

Energy, fuels and environmental policies relevant to algae production and use in NW Europe

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Contents

1	Executive summary	3
2	EnAlgae policy landscape analysis for Belgium	5
2.1	General Climate Change Policy Framework - Belgium	6
2.2	Bioenergy - Belgium	7
2.3	Biofuels - Belgium	9
2.4	Environment - Belgium	10
3	EnAlgae policy landscape analysis for France	11
3.1	General Policy Framework - France	12
3.2	Bioenergy - France	13
3.3	Biofuels - France	16
3.4	Aquaculture/Wastewater - France	17
4	EnAlgae policy landscape analysis for Germany	18
4.1	General Policy Framework - Germany	19
4.2	Bioenergy - Germany	21
4.3	Biofuels - Germany	25
5	EnAlgae policy landscape analysis for Ireland	26
5.1	General Policy Framework – Ireland	27
5.2	Power Generation - Ireland	30
5.3	Biofuels - Ireland	31
6	EnAlgae policy landscape analysis for the Netherlands	32
6.1	General Policy Framework - Netherlands	34
6.2	Bioenergy – Netherlands	36
6.3	Biomass refining - Netherlands	38
6.4	Biofuels - Netherlands	39
6.5	Water, wastewater & Aquaculture - Netherlands	39
7	EnAlgae policy landscape analysis for the UK	40
7.1	General Framework - UK	41
7.2	Bioenergy Strategy - UK	43
7.3	Power Generation - UK	44
7.4	Biofuels - UK	47
8	EnAlgae policy landscape analysis for Luxembourg	48
8.1	General Policy Framework – Luxembourg	49
8.2	Bioenergy – Luxembourg	49
8.3	Biofuels – Luxembourg	51
9	EnAlgae policy landscape analysis for Switzerland	52
9.1	General Policy Framework – Switzerland	53
9.2	Bioenergy - Switzerland	55
10	Summary of NW Europe country reports for landscaping policies	57

Energy, fuels and environmental policies relevant to algae production and use in NW Europe

1 Executive summary

In the period 2012-2014 national and regional policies of eight countries of the NW European region were landscaped for identifying policies and economic incentives that could have an impact on the commercialisation of energetic algae concepts (micro- and macro-algae). The countries that were scoped were Belgium, France, Germany, Ireland, Luxembourg, Netherlands Switzerland, and the United Kingdom. With exception of Switzerland, the seven other countries are full members of the European Union (EU). Data were collected via desk-based work using online available information in national-, regional-, and EU-level web-pages. Policy data for the NW European region were not easily accessible, as policy documents were stored in websites of ministries or websites of national or regional government organizations e.g. funding bodies etc. Moreover policies were typically communicated in local languages and few were available in other languages.

Many of the identified national and regional policies in this landscape analysis were in fact response mechanisms to overarching strategies and targets of EU or international agreements (e.g. UN Kyoto Protocol). Nevertheless, all countries set their own priorities and strategies in order to reach the targets. The analysis revealed that the national strategies that energetic algae could fall under were sustainable development and climate change, biobased economy, bioenergy, and environment and waste. One level under these strategic frameworks there was an orchestration of roadmaps, action plans, and a plethora of activities that aimed at reaching the primary targets.

Algae were acknowledged in many national strategies (see Germany, Netherlands, Ireland,) as an important biomass resource for biobased economy, although there was some confusion whether energetic algae is an energy crop or a waste resource. The lack of clarity in classifying algal biomass affects how energetic algae projects and their products are supported by policies and economic instruments. For example, in the UK while energy crop projects were economically supported by the UK Government, algae biomass was not eligible for support. On the other hand, in Ireland fuels from macro-algae (seaweed) could receive double green certificates, due to their high sustainability performance. Finally in Bretagne, France, there was a regional economic scheme that supported regional development and construction of AD projects for green algal blooms. The scheme aimed at mitigating the environmental nuisance arising from excess wild green algae production in Bretagne coastline. In the last case, algae were considered a water pollutant.

An important aspect that affects whether a biomass source is favoured for energy production is the sustainability performance in a lifecycle perspective. In the EU Renewable Energy Directive (RED) sustainability criteria are described only for biofuels. In a national level, all eight countries had set criteria for environmental and social sustainability of bioenergy. For Switzerland, Germany, Netherlands, the UK, Belgium, and Luxembourg sustainability performance was very high on their national priorities. In Germany critical eligibility criterion for government funding for advanced energy technologies was the compliance with binding sustainability criteria.

One sustainability criterion that is particularly important for energy crops, yet not for algae, is the agricultural land footprint. In countries like Switzerland, Belgium, Netherlands and Luxemburg agricultural land use was prioritised for food production, and thereby energy crops were often not supported

concepts. However, algae do not necessarily need agricultural land to grow. They can be produced in marine environment (coastline, off-coast, or archipelago) or inside special bioreactor facilities placed e.g. on brownfields. Thereby algae are not a typical energy crop.

