribution hubs, are critical to enable new manufacturing capacity and generating capacity in the UK. • High levels of renewable power will need much greater investment in storage and grid infrastructure, and ultimately a European supergrid that is designed to be inclusive of all offshore and marine technologies so that infrastructure to integrate capacity is in place ahead of time as the markets for these technologies mature.¹³ • In the absence of a clear planning body, with the upcoming replacement of the Infrastructure Planning Commission with a Major Infrastructure Unit, there is caution in the industry and the pace of infrastructure projects has slowed by energy companies. • A decision regarding the electricity market reform and gas market arrangements are considered to be a matter of urgency in the near-term to give certainty to the market and drive investments in electricity generation¹¹.
Skills gap	• The UK needs to develop a new national skills strategy focused on skills to address the shortage of people with the technical knowledge and skills in renewable energy-related sectors. • There are currently only 20 universities out of around 325 institutions offering dedicated renewable energy courses in the UK. • The coalition government has already taken clear steps to address shortfalls in low-carbon skills provision and is working with the Minister for Universities and Science to ensure that the UK has a flexible training framework that will deliver the skills required for the low carbon economy.

I. The UK Climate Change Opportunity

The UK has an opportunity for renewable scale-up to satisfy multiple policy and economic goals: emissions targets, energy security and job and industry creation.

There are multiple goals of renewable scale-up



Source: DBCCA Analysis, 2010

The UK has an opportunity to marry up climate change mitigation with job creation by investing in new renewable energy projects and low-carbon initiatives.

Through the scale up of renewable energy sources across the UK economy, multiple economic and policy goals can be met:

- **Renewable Mandates:** The UK is bound by the EU Energy Directive to meet 15% of its overall energy needs with renewable sources by 2020. In 2009 the UK derived 3.1% of energy needs from renewable sources.⁷³
- Renewable Energy required to meet this target is split across the three energy sectors of power generation, heat and transport.
- The UK's Renewable Energy Strategy¹⁷ (RES) was launched in July, 2009 outlining how the UK aims to move towards the 15% renewable energy target. A key issue in helping to reach the target will be reducing energy demand and the amount of energy required overall across all sectors of the economy.
- The remaining energy will need to be derived from renewable sources across the three main sectors with the following breakdown:
 - Power Generation – ~30%, including 2% from small-scale micro-generation (117 TWh)
 - Heating – 12% (72 TWh)
 - Transport – 10% (49 TWh)
- Yet at the end of 2009 the proportion of renewable sources within each of these sectors is far short of these targets:
 - Power Generation – ~7%
 - Heating – ~1%
 - Transport – ~3%
- **Creating New Industries:** Within each energy sector, there are technologies at various stages of development and commercialization:

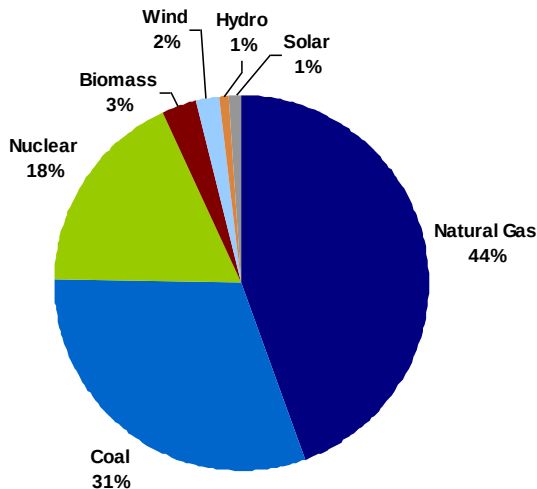
I. The UK Climate Change Opportunity

- Power Generation – hydro, onshore and offshore wind, biomass, solar, wave and tidal. Of these, the key contributors in the UK are currently biomass, onshore and offshore wind (4 GW combined) and hydro.
- Heating – air source heat pumps, ground source heat pumps, biogas heat, biomass district heating, and biomass boilers.
- Transport – biofuels.
- These technologies present opportunities to create new long-lasting industries for the UK. In this paper, we will focus on the power generation and heating sectors – split across three main sectors: domestic, industrial and commercial uses of heat - of renewable energy.
- **Emission Targets:** The UK is also bound under the UK Climate Change Act¹⁸ to cut its GHG emissions by 34% by 2020 and 80% by 2050. In June, 2009 the country set the first of three five-year carbon budgets that will set out the UK's trajectory for reducing carbon emissions over the period 2009-2022. Contributions to achieving these budgets will come from sectors covered by the European Emissions Trading Scheme including power generation. Indeed a shift towards renewable power generation and heating and electric transportation will all help to decarbonize the UK economy. Forty seven percent of UK emissions come from heat for space and water heating, cooking and industrial processes. Over 30% of emissions come from the power generation sector, with the remainder from transport. Contributions from renewable energy for power and heat will therefore be key to meeting emission targets¹⁹.
- **Security of Energy Supply:** Over the next decade it is estimated that 22.5 GW of total current power capacity will need to be replaced as coal and oil generation become subject to stringent environmental standards, such as the EU Revised Large Combustion Directive, and nuclear power stations reach the end of their lifetimes²⁰.
- After spending over 30 years as a net exporter of energy, the UK became a net importer in 2004. This, alongside higher fuel prices, increased concern over the security of energy supply and a shortage of gas imports during winter 2009, has increased the attention on UK energy imports and exports.
- Net coal imports made up 13% of UK primary energy supply in 2009 and in 2009 58% of the UK's gas imports came via pipeline from Norway or from Norwegian gas fields²¹.
- Alongside investment in new generating capacity is the need for investment in power networks. If the UK is to maintain security of supply then new renewable generation and new conventional plant will require access to the power grid and some parts of the network may need to be strengthened to accommodate renewable generation²².
- **Creating Jobs:** According to the former UK Government's Low Carbon Industrial Strategy²³ there could be up to 1.28 million jobs in renewable energy in the UK by 2015 if the country seizes the opportunity to become a global centre of low carbon industry and green manufacturing.
- **Regional Development:** The North-East and Wales are regions with the highest unemployment rates compared to the South-west and South-East where unemployment was lowest for the period March-May, 2010²⁴.
- This represents a significant regional opportunity to rejuvenate parts of the UK historically known for manufacturing and industry, by creating thousands of new jobs along the production chain and regional economic growth.

II. UK Renewable Industries

The level of renewable power generation scale-up needed is large, given that currently renewable sources make up 7% of power generation.

UK Power Generation Mix, 2009



Key Renewable Heat Generating Technologies for Development
Solid biomass
Bio-liquids
Biogas on-site
Biomethane
Solar thermal
Ground-source heat pumps
Air-source heat pumps

Source: DBCCA Analysis, 2010; UK Department of Energy and Climate Change, 2010²⁵.

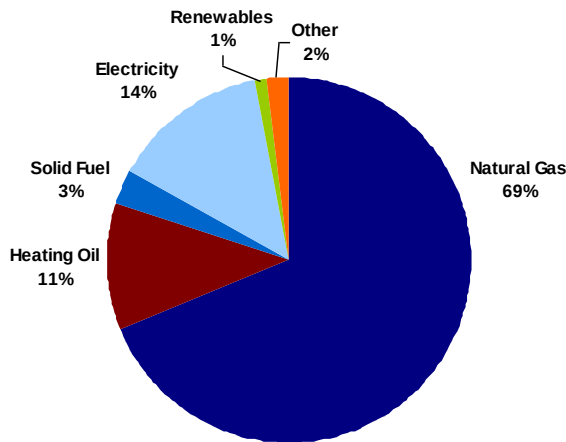
The UK must focus on key sectors that have the most potential to drive the transition to a low-carbon economy.

- To meet the overall 15% renewable energy target, the UK would need to derive 30% of its power generation from renewable sources by 2020, but currently generates just 7% of its power needs from renewable sources²⁵.
- In terms of energy use, the UK has the third lowest contribution from renewable compared to any other major EU economy, so the growth in capacity needed will come from a very small base.
- According to the Green Investment Bank Commission¹², the investment needed to reach the overall 15% by 2020 renewable energy target is estimated to be £550 billion by 2020.
- Offshore wind, anaerobic digestion and upcoming marine technologies are key sectors that could help drive the UK towards meeting its power generation targets.
- Offshore wind is viewed as the most significant scalable opportunity for the UK, however there needs to be a 'quantum leap' in offshore wind capacity investment, otherwise the UK risks missing its 2020 renewable energy targets¹¹.
- With the new UK coalition government in place, there is an opportunity to clearly set out the path towards the UK's low carbon economy and set strategic incentives that will support the growth of key renewable technologies in the power and heat sectors.
- However, renewable power generation scale-up will only be achieved if the new coalition government implements suitable policies to achieve 'TLC' for investors and addresses the non-financial barriers including infrastructure constraints, lengthy planning procedures and delays in grid connectivity for renewable generators.
- We address the UK's feed-in tariff policy for renewable power generation in Section III.

II. UK Renewable Industries

And renewable sources accounted for only 1% of the UK heating supply in 2007

UK Heat Generation Mix, 2007



Key Renewable Power Generating Technologies for Development
Fixed offshore wind
Floating onshore wind
Onshore wind
Micro-generation wind
Wave
Tidal range
Tidal stream
Anaerobic digestion
CHP
Solar PV
Hydro-electric

Source: Parliamentary Office of Science and Technology, 2010²⁶; DBCCA Analysis 2010.

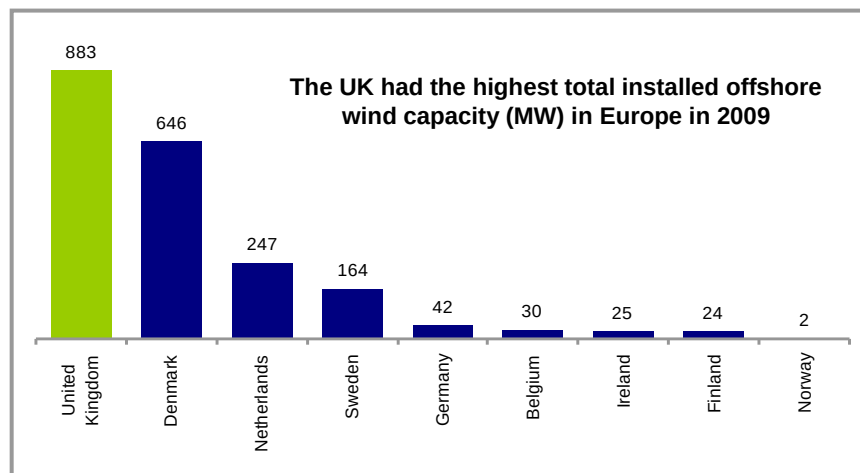
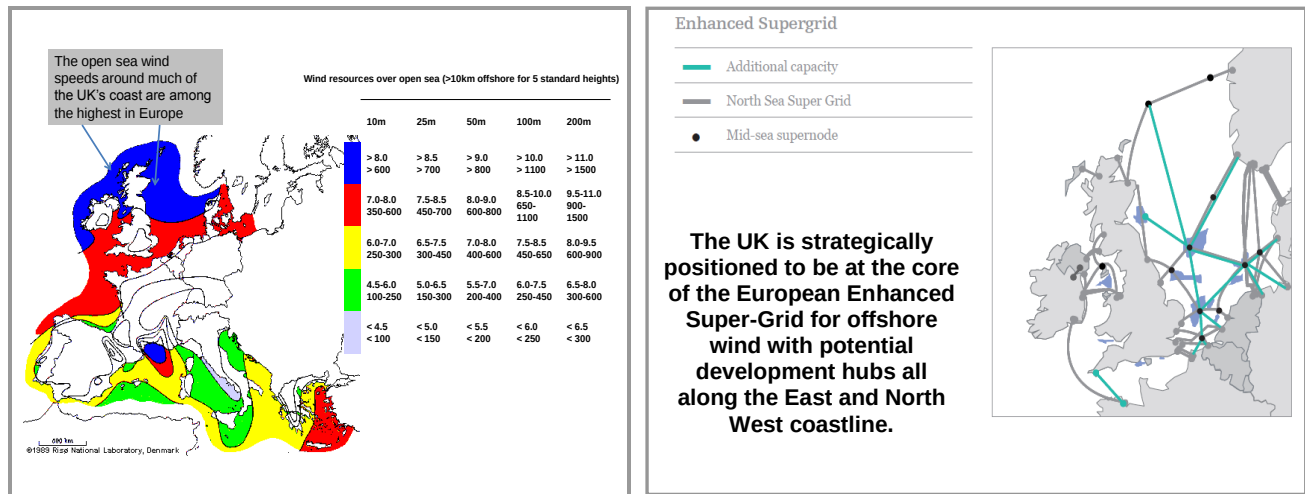
Heating accounts for 50% of all UK energy use and associated CO2 emissions, so renewable heating technologies could make a significant contribution towards carbon reduction and renewable energy targets.

- The UK needs to derive 12% of its heat supply from renewable sources by 2020 to meet its overall 15% renewable energy target, yet currently only 1% of heat is derived from renewable sources²³.
- To achieve the 12% target will therefore require unprecedented growth in markets for renewable heating technologies such as those shown in the table above.
- Analysis carried out by the Department of Business Enterprise and Regulatory Reform suggests that if renewable heat were to meet 12% of overall heat demand by 2020, this would mean around 100,000 households using heat pump technology¹⁸ compared to fewer than 10,000 at the end of 2009 as well as a substantial amount of biomass heat capacity.
- Heating currently accounts for almost 50% of the UK's final energy use and 47% of carbon emissions and is split across three main sectors: domestic (54%), industrial (30%) and commercial (16%)²⁶.
- The UK heat market is highly complex with eight gas distribution networks covering a separate region of the country. In addition there are a number of smaller networks owned and operated by Independent Gas Transporters. It is unusual for households or businesses to buy or sell heat in the same way that electricity is bought or sold on the national grid.
- As a result, up until now, UK heat consumers generally buy heating fuel (natural gas, oil, coal, wood) or electricity and convert these to heat on site in boilers or electric heaters.
- This could change however with the widespread adoption of biomass plants that produce biogas through the process of anaerobic digestion. This renewable gas can then be used to generate heat or power on site.
- The biogas can also be upgraded by cleaning to form biomethane which can leverage the existing national gas grid infrastructure.
- A National Grid study found that if all UK waste biomass (sewage, animal manure, and food waste) were used to produce biogas and subsequently biomethane then this could substitute for 48% of residential gas demand by 2020⁵.
- The previous UK government proposed the introduction of a Renewable Heat Incentive including a tariff for biomethane injection as laid out in DECC's Renewable Heat Incentive Consultation.²⁷ However industry analysis suggests that the added benefits of biomethane injection, compared to power generation from biogas, in terms of primary energy utilization and emission reduction potential are not correctly reflected in the former government's proposed tariff¹⁴.

II. UK Renewable Industries

Offshore wind is viewed as the most scalable renewable power generating opportunity for the UK, giving the country an opportunity to become a strategic world leader in the technology.

Onshore and Offshore Wind Resources



Source: European Wind Atlas⁷¹, Risø National Laboratory, Denmark, 1989²⁸ Copyright Risø DTU; Global Wind Energy Council, 2009²⁹; The Offshore Valuation Group, 2010 – 'The Offshore Valuation'³²; DBCCA Analysis, 2010

Offshore wind represents the most scalable renewable technology for the UK, but issues with pre-construction financing, manufacturing capacity and planning delays are hindering the industry's current growth rate.

