EnAlgae policy landscape analysis for

the UK

Landscape analysis of national and regional policies of the UK that can have an impact in algae cultivationrevealed a number of strategies, mandates, and economic incentives for climate change, bioenergy, and water. Many of the identified policies are in fact response mechanisms to EU-level overarching strategies and targets. Nevertheless, each country can set its own priorities and strategies in order to reach EU targets. For this, we have looked upon UK policiesat country and regional level that could stimulate investment for algae cultivation.

Production ofEnergetic Algae (or algae for production of fuels and energy) is a new concept in theUK, and existing bioenergy and environmental strategiesfew schemes were found to be actively supportive toenergetic algae. An example relevant to algae is the Renewable Heat Incentive (RHI). For bioheat tariff scheme, algae are an eligible biomass type for biogas and bioheat production. To identify other policies that could affect energetic algae, research was focussed on generic biomass, bioenergy and environmental strategies.

With regards to energy targets, UK has a primary obligation set in the EU Renewable Energy Directive (RED) to source 15% of its energy use from renewables by 2020, including and 10% of transport. In response to RED targets, UK plans to source 30% of electricity, 12% of heat consumption from renewable sources.Also at a national level theUK has a target to reduce its emissions by 34% by 2020, and 80% by 2050. To empowermarket changes and meet targets, the UK produced strategies and policy frameworks on energy and environment. Also, Scotland and Wales have published regional action plans in line with national targets. Technologies that UK policies strategically support, for reducing their emissionsand increasingthe share of renewables in the energy mix, are biomass power and biomass Combined Heat and Power (bio-CHP), Anaerobic Digestion (AD), and transport biofuels among others. Both AD and transport biofuel technologies have strong potential to use algae as biomass feedstocks.

The UK plans to support all these strategic energy technologies by providing 1) financial support, 2) unblocking barriers for investment, and 3) underpinning technology development. Low carbon action plans have acknowledged the need to be frequently updated in order to enable uptake of the emerging technologies. Uptake of strategic energy technologies is supported mainly by feed-in tariffs schemes, tradable renewable certificates, and guarantees. Alsounderway, is a major Electricity Market Reform (due by 2016) that envisages supporting sustainable renewable electricity technologies, at aminimum cost for the consumer.

As regards tocultivation of energy crops, there was a capital investment grant available for new land plantations that closed in 2013. Fifty percent of thecost for planting and cultivatingshort rotation coppice and Miscanthus,was covered by the scheme, and for up to three years.

Finally as regards to environmental policies, UK wastewater policy falls under the Water Framework Directive of EU, according to which policy framework focuses on water scarcity and water pollution priority areas. For wastewater, strategies for handling and recovering urban and agricultural wastewater are in the spotlight.

In the following sectionfindings from landscape analysis of UK legislation are listed by topic. Firstare presented the overarching strategies and acts, which are then followed by targeting incentives.