Strategic advanced bioenergy production technologies that the NW European region prioritised to support for reducing the GHG emissions and increasing the share of renewables in the energy mix, were primarily biomass power, biomass CHP, and AD. Except these three technologies, there are numerous other technologies that one or another country prioritises to support, but the above three technologies are currently actively supported by all eight NW European countries. For reference, other bioenergy technologies include biomass gasification, advanced biofuels, and wastewater treatment. From a technology perspective, AD is the technology most compatible with algae, although algae combustion for power or CHP could also fit. Policies mainly support bioenergy technologies by creating support policies, providing financial incentives, and funding subsidies for underpinning technology development and demonstration.

In identified targeted energetic algae policies, a technology that was strategically connected to algae is anaerobic digestion (AD) for production of biogas and biomethane. In fact AD can connect to algae two-fold. On one hand, algae biomass can feed AD for biogas production, acting as feedstock. On the other hand, algae (micro- and macro-algae) can act as wastewater treatment method filtering CO₂ and nutrients while algae grow. Both configurations were found to be supported by national policies.

The energy crop vs. waste classification of algae is very relevant in connection to AD technology. AD typically uses a mixture of feedstocks for feeding the production of biogas, like food crops, food waste, straw, manure, sewage, or algae. AD is a mature technology in the NW European region, with Germany having more than 1,000 AD plants. Although most of the AD plants in NW European region use a mixture of feedstocks, not all AD feedstocks are eligible for government subsidies. Some countries' policies were found to prioritise feeding AD with food or agricultural wastes, for example the Netherlands, Switzerland, and France, while other countries like Germany were found to encourage exploitation of unused biomass for bioenergy production, and especially biomass that does not have competitive market uses.

Among the eight countries' policies that were landscaped, the most innovative energetic algae policies were found in Ireland and in the Netherlands. Ireland primarily is scoping macro-algae, while Netherlands supports both micro- and macro- algae. Other countries like Germany, France, or the UK (see e.g. RHI) have made considerable efforts to include energetic algae and algae advanced energy technologies in their strategies and existing economic support tools.

2 EnAlgae policy landscape analysis for Belgium

Landscape analysis of national and regional policies of Belgium, that could have an impact in algae cultivation, revealed a number of strategies, mandates, and economic incentives on climate change, bioenergy, and water. Production of Energetic Algae (or algae for production of fuels and energy) is a new concept in Belgium, and existing bioenergy and environmental strategies were not found to be actively supportive to energetic algae. Consequently, to identify policies that could affect energetic algae, research was focussed on generic biomass, bioenergy and environmental strategies.

Many of the identified national and regional policies in Belgium are in fact response mechanisms to EU-level overarching strategies and targets. Nevertheless, Belgium, like each EU member state, can set its own priorities and strategies in order to reach the EU targets. With regards to national energy targets, Belgium has a primary obligation set in the EU Renewable Energy Directive (RED) to source 13% of its energy use from renewables by 2020, including 10% from transport. In response to RED targets, Belgium plans to source 20.9% of electricity and 11.9% of heat consumption from renewable sources. Most energy and climate change policies are partitioned by region (Wallonia, Flanders, Brussels-capital region), which leads to an unclear division of strategies within the regions and between the federal and the regional authorities.

Technologies that Belgium national and regional policies strategically support for production of electricity, heat and biofuels include solar, hydro, biogas, landfill gas, and waste combustion. Further on, these technologies are ranked based on satisfying a list of criteria such as cost of technology, land footprint, and CO₂ economy. Advanced energy technologies entailing low capital costs, low land footprint (e.g. offshore), and high CO₂ savings (including sustainability based on RED), rank strategically higher in Belgian energy and climate policies. Belgian policies support energy technologies by providing financial support, and underpinning technology development. Uptake of energy technologies is economically supported by a quota system (Green Certificates), capital investment subsidies, and product tax regulations.

Energy producers are obliged to satisfy quotas by presenting Green Certificates. The certificates are tradable in the market and have a minimum price guaranteed by the federal government. In regard to the subsidies, admissible costs vary by technology and they are 50% for biomass, biogas and CHP generation plants. Finally the tax cuts are applied for the biofuels sector in a national level in combination to fuel quotas.

Finally as regards to the environment, inland and coastal water as well as wastewater policies have been looked upon. These policies fall under also regional law in Belgium. The identified policies set the framework for water and wastewater management for improving natural environment, agriculture and fisheries.

In the following section findings from landscape analysis of Belgian legislation are listed by topic. First are presented the overarching strategies and acts, which are then followed by targeting incentives.