- The previous government's Renewable Energy Strategy, 2009¹⁷, states that the target of reaching 15% of all UK energy from renewable sources by 2020 means that 35-40 GW of power generating capacity will have to come from renewable sources.
- The majority of this will have to be from onshore and offshore wind as it is currently the most scalable and cost effective renewable power generating technology for the UK, possibly delivering over £60 billion of investment by 2020³⁰.
- The UK Crown Estate has identified potential offshore wind development sites adding up to close to 50 GW in capacity. This would account for 65-70% of the total generating capacity in the UK in 2010⁷⁷.

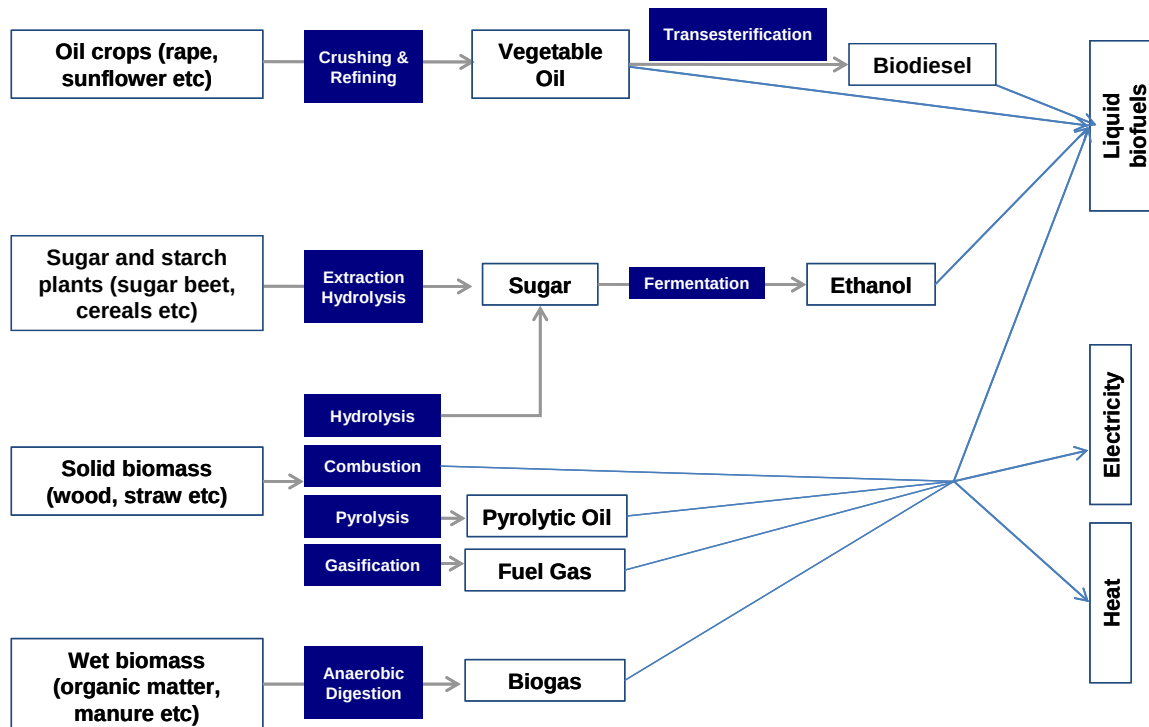
II. UK Renewable Industries

- The UK has reached a total of 5 GW of wind power in 2010, including onshore and offshore projects. A major boost came with the opening of the world's largest offshore wind farm, the Thanet Offshore wind farm off the coast of Kent, in September 2010.
- Total offshore wind capacity reached 1 GW early in 2010. There are over 40 GW worth of offshore sites currently being brought forward by developers in UK waters, which could bring over £120 billion of private investment to the UK³¹.
- However at the end of 2009, 300 MW had been installed offshore in the year, less than half the average annual roll out rate of 1.1 GW of offshore wind that is estimated to be needed to meet the UK's 2020 target. This is primarily attributed to planning delays and difficulties in pre-construction financing owing to construction risks and insufficient returns for private investors¹¹.
- The scale of potential for the UK offshore wind energy sector has been described as 'phenomenal,' with average capacity factors of around 35%²⁹, which is on a par with UK hydro and only 5% less than average load factors for conventional thermal generation.
- In harnessing just 29% of the practical offshore renewable resource (wind, wave, tidal and tidal stream) of the UK by 2050 the electricity equivalent of 1 billion barrels of oil could be generated by 2050 annually, matching North Sea oil and gas production and making the UK a net electricity exporter³².
- The UK's former government saw a potential for 33GW of offshore wind capacity in the UK.⁷⁵ To install 12-13 GW would necessitate an investment of £33 billion⁷⁶ as well as a further £7 billion for the associated offshore transmission connections.
- The reason for such high potential is the superb geographical situation of the UK. The UK has potentially the largest offshore wind resource in the world, with its relatively shallow waters and a strong wind resource extending far into the North Sea.
- In January 2010, the Crown Estate announced the successful bidders for each of the 9 Round 3 offshore wind zones within UK waters. Prior to this the UK had already begun to develop its offshore wind resource with 15 GW of fixed offshore wind sites allocated through Rounds 1, 2 and the Scottish Exclusivity Agreements.
- With such a high offshore potential, the UK has a strategic role in taking leadership in the current EU super grid negotiations to ensure that the UK derives maximum value from its design and implementation.
- However, much of the potential expansion of wind resources in the UK, both onshore and offshore, will depend on the regulatory environment and how much 'TLC' can be created by policy to encourage investors to inject capital into projects, as discussed in Section III.
- Key non-financial barriers must also be addressed including grid connectivity lead-times, the renewable planning procedure and support infrastructure such as offshore vessels and port availability and the technology confidence gap in offshore projects.

II. UK Renewable Industries

Biomass power generation technologies are already mature in other European countries and have the potential to become an important source of renewable power and heat in the UK, but suitable incentives are needed to stimulate the market.

Biomass / Bioenergy processes and end-products



Source: European Biomass Association³³; DBCCA Analysis 2010

Biomass refers to renewable energy originating from biological material and using various transformation processes it is transformed into biofuels, bioheat or bioelectricity.

- Biomass covers a range of renewable fuel sources derived from organic matter such as trees, plants, manure and waste. It is a particularly versatile source of renewable energy and can be used in a number of ways to create bioenergy.
- Bioenergy is energy produced from the direct or indirect combustion of biomass material, such as energy crops, wood, manures and slurries or organic waste converted to biogas. It can be used to generate heat or electricity and to produce transport fuel.
- Landfill gas is currently the most significant source of biomass-based power generation in the UK, but potential for further growth is limited because most major landfill sites are already exploited.
- Further biomass power generation in the UK is likely to come from waste or energy crops.
- The Department for Business Enterprise and Regulatory Reform estimates that there is between 64-78 TWh of domestic biomass resource available for bioenergy production for heat and electricity in the UK³⁴. In order to generate power or heat from biomass sources the process of anaerobic digestion (AD) is most frequently employed. AD utilizes biodegradable waste, agricultural slurry, sewage and food and drink industry waste to produce biogas, which can be used to generate heat and power, and subsequently biomethane which can be used as a source of heat by injection in to the natural gas grid.
- The UK produces over 100 million tonnes of such organic waste each year that could be used to produce biogas³⁵.

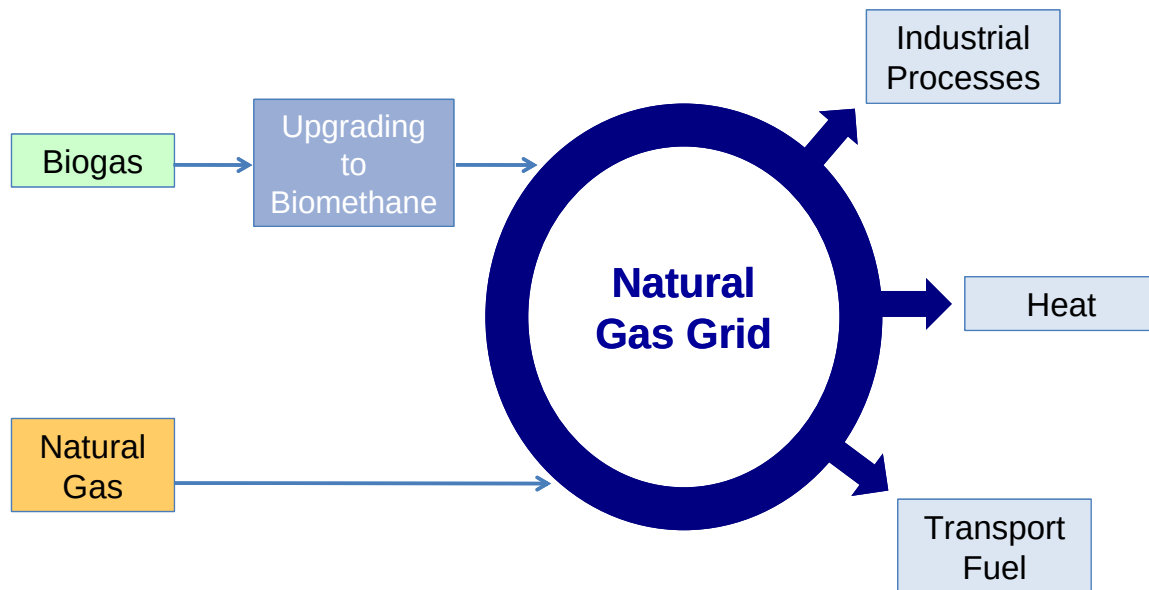
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- The UK's 2007 Biomass Strategy undertaken by the Department for Environment Food and Rural Affairs, DTI, DfT estimates that the anaerobic digestion of food waste, livestock slurries, sewage sludge and energy crops to produce biogas in the UK could contribute to at least 10-20 TWh of heat and power by 2020, representing 4-8% of the overall 15% renewable energy that is required by 2020 to meet the UK's Renewable Energy Directive obligations³⁶.
- However, achieving this potential by 2020 would necessitate the collection and separation of organic waste as well as the development of anaerobic digestion plant networks across the UK.
- Distributed energy systems would help to de-carbonize the UK economy and AD is identified as one of the best energy-from-waste options for community scale development. Community level power generation may also avoid grid connection and planning obstacles that pose barriers to larger facilities.
- The technology of AD is much more widely deployed in many countries than in the UK. There are currently only 37 anaerobic digestion plants in the UK³⁷. This compares to around 4,500 biogas plants in Germany.
- Crops such as maize, grass or cereals can also be used as feedstock for anaerobic digestion and indeed the best crops are those with the leafiest areas.
- However, there is concern from some that these energy crops compete for land used for food production and could therefore raise commodity prices and affect food security as seen to an extent in Germany, an issue that must be factored in to potential growth forecasts in the UK. Greater recovery of wood from managed and unmanaged woodland and better exploitation of the existing supply of waste materials could make a significant contribution to the UK biomass power generation and heat generation sectors¹⁷.
- There is also concern about the scale at which 'sustainable' biomass schemes become unsustainable. This becomes a more critical factor where the biomass is internationally sourced and brings with it a carbon footprint that exceeds any carbon gain. It is also a sensitive area in respect of development economics and food/energy security.
- Apart from the land needed to grow biomass crops, increased use of bioenergy would entail significant changes in land use for infrastructure needed for production and processing.
- A possible solution to increased competition for land for biomass crops could be to encourage farmers to 'inter-crop' and harvest a green biomass crop during the spring when planting is not usually for the food chain, perhaps encouraged by an inter-crop tariff.
- The former government's Renewable Energy Strategy stated that it is supporting research on the social, environmental and economic effects of biomass use for power generation and heat. The research will identify the type of energy crop best suited to conditions in England and Wales and develop solutions for growing these crops so that their potential benefits are realized.
- The high uptake of biomass generating technologies like AD across Europe shows that despite the high upfront costs of building AD plants and the various feedstocks and handling issues involved, the technologies do not face any insurmountable technology challenges or equipment performance barriers.
- Therefore **a key reason behind what has prevented the small-scale biogas industry maturing so far in the UK has been the lack of a price tariff**. A robust long-term incentive scheme such as Germany's FiTs is needed to support the industry going forward, but there is concern in the industry that the UK's new FiT system for bioelectricity from solid and wet biomass sources and proposed Renewable Heat Incentive (RHI) for bioheat do not go far enough to stimulate the uptake of bioenergy technologies, as discussed in Section III.

II. UK Renewable Industries

The subsequent ‘upgrading’ of biogas to produce biomethane which can be injected into the natural gas grid, withdrawing the equivalent energy volume at another point on the grid could hold huge potential for the UK heat market.

Biomethane can be injected into the existing natural gas infrastructure



Source: NGVA Europe ³⁸; DBCCA Analysis, 2010.

Biomethane, produced from biogas, can be injected into the UK gas grid and used to heat homes and businesses, creating a further demand for anaerobic digestion in the UK. In this way, biogas could contribute up to 50% of residential (heat) demand in the UK.

- Biomethane is pipeline quality gas derived from organic material. It has identical properties to natural gas, but is derived from biogas which has been cleaned or ‘upgraded’ to meet gas pipeline specifications.
- Biomethane can be injected into the gas network or compressed for use in natural gas vehicles. Once the gas is in the gas network it can be used in exactly the same way as natural gas, representing an important additional market for biogas in the UK.
- A National Grid study suggests that 48% of the residential gas demand could be derived from biomethane injection if all waste were directed to biomethane production⁵.
- In addition, the UK has the opportunity to be a European leader in the manufacture of biomethane from waste and its injection into the gas network as the industry is still in its infancy in other countries.
- Although Germany has developed a mature anaerobic digestion industry in relation to landfill gas, there has been comparatively little upgrading and injection of biomethane.
- Despite having around 4,500 anaerobic digestion plants, there are only around 35 plants in operation in Germany that inject biomethane into the gas grid, representing a large amount of wasted heat.
- In the UK, gas is delivered via a network of pipes owned by the National Grid and the Gas Distribution Network Owners. These firms, and the flow of gas, are strictly regulated.
- Additional costs are incurred by those wanting to inject biomethane into the grid in order to comply with these regulations. For instance biomethane produced from the treatment of waste can only be injected into the gas grid once it has been cleaned up and treated to an appropriate agreed standard. To date in many countries it has not made commercial sense to invest in the high costs of biogas upgrading. Biogasmax³⁹ states that the upgrading costs depend on the size of the biomethane production plant ranging from 0.11-0.22 euro cents/Nm3 for large or small plants.