## General Framework

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| Policy | Key Measures/Aims |
| Climate Change Act 2008[[1]](#footnote-2) | Aims to reduce CO2 emissions by 34% by 2020 and 80% by 2050 compared to 1990 levels. The Climate Change Act introduced a series of Carbon Budgets that cap emissions over five year periods. The first three carbon budgets will run from 2008-12, 2013-17 and 2018-22. |
| The Low Carbon Transition Plan 2009[[2]](#footnote-3) | Outlines how the UK will meet the 34% cut in emission by 2020 and 80% by 2050 on 1990 levels through emission reductions in UK economy. Target sectors include power and heavy industry; transport; homes and communities; workplaces and jobs; and farming, land and waste.  This includes 1) produce around 30% of our electricity from renewables, 2) fund up to 4demonstrations of CCS projects for coal-fired power plants, 3) secure funding and give incentive for improving energy efficiency in residential buildings, 4) provide £120 million and £60million for development and use of off-shore wind farms and marine energy respectively, 5) develop framework for tackling emissions from farming, and 6) cut emissions from road transport by improving car engines, incorporating clean technologies, and committing to sourcing 10% of UK transport fuel by 2020. |
| The Carbon Plan:  Delivering our low carbon future 2011[[3]](#footnote-4) | Outlines how the UK will facilitate decarbonisation of UK energy economy by 2050 for meeting 80% CO2 reduction of emissions compared to 1990 levels, and specifically in buildings, transport, industry, power, and agriculture, land use, forestry, and waste.  This includes 1) Gradual replacement of fossil fuels with electricity, sustainable bioenergy, nuclear, and hydrogen; 2) decarbonisation of electricity, by increasing efficiency of production, distribution, and use, and through coupling with CCS projects |
| National Renewable Energy Action Plan 2011[[4]](#footnote-5) | Under the EU [Renewable Energy Directive](http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:140:0016:0062:en:PDF), the UK is obliged to meet a target of sourcing 15% of consumed energy from renewables by 2020, including 30% of electricity, 12% of heat, and 10% of transport. This document outlines the measures and the trajectory by which these targets will be met.  The policy framework is made up of three key components: Financial support for renewables; Unblocking barriers to delivery; and Developing emerging technologies. |
| UK Renewable Energy Roadmap 2011[[5]](#footnote-6) | The UK Renewable Energy Roadmap outlines the 8 key technologies which have the greatest potential for the UK to meet the RED targets. For each of these technologies (on- and off-shore wind, marine energy, biomass electricity, and biomass heat, ground source and air source heat pumps, and transport fuels) the current deployment of that technology is indicated, together with the potential future uptake trajectories and the key barriers towards achieving uptake of that technology. Actions to address these barriers will be established and the impact of these actions on deployment will be monitored over time and new roadmaps developed to achieve these targets. |
| Planning our Electric future White Paper2011[[6]](#footnote-7) (Electricity Market Reform) | Outlines the possible mechanisms to create a secure mix of electricity sources including gas, new nuclear, renewables, and carbon capture and storage, attract investment and reduce impacts on customer bills. Within the Electricity Market Reform package, due to be introduced from 2016, there are a range of fiscal incentives to promote low carbon energy  1) A carbon floor price will be introduced to give a guaranteed price for carbon;  2) Carbon will be priced at £15.70/tCO2 in 2013, increasing to £30/tCO2 in 2020 and £70/tCO2 in 2050;  3) A feed-in tariff with contract for difference (CfD) scheme will promote long term certainty over revenues to investors;  4) a capacity mechanism where energy suppliers provide demand-response generation, and  5) anemissions performance standard set at 450g CO2/kWh, encouraging carbon capture from coal fired power stations. |
| Renewables Action Plan (RAP) for Scotland 2009[[7]](#footnote-8) | Outlines how Scotland will facilitate the strategy of sourcing 20% of energy consumption from renewables, and more specifically 50% of electricity, 10% of renewable transport, and 11% of heat. To achieve this, RAP envisagesdecarbonisation of energy by focusing in Energy efficiency, Low carbon vehicles, CCS, and renewable heat sectors. RAPwants to identify what needs to be done, make a plan for the first 24 months, and develop a live document tracking progress in economic and technological developments. |
| National Policy Statement  for Waste Water [[8]](#footnote-9) | • Sustainable development–to seek waste water infrastructure that allows us to live within environmental limits and that Helps ensure a strong, healthy and just society, having regard to environmental, social and economic considerations;  • Public health and environmental improvement – to continue to meetour obligations under the Urban Waste Water Treatment Directive (UWWTD) 21 by providing suitable collection and treatment systems to limit pollution of the environment;  • To improve water quality in the naturalenvironment and meet our obligations under Related European Directives, such as the Habitats Directive 22 , the Water Framework Directive (WFD) 23 and its Daughter Directives |
| The Future of Water Resources in the UK[[9]](#footnote-10) - 2011 | The aim of this document is to explain, from an industry perspective, the current issues of main interest: the availability of water, the future management of water resources, abstraction licenses and trading, and potential mechanisms for improving the efficient allocation of water resources.  It contains within it a series of proposals which could be implemented relatively easily and without recourse to legislative change. The paper is intended to provide a clear view of the industry position, and as a basis for further discussion. |