2.1 General Climate Change Policy Framework - Belgium

Policy	Key Measures/Aims
National Action Plan on Renewable Energy 2020	Sets objectives for heating, power and transportation to reach a 13% share of renewable energy by 2020. Sectorally, this equates to 20.9% renewable electricity (23 TWh), 11.9% heating and cooling (30 TWh) and 10.14% transport (9 TWh) by 2020.
Vlaanderen in Actie Pact 2020	It is a project aiming to stimulate an innovative, sustainable and social Flanders by 2020. In practice, concrete actions and goals are set in the field of energy, economy, welfare, etc.
Flemish climate policy plan for 2006–2012 (Vlaamse Overheid 2006).	Outlines measures to reduce greenhouse gas emissions by 5.2% between 2008 and 2012 compared to 1990.
Wallonian Climate-Air plan for 2007–2012¹	It contains more than 100 measures to reduce GHG emissions by 7.5% compared to 1990 levels. However, the Climate-Air plan does not explicitly break down the target of 7.5% into sector targets in Wallonia. These measures apply to all sectors including industry, transport, energy, buildings, agriculture, and involve a broad range of actors, such as public authorities, transport and the tertiary sector.
Brussels-Capital Region's Government Agreement 2009–2014	It outlines the main measures to be undertaken by the Government of the Brussels-Capital Region by 2014. According to this agreement, the Brussels-Capital Region plans a 30% reduction of GHG emissions by 2025 (baseline 1990) through the implementation of several measures promoting inter alia energy efficiency and renewable energies. However, the plan does not provide further details on the targets to be reached in each sector.
Brussels-Capital region's action plan (March 2010) in response to Covenant of Mayors (DG TREN)	The Brussels-Capital Region has established an action plan published in March 2010 and outlining the measures to be implemented to achieve emission reductions of 30% by 2025.
Brussels Code for air, climate and energy control (COBRACE) (31 May 2013)²	It integrates air, climate and energy areas in one single regulation and coordinates the different corresponding measures.
Flemish climate programme 2013–2020 (draft 1 February 2013)- Vlaamse Regering 2013	The final plan has not been approved yet (October 2013). The plan comprises two separate but mutually strongly aligned components: The Vlaams Mitigatieplan and the Vlaams Adaptatieplan. The first document aims at reducing the emission of greenhouse gases in Flanders by 15% over the period 2005-2020 (indicative objective). That policy plan reaches beyond the borders of individual domains and each sector should finally take its responsibility and present measures to contribute to the intended objective. The second document proposes policy and measures for each non-ETS sector and assesses their impact on greenhouse gas emissions. If in Flanders a difference persisted between the expected emission reductions and the indicative objective of -15%, the flexibility mechanisms will be employed.
Wallonia Climate Decree (expected)	Wallonia is preparing a Climate Decree which should enable it to meet its commitments to cut total greenhouse gas emission (ETS and non-ETS) by 30% by 2020 and by 80 to 95% by 2050, compared to the 1990 level.
Wallonia Climate-Air plan for 2013 (Expected)	
Regional Sustainable Development Plan for Brussels-capital region (expected)	

¹ <http://airclimat.wallonie.be/spip/Plan-Air-Climat.html>

² <http://www.energiesparen.be/node/3075>

2.2 Bioenergy - Belgium

Policy	Ambitions	Policy Measures	Financial Incentives
Walloon Electricity Decree of 2001³ - revised in 2006 (will be revised again in March 2014)	Measures for reaching 8 TWh of renewable electricity in 2020 in Wallonia region.	New amendments underway are a new Green Certificates (GC) delivery method, and new biomass strategy. Electricity suppliers have to deliver a quota of those GC otherwise they will pay a fine (100€). TSO have the obligation of buyback of the GC in excess (possible integration with tariff). Industrial customers are exonerated of a part of the quota and extra cost of TSO.	A system of Green Certificates will be delivered to green producer in function of cost of technology, CO2 economy, electricity FWD. The cost of the system is charged to end users
Royal Decree of 16th July 2002	Federal establishment of mechanisms to promote electricity generated from renewable energy sources	Owners of installations for the production of electricity from renewable energy sources offshore will be granted green certificates by the CREG (Commission for the Regulation of Electricity and Gas, the federal regulatory body). These green certificates are valid for five years.	-
Decree of 29th March 2007 (Brussels Region)	Quotas fixed for green certificates from 2008 onwards	Electricity suppliers are obliged to prove, by submitting certificates, that a certain statutory and continuously increasing proportion (quota) of the electricity they supply was generated from renewable sources. The minimum price per certificate is guaranteed by statutory law. Green certificates are allocated provided the installation meets several requirements, including attesting to CO2 savings of at least 5% compared with conventional installations.	The number of certificates issued depends on the amount of electricity generated (in kWh) and the amount of CO2 saved. The formula for the calculation of the number of green certificates under 1 MW is the same for all technologies. Above a capacity of 1MW, one certificate is issued for each MWh of electricity produced.
Flemish Energy Decree of 2009	Green certificates (Groenstroomcertificaten) quota system and a certificate trading scheme to support renewable energy technologies (Solar, hydro, biogas, landfill gas, waste combustion, other)	One certificate is equal to 1 MWh of electricity from renewable sources and is issued by the Flemish regulatory authority (VREG). Some caps apply to large volumes supplied.	The energy supplier must pay an administrative fine of €125 for each missing certificate (€118 as of 2013 and €100 after 2013). Green certificates may be sold to the distribution grid operator: 1) For biogas installations: €110 if operating after 31 July 2012 and no other grant is given, otherwise €100 with a guarantee of 10 years, or 20 years for AD of wastes; 2) For waste combustion and landfill gas installations the price is €60 with 10 years guarantee.