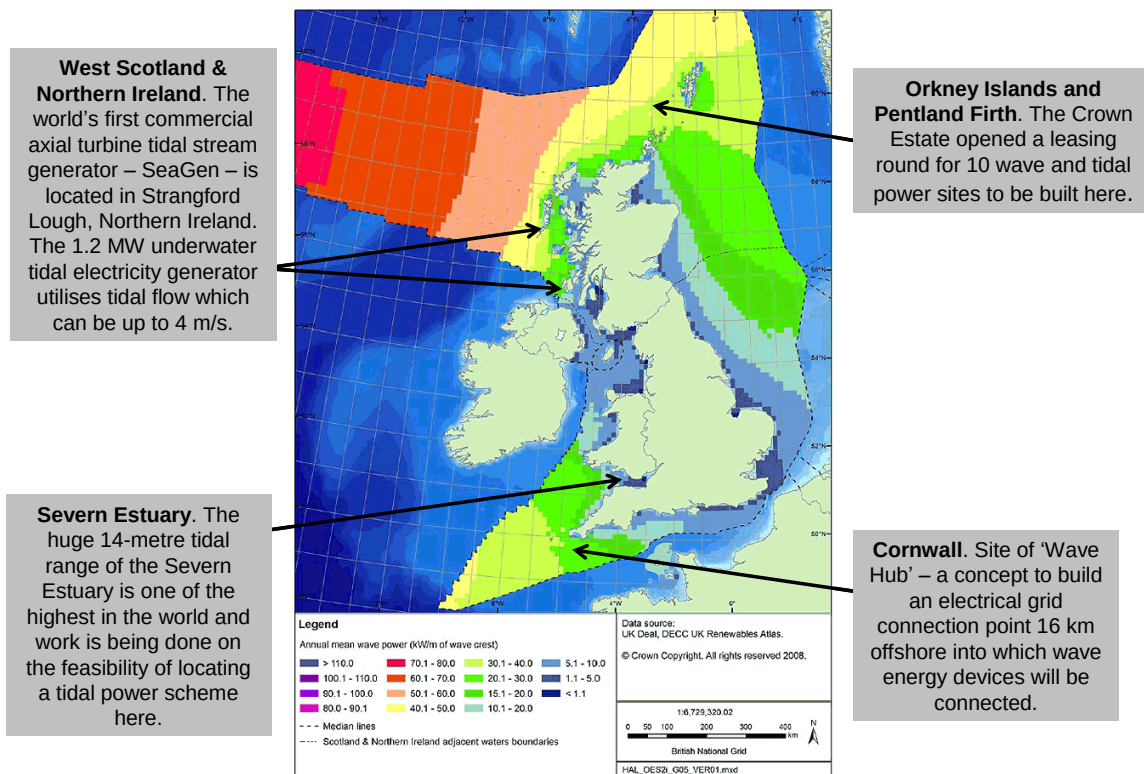
II. UK Renewable Industries

- The UK plans to allow injection of biogas into the gas grid from April, 2011 incentivized by the Renewable Heat Incentive which, if structured correctly, could be a vital mechanism to overcome additional cost barriers and drive the market for biomethane injection and biogas as a heat source.
- However, as discussed in Section III the UK's proposed renewable heat tariff for biomethane injection has been challenged by industry^{13, 14} and there are calls for increasing the final tariff adopted to encourage the adoption of this technology.

II. UK Renewable Industries

Furthermore, the UK's marine energy industry has the potential to become a worldwide market leader, utilising the country's superb resources. However the technologies are still very much in their infancy and face substantial barriers to commercialization, partially due to the lack of a differentiated generation tariff to encourage their incubation.

Marine and Tidal Resources: The UK wave and tidal resource is the best in the world offering opportunities for a wide array of projects.



Source: Department for Business Enterprise & Regulatory Reform,⁴⁰; DBCCA Analysis, 2010.

The UK has some of the best sites in the world for tidal and wave resources and has installed the world's first test-site off the coast of Cornwall, however there are significant barriers to overcome to move the technology from the demonstration stage to commercialization.

- Marine renewable power is comprised of wave (converting the energy in movement of waves into power), tidal stream (harnessing energy in fast-flowing tidal currents) and tidal range (using the difference in water height between low and high tide).
- Marine-based power generation is thought to be a renewable sector with high prospects for the UK given that the country has one of the best tidal stream and wave climates in the world.
- Thanks to its shallow waters, a long coastline, strong tides and exposure to Atlantic waves it is geographically positioned to establish itself as the world leader in tidal and wave energy and has already taken a lead in developing technologies at the demonstration stage³².
- The strongest wave resource in the UK is located off the west coast and north Scotland in four main regions: Western Scotland; South West Wales, Cornwall and the Orkney Islands.
- If the UK were to exploit the full potential of its marine resource, it is estimated that between 15-20% of the current UK power demand could theoretically be met by wave and tidal stream energy.⁷⁴

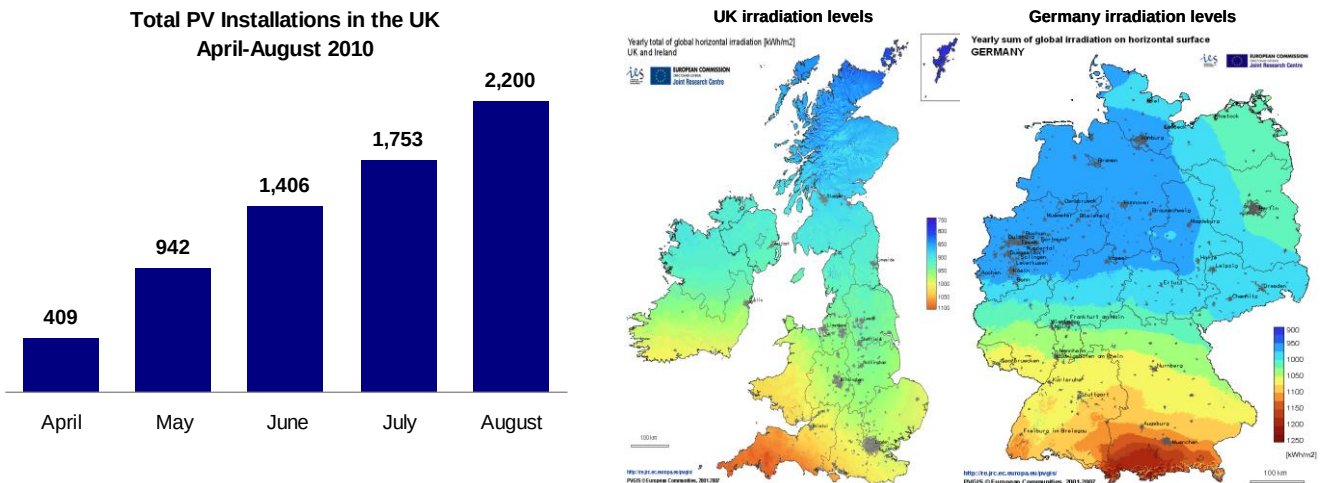
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- The former government released its UK Marine Energy Action Plan 2010⁴¹, laying out key recommendations for pushing forward with all forms of marine energy. Alongside this, in March, 2010 the Crown Estate announced the world's first commercial wave and tidal stream leasing round, for 1.2 GW in Scotland's Pentland Firth and Orkney waters.
- Another important demonstration project, 'Wave Hub,' is a major marine scheme that will create an electrical 'socket' on the seabed in 50 metres of water around 10 miles off the coast. It will be connected to the National Grid via a seabed cable. Groups of wave energy devices will be connected to Wave Hub and float on or just below the surface of the sea to assess how well they work and how much power is generated prior to commercial deployment. Wave Hub will have an initial capacity of 20 MW but has been designed to scale up to 50 MW in the future.
- However, aside from these early demonstration projects, the current the level of power generation from marine resources in the UK is negligible.
- Growth will be from a very small base, putting actual estimates of 2020 capacity at close to 1-2 GW, representing just 2% of the current overall power demand, far short of the 15-20% potential.
- The reason for slow uptake of marine renewable is that the sector has key barriers to overcome to move it from demonstration into pre-commercial stages and the most important limitation is financing, owing to the fact that most technologies are still in their embryonic stages.
- Other key barriers to overcome include high upfront capital costs, technology performance issues, potentially high O&M costs and unknown capacity factors.
- A proposed tidal power plant in the Severn Estuary has recently come under pressure owing to financing difficulties. A feasibility study into the project concluded that it would not be possible to finance through private funding alone.
- Without large-scale public and private backing, the 'technology push' and 'market pull' mechanisms for the marine sector are currently inadequate. It is estimated that to reach the next stage of development the marine renewable industry needs in the region of £50-60 million in annual support over 5 years.
- There is an urgent need to address marine renewable policy support, funding mechanisms available as well as other barriers to uptake once the technologies are proven such as grid connectivity and planning, as discussed later in this section.
- A Green Investment Bank in the UK could be mandated to focus on particular marine technologies with the greatest potential to support them in the development stages until they mature to lower risk investments in the commercial phase. Such a facility would provide credit enhancement and take the technology deployment risk that the private sector is unwilling to bear.
- The marine renewable industry believes that there is a funding gap between the capital grants available for small-scale prototype development and the revenue support for long-term operation³¹. The new coalition government needs to ensure that long-term funding is available to facilitate testing at sea and to reflect the high costs of installation of initial projects.

II. UK Renewable Industries

And although the UK is far from the sunniest country in Europe, it has solar irradiation levels comparable to Germany, one of the biggest solar markets in the world. Sunnier spots, and potential for the highest returns for investors due to the higher availability/kWh production, will be in the South and South West of the UK.

Solar PV installations in the UK and UK Solar irradiation levels vs. Germany



Source: Ofgem E-Serve, Issue 1/September 2010⁴²; European Commission Joint Research Centre⁴³; DBCCA Analysis, 2010.

The UK has solar radiation levels in the south and south west that are comparable to Germany, where the solar PV market is mature owing to its robust and comprehensive policy.

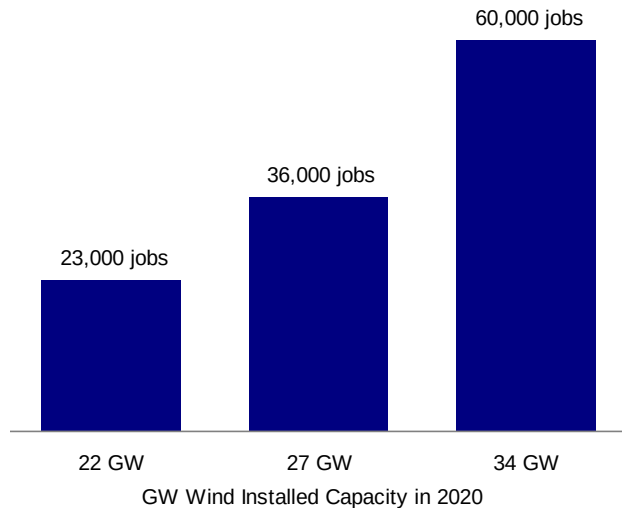
- Although the UK is not renowned for its sunny climate, the country still gets 60% of the sunlight that is received at the equator, so there is still a lot of potential energy available to utilize.
- Solar PV technology has many applications in the UK, both for stand-alone systems and for integration onto buildings.
- The technology has been used in the UK over the last 20 years for many applications, particularly in remote areas where grid connection is impractical, however it has so far failed to be adopted at a wider household scale.
- However as a result of new incentives for micro-generation introduced in the UK in April, 2010, and discussed in Section III of this paper, it is estimated that the solar PV market has the potential to grow five fold in 2010 to 96 MW and 30 times over by 2015, up by 1500% from just 6 MW in 2009.
- In April, 407 solar PV installations registered with FiT Licensees in the UK to receive FiTs, followed by 891 solar PV installations in May and 1406 solar PV installations in June, 2010⁴².
- During April-August 2010 homeowners installed over 6,600 PV systems with the South West and South East seeing almost 50% of all solar PV installations.
- In total, the UK has seen 16 MW of new solar PV installed in the first 6 months of the FiTs scheme. This is in line with the Department of Energy and Climate Change's 'take off' projections.
- Installations in the UK are unsurprisingly higher in the South East and South West compared to Northern regions due to the corresponding irradiation levels being higher in the South, but also due to the installation space being higher.
- The Planning Resource, which reports on planning, housing and regeneration in the UK, has reported that the South West is set to lead solar power installation in the UK. The region currently has 750 MW of applications in the project pipeline⁴⁴.
- Solar Century, the UK's largest independent solar company, have said that the UK solar revolution could now be underway. The company states that it took Germany and Spain around 3 years to reach a substantial market scale for solar PV following the introduction of their incentive schemes and no doubt the UK has the potential to develop a similar market⁴⁵.

II. UK Renewable Industries

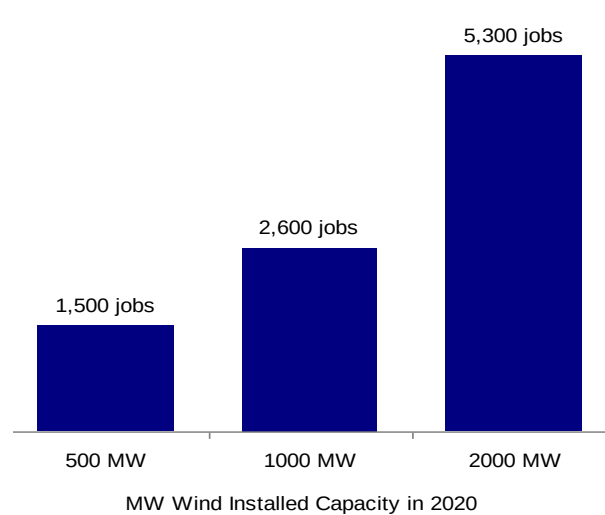
Resulting from the development of all these renewable industries is the opportunity to create green jobs and support regional development in areas of the UK where unemployment is high and local economies are in need of rebalance.

UK Wind and Marine Job Potential

Total wind energy (onshore and offshore) jobs in the UK for installed capacity scenarios in 2020



Total direct Scottish jobs created from increased installed capacity of marine renewables by 2020



Source: Boettcher et al 2009⁴⁶; Bloomberg New Energy Finance, 2009; European Wind Energy Association, 2010⁴⁷; Forum for Renewable Energy Development in Scotland, 2009⁴⁸; and DBCCA Analysis, 2010.

A key focus of recent policy around the world has been the development of 'green' jobs. Various studies have shown that thousands of jobs can be created by the growth of renewable energy across all sectors in the UK.

Wind Jobs

- Estimates of the numbers of jobs that could be created by increasing offshore wind capacity in the UK range from 23,000 to 70,000, depending on the total capacity installed.
- As well as being dependent on the size of offshore wind capacity that the UK is able to secure, job opportunities will also depend on the extent to which the new coalition government is prepared to support the offshore wind sector.
- It has been predicted that the UK will closely follow Germany as the largest wind market in 2010 and across the wind sector as a whole the UK could see up to 60,000 jobs created by 2020 if installed capacity reaches 34 GW⁴⁷.
- The majority of wind production chain jobs will fall across two main stages of the supply chain: manufacturing of turbine components and installation/ operation.
- This represents a significant regional opportunity to rejuvenate parts of the UK historically known for manufacturing and industry. Many of the manufacturing processes such as manufacture of wind towers and foundations for the offshore wind industry could draw on existing skills and knowledge bases in the offshore oil and gas sectors, with manufacturing hubs traditionally in the north east of the UK and, many disused brown field port sites along the East coast of the UK and South Wales have the potential to be redeveloped into offshore wind hubs (and other marine energy hubs), creating local employment.