## Bioenergy Strategy

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| Policy | Key Measures/Aims |
| Biomass Strategy 2007[[10]](#footnote-11) | The strategy outlines how some 8.3Mtoe energy could be produced from biomass, through improving technology innovation, developing supply chains, prioritize and incentivize use of biomass for energy in electricity, heat, and transport fuels sectors.  It includes:1) targets of 1 M dry tonnes of biomass from underused woodland;2) suggesting an additional 350,000 ha of land could be used to produce energy crops by 2020; and 3) expanding the range of biomass sources used for energy production to include residues and wastes, and solid recovered fuels. |
| Anaerobic Digestion Strategy &Action Plan 2011[[11]](#footnote-12) | Presents the vision of valorising waste through AD, identifies the barriers to implementation of AD projects, and proposes routes to overcome these obstacles, including dissemination and training, building new markets for by products and energy crops, and mapping economic incentives for investors. It is estimated that AD deployment for heat and electricity could reach between 3 and 5 TWh by 2020. A fund of £10m over 4 years was announced to stimulate investment in additional AD capacity. |
| Bioenergy Action Plan for Wales[[12]](#footnote-13) | Outlines the main obstacles and presents plans for regional incorporation of bioenergy in Wales. Main concerns addressed are: CHP of biomass resources, environmental sustainability of imported biomass, air quality, biomass demand response, AD and injection of gas to gas-grid, development of biomass supply chains, planting forests and wood land management, regional development, identifying other uses of biomass (biofuels). |
| Bioenergy Strategy (2012)[[13]](#footnote-14) | Outlines a strategic framework for use of bioenergy from biomass and wastesfor heat, electricity and transport. The target is to achieve the cost effective delivery of our 2020 goals, in a way that is consistent with other objectives across the economy and longer term carbon reduction ambitions to 2050. |
| The Future of Heating:A strategic framework for low carbon heat in the UK (2012)[[14]](#footnote-15) | Outlines 1) how the UK uses heat;2) the potential ways in which heat demand can be met in the future, 3) the possibilities for reducing energy demand in buildings through the decarbonisation of heating and cooling of buildings, including switching to low carbon energy generation and the deployment of CCS.  Measures are proposed to improve building level heating systems promoting the development of heat pump and solar panel technologies, , and developing heat networks through CHP, linked to low carbon heat sources, invest in biomass, biogas, and CCS for heating industry.  The document makes a series of questions and invites all stakeholders for decarbonizing heat to comment. Comments are due to be published in a special DECC report by 2014. |