³ <http://wallex.wallonie.be/index.php?doc=9075>

Besluit van de Vlaamse Regering houdende algemene bepalingen over het energiebeleid – het Energiebesluit van 19 November 2010			
Resolution for modification of the Flemish Energy Resolution (8th April 2011, 8 July 2011)	Ensures the sustainability of feedstock used for bioenergy production	Modifies the Energy Resolution by introducing sustainability criteria for the liquid biomass and guarantees of origin. To be eligible for green certificates, it is necessary to show that biomass is sustainable according to the criteria and that biomass is not an industrial feedstock.	
Flemish Support for Investment - Support for ecological investments (ecologiesteun) 16 March 2012⁴	A new support scheme for strategic ecology projects involving investments in green-technology can be subsidized		For SMEs, the maximum subsidy is 40% of admissible costs, and 20% maximum for large organisations. The admissible costs vary according to technology, and are 50% for biomass, biogas and CHP generation plants.
Walloon Support for Investment	Investment premium (and exemption from property tax)	Costs vary according to technology.	Subsidy is at most 50% of admissible additional costs and at most 20-30% for large enterprises.
Brussels Support for Investment	The 'energy premiums' supports project promoters in acquiring installations for the production of energy from renewable energy sources.		Scheme provides premiums equivalent to 30% costs for non-PV electricity generation. Collective housing and the industrial sector provides 50% costs towards costs of feasibility studies.
Steunregeling groene warmte (Flemish Green Heat) 2012⁵	Increase the uptake of renewables in heat generation and cooling in Flanders	Provides financial support for residual heat valorisation, the production of useful heating or cooling from biomass and the injection of biogas into the gas grid. Aid is for a new or renewed installation with a thermal output of 1MW. Aid cannot be combined with cogeneration or green certificates. Solid, liquid and gaseous organic-biological substances are eligible except wastes which can be recycled, or wood with industrial markets. A 6 monthly call system will be used to fund plants.	Scheme has an overall budget of €4.4 million in 2012. Up to €6 per MWh is available to applicants, but requests with lowest support needs per MWh will be more highly ranked.

⁴ <http://www.agentschapondernemen.be/download/file/fid/23995>

⁵ <http://www.energiesparen.be/node/3075>

2.3 Biofuels - Belgium

Policy	Ambitions	Policy Measures	Financial Incentives
Tax regulation mechanism (exoneration d'accise pour l'huile de colza) - (Arrêté du 10 Mars 2006)	Rapeseed oil fuel to be totally exempt of excise duty	Subject to the exemption of excise duty are only biofuels from rapeseed oil that 1) shall be used as a biofuel under the code NC 1514, and 2) the natural or legal person producing the rapeseed oil shall sell it to the end consumer without intermediary.	
Tax regulation mechanism (défiscalisation des biocarburants)-10/06/2006 Art. 4 Loi des Finances du 10 Juin 2006)	Encourage the uptake of biofuels in the fossil fuel pool.	It introduces a reduction of the excise rate of biofuels contained in petrol and diesel products and produced by units authorised by the Belgian Government. To that purpose, the Accreditation Commission publishes calls for applications in the official register of the European Union. The accreditation is delivered to the companies for a period of maximum six years However, the maximum eligible amount of biofuels of the authorised production units shall not exceed: For bioethanol: 187,500,000 litres until 30 September 2013. For FAME: 284,000,000 litres until 30 September 2013.	Excise for petrol products containing at least 10% v/v bioethanol: €245.4146 per 1,000 litres; Excise for diesel products containing at least 7% v/v of FAME: €198.3148 per 1,000 litres.
Royal Decree 22/11/2006⁶	Defines the rules for the marketing of biofuels which are not standardised	These rules are valid for diesel containing more than 5% (v/v) of biodiesel, gasoline containing more than 5% (v/v) ethanol, or pure rapeseed oil. It indicates that the exemption decision may be granted for non-standardised biofuels when they are sold from a limited number of parties in the context of a specific project or to the final consumer of rapeseed. Waivers are valid for a period of three years and may be extended for a further period of three years based on a new application. It may be withdrawn in the event of non-compliance with permit conditions.	
Biofuel quota -Royal Decree 22/07/2009 (obligation d'incorporation des biocarburants Art. 4 Loi du 22 Juillet 2009)⁷	Promotes the blending of biofuels into the fossil fuel pool.	The providers of petrol or diesel fuels have to ensure that biofuels make up at least 4 % of the company's total annual sale of fuel. The obligation must be fulfilled by the end of each calendar year. The following rates apply: FAME (fatty acid methyl ester): at least 4% v/v of the diesel amount Bioethanol or Bio-ETBE: at least 4% v/v of the petrol amount.	If a provider fails to fulfil the quota they shall pay a fine amounting to €900 per 1,000 litres of biofuel that was not blended with the annual amount of petrol or diesel products sold.
Royal Decree 26/11/2011⁸ numac 201102435 pub. 07/12/2011	Royal Decree establishing product standards for biofuels	Transposes the sustainability criteria for biofuels from the RED 2009/28/EC and FQD 2009/30/EC and determines which are the sustainability criteria and reporting obligations to be applied to biofuels. The BioFuel database, which will provide a register for biofuels production and declarations of the sustainability of the products, which will begin operation in 2013.	