II. UK Renewable Industries

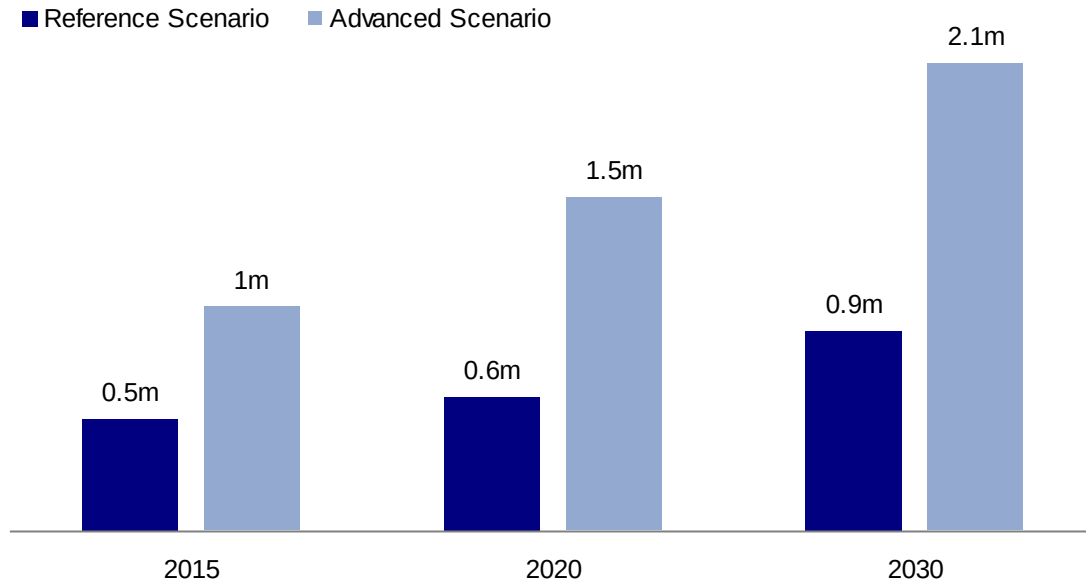
Marine Jobs

- The UK wave and tidal sector could add around 1.4 GW of capacity by 2020 in an optimistic scenario and provide around 2,100 jobs⁵. This presents an opportunity for the UK to create an industry cluster in the sector.
- As already discussed, some of the best marine resources are located around Scotland and it is estimated that if 500 MW of marine energy were to be installed by 2020, this would create 1,500 direct Scottish jobs, 2,850 jobs overall. The number of people employed would increase to 5,300 direct Scottish jobs and 10,000 jobs overall if 2000 MW of capacity were to be installed⁴⁸.
- However such ambitious growth in installed capacity for marine projects will depend greatly on technology and supply chains as well as speeding up grid connectivity for developers and remedying delays to planning and consenting.

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Waste-to-energy and Biomass have the potential to create a large number of jobs in the UK

Global biomass industry could create up to 2.1 million jobs by 2030



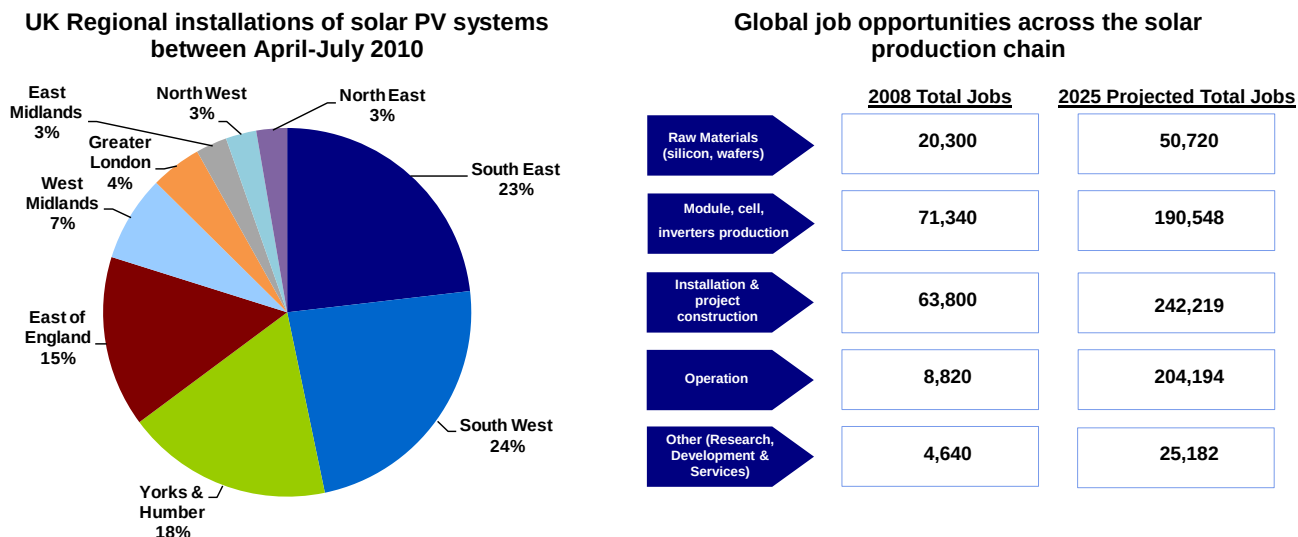
Source: UNEP, 'Green Jobs,' 2009⁴⁹; European Renewable Energy Council⁵⁰; DBCCA Analysis, 2010.

Although the wind industry is viewed as being the most scalable opportunity for the UK, biomass (and particularly biogas for power generation and heat) is a key growth sector.

- The UK bioenergy industry is in its infancy compared to other markets in Europe such as Germany and the Czech Republic.
- There are few studies directly focused on the potential employment in the UK from biomass, however the Anaerobic Digestion and Biogas Association has estimated that the industry has the potential to be worth £1.7 billion and employ around 40,000 people by 2020⁵¹.
- The European Renewable Energy Council estimates that the global biomass industry could create up to 2.1 million jobs by 2030 in its advanced scenario for growth⁵⁰.
- Installing and operating biomass heating services including production, processing and distribution of the raw material could create up to 580,000 jobs across Europe by 2020⁵².
- In Germany, the world leader in biomass technology, the sector has eclipsed wind power in terms of full time equivalent jobs. There were estimated to be 96,000 people employed in the biofuel and biomass sector in 2006⁵².
- A 2007 report by the Oko-Institut and the Institut für Energetik in Germany indicated that the European sustainable production for biomethane may be 500 billion cubic meters per year, generating 2.7 million new jobs in the EU, mainly in agriculture and manufacturing, construction of biogas plants and biogas upgrading plants⁵².

II. UK Renewable Industries

And there has been a large increase in solar energy jobs regionally as a result of increased uptake of solar PV systems in the UK since April, 2010.



Source: Ofgem, 2010⁴²; Bloomberg New Energy Finance, June 2009⁵³; DBCCA Analysis, 2010.

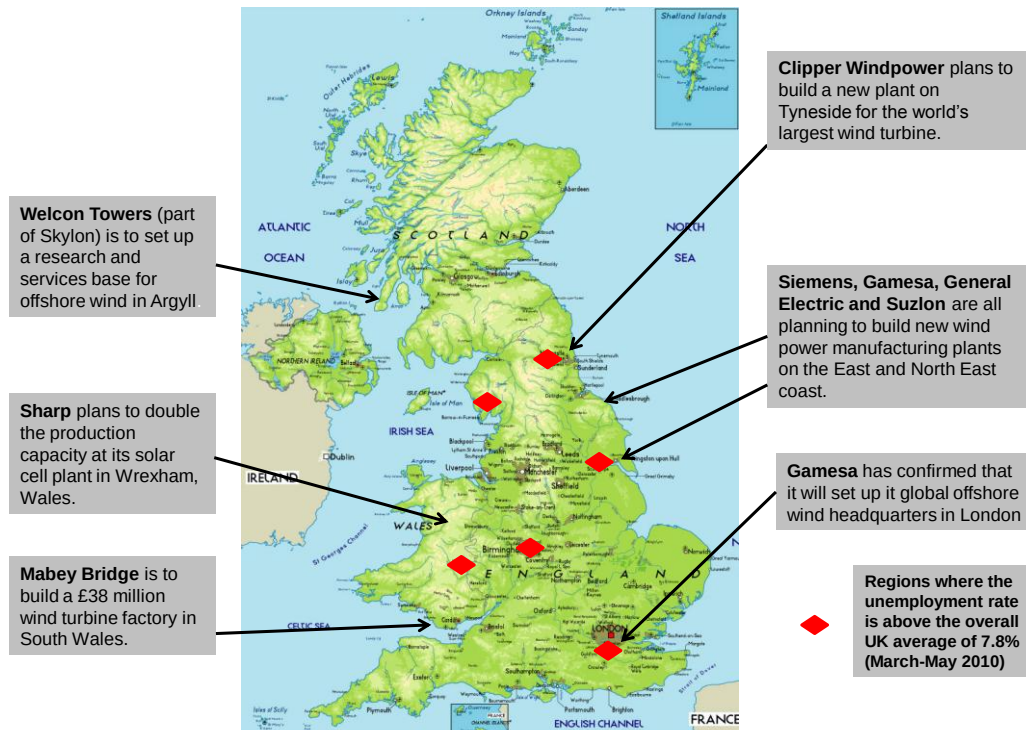
Solar energy jobs are seeing an increase in the UK, predominantly supported by small-scale generation projects.

- Work by many researchers' shows that solar energy is the most effective and efficient job creator among energy alternatives. PV production is said to add 10 jobs per MW and installation adds 33 jobs per MW according to the PV Group, thus boosting local economies and creating domestic green jobs⁵⁴.
- The solar energy sector in the UK is set to boom over the next few years, with many households likely to install panels on their roofs and sell off excess power for profit, increasing the demand for skilled workers to install the systems⁴⁵.
- Solarcentury, the UK's largest independent solar company and supplier, announced in August 2010 that it had boosted employment in its solar PV installation network from 200 people in January, 2010 to 350 people in August. It said that most of its associate firms were confident of further growth of up to 50% for the remainder of 2010 and well over 500 jobs by 2011⁴⁵.
- Subsequently the demand for skilled workers in areas of the UK which are projected to see the highest uptake of solar systems is set to increase.
- In September, 2010 a 1.35 MW solar energy farm in Cornwall, South West UK was granted permission by the local council, representing the first medium-scale solar PV farm in the country. The scheme could create 300 jobs with all the components being made in Cornwall and only the silicon cells being sourced from outside the country⁵⁵.
- Solon – one of Europe's largest manufacturers of solar modules in Europe, also announced in August, 2010 that it has signed a deal with UK developer 35 Degrees to build a 1.3 MWp solar power plant on Cornwall.

II. UK Renewable Industries

And although the UK lags behind other European and Asian countries in terms of domestic renewable manufacturing, 2010 has seen a marked increase in major companies looking to enter the UK supply chain in areas that would benefit from redevelopment.

UK Green Manufacturing



Source: Office for National Statistics²⁴, July 2010; DBCCA Analysis 2010.

There has been a lot of interest in 2010 from multinational renewable manufacturers looking to locate in the UK, particularly to exploit the UK's offshore wind resources. To seize this opportunity to create green regional jobs, there is an urgent need to increase the numbers of skilled workers and specialist training programs offered.

- Only if a strong UK-based supply chain is established, can the UK unlock the renewable energy industry's potential for job creation and foster the business environment to attract, build and sustain enterprises across it⁶.
- Disappointment came in August, 2009 with the closure of Vestas's wind turbine manufacturing plant on the Isle of Wight. Vestas was the UK's only major wind turbine manufacturer and described the closure of the plant as a necessary commercial decision owing to the slow pace of growth of the UK's onshore wind turbine market. The firm has said that it will consider returning to the UK if the onshore market picks up pace.
- However, in light of the UK's huge offshore resource, and the commitment by the coalition government to fund port upgrades as discussed further on, there have been a wave of recent positive announcements in 2010 regards manufacturing. **Six major offshore wind turbine manufacturers – General Electric (GE), Gamesa, Suzlon Energy, Clipper Windpower, Siemens and Mitsubishi - have all signaled their intention to produce wind turbines in the UK.** GE's plans involve building a manufacturing plant that will create 2000 jobs; Gamesa has chosen the UK to be the centre of its offshore wind business and will invest €150 million between 2010-2014, creating 1000 jobs; Siemens will invest £80 million on new UK production facilities on the East and North East coast, creating 700 jobs; Suzlon Energy is considering investing \$1.6 billion to build a wind turbine manufacturing plant in the UK; Clipper Windpower plans to

II. UK Renewable Industries

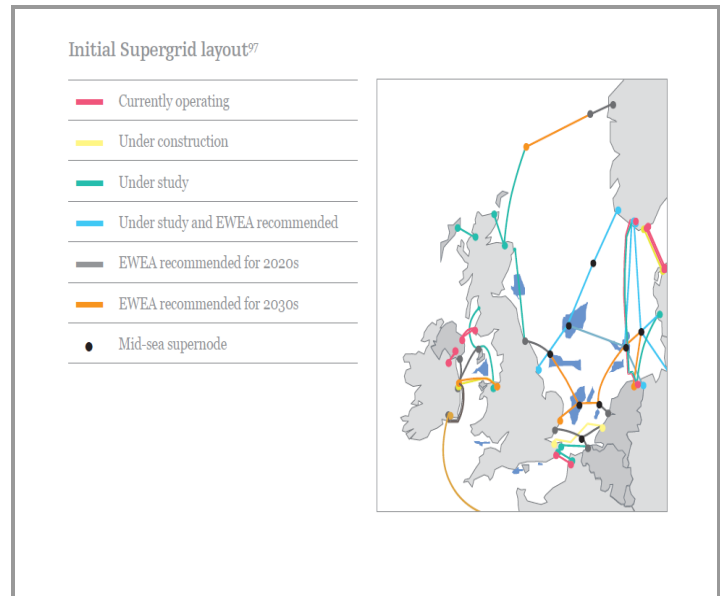
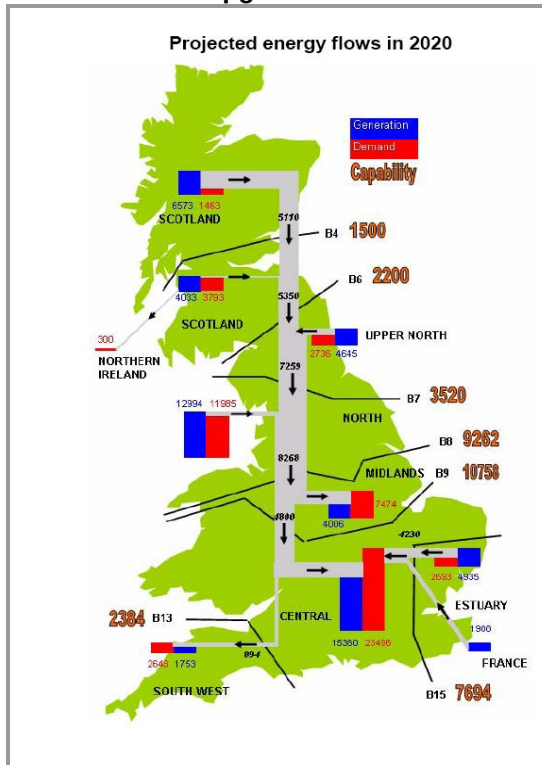
build a wind turbine testing site for the world's largest offshore wind turbine in Newcastle, potentially creating 1500 jobs⁵⁶; and Mitsubishi is planning to invest £100 million in offshore wind in the UK.