## Power Generation

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| Policy | Ambitions | Policy Measures | Financial Incentives |
| Renewables Obligation (RO)[[15]](#footnote-16) | The RO requires licenced electricity suppliers to source an increased amount of their electricity sales from renewable sources or pay a penalty. | Renewable Energy Generators are issued with Renewable Obligation Certificates (ROCs) based on their renewable energy output. The focus is on scales greater than 5MWe, but installations >45 KWe are eligible. Renewable targets are 12.4% from 2012/13, rising by 1% per year to 2015/16. Scheme runs to 2037.  If a generator produces more electricity than it needs, it can trade ROCs which have a monetary value. If there are not enough certificates from a supplier, they must buy ROCs or pay into a buyout fund. A review of ROC scheme is currently underway. It is planned that mandatory sustainability reporting is introduced since 2013, and that sustainability criteria will need to be met in order to obtain ROCs. Sustainability criteria will be upon Renewable Energy Directive criteria. For bioliquids used for energy generation, sustainability criteria are as for the RTFO. The RO will close to new entrants in March 2017, by which time the Electricity Market Reform (EMR) will have taken over. | The amount of electricity which needs to be generated varies by technology with more developed technologies eligible for more ROCs than more developed technologies.  For 2013/14 obligation is 0.206 ROCs per MWh, and for 2015/2016 will be 0.290. Price per ROC for 2013 was £42.02. |
| Feed in Tariff(FiT)[[16]](#footnote-17),[[17]](#footnote-18) | FiTs aim to promote the deployment of proven, small scale low carbon electricity generation (up to 5MW) technologies (solar, photovoltaic panels, wind turbines, water turbines, AD, micro combined heat and power)located in England, Wales, and Scotland, and particularly by groups not traditionally involved in the electricity market. | Made up of a generation tariff and an export tariff. The generation tariff is guaranteed for between 10-20 years, and the level varies by technology and size of installation. The export tariff is paid where electricity is fed into the National Grid. Suppliers may choose to claim the market value for the electricity in place of the export tariff. AD is the only bio-based technology supported under the FiT scheme. | Applicants should be AD installations with <5MW capacity.  Both export and generation tariff are index linked so will vary based on the previous year’s retail price index. Since [April 2014 degression](https://www.ofgem.gov.uk/ofgem-publications/89098/fitpaymentratetableforpublication1october2014nonpvtariffs.pdf), the generation tariff for AD installations: 1) £11.21 p/kWh for plants <250kW, 2) £10.37 p/kWh for plants between 250kW and 500kW and 3)£9.02 p/kWh for plants >500kW. In 2013/2014 the export tariff is £4.77 p/kWh. Prices are expected to change again by April 2015. |
| Electricity Market Reform: Contracts for Difference - 2011 | The current support regime of FiT will be gradually replaced by a system of feed-in tariff Contracts for Differences (CfD). Changes are due to be implemented as early as 2014 but with a transitional phase until 2017 during which the new support regime will co-exist with the current regime. CfDsare intended to shift the electricity market price risk from the generator to the consumer, reducing risk and the cost of capital for investors. |  | The CfD is a contract to pay or be paid the difference between a market reference price for electricity and an agreed “strike price”. It is a two-way contract which could lead to the generator receiving payments from or having to make a payment to its counterparty under the CfD. |
| Renewable Heat Incentive (RHI)[[18]](#footnote-19), [[19]](#footnote-20), [[20]](#footnote-21), [[21]](#footnote-22) | The RHI aims to incentivise the generation and use of renewable heat from solid and gaseous biomass, on-site biogas and injection to the grid, and energy from waste, at all scales in England, Wales, and Scotland. | Tariffs are guaranteed for 20 years, and are paid on a quarterly basis through Ofgem. Tariffs vary by technology and scale. RHI is currently dedicated to non-domestic use, although [RHI for domestic use](https://www.ofgem.gov.uk/environmental-programmes/domestic-renewable-heat-incentive)has opened since Spring 2014. There are plans to incorporate sustainability reporting into the RHI. Sustainability reporting will vary by scale. For plants above 1 MWh capacity, biomass sustainability requirements are to be fulfilled quarterly per year. For plants below 1 MWh capacity, compliance with sustainability criteria will be based on a recommended feedstock suppliers list who have had the sustainability of their feedstocks audited.  Solid biomass must be wood, straw, agro-industrial residues, food or other wastes, or sewage sludge.  Biogas must be produced from AD, gasification, or pyrolysis of biomass (no landfill). In this case biomass is defined as plant matter, animal matter, fungi or **algae** (but not peat). | Ofgem are responsible for publishing quarterly [tariff tables](https://www.ofgem.gov.uk/environmental-programmes/non-domestic-renewable-heat-incentive-rhi/tariffs-apply-non-domestic-rhi-great-britain) showing the tariffs that will be applicable for each tariff period following DECC’s quarterly degression announcements in 2014.  From Oct. 2014Tier 1[[22]](#footnote-23)prices are:  Small solid biomass (<200 kWh)7.6 p/kWh; medium (200 kWh to <1,000 kWth) 5.1 p/kWh; and large (1,000 kWth and above) 2p/kWh.  Solid biomass CHP: 4.1 p/kWh.  Biomethane injection & Small biogas combustion (Less than 200 kWth): 7.5p/kWh; Medium biogas combustion (200 kWth and above & less than 600 kWth): 5.9 p/kWh; and Large (600 kWth and above) 2.2 p/kWh. |
| Renewable Energy Guarantee of Origin (REGO)[[23]](#footnote-24) | To show that electricity was produced from eligible renewable energy sources. | REGOs are issued by Ofgem, and works alongside the ROC scheme.The main use of REGOs is in fuel mix disclosure FMD by electricity suppliers. FMD requires licensed electricity suppliers to disclose to their customers, and potential customers, the mix of used to generate the electricity supplied annually (coal, gas, nuclear, renewable and other).  One REGO is issued for each megawatt hour (MWh) of eligible renewable output generated (with effect from 5 December 2010).  The primary use of REGOs in Great Britain and Northern Ireland is for Fuel Mix Disclosure (FMD). | No market value at present, but it is envisaged that within the next few years REGO’s may become more important. Consumers are getting informed and can choose. |
| Climate Change Levy (CCL) - 2001 |  | It is a tax chargeable on non-domestic supplies of certain energy products (including electricity) in the UK. Electricity generated from renewable sources is exempt from such tax and generators of green electricity are issued with Levy Exemption Certificates (LECs) that evidence the green origin of the electricity. LECs are another source of revenue: generators sell the LECs to suppliers together with the green electricity and suppliers will be able to use these LECs as evidence that they have supplied energy from renewable sources and are therefore exempt from paying CCL for such supply. | It is currently levied on electricity suppliers at a rate of 0.509p/kWh. This rate is adjusted annually in line with inflation. |
| Energy Crop Scheme[[24]](#footnote-25)-  Now closed | To incentivise the planting of energy crops for bioenergy and biofuels markets | Provides grants for establishing short rotation coppice (including willow, poplar, hazel, silver birch, sycamore, sweet chestnut and lime) and Miscanthus in appropriate locations. ECS participants can plant in one year, or choose to phase the planting for up to three years.  Under the arrangements for the current scheme planting can be undertaken in 2013, 2014 and 2015  Crops must be used for heat, combined heat and power (CHP) or power generation.  Own use is permitted. | Payments will be made on the basis of: 50% of actual costs i.e. suppliers/ materials/ contractor costs and/or 50% of on-farm costs i.e. use of own labour and machinery, where applicable |