⁶ http://economie.fgov.be/fr/modules/regulation/arrete_royal/20061122_ar_completant_ar_20050304_relatif_biocarburants.jsp

⁷ http://economie.fgov.be/fr/consommateurs/Energie/Energies_renouvelables/Biocarburants/#.Um_uN1OfiW8

⁸ http://translate.google.be/translate?hl=en&sl=fr&tl=en&u=http%3A%2F%2Fwww.etaamb.be%2Ffr%2Farrete-royal-du-26-novembre-2011_n2011024352.html&anno=2

2.4 Environment - Belgium

	Key Measures/Aims
Law on the protection of surface waters against pollution – 2003 (Loi sur la protection des eaux de surface contre la pollution)⁹	The Act of 26 March 1971 on the protection of surface waters against pollution, following the first version of 1 January 1989 and updated to 12 September 2003. It is composed of 50 items divided into three chapters. The initial section defines certain terms, such as, "public water system", "coastal", "pollution", etc. General Provisions 1) specific for the Flemish Region on the non-priority public sewer provisions (and small sewage treatment facilities) 2) Special provisions for the Flemish Region in pollution charges of water.
Order of the Flemish Government in implementation of Chapter III bis of the Act of 26 March 1971 on the protection of surface waters against pollution – 2007 (Arrêté du Gouvernement flamand portant exécution du chapitre IIIbis de la loi du 26 mars 1971 sur la protection des eaux de surface contre la pollution)¹⁰	It rules the acceptable quality of wastewater that is allowed to discharge in nature, giving specific metrics for common pollutants.
Flemish decree creating the Strategic Advisory Council for Agriculture and Fisheries – 2007 Décret portant création du Conseil consultatif stratégique pour l'Agriculture et la Pêche (Vlaamse Gewest)¹¹	The Council is assigned to: 1) issue opinions, initiative or upon request, 2) contribute, monitor and interpret to development, and 3) advise on the draft decree. For all economic, ecological, social and societal aspects of agriculture, horticulture, rural, and fisheries sectors of Flemish region.
Law on non-navigable water - 2010 (Loi relative aux cours d'eau non navigables)¹²	The law covers the rules on non-navigable water (inland waters; classification/declassification; waterworks; dam). The text is formed by 25 items divided into four chapters: From classification of rivers non-navigable (I) The regular work of cleaning, maintenance and repair (II) Extraordinary improvements or changes (III) General (IV).

General sources:

<http://www.cakmak.av.tr/pdf/Global%20Renewable%20Energy%20Guide%202012.pdf>
http://ec.europa.eu/europe2020/documents/related-document-type/index_en.htm
http://ec.europa.eu/clima/policies/g-gas/progress/docs/be_2013_en.pdf
http://ec.europa.eu/europe2020/pdf/nd/nrp2013_belgium_en.pdf

⁹ http://faolex.fao.org/cgi-bin/faolex.exe?rec_id=011037&database=faolex&search_type=link&table=result&lang=eng&format_name=@ERALL

¹⁰ http://faolex.fao.org/cgi-bin/faolex.exe?rec_id=066666&database=faolex&search_type=link&table=result&lang=eng&format_name=@ERALL

¹¹ http://faolex.fao.org/cgi-bin/faolex.exe?rec_id=066663&database=faolex&search_type=link&table=result&lang=eng&format_name=@ERALL

¹² http://faolex.fao.org/cgi-bin/faolex.exe?rec_id=021203&database=faolex&search_type=link&table=result&lang=eng&format_name=@ERALL

3 EnAlgae policy landscape analysis for France

Landscape analysis of national and regional policies of France that could have an impact in algae cultivation revealed a number of strategies, mandates, and economic incentives on climate change, bioenergy, and water. Although French aquaculture industry is an old and established sector among the EU countries, production of Energetic Algae (or algae for production of fuels and energy) is a new concept in France, and existing bioenergy and environmental strategies were not found to be actively supportive to energetic algae. The only exception to this is a regional policy for Bretagne that aimed at mitigation of environmental nuisance arising from excess wild green algae production in Bretagne coastline. The policy assists regional development and construction of AD projects for green algae. To identify policies that could affect energetic algae, research was focussed on generic biomass, bioenergy and environmental strategies.