- UK Prime Minister David Cameron said he wants the UK to be a leader in the offshore wind industry and that “commitments shown by companies like Gamesa who want to come to the UK and invest is good news for jobs and growth and good news for our clean energy future.”
- In July, 2010 the Secretary of State announced £10 million in grants to the offshore wind industry with £5 million going to 7 UK firms with the intention of increasing the UK domestic supply chain for wind and creating jobs. Companies such as Hartlepool-based JDR Cables – who provide offshore wind transmission cables – and Rugby-based Converteam, a DC conversion technology firm were among those that received funding⁵⁷.
- It is not only wind energy that is receiving increased interest from global manufacturers. In July, Sharp announced that it was doubling its annual production for crystalline solar cell modules to 500 MW at its Sharp Manufacturing Company of UK.
- An interesting development outlook is that when looking at the proposed locations of these manufacturing sites, the UK has a significant opportunity to marry up the growth of new renewable industries whilst creating employment in areas of the country that are most in need of regeneration, especially in the wind and offshore energy industries.
- Official figures from the Office of National Statistics show that in April, 2010 there were almost 2,500,000 people unemployed in the UK, with the North-east having an unemployment rate at nearly three times the rate in the South-east²⁴.
- The North-east and Wales had the two highest unemployment rate at 9.3%, and 8.5% respectively compared to the South-west and South-east at 6.1% and 6.4% respectively.
- A caveat to this however is that not all jobs created by the UK renewable sector will necessarily be local, owing to skills shortages in key technical subjects. Although the North East of the UK has existing expertise in offshore drilling, **there are currently only 20 UK universities, out of around 325 institutions, offering dedicated renewable energy courses; 4 offering dedicated alternative energy courses; 2 offering dedicated to wind energy courses; and 1 offering dedicated solar energy courses.**
- This means that there is an acute skills shortage in the technical renewable sector with a lack of skilled technicians and professional engineers. Basic skills in science, technology and engineering are a requirement for higher-skilled renewable energy roles.
- The former government set up a National Skills Academy for Power to work with regional clusters of training providers. However the Academy was criticized in the House of Commons Environmental Audit Committee's December 2009 report for not going far enough. The committee concluded that the skills gap still represents a major barrier to UK success in environmental markets⁶.
- The Department for Business, Innovation and Skills launched the low-carbon skills consultation in March 2010 outlining plans for 3500 co-funded apprenticeships, with 2500 in the wind sector, Such regional schemes are valuable but need to be linked to a national strategy, which is currently lacking in the UK.
- Without changes to the labour force, the UK could risk missing out on the chance to marry up growth in its renewable energy sector with regional redevelopment in areas of highest unemployment.

II. UK Renewable Industries

There is also a need to address non-financial barriers in grid infrastructure and port availability if the UK is to deploy sufficient renewables resource to generate ~30% of electricity by 2020.

UK Infrastructure upgrades



Source: National Grid Seven Year Statement, 2010⁵⁸ © National Grid plc, all rights reserved; The Offshore Valuation Group, 2010 – ‘The Offshore Valuation’³².

Much of the UK's transmission system was constructed in the 1950's and 1960's to transport and distribute electricity generated from coal fired power stations. Resultantly the UK grid is designed for the distribution of electricity from a small number of large power stations, rather than a large number of small renewable installations

Transmission Infrastructure

- The UK's high-voltage electricity transmission system is owned and operated by the National Grid.
- The UK's grid and transmission system is heavily reinforced in former coal-mining regions, but has limited capacity in many areas that are best suited for renewable energy generation. For instance there are no high voltage transmission lines in North West Scotland where onshore wind speeds are high.
- The grid infrastructure was built to transmit a maximum of 75 GW of electricity, but by 2020 it will need to carry as much as 120 GW.
- The predominant power flow on the GB transmission system is from north towards south. There is a net export of power from Scotland to the south and the circuits between these regions are already operating at their maximum capacity.
- Yet under all scenarios from various market analysis' for renewable energy growth to 2020 in the UK, there are significantly heavier flows of electricity from Scotland through the North of England, as well as a high volume of offshore wind farms off the East Coast and contributions from Wales⁵⁸.
- Areas of the onshore grid network will need to be reinforced to facilitate the transmission of the electricity from new offshore generation sites to onshore demand centres.

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- According to a 2009 Electricity Networks Strategy Group study, offshore wind generation in England and Wales raises a number of connection issues onshore; particularly in Wales and along the English East Coast between the Humber and East Anglia⁵⁹. The increased power transfers across the North to Midlands boundary and increased generation off the East Coast and Thames Estuary results in severe overloading of the northern transmission circuits around London.
- Offshore renewable energy also poses a challenge for transmission infrastructure offshore. Developing the UK's offshore renewable energy resource will require large sub-sea electrical cables connecting regions of high resource concentration, and between the UK and mainland Europe.
- When the transmission regime is introduced, the grid connections will be controlled by new Offshore Transmission Operators with specific responsibility for constructing and maintaining individual offshore networks to encourage competition and reduce prices. The risk is that this will result in a number of 'point-to-point' transmission systems, rather than a network of connected installations or a national offshore grid.
- This needs to be carefully managed to ensure that the new individual offshore grids are constructed in such a way that they are flexible enough to connect to a possible North Sea Supergrid with the rest of Europe, and to allow connection for other marine renewable technologies such as wave and tidal³². Renewable UK highlights that if the transmission regime is not right then the scale and timing of delivering grid connections could reduce the efficiency of the process.
- In February, 2010 Ofgem published its Project Discovery report⁶⁰, the culmination of a year-long study into potential options for electricity market reform. Key conclusions included:
 - The need for far reaching energy market reforms;
 - There is reasonable doubt over whether the current energy arrangements can deliver secure and sustainable energy supplies;
 - Prompt action will reduce risk to energy suppliers and help progress towards climate change targets;
 - Five options for consultation were identified including targeted reforms, enhanced obligations, enhanced obligations and renewable tenders, capacity tenders, and a central energy buyer option.
- The new coalition government has announced a plan to continue with the proposed reform of the electricity market. The coalition government will also evaluate the role of the UK regulator Ofgem and intends to publish a White Paper in spring 2011.
- It is vital that this review ensures that strategic transmission line upgrades are given priority to increase renewable power capacity.
- Timely decisions on this reform, along with potential new measures such as the introduction of a Green Investment Bank as discussed in Section III, are a priority to install investor confidence in renewable infrastructure and project development in the near-term.
- The publication of the UK's first Infrastructure Plan in October, 2010 placing low carbon technology at the heart of plans to overhaul the UK's infrastructure is a clear sign of the commitment to the sector by the coalition government.

II. UK Renewable Industries

Proposed UK Port Upgrades – 20 ports have been identified that meet the criteria to become offshore wind ports in the UK.



Source: Wind Power Monthly, June, 2010⁶¹.

- The physical deployment of renewable projects is also an issue that cannot be underestimated, with a major barrier being the shortage of suitable deployment vessels and port facilities to transport equipment and maintain offshore and marine projects. For instance, tidal devices are potentially massive structures that have to be secured underwater and need specific deployment vessels with heavy lift capabilities.
- There are concerns by overseas wind firms hoping to invest in the UK and expand their offshore supply chains that there is a lack of available port capacity and related land⁶². Wind Power Monthly states that a number of European ports, such as Bremerhaven in Germany, are already serving the offshore wind sector so the UK is missing out on a share of this market activity whilst its facilities are not up to standard. The effective development of an offshore wind farm requires ports for three stages: manufacturing, construction and operation and maintenance of the wind farms once completed.
- An industry survey of UK port potential in terms of becoming offshore wind ports found that 20 ports that have the necessary land space and marine capabilities were identified, as seen on the map above⁶².
- And a study by the previous UK government of ports concluded that 15 ports would be needed by 2020 to meet the demand of Round 1, 2 and 3 UK offshore wind projects.
- A large share of these offshore projects are set to be in the North Sea so it is here that the need to develop port infrastructure to guarantee the supply chain is most urgent.
- The re-development of ports to act as 'super hubs' that can support manufacturing and construction as well as contain suitable vessels for the offshore renewable industry will also create thousands of jobs in the sector, as already discussed.
- However, a number of factors are preventing ports from entering this new market, such as ownership structures and the economics of the market. Port owners see wind industry players as reluctant to commit to contracts or tenancies which would allow specific investment in terms of quayside or land development for the long term⁶². UK ports are in private ownership, so operators are motivated by maximizing the yield on their land. However, the wind industry has

II. UK Renewable Industries

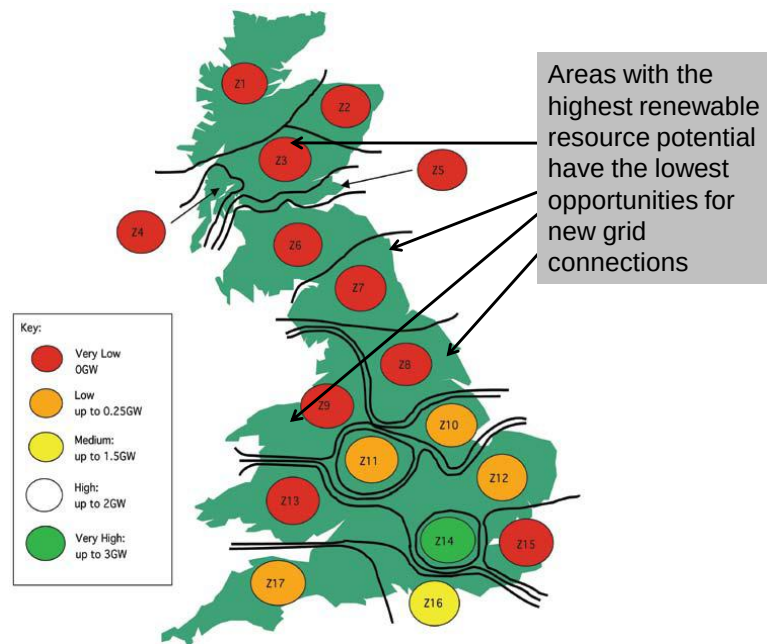
high demands but is always seeking to reduce costs so presents a tough challenge for port owners if they have a choice of different, higher-earning uses for their land.

- Often, the wind industry demands top-quality sea-front space but cannot afford the premium rents of port operations.
- To help overcome this situation, the former UK government announced a £60 million competition fund in March, 2010 to help UK ports host offshore wind manufacturers, creating a stable framework to attract renewable investment. Such competition for land development will add confidence that the appropriate UK port infrastructure can be made available to support production plans.
- A key positive outcome of the coalition government's October Spending Review was that the £60 million port fund was maintained as part of a wider £200 million allocated to low carbon technologies, demonstrating that the new government is acutely aware of the importance of redeveloping port infrastructure.
- Scotland's government has also set aside £70 million to create a fund that will help pay for improvements at port facilities needed to spur investment in offshore wind power.
- This level of funding is strong recognition by the coalition government of the importance of port re-development given the scale of infrastructure build-out required to meet the 2020 renewable target.
- Port capacity could also potentially impact the wider energy infrastructure expansion such as CCS and storage and nuclear programmes and is also vital in serving the infant wave and tidal renewable sector. Key infrastructure upgrade considerations must therefore be inclusive of all low carbon technologies' needs and future budget cuts must take into account the wider benefits of port re-development.

II. UK Renewable Industries

But increases in renewable infrastructure and port availability will only ensure increased renewable projects if the planning system is reformed and renewable grid connection speeds are improved.

Grid connectivity opportunities and planning issues



Source: National Grid GB Seven Year Statement 2010⁵⁸ © National Grid plc, all rights reserved; DBCCA Analysis, 2009.

The planning process offers the UK renewable energy sector the opportunity either to move quickly ahead of rival countries, or to become mired by red tape.

- The UK planning system has historically been difficult for the renewable energy industry to navigate and it is acknowledged that reforms are needed to speed up the process.
- The reasons for planning delays are complex. Some proposals for renewable energy, onshore wind farms in particular, can be highly controversial within the local communities concerned due to NIMBY (not in my back yard) objections putting pressure on elected members and officials and leading to delays in decision making.
- In the UK the average onshore wind farm waits 17 months for a decision by local planning authorities and only 25% of applications are approved.
- Permission to build an onshore wind farm takes on average 8 months in Finland, 10 months in Austria and 15 months in Romania, compared to 27 months in the UK⁶³. And although the UK still appears in the top 10 list of countries in terms of building consent times, this study has been criticized by the UK wind industry for failing to quantify the figures and presenting a misleadingly optimistic picture of the UK planning regime by not taking into account the final answer: consent or refusal..
- Over 40 GW of offshore wind farm sites are currently being pursued by developers. But this expansion could be limited by the inability of wind farms to connect to the grid network.
- In addition to gaining planning consent, obtaining a timely grid connection is a key enabler for increasing the UK's share of renewable power generation. As the areas with the best wind resource are generally further away from areas of demand it is likely that new grid infrastructure will be required.
- As the map above demonstrates there is a major problem in the UK with the least grid connectivity opportunities in those areas with the highest renewable resource. Many renewable energy projects are resultantly held in a queue

II. UK Renewable Industries

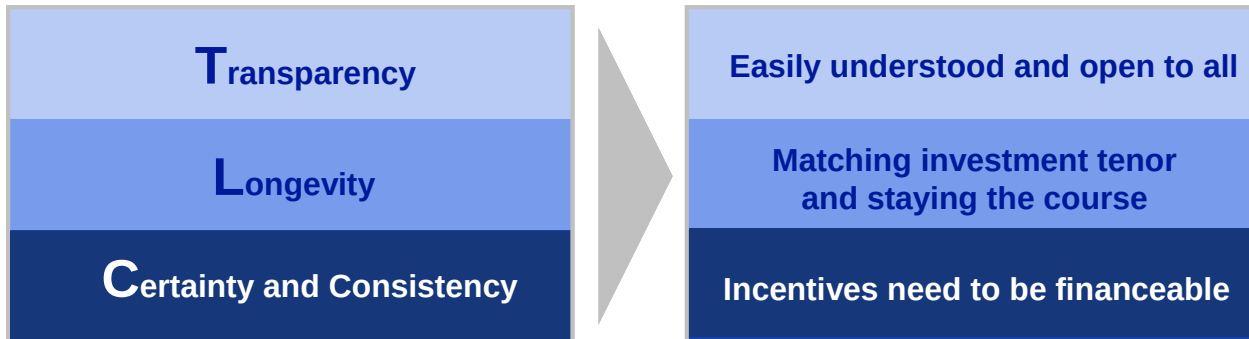
system awaiting a grid connection date, with some generators given 2020 as the earliest connection date to the network.

- In June, 2010 the new coalition government decided that it will replace the Infrastructure Planning Commission (IPC), a body with power to fast track major infrastructure projects, with a Major Infrastructure Unit in April 2012.
- Under the new system, elected ministers will have final say on projects. In the former system, unelected commissioners from the IPC signed off on major projects.
- However, according to the Confederation of British Industry (CBI) there is concern about whether ministers can deliver timely planning decisions under the new scheme and be willing to make tough decisions that could be politically unpopular. There is also concern that modifying the system will cause even more delays to projects which were still under consideration by the IPC⁶⁴.
- CBI reports state that there are 37 important planning applications made under the original planning regime which preceded the Infrastructure Planning Commission which have never been determined, including biomass power stations and wind farms. Some of these have been awaiting a decision for 3 years and combined are equivalent to 20% of UK generating capacity.
- Whatever body is responsible for planning, the key message is clear: certainty and clarity for decisions on major renewable infrastructure projects is a pre-requisite for setting the UK in a track to meeting its 2020 targets.

III. Regulatory Drivers

Government policy support remains a key focus for investors. There are three key drivers that investors look for in policy.

DBCCA's concept of 'TLC': Investors essentially look for 3 key drivers in policy



Source: DBCCA (2009) 'Paying for Renewable Energy: TLC at the Right Price: Achieving Scale through Efficient Policy Design'² and DBCCA Analysis, 2010.

TLC: Transparency, Longevity and Certainty, drives investment. As investors, this has been our message to policy makers for much of 2009 and 2010.

- Without public policy intervention, market prices do not reflect the costs associated with GHG emissions and therefore do not provide appropriate incentives for low carbon technologies.
- Therefore government support remains a key focus for investors in the renewable energy sector.
- Before private investors will commit large sums of capital to the renewable energy sector in the UK, and anywhere in the world, there must be transparent, long-term and certain regulations governing carbon emissions, renewable energy and energy efficiency. Investors, in short, need TLC.
- As investors, DBCCA essentially look for Transparency, Longevity and Certainty (TLC) in assessing the potential success of low carbon policies in countries. Incentive policies, such as feed-in tariffs (FiTs) along with mandates and standards and emissions targets support climate change sectors.
- Without an international agreement on carbon emissions, investors will be reliant on the quality of regulation provided by individual countries, because large disparities exist between countries in the degree of regulatory TLC they provide.
- Having an effective regulatory framework for renewable energy in the UK will mean that the country will attract more capital and create more green jobs. Investment capital will find the best returns, wherever they are. Countries that do not provide them will get left behind in the low carbon economy race.
- **DBCCA views FiTs with advanced price discovery features as having the most potential to enable scaling of renewable deployment in the UK.** Germany and Ontario remain leading examples of regions with an advanced FiTs.
- Innovative financing structures are needed that complement the fundamental features of renewable energy and can support the scale and speed of industrial growth needed to meet the UK's renewable targets.