## Biofuels

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| Policy | Ambitions | Policy Measures | Financial Incentives |
| Renewable Transport Fuels Obligation (RTFO)[[25]](#footnote-26), [[26]](#footnote-27), [[27]](#footnote-28) | The RTFO obligates suppliers of fossil fuels and biofuels to include increasing levels of biofuels (both liquid and gaseous), as specifically defined in the RTFO order, in the road transport fuel mix. | All fuel suppliers who supply at least 450,000 litres of fuel a year are obligated to comply.  The amount of biofuel that must be supplied increases annually until April 2013 when it will reach 4.75% of total road transport fuel supplied by volume. This target is set to continue for 2014/15.  Owners of biofuel at the duty point are awarded one (RTFC) per litre of biofuel or kilogram of biomethane supplied. The unit of measuring is subject to change in the future.  Sustainability criteria of biofuels are strict. Biofuel that does not meet these sustainability criteria will be counted as fossil fuel and accrue an obligation to supply sustainable biofuel, in the same manner as any other fossil fuel. Fuels produced from certain feedstocks are eligible for double counting. These include fuels derived from wastes and residues as well as those from lignocellulosic and non-edible cellulosic material (no forest biomass).  At the end of the year, suppliers of fossil road transport fuel demonstrate compliance with the RTFO by redeeming the appropriate number of RTFCs to demonstrate the required volume of biofuel was supplied. Alternatively, obligated fossil fuel suppliers can pay a buy-out price per litre of obligation, the buy-out price being set in the RTFO order. Suppliers are allowed to carry over RTFCs from one year to the next, provided that no more than 25% of the supplier’s obligation to supply biofuel for the later year is met by carrying over RTFCs and the fuels supplied met the sustainability requirements of the period in which the certificates are redeemed. | In January 2014 RTFC auctionswere put on hold due to lack of market demand. The last RTFC price was 10p/l. |