Many of the identified national and regional policies in France are in fact response mechanisms to EU-level overarching strategies and targets. Nevertheless, France, like each EU member state, can set its own priorities and strategies in order to reach the EU targets. In regard to national energy targets, France has a primary obligation set in the EU Renewable Energy Directive (RED) to source 23% of energy from renewable sources, including 10% of transport fuels by 2020. In response to RED targets, France plans to source 27% of renewable electricity, 33% of heating and cooling consumption from renewable sources.

Technologies that French policies strategically support to reach renewable targets, include biogas from Anaerobic Digestion (AD) of agricultural and food wastes, and bioelectricity and bioheat from combustion of wood and waste. Regarding waste, France wishes to invest mainly in the development of waste recovery technologies such as AD, and not in landfilling or waste incineration. France envisages positioning itself as the leader in AD technologies among others. Because 50% of solid biomass electricity comes from waste incineration, France wishes to invest further in other bioenergy technologies like AD, biomass power or biomass CHP. Yet AD technologies have strong potential to use algae as biomass feedstock, especially if algae are produced in conjunction with wastewater or flue gas bioremediation.

To reach its targets France has issued several financial schemes for project development and capital investment, like funds for research and development, financial aids for creation of industrial demonstrations, installation or purchase of equipment in domestic and commercial sector, soft loans, etc. Additionally to reach the renewable energy quotas, France has created policies like feed-in tariffs for bioelectricity and bioheat and tax exemptions for biofuels.

For transport biofuels, in order to reach the 10.5% renewable target, biofuels have to be blended with conventional fuels as defined for each fuel type. If the fuel suppliers do not follow the biofuels quota, they will enter in a higher tax-rate for polluting activities (TGAP).

Further on, findings from landscape analysis of French legislation are listed by topic. First are presented the overarching strategies and acts, which are then followed by targeting incentives.

3.1 General Policy Framework - France

Policy	Key Measures/Aims
Grenelle de l'Environnement. Grenelle Environment Law (2009,2010)¹³	The Grenelle Environmental Law is based on the recommendations of the Grenelle Environment Forum, which was to establish France's priorities for sustainable development. There have been two Grenelle laws, the first in 2009 and the second in 2010. One of the recommendations was to increase renewable energies by 50% in 2012 and 120% by 2020. The details of the Grenelle Environment law are summarised in the National action plan for the promotion of renewable energies 2009-2020.
National Renewable Energy Action Plan (2010).¹⁴ (In accordance with Article 4 of European Union Directive 2009/28/EC).	The National Renewable Energy Action Plan (NREAP) envisages an increase in the production of biomass electricity from 3.8 TWh in 2010 to 17.2 TWh in 2020, by doubling solid biomass electricity production (wood and household waste) and tripling biogas electricity production. The incineration of household waste (currently representing more than 50% of solid biomass electricity production) should remain the same; it is therefore wood and biogas that should provide the additional 13.4 TWh. Various incentives and aid schemes have been established towards reaching these targets: financial aid for research and development projects, aid for the creation of industrial demonstrators, aid for the installation or purchase of equipment, soft loans, etc. France intends to position itself as the leader in technologies as diverse as wind power, maritime energies, solar photovoltaics and thermodynamic, the production of biogas units, etc. The National Renewable Energy Action Plan sets a target of the share of renewable energies to be 23% in total, and broken down to 27 % in electricity sector, 33 % in heating/cooling sector, and 10.5 % in transport sector by 2020.
Decree of 15 December 2009 on the multiannual investment program of heat production¹⁵	The multiannual investment program for bringing renewable heat technologies to the market for satisfying heating capacity targets. Strategic technologies are among others: Power (co)generation from biomass (not through biogas): 2300 MW from the date of publication (11 January 2010) of this Order and till December 31, 2020. The development objectives of the heat production from renewable energies in France are as follows, in terms of overall production: For heat produced by cogeneration from biomass: 2,400 ktoe to 31 December 2020. With the renewable share of waste, 900 ktoe to 31 December 2020. For biogas: 555 ktoe by 31 December 2020.
The Waste Action Plan 2009-2012	The priority objectives are foremost source reduction of waste production and the development of recycling and recovery. The plan includes: - 7% reduction in the production of household and similar waste per capita over the next five years, of the order of 1.5 million tons of waste avoided; - Improving the recycling rate of organic matter to 35% in 2012 and 45% in 2015 for household waste and 75% in 2012 for corporate waste and packaging; - Better use of waste to reduce by 15% of the amounts sent to incineration and landfill. Support will be prioritized to waste prevention, for which €195 million for 2009-2011 (or 34% of fund) will be allocated, waste recycling programs will receive €105 million (18%), organic recovery with 18% to €105 million.