III. Regulatory Drivers

Climate change policy regimes vary substantially around the world. Investors will look to deploy capital in renewable energy in countries that offer robust policy support regimes and the best investor criteria of Transparency, Longevity and Certainty ('TLC').

Climate change policy regimes around the world:

Country	Emissions Control			Financial Support				Long-term Grid Improvement Plan
	National Binding Emissions Target	National Renewable Electricity Standard	National Long-term Energy Efficiency Plan*	National Feed-in Tariff	Long-term Government-based "Green Bank"	Tax Benefits	Long-term Funding Programs	
Germany	✓	✓	✓	✓	✓	✓	✓	✓
China	✓	✓	✓	✓	✓	✓	✓	✓
United Kingdom	✓	✓	✓	✓ <i>Microgen FITs</i>	⌚ <i>Proposed</i>	✓	✓	⌚ <i>Proposed</i>
United States	⌚	⌚	⌚	⌚	⌚	✓	⌚	⌚

Source: DBCCA Analysis, 2010.

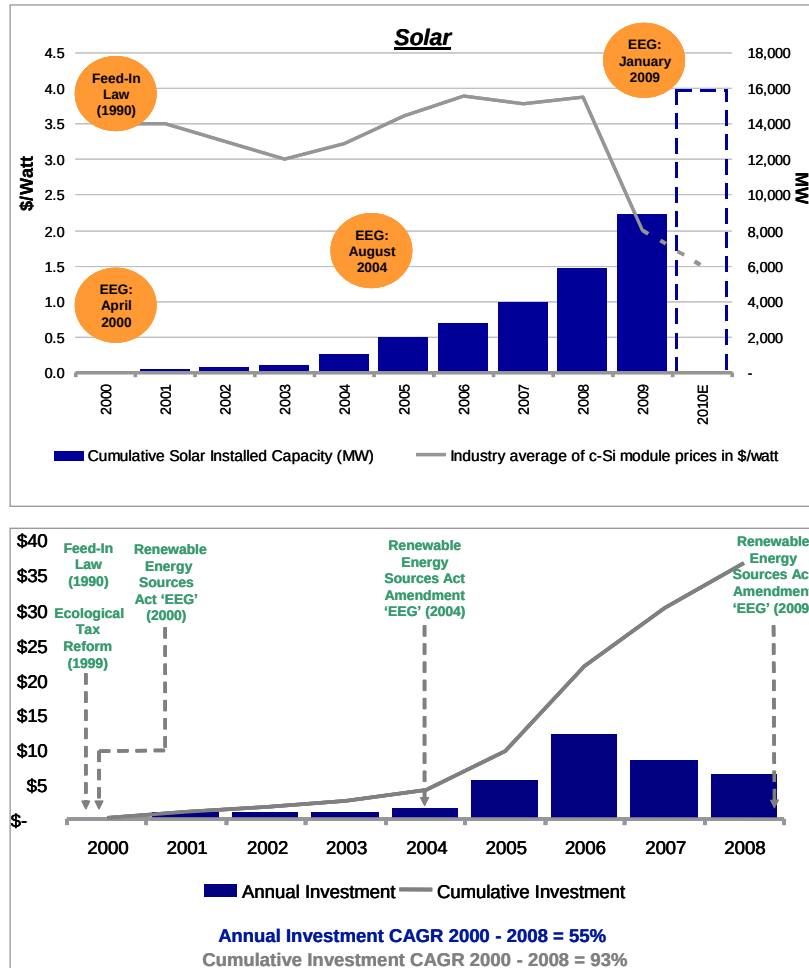
Climate change policy regimes vary substantially around the world, and often need to be assessed within their own context.

- Climate change policy regimes vary around the world.
- Policy regimes contain a variety of interrelated elements, and in the case of climate change, there are different types of targets set with the goal of reducing emissions, increasing the penetration of renewables, boosting energy efficiency, or transforming an industry or sector. Financial incentives, especially feed-in tariffs, are critical for the achievement of targets.
- The most attractive areas for investors in renewable energy will be those that offer the most robust policy regimes.
- Regions that have national binding emission and renewable targets, long-term efficiency plans, national feed-in tariff schemes and other incentive structures such as funding programs and grid improvement plans are seen as offering the most 'TLC' to investors.
- The key developments in policy remain at a country and regional level, with countries such as Germany and China continuing to take significant steps that could potentially set the benchmark for other regions. These countries have developed robust policy frameworks, including clearly defined national targets, strong incentives and integrated plans, which can lead to more green jobs, increased innovation and a growth in technology adoption.
- The UK also measures up well in most categories and therefore it exhibits strong elements of TLC. However, policies will need to demonstrate stability in coming years. By contrast, the United States still has a long way to go in order to demonstrate a comprehensive framework.

III. Regulatory Drivers

The feed-in tariff is a preferred means of incentivizing the growth of clean energy, offering 'TLC' to investors and enhancing returns.

German renewable legislation has driven capacity and the learning cost curve:



Source: German Federal Ministry for Environment, Nature Conservation and Nuclear Safety; Bloomberg New Energy Finance; DBCCA Analysis, 2010

Policy makers worldwide both at the state and local level are beginning to take notice of how successful advanced FiT regimes can be in achieving a significant net benefit. A feed-in tariff should support mandated renewable energy targets in the UK by creating investor TLC with a pathway subject to transparent price discovery as it reaches grid parity.

- There is strong evidence that renewable energy targets can be met through a strong volume response incentivized by feed-in tariffs (FiTs).
- In our "Paying for Renewable Energy – TLC at the Right Price" green policy paper published in December 2009, DBCCA identified the key features of an advanced FiT scheme that could deliver TLC at the right price². The core elements of any FiT are: defined eligible technologies; tariff pricing differentiated by technology; a standard offer, for a guaranteed payment for renewable electricity generation; a guaranteed interconnection for all renewable generators; payments over a long timeframe; and linkages to mandates and targets of a country.
- Prices of FiTs are set relative to an IRR target and adjust to market supply/demand dynamics, adjusting via grid parity targets, degression or periodic review.
- A FiT policy is particularly good at achieving scale against a target, reducing cost of capital due to increased certainty, bringing in IPPs and expanding the market and ease of understanding.

III. Regulatory Drivers

- FiTs are called subsidies or incentives. However, if a FiT has grid parity as a goal, then arguably the FiT tariffs are there to encourage learning at scale/cost reduction for the particular technology. As such they encourage 'infant' technologies, such as the case of solar PV in Germany.
- Many countries with high rates of renewable growth use FiTs.
- This is demonstrated by looking at the scale-up of renewable energy in Germany. A Poyry and Element Energy study shows that between 2000 and 2005 the average annual growth per annum of solar PV in Germany was 79.8% and for biomass it was 50.6%.
- Led by FiTs, renewable energy markets in Germany have developed into a robust industry, as indicated by the rate of growth in capital investment and public equity markets.
- Germany is also global leader in biomass, wind and solar job creation with an 87% increase in green jobs in Germany from 2004-2009.
- The German government attributes 66% of the increase in jobs to be as a result of the Renewable Energy Sources Act (EEG), specifically the amendments in 2004.
- The main policy driver behind its renewable energy sector has been the feed-in tariff, which provides certainty of long-term cash flow to projects. FiTs have helped to halve the costs of PV in Germany in less than 10 years.
- Often, even in country's with high FiTs, newer technologies experience difficulties in obtaining commercial loans, so government guarantees, capital grants and preferential tax treatments have helped to bridge this gap.
- Poyry and Element Energy argue that the success of the FiT scheme in Germany for instance should be viewed in the context of not just a successful FiT design, but also the role played by other factors such as fiscal incentives in lowering hurdle rates for small-scale investors¹⁶.

III. Regulatory Drivers

The UK largely missed out on the initial growth of wind energy and solar energy experienced in countries such as Germany due to a lack of suitable policy support. In April, 2010 a new FiT scheme was introduced to the UK and hopes are that this will revolutionize renewable investment.

The UK's current feed-in tariff system is effective until 2013:

Technology	Scale	Tariff level for new installations in period (p/kWh) [inflated annually]			Tariff lifetime (years)
		Year 1: 1/4/10-31/3/11	Year 2: 1/4/11- 31/3/12	Year 3: 1/4/12- 31/3/12	
Anaerobic Digestion	<500 kW	11.5	11.5	11.5	20
Anaerobic Digestion	>500 kW	9.0	9.0	9.0	20
Hydro	<15 kW	19.9	19.9	19.9	20
Hydro	>15-100 kW	17.8	17.8	17.8	20
Hydro	>100 kW-2 MW	11.0	11.0	11.0	20
Hydro	>2-5 MW	4.5	4.5	4.5	20
Micro CHP Pilot	<2 kW*	10*	10*	10*	10*
PV	<4 kW (new build)	36.1	36.1	33.0	25
PV	<4 kW (retrofit)	41.3	41.3	37.8	25
PV	>4-10 kW	36.1	36.1	33.0	25
PV	>10-100 kW	31.4	31.4	28.7	25
PV	>100kW-5 MW	29.3	29.3	26.8	25
PV	Stand alone system	29.3	29.3	26.8	25
Wind	<1.5 kW	34.5	34.5	32.6	20
Wind	>1.5-15 kW	26.7	26.7	25.5	20
Wind	>15-100 kW	24.1	24.1	23.0	20
Wind	>100-500 kW	18.8	18.8	18.8	20
Wind	>500 kW-1.5 MW	9.4	9.4	9.4	20
Wind	>1.5-5 MW	4.5	4.5	4.5	20
*Existing micro-generators transferred from the RO		9.0	9.0	9.0	To 2027

Source: UK Department of Energy and Climate Change, "Feed-in Tariffs. Government's Response to the Summer 2009 Consultation"⁶⁶; DBCCA Analysis, 2010

As of April 1, 2010, businesses, consumers and communities in the UK started to benefit from feed-in tariffs (FiTs) for electricity generated from small-scale renewable and low carbon generation technologies

- The UK largely missed out on the initial growth of wind energy experienced in countries like Germany and industry experts cite a lack of robust policy as the primary reason for this lag. The UK only introduced a market based incentive structure (the Renewable Obligation) in 2002, and although the scheme has been relatively successful in increasing the deployment of large scale renewable, it was never intended to support micro-generation so domestic and commercial micro-generation and onsite renewable technologies have remained neglected by policy.
- However, in April 2010 the former UK government introduced FiTs for small generation, which will work alongside the RO for large projects⁶⁶.
- The UK FiT will be paid to small scale low carbon electricity generators (<5 MW of generating capacity) and electricity projects above 5 MW will continue to be supported by the Renewable Obligation under the new coalition government proposals.
- FiTs are available across a range of technologies – micro wind turbines, solar PV, micro hydro, anaerobic digestion and micro CHP. Biomass electricity will continue to be supported by the RO.
- All micro generation (<50 kW) will be supported by FiTs. Small generation (>50 kW and below 5 MW) will be able to choose between FiTs and the RO.
- In October, 2010 it was confirmed that remanufactured plants on the sites of disused mills and water turbines will be eligible for FiTs, an 'easy win' that will encourage thousands of homes and communities to restore old systems.⁷²
- FiTs will provide small scale electricity generators two elements of payment: a generation tariff and an export tariff.
- Both the generation and export tariffs are linked to the Retail Price Index to alter with inflation.

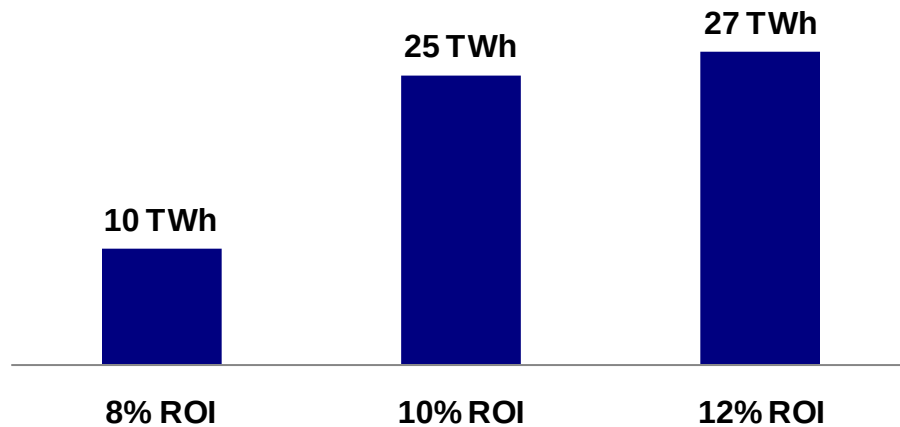
III. Regulatory Drivers

- The FiTs were calculated by the former government so that they will give investors a 5-8% rate of return for well sited technologies and rates of return will depend significantly on the conditions of individual installations.
- As discussed in Section II, micro solar PV has already been a clear winner from the FiT due to its widespread applicability and the uptake of solar systems witnessed since April.
- The feed-in tariffs in the UK are paid for by electricity suppliers (not through the central budget) who pass on the cost of the scheme to all their electricity customers via an increase in electricity bills. The scheme includes a levelization process so that the overall costs are spread uniformly across all companies.
- However, the Office of National Statistics considers the FiTs to be both government spending, because it is money allocated by government to a particular purpose, and a 'tax' because there is a compulsory payment levied on consumers.
- The FiTs were scheduled to be reviewed in 2013 and the coalition government announced in the October Spending Review that it will abide to this timetable and look to refocus the FiT according to the most 'cost-effective technologies' at the first review period.
- In 're-focusing' the FiTs there is an opportunity to re-evaluate all renewable technologies and ensure that the tariffs paid to technologies with the highest scalability and carbon abatement potential are examined, as detailed later in this section.
- However, an early review of the tariffs could still take place in the event that the coalition government deems the deployment rates of technologies to be higher-than-expected.
- What is vital is that the UK needs to be more concerned with establishing a viable domestic base for its renewable sector.
- There have been concerns that huge areas of land in southern England could become covered with solar panels. A possible solution to this would be the entry of a building integrated PV tariff. This would focus stronger support for systems that are incorporated into the built environment, rather than seeing subsidies going more into rural businesses carrying little public or political benefit. Such a tariff would also involve households and local communities in driving the shift into renewable, a key aim of the coalition government.
- No further details on the mechanism of the FiT review are available at the time of writing this paper. If DECC intends to move towards 'thresholds' rather than periodic reviews in its tariff revising process it should also take the opportunity to raise the UK's ambition level. There is considerable scope for expanding the UK renewables sector without risk of overheating.
- Low levels of ambition through, in effect, a cap will not lead to the UK achieving its 2020 renewable goals in the longer-term. In the interest of investor certainty, the key focus should be on the end-goal of meeting the 2020 renewable mandates, rather than on the scale of technology take-up rates. In this way, investment, innovation and employment opportunities would not be undermined.

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And although broadly speaking there has been a positive response to the UK FiT, there are certain issues which need to be addressed in the future if the scheme is to recognize the full potential of the UK's renewable resources and unlock the necessary investment.