1. <http://www.legislation.gov.uk/ukpga/2008/27/contents> [↑](#footnote-ref-2)
2. <http://webarchive.nationalarchives.gov.uk/20100509134746/http:/www.decc.gov.uk/en/content/cms/publications/lc_trans_plan/lc_trans_plan.aspx> [↑](#footnote-ref-3)
3. <https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/47613/3702-the-carbon-plan-delivering-our-low-carbon-future.pdf> [↑](#footnote-ref-4)
4. <https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/47871/25-nat-ren-energy-action-plan.pdf> [↑](#footnote-ref-5)
5. <https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/48128/2167-uk-renewable-energy-roadmap.pdf> [↑](#footnote-ref-6)
6. <https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/48129/2176-emr-white-paper.pdf> [↑](#footnote-ref-7)
7. <http://www.scotland.gov.uk/Resource/Doc/278424/0083663.pdf> [↑](#footnote-ref-8)
8. <https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69505/pb13709-waste-water-nps.pdf> [↑](#footnote-ref-9)
9. <http://www.water.org.uk/home/policy/positions/the-future-of-water-resources> [↑](#footnote-ref-10)
10. <http://www.biomassenergycentre.org.uk/pls/portal/docs/PAGE/RESOURCES/REF_LIB_RES/PUBLICATIONS/UKBIOMASSSTRATEGY.PDF> [↑](#footnote-ref-11)
11. <http://www.defra.gov.uk/publications/files/anaerobic-digestion-strat-action-plan.pdf> [↑](#footnote-ref-12)
12. <http://wales.gov.uk/docs/desh/publications/101014bioenergyprogressen.pdf> [↑](#footnote-ref-13)
13. <https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/48337/5142-bioenergy-strategy-.pdf> [↑](#footnote-ref-14)
14. <http://www.decc.gov.uk/en/content/cms/meeting_energy/heat_strategy/heat_strategy.aspx> [↑](#footnote-ref-15)
15. <http://www.decc.gov.uk/en/content/cms/meeting_energy/renewable_ener/renew_obs/renew_obs.aspx> [↑](#footnote-ref-16)
16. <http://www.decc.gov.uk/en/content/cms/meeting_energy/renewable_ener/feedin_tariff/feedin_tariff.aspx> [↑](#footnote-ref-17)
17. <https://www.ofgem.gov.uk/ofgem-publications/58855/fit-generator-guidance.pdf> [↑](#footnote-ref-18)
18. <https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/48041/1387-renewable-heat-incentive.pdf> [↑](#footnote-ref-19)
19. <https://www.ofgem.gov.uk/ofgem-publications/83036/rhiguidancedocumentvolonesept2013edits-consultationver.pdf> [↑](#footnote-ref-20)
20. <https://www.ofgem.gov.uk/ofgem-publications/83034/rhiguidancedocumentvoltwosept2013edits-consultationver.pdf> [↑](#footnote-ref-21)
21. <https://www.ofgem.gov.uk/publications-and-updates/guidance-volume-one-two-and-fuel-measurement-and-sampling-guidance> [↑](#footnote-ref-22)
22. Tier 1 incentives are given. Draft RHI guidance published in Sept. 2013 proposes a tier 1 rate for the first 1,314 hours of heat production in a year, after which rates switch to Tier 2. [↑](#footnote-ref-23)
23. <http://www.ofgem.gov.uk/Sustainability/Environment/REGOs/Pages/REGOs.aspx> [↑](#footnote-ref-24)
24. <http://www.naturalengland.org.uk/ourwork/farming/funding/ecs/> [↑](#footnote-ref-25)
25. <http://www.dft.gov.uk/topics/sustainable/biofuels/rtfo/> [↑](#footnote-ref-26)
26. <https://www.nfpas-auctions.co.uk/etoc/news.html#rtfo> [↑](#footnote-ref-27)
27. <https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/301079/part-2-c-and-s-guidance-yr7.pdf> [↑](#footnote-ref-28)