¹³ <http://www.developpement-durable.gouv.fr/-Le-Grenelle-de-l-environnement-de-.html>

¹⁴ http://ec.europa.eu/energy/renewables/action_plan_en.htm

¹⁵ http://www.legifrance.gouv.fr/affichTexte.do;jsessionid=B8159E9B779A93928734F471FCDC158D.tpdjo13v_3?cidTexte=JORFTEXT000021645823&dateTexte=20130212

3.2 Bioenergy - France

Policy	Ambitions	Policy Measures	Financial Incentives
Feed-in-tariffs of Renewables Obligation (2011) (Obligation d'Achat des Énergies Renouvelables)¹⁶	Promote the uptake of renewable power.	All the energy suppliers (including the national power supplier EDF) are to get premium tariffs when producing electricity generated by renewable sources of electricity or cogeneration. Both private and public suppliers are eligible for these tariffs. Tariffs vary according to technology used, the origin of biomass, and if additional energy efficiency measures are taken. These renewable energy technologies are not subject to a cap. Except a fixed base rate a premium can be assigned according to criteria of power, resource use and energy efficiency.	Biomass combustion: Fixed rate for 20 years: 4.34 c€/kWh plus a premium of energy efficiency between 7.71 and 12.53 c€/kWh Biogas: Fixed rate for 15 years between 8.121-9.745 c€/kWh depending on the power plus a premium energy efficiency between 0 and 4 c€/kWh Biomethane injected to the grid: A fixed tariff of between 11.19-13.37 c€/kWh for 15 years with a premium of between 0-2.6 c€/kWh for utilisation of livestock effluent and 0-4 c€/kWh for energy efficiency.
Sustainable development Income tax credit 2005-2012^{17, 18} (Crédit d'impôt)	This measure contributes to the achievement of French targets in energy saving and renewable energies in the domestic sector.	The income tax credit is granted to tax payers, who pay expenditure for equipment for their main residence that for increasing energy efficiency and use of renewables. In particular, eligible equipment for production of renewable energy are: heating appliances operating on wood or other biomasses with a maximum capacity of 300 MW, equipment for the production of electricity operating on biomass. Plants that generate more than 3 kW are eligible only if the electricity consumption of the building is higher than half of the nominal installed capacity. The tax credit was valid until 2012. However, it is extended until 2015 for installations carried out in buildings completed before two years ago.	End-users that install renewable energy plants at their principal residence may claim 32% of the net hardware costs from tax. The ceiling for eligible expenditure, fixed at €8,000 for a single person and €16,000 for couples subject to joint taxation, plus €400 per dependant.
Reduced VAT rate^{19, 20}	This measure contributes to the achievement of the French targets in energy saving and renewable energies in the domestic sector.	Aimed for funding work on residential buildings that are more than 2 years old, for purchasing and setting up electricity and heat production equipment in the existing residential sector, e.g. biomass plants. The following renewable energy technologies are eligible: boilers, heat pumps, fireplace inserts, wood-burning stoves, solar water heaters	On the French mainland and in Corsica, the reduced VAT rate is 7%. In the overseas departments and regions of Guadeloupe, Martinique and Réunion, the VAT amounts to 2.10% (Art. 296, Code general des Impôts)

¹⁶ <http://www.developpement-durable.gouv.fr/Les-tarifs-d-achat-de-l,12195.html>

¹⁷ <http://www.res-legal.eu/search-by-country/france/single/s/res-e/t/promotion/aid/tax-regulation-mechanisms-i-credit-dimpot/lastp/131/>

¹⁸ <http://www.res-legal.eu/search-by-country/france/single/s/res-hc/t/promotion/aid/tax-regulation-mechanism-credit-dimpot-developpement-durable/lastp/131/>

¹⁹ <http://www.res-legal.eu/search-by-country/france/single/s/res-e/t/promotion/aid/tax-regulation-mechanisms-ii-value-added-tax-reduction/lastp/131/>

²⁰ <http://www.res-legal.eu/search-by-country/france/single/s/res-hc/t/promotion/aid/tax-regulation-mechanisms-ii-value-added-tax-reduction-1/lastp/131/>