Higher rates of return yield higher renewable power generation (TWh) by 2020



Source: Poyry/ElementEnergy, "Design of Feed-in Tariffs for Sub-5 MW Electricity in Great Britain"¹⁵, June 2009; DBCCA Analysis, 2009.

The UK's new coalition government has pledged to develop a full system of FiTs and in our view there are certain key elements which need to be addressed from an investor's perspective.

- A fundamental issue in the success of the UK FiT scheme is whether the tariff levels and rates of return are set at the appropriate levels to attract commercial and community level investors.
- Despite attractive tariffs for micro solar PV and high uptake so far, the level of tariffs overall and the financial returns on offer for the types of larger scale systems, typically favoured by businesses, are considered too low to drive large-scale investment.
- The tariff for Solar PV systems fall from £0.41/kWh for small-scale systems generating less than 4kW to £0.29p/kWh for systems generating more than 100 kW⁶⁶. Resultantly the installations of small-scale systems have taken-off faster than those larger system installations.
- Similarly tariffs for wind turbines range from £0.35p/kWh for micro turbines to just £0.045p/kWh for large-scale business projects providing between 1.5-5 MW capacity.
- The electricity generating tariffs for other technologies, such as anaerobic digestion, have also been challenged by the market as not being sufficient to allow smaller-scale commercial plants to be built without further grant aid ^{13,14}.
- The Renewable Energy Association disputes a number of assumptions used to derive the FiTs, including the treatment of gate fees and energy crops as feedstocks. Tariff banding needs to account for the differences in feedstock of anaerobic production plants¹⁴.
- According to industry the UK FiT for anaerobic digestion fails to recognise this. For plants >500 kW the 9p/kWh tariff is viewed as being too low and the industry calls for it to be set at the originally proposed 11p/kWh¹⁴ in any future FiT reviews.
- In Germany feed-in tariffs for biogas need to be in the region of 16p/kWh to be attractive to investors.
- The bioenergy industry has also challenged the tariff rate of 11.5p/kWh for anaerobic digestion systems <500kW and suggests that new bands of <50kW and 50-200kW are needed with corresponding tariffs of 33p/kWh and 21p/kWh respectively to stimulate widespread uptake of smaller farm systems^{14, 67}.
- Although Germany's FiTs aim to provide a rate of return of between 5 and 7%, this cannot be compared on a level basis to the UK.

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- Firstly this is due to the fact that the German FiT, like many other European schemes, is not limited only to micro-generation like the UK scheme,
- Furthermore, the premium tariff model chosen by the former government for the UK FiT increases hurdle rates by around 1%. In Germany the government provides low interest loans to businesses and households, lowering the hurdle rates for investors. Germany's FiT is also operated across all levels of technologies, not just small scale, and in mature markets where investors are already confident and familiar with investments in renewable projects^{13, 14}.
- Industry analysis has shown that a FiT rate of return of between 8-14% could be needed to encourage renewable investment by commercial investors in the UK¹⁵.
- Yet according to this analysis, even an 8% tariff would be insufficient for developers or utilities since 8% is equal to the minimum point on the hurdle rate distribution for these investors. By comparison, domestic and commercial building owners have minimum hurdle rates of 3% and 6% respectively, so there is a substantial portion of the population willing to invest at 8% ROI. A Rate of return at this level would therefore stimulate domestic investors, but not the majority of large-scale investors.
- At a higher rate of 10% there would be an increase in total electricity generation by 2020 due to the widespread uptake of larger scale technologies by developers and utilities. A further increase to the ROI to 12% would not result in a significantly larger capacity of generation since at 10% most technologies are being deployed at their maximum rate given supply and demand constraints.
- This analysis calls for the UK FiTs to be set at levels sufficient to yield at least a 10% ROI, with no degression for 3 years until the first tariff review, to give investors greater certainty in the near-term. This could transform the prospects for small scale renewable generation and deliver around 25 TWh of generation by 2020 - triple what the current FiTs would deliver.
- Aside from expanding tariff rates and increasing ROI's, an opportunity exists according to market reaction if FiTs are expanded to sectors currently not included in the scheme such as the marine sector. The FiT system could act as a stimulator to more infant technologies, helping them overcome the 'valley of death' where funding for early stage technologies often dries up.
- For offshore wind, the mechanism to bring projects forward is the Renewable Obligation, but the market states that this falls short of an effective solution to attract investment in the critical pre-construction stages of projects due to the fact that the ROC market does not address the different risk profiles over the project life cycle¹¹. It increases return available over the project life, which is attractive to utilities, but not to more risk-averse investors or those with shorter investment horizons. So the benefits of ROCs are only realized once a project is operational, leaving investors exposed during the construction phase. Increasing the number of ROCs could remedy this but FiTs are also being considered for the offshore market. Solutions need to specifically address the risk associated with the construction phase of large projects.
- The new coalition government has agreed to the establishment of FiT systems and a decision over retaining the RO or replacing it with FiTs in its entirety is still being negotiated. Industry expresses the need for clarification on the support mechanism for offshore wind is needed quickly to minimize any disruption to Round 3 offshore wind projects and to ensure investor confidence in the sector⁶.
- A FiT for offshore wind as a replacement for RO payments would be advantageous for several reasons: by introducing the notion of double ROCs for offshore wind the procedure has already become more of a hybrid that edges towards FiTs in any case; a shift to offshore wind FiTs would involve a large reduction in the bureaucracy surrounding the RO and allow greater transparency.

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- In addition industry has reacted negatively to the cut in the previously announced export bonus of 5p/kWh to 3p/kWh for firms selling power back to the grid as businesses, unlike households, will have to pay tax on the revenue they generate through the scheme.
- Reaction to the FiT also shows a negative response to the fact that under the UK FiT program, existing systems remain ineligible for the FiT, except those transferring from the Renewables Obligation (at the fixed rate of £0.09/kWh). According to DECC this was on the basis of the understanding that these installations already exist and have been installed and are operating without financial support, however many market views disagree with this.

Summary of industry reaction to the FiT:

Market Reaction/ Challenges	Justification
The targeted FiT Rate of Return of 5-8% is too low	Industry analysis suggests that the Rate of Return should be 8-14%, with a minimum of 10%. The returns on offer for larger scale systems, favored by businesses, are too low to drive investment ^{14,15,16} .
Tariff levels for some technologies are too low for larger systems	The tariffs for solar PV systems fall from 41p/kWh for small-scale systems generating less than 4kW to 29p/kWh for systems generating more than 100 kW. Similarly for wind, the tariff ranges from 55p/kWh to 4.5p/kWh, favoring the smallest systems ^{13, 14} .
The FiT for Anaerobic Digestion is too low	The REA disputes a number of assumptions used to derive FiTs for Anaerobic Digestion, including the treatment of gate fees and energy crops as feedstocks, and calls for FiTs to be increased as a result of these factors. ^{14, 65}
The Rate of Return cannot be compared to Germany	Although the German FiT system provides rates of return between 5-7%, this cannot be compared on a level basis to the UK. The premium tariff model chosen by the former government for the UK FiT increases hurdle rates by around 1%. In Germany the government provides low interest loans to businesses and households, lowering the hurdle rates for investors. Additionally Germany's FiT covers all levels of technologies, not just small scale and is a mature policy ^{13, 14} .
The FiT only applies to projects up to 5 MW	The cap of 5 MW has been criticized as being too low and suggestions are that the FiT scheme should be expanded to encompass larger renewable systems, as many other European FiT schemes do. The 5 MW cap makes the estimation of resource potentials for several technologies challenging ¹⁵ . Wave and tidal schemes for instance are likely to be deployed in clusters with total capacities exceeding 5 MW due to maintenance costs of sites that are far from the shore.
There is no FiT for Offshore wind	There is no inclusion of Offshore Wind and larger scale onshore projects within the current UK FiT scheme, and instead these are still supported by the Renewable Obligation (RO) scheme. A decision on whether to transfer from the RO to a full system of FiTs is still being negotiated but needs to be made quickly to maintain investor confidence in key Round 3 offshore wind projects ³ .
The Export tariff of 3p/kWh is too low and has been revised downward from the original proposal of 5p/kWh	The export tariff for electricity to the grid was reduced to 3p/kWh. Indications show that the buy-out price for FiT electricity would be less than 4p and investors will naturally rely on the minimum guarantee represented by the export tariff. It has been suggested that the export tariff be revised upward to the original 5p/kWh to stimulate investment ¹⁴ .
Ofgem will be taking a lead role in monitoring and facilitating the financing of the FiT scheme.	Ofgem, the UK electricity and gas regulator, will have to overcome various administrative hurdles to create a streamlined and consumer-friendly process for the FiT scheme.
Immature technologies such as wave and tidal are not included	There is no FiT for immature technologies such as wave and tidal, which limits their commercial adoption ^{13,14} .

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Summary of industry reaction to the FiT rates

Feed in Tariff Technology	Current UK FiT (per kWh)	FiT: Industry Challenge	Current ROI	ROI: Industry Challenge	Source
Anaerobic Digestion <500kW	11.5p	33p/kWh (<50kW) and 21p/kWh (50-200kW)	5-8%	8-14%	National Farmers Union & Renewable Energy Association; Poyry & Element Energy ^{13, 14,15,16,}
		16p/kWh (equivalent to €0.18/kWh Germany with ROI 7-8%)	5-8%	8-14%	Poyry & Element Energy ^{15,16}
Anaerobic Digestion >500kW	9p	Needs to be increased to original 11p/kWh	5-8%	8-14%	Anaerobic Digestion and Biogas Association; Poyry & Element Energy ^{15, 16,51}

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In addition to the electricity FiTs, the UK coalition government has committed to the introduction of a Renewable Heat Incentive to stimulate the renewable heat sector to reach 12% of heat generation from renewable sources by 2020.

Proposed UK Renewable Heat Incentive Tariffs

Small Installations					Medium Installations				
Technology	Scale	Tariff (p/kWh)	Deemed or Metered	Tariff lifetime (years)	Technology	Scale	Tariff (p/kWh)	Deemed or Metered	Tariff lifetime (years)
Solid biomass	Up to 45 kW	9.0	Deemed	15	Solid biomass	45-500 kW	6.5	Deemed	15
Bio-liquids	Up to 45 kW	6.5	Deemed	15			2 (fuel tariff)	Optional	15
Biogas on-site combustion	Up to 45 kW	5.5	Deemed	10	Biogas on-site combustion	45-200 kW	5.5	Deemed	10
Ground source heat pumps	Up to 45 kW	7.0	Deemed	23	Ground source heat pumps	45-350 kW	5.5	Deemed	20
Air source heat pumps	Up to 45 kW	7.5	Deemed	18	Air source heat pumps	45-350 kW	2.0	Deemed	20
Solar thermal	Up to 20 kW	18.0	Deemed	20	Solar thermal	20-100 kW	17.0	Deemed	20

Large Installations

Technology	Scale	Tariff (p/kWh)	Deemed or Metered	Tariff lifetime (years)
Solid biomass	500 kW and above	1.6-2.5	Metered	15
Ground source heat pumps	350 kW and above	1.5	Metered	20

Source: UK Department of Energy and Climate Change, "Renewable Heat Incentive Consultation on the proposed RHI financial support scheme²⁷," 2010; DBCCA Analysis, 2010.

Heating accounts for 50% of UK energy consumption and associated CO2 emissions. Renewable heating technologies could make a significant contribution towards carbon reduction and renewable energy targets. In 2010, the UK introduced a system that provides incentives for renewable heating sources, to be effective from April, 2011.

- The UK heat mix is dominated by natural gas (~69%) with other sources such as oil, solid fuel and electricity making up the remaining majority proportion. Renewable fuel only accounts for 1% of UK heat supply at present.
- Heating accounts for 47% of UK carbon emissions and if the UK is to meet its EU target of 15% energy from renewable then heat incentivization is definitely needed²⁶. Thus the former government set the target of increasing the supply of renewable heat in the UK to 12% by 2020.
- As well as the FiT system for renewable electricity, the preceding government also launched a new incentive scheme for renewable heat, the Renewable Heat Incentive (RHI), providing a guaranteed tariff payment, directly to owners for each unit of heat energy generated.
- Tariffs proposed so far are those formulated by the previous government early in 2010.
- Confirmation that the coalition government will progress with a RHI in June, 2011, as revealed in the October Spending Review, has been met with widespread support from the anaerobic digestion and renewable energy industry and shows its commitment to the sector.
- Upcoming consultations on the RHI could result in new tariffs being announced, offering an opportunity to improve the proposed tariff structure to ensure that they unlock sufficient capital to align them with the UK's 2020 renewable targets.

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- This RHI, the first of its kind anywhere in the world, is viewed as a ground-breaking incentive in the UK that will move renewable heat to the heart of UK energy policy.
- Biomass heat markets are expanding steadily in Europe. Trends include growing use of solid biomass, use of biomass in building-scale or community-scale CHP plans and use for centralized district heating systems. Globally there is 270 GWth of heating capacity from biomass.
- Under the proposed RHI, tariffs will be offered for various types of renewable heat technologies including solid biomass, biogas, air source heat pumps and solar thermal.
- As previously discussed, biogas is produced from biomass in the process of anaerobic digestion and the resulting biogas can be burned in a boiler for heating or used to generate electricity. The heat would be eligible for the RHI and the electricity would be eligible for the FiT, providing the system meets the eligibility criteria of both the incentive schemes.
- In setting the tariffs, the former Government sought to allow a 12% rate of return (6% for solar thermal). There is debate in the market about whether the tariffs are sufficient and whether they will deliver this rate of return.
- Households are expected to play an important role in the success of the RHI through the uptake of renewable heating systems. The RHI provides for renewable district heating schemes, which may benefit groups of residential people. There is a proposed uplift for district heating systems as it was acknowledged by the former government that such schemes would involve greater capital expenditure to build the necessary pipe infrastructure.
- The initial expectation had been that the RHI would be funded via a levy on those who supply fossil fuels for heating. The UK Energy Act contains the statutory powers to introduce such a levy. However, heating fuel suppliers are not a small, homogeneous group of licensed entities and the difficulties of imposing a levy on all such suppliers appear to be complex and substantial.
- The coalition government's announced in the October Spending Review to fund the RHI with £860 million pa from general taxation can be seen as a positive move, avoiding the issue of how to distribute costs between heat providers.
- The RHI is expected to go ahead in June 2011
- What is vital is that the final RHI scheme structure, which is now under review, does not result in any further delay to the schemes start date that could undermine the UK's chances of deriving 12% of heat from renewable sources by 2020.

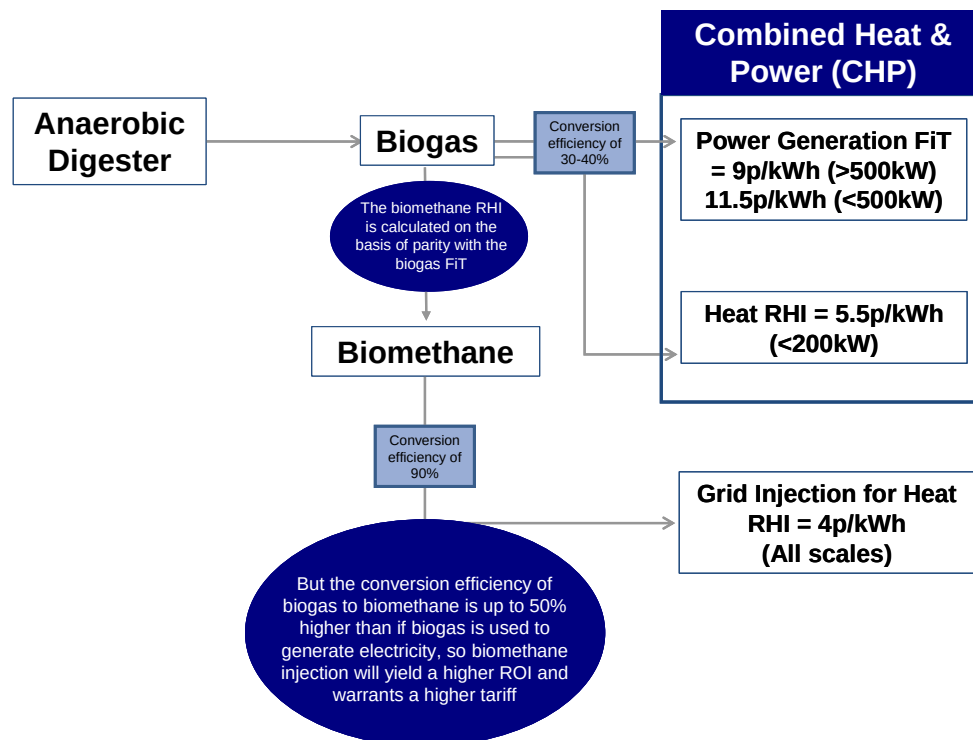
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Further upgrading of biogas forms biomethane which will also be eligible for a tariff under the RHI for injection into the natural gas grid. The tariff is set to be at parity with electricity produced from anaerobic digestion under the FiT; however there are many reasons why biomethane injection warrants a higher RHI tariff.

Biomethane injection is a more efficient use of biogas than power generation

Proposed renewable heat incentive tariff for biomethane

Technology	Scale	Tariff (p/kWh)	Deemed or Metered	Tariff lifetime (years)
Biomethane injection	All scales	4.0	Metered	15



Source: UK Department of Energy and Climate Change, "Renewable Heat Incentive Consultation on the proposed RHI financial support scheme²⁷," 2010; DBCCA Analysis, 2010.

Injecting Biomethane into the UK natural gas grid could substitute for 48% of the county's residential gas demand. Biomethane injection warrants a higher RHI incentive to overcome additional costs of installation and to reflect its superior qualities in terms of energy conversion efficiency.

- Under the former government's proposed RHI for 2011, there would also be a tariff for injecting upgraded biogas, biomethane, into the natural gas grid. It is estimated that if all UK waste biomass resources were used, bio-methane could substitute for 48% of residential gas demand⁵.
- Biomethane injection leverages the existing natural gas transmission line and distribution infrastructure and facilitates the development of projects in locations where there is no nearby heat demand. It can then be withdrawn at points to heat households, be used as a transport fuel or for industrial processes in exactly the same way as natural gas.
- The RHI tariff for biomethane injection into the natural gas grid has been set at 4p/kWh with an expected rate of return of 12%, the same as all other renewable heat technologies under the RHI (except for solar thermal which is set to deliver a 6% return on investment).
- However, the tariff for biomethane injection was calculated in a different way to the other renewable heat technologies.

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- The biomethane tariff was calculated to provide an incentive that is **at parity per unit of gas produced** to support given under the FiT for anaerobic digestion above 500 kW to generate electricity rather than on the basis of rate of return⁶⁸.
- The key assumptions on gas engine and injection costs/characteristics used by the former government in calculating the RHI support tariff for biogas injection based on parity with the FiT for AD were as follows:

Costs/Characteristics used in calculating the UK Renewable Heat Incentive for Biomethane injection:

Parameter	Units	Gas Engine (<5 MW)	Injection (equivalent to 2 MW of net gas output)
Digester capacity	kW	2,667	2,667
Cost of gas from digester	£/MWh	17	17
Output capacity	kW	933	2000
Utilization	%	95%	95%
Lifetime	Years	15	15
Conversion efficiency	%	35%	75%
Capex	£/kW	1000	550
Opex	£/kW/yr	50	49.5
Revenue per unit output	£/MWh	120.0	21.9

Source: DECC, "Impact Assessment of the Renewable Heat Incentive Scheme for Consultation in January 2010"⁶⁹.

- The idea of linking the RHI tariff for biomethane to the anaerobic digestion FiT was designed to give generators the option of generating power from biogas on-site, or turning it into biomethane and injecting it into the grid based on what is most appropriate for their circumstances rather than on a comparison between support levels.
- However, this notion is challenged by industry as by linking the biomethane RHI tariff to the FiT for AD, much depends on whether the FiT tariffs are set at an appropriate level in the first place which the market feels is not the case, as discussed previously^{13, 14}.
- In addition, industry analysis shows that the 4p/kWh tariff for biomethane would be insufficient to stimulate investment in biomethane grid injection projects and warrants a differentially higher tariff compared to that given to AD under the FiT^{13, 14}.
- Analysis suggests that an RHI tariff between 5-9p/kWh will be needed to attract investors to inject biogas rather than generate power¹⁴.
- In contrast to the UK's proposed biomethane injection tariff, in Germany the tariff needs to be at least €0.08/kWh (6p/kWh) to make it an attractive investment.
- The basis for challenging the 4p/kWh biomethane injection tariff in many studies is that there are added benefits of injection over power generation, particularly its higher efficiency of energy use, along with higher upfront cost of the technology.
- The Anaerobic Digestion and Biogas Association highlight that the most effective use of the government RHI will be to promote the production of biomethane from anaerobic digestion⁷⁰.
- Moreover, there is criticism of 'sustainable' energy policies which might bring about unsustainable changes in land-use practice. The fear is that the cost of farm-scale bio-digesters could push farmers into using their own feedstock (or crops) as energy sources; thus adding to the cost of food/feed imports and their environmental impact. Because grid injection of biomethane is more appropriate at a town/city scale it is not, in principle, as exposed to the same 'perverse incentives'. None of these factors were adequately represented in the assumptions used to derive the tariff for biomethane injection.
- The table below summarizes these market challenges to the biomethane tariff and why experts believe it should be increased and differentiated from the FiT paid to AD:

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Challenges to the proposed UK biomethane injection tariff:

Challenges to the 4p/kWh biomethane RHI tariff	
Higher energy conversion efficiency	By injecting biomethane into the grid, waste heat that would otherwise have been lost is utilized, making the process a far better use of primary energy. The conversion efficiency of biogas to biomethane is around 90% , compared to a conversion efficiency of 30-40% if the biogas is used to generate electricity. The gas then passes through existing pipelines and can be used in 80-90% of efficient boilers. The assumption used by DECC was that conversion efficiency of biogas injection was 75% . This can be seen as a large underestimation of the added benefit of injection.
Higher contribution to the UK's 2020 Renewable Energy Target	The Department of Energy and Climate Change expects biomethane grid injection to make up 10% of renewable heat by 2020, a contribution to the overall renewable energy target that is 10 times greater than that made by electricity from AD under the FiT.
Higher upfront and operational costs to the developer	AD plants need to be developed, scrubbing plants need to upgrade biogas to a quality that is acceptable to be injected into the grid, new pipelines need to be built and metering and grid injection facilities need to be put in place, all adding a cost to developers to inject biomethane.
Infancy of the technology compared to AD for electricity generation	Biomethane injection is a new concept in the UK, so there are additional risks associated with technology confidence and supply chain issues, which requires an additional incentive to overcome.
System inertia needs to be broken	Power generation is the default choice of many project developers who may be unfamiliar with biomethane injection, so a higher incentive is needed to encourage uptake of the technology and break inertia. Unless there is a compelling economic incentive to undertake biogas injection, developers will choose power generation with which they are familiar and for which the technology has a long track record.
Higher displacement of GHG emissions	As biomethane is a higher use of primary energy, it displaces more GHGs from fossil fuels which would otherwise have been used.

Source: DBCCA Analysis 2010; National Grid⁶⁵, 2010; Renewable Energy Association, "Response to the Renewable Heat Incentive (RHI) Consultation," 2010¹⁴, National Farmers Union⁶⁷; Anaerobic Digestion and Biogas Association⁵¹.

- It is not just the RHI tariff for biomethane injection which has been challenged by industry for perhaps being set too low.
- Industry suggests that the RHI for ground-source heat pumps should be increased by 2p/kWh to compensate for borehole drilling costs; and the tariff for solar thermal is insufficient to deliver a 6% return. A tariff of nearer 25p/kWh is required to deliver this compared to the proposed maximum tariff of 18p/kWh under the RHI¹⁴.
- Now that the coalition government has committed to supporting the RHI and the funding mechanism has been decided, the consultation of the scheme must now focus in on the individual tariffs, carefully considering these industry and market concerns in order to unlock the maximum investment potential in this sector.

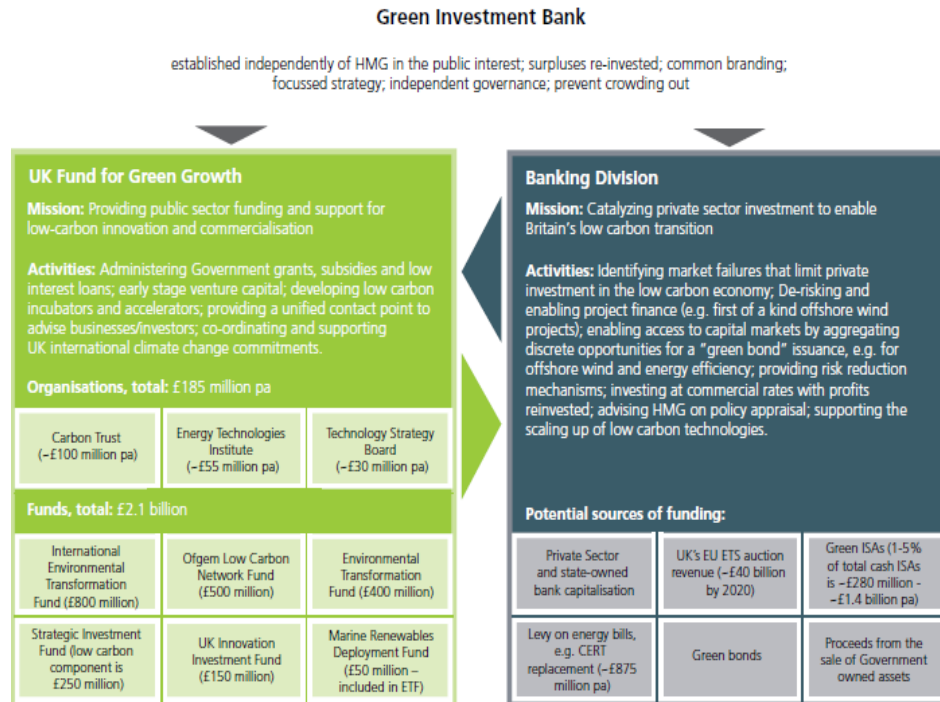
Industry and market challenges to selected RHI rates:

Renewable Heat Incentive Technology	Proposed UK RHI Tariff	RHI: Industry Challenge	Source
Biomethane Injection	4p/kWh	5-9p/kWh	Renewable Energy Association ¹⁴
Solar Thermal <20 kW	18p/kWh	25p/kWh	Renewable Energy Association ¹⁴
Solar Thermal 20-100 kW	17p/kWh	21p/kWh	Renewable Energy Association ¹⁴
Solar Thermal >100 kW	New tariff band proposed	13p/kWh	Renewable Energy Association ¹⁴
Ground Source Heat pumps	1.5-7p/kWh	3.5-9p/kWh	Renewable Energy Association ¹⁴

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In addition to FiT policies that enhance returns, a Green Investment Bank is planned to mitigate the risk of investing in renewable projects in the UK.

A green investment bank structure



Source: Green Investment Bank Commission, 2010¹².

There may be a need for a more direct role for the new coalition government in reducing the financing risk of renewable energy projects, especially large-scale projects.

- The former government proposed the creation of a Green Investment Bank (GIB) to facilitate private finance for a low carbon transition, something that the new coalition government has endorsed³.
- The Green Investment Bank Commission released a report in June, 2010 on the proposed GIB and highlighted an overview of the financial products the bank could offer and how funds might be raised.
- The Commission estimated that £550 billion could be required by 2020 and £800 billion by 2030 for investment in supply chains and infrastructure in order to meet the UK climate and renewable targets, but that insufficient capacity in debt capital markets, perceived risk around policy support frameworks, risk around new technologies being rolled out and difficulties with financing large numbers of smaller projects have made low carbon infrastructure financing unachievable without scaled up Government intervention.
- Banks are often unwilling to provide project finance at the pre-construction stage due to the associated construction and technology risks, and political risk of policy change unless there is a contingency plan to mitigate the risks.
- Market analysis concludes that although pension funds and insurance funds have high access to funds, their attitudes towards technical, construction and price risks associated with pre-construction of major renewable projects are deemed to be unacceptable for them to invest¹¹.
- Private investors could be willing to accept the risks of offshore wind projects provided that the returns available are commensurate with the risk profile, but at the moment there is a mismatch with high risk and returns only in line with a utility-type return.
- The GIB should act in the public interest to identify and address market failures and investment barriers by selling by selling innovative financial products. According to the Green Investment Bank Commission¹², the proposed primary focus of the GIB should be on lowering risk for investors and catalyzing low carbon investment by:

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- Unlocking project finance through equity co-investment, first loss debt and insurance products for low carbon technologies;
 - Creating green bonds to assess the large pools of capital held by institutional investors. Such profits would fit with the long-term investment thesis of pension funds and life insurance companies;
 - Selling green ISA's and green energy bonds, which would be an important way for retail investors to make a contribution to the funding of green infrastructure, and
 - Use the potential rationalization of quangos and their funds to radically improve Government support for low carbon innovation.
- The final balance between Government backing and independence from the UK Treasury will be critical to determine the effectiveness of a new GIB. However the GIB Commission's June report¹² failed to add clarity on the issue of scale and scope, with no direction on how the bank would be funded or structured making the ability of a GIB to stimulate expansion of private sector investment a theoretical concept.
 - The coalition government's October Spending Review confirmed the establishment of a GIB and allocated an initial £1 billion capitalization, short of the £2 billion proposed by the former government in March,
 - The coalition government hopes that further funding will come from the private sector and from future government asset sales, including the sale of its share in uranium firm Urenco.
 - Despite the clarification on funding, the current proposals still fall short of specifying under what premises a GIB would seek to invest and what particular technologies would benefit from GIB funding.
 - Deep sea offshore wind is a priority for the UK to meet its renewable power targets but there is a real need to lower construction risk and offset political uncertainty.
 - A key issue for offshore wind is that the current mechanisms for support in the form of the Renewable Obligation and carbon price are unlikely to address the specific challenges of offshore wind pre-construction finance¹¹. Should the GIB's criteria for investment end up being similar to those used by commercial banks (as an independent body required to raise money and operate on a commercial basis with no Treasury support), then it would be open to the same risks as a commercial bank. The need for a return in investments to provide future capital for the GIB and returns for its shareholders would limit its activities to those already available to the private sector – not increasing overall investment in large-scale green infrastructure such as offshore wind.
 - However if the GIB's mandate is set so that it only invests in conjunction with the private sector, it will increase overall investment and give the private sector the confidence to invest in the first place.
 - According to the UK Infrastructure Plan released in late October the GIB will be fully designed and ready for launch in the spring of 2011.

IV. References

The study draws on the following work referred to in the text:

- ¹ European Commission (2009) Directive 2009/28/EC Of The European Parliament And Of The Council of 23 April 2009 on the promotion of the use of energy from renewable sources.
- ² DBCCA (2009) 'Paying for Renewable Energy: TLC at the Right Price: Achieving Scale through Efficient Policy Design.'
- ³ HM Government (2010) 'The Coalition: our programme for government.'
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