Zero percent-interest loan (Éco-prêt à taux zéro) 2009²¹	Renewable heating and/or hot water (bioenergy/wood heating). It allows the financing of work aiming at improving the energy performance of the housing built before 1990	One of the conditions in order to benefit from the loan is to carry out the installation of a heating plant or of a sanitary hot water system using biomass. Only one loan can be granted per housing unit.	The amount of the zero percent-interest loan equals the amount of the costs of the works undertaken and shall not exceed: <ul style="list-style-type: none"> • €20,000 if two categories of work are carried out and with reimbursement within 10 years. • €30,000 if at least three categories of work are carried out and with reimbursement within 15 years.
Tenders (Appels d'offres)^{22 23}	Promotion of production of electricity from renewables	A promotional tariff may be awarded to the winners of tenders for the construction of renewable energy plants (biomass and biogas among others). Tenders are invited at irregular intervals to reach the target production of electricity from renewable sources, which is specified in the multi-annual investment plan (PPI). The calls for tenders are published in the official gazette of the European Union.	The actual payment to be awarded is calculated in accordance with the successful tenderer's finance plan.
The Heat Fund Biomass 2008 (Fonds Chaleur)^{24 25}	Support between 2009 and 2020 the production of renewable heat up to 5.5 Mtoe, or more than a quarter of the renewable energy production target set by the Grenelle Environment Forum.	€1.2 bn fund between 2009-2013 is available for the development of large scale projects (over 1,000 toe/yr) for production of heat in services, agriculture, and industrial sectors through biomass plants.	The payment to be awarded is calculated in accordance with the successful tenderer's finance plan and with consideration of the relation between the amount of support asked for and the amount of renewable heat produced.

²¹ <http://www.res-legal.eu/search-by-country/france/single/s/res-hc/t/promotion/aid/loan-eco-pret-a-taux-zero/lastp/131/>

²² <http://www.res-legal.eu/search-by-country/france/single/s/res-e/t/promotion/aid/tenders-appels-doffres/lastp/131/>

²³ <http://www.cre.fr/documents/appels-d-offres>

²⁴ <http://www2.ademe.fr/servlet/KBaseShow?sort=-1&cid=96&m=3&catid=25160>

²⁵ <http://www.developpement-durable.gouv.fr/Presentation-generale,25027.html>

Purchase of Injected Biogas (2010) ²⁶	Aims to increase biomethane injection into the grid stimulating heat, electricity and biofuels production.	<p>€200M per year has been set aside for 2020. Gas suppliers premium tariffs for biomethane injected into natural gas grids:</p> <ul style="list-style-type: none"> - For installations of less than 12 MWe cogeneration, there are feed-in tariffs regulated. - Facilities that produce biomethane and inject into the network can by November 2011 purchase a guaranteed tariff. - For installations combining cogeneration and injection, there is a purchase price, called price "double recovery." - Separate aid that is fixed at the territorial level: Funding supplement, if necessary, for biogas projects and project guidance to the most attractive valuations. 	<p>Tariffs depend on installation size and feedstock used to produce the biomethane.</p> <p>Non-hazardous waste facilities may purchase rates for injected biomethane between 4.5 and 9.5 c€/kWh depending on the size of the installation.</p> <p>Other biogas plants' purchase rates of injected biomethane consist of a base rate between 6.4-9.5 c€/kWh depending on the size of the facility, which may be added a premium calculated according to the nature of the feedstock (input) processed by anaerobic digestion used. This premium is between 2-3 c€/kWh, if the input is waste products from agriculture or agribusiness, or it is 0.5 c€/kWh, if the input household waste.</p> <p>When inputs are "mixed" (co-digestion), the premium is weighted prorated amounts of inputs used by the installation.</p>
Energy Performance Plan for farms (EPP) - Plan de Performance Énergétique (PPE) ²⁷ 2009-2013	Reduction of GHG emissions from farms through increase of energy generation on farm from renewables and reduction (direct and indirect) of energy consumption, so that 30% of agricultural enterprises should be low energy by 2013.	The area 5 of the program that promotes the production of renewable energy provides for aid for investments for the installation of solar water heaters, biomass boilers, thermal exchangers and heat pumps, and for AD units and equipment linked to the production of electricity on an isolated site not connected to the network, or linked to the production of electricity on an isolated site not connected to the network.	<p>Investment in AD units is limited to €500,000.</p> <p>The energy performance plan has a budget for 2009 of €35 million. A further €7 million was released for AD projects in 2010.</p>
Support plan for waste policies (ADEME) for the development of methanisation facilities	In line with the priorities of the Grenelle Environment Forum to move from landfills of wastes towards material and organic recycling: From 24% of household and similar waste to 35% in 2012, and then to 45% in 2015.	<p>Support for AD projects is provided in particular through evaluation of existing units, in particular by their environmental, energy and sanitary performance, and by technical and financial support for operations exemplifying the methanisation of biowaste or agricultural effluent.</p> <p>Only the "biogas production" aspect will be taken into account in the aid assessment (not the recovery of biogas).</p>	In this context, AD equipment may benefit from an aid of 30% maximum, calculated from an assessment basis of the amount of the operation with a ceiling of € 10 million before tax.

²⁶ <http://www.developpement-durable.gouv.fr/Dispositif-de-soutien-a-la-filiere>

²⁷ <http://agriculture.gouv.fr/plan-performance-energetique-des>

3.3 Biofuels - France

Policy	Ambitions	Policy Measures	Financial Incentives
The partial tax exemption for biofuels in France - 'La Defiscalisation Partielle des Biocarburants' 2011-2015²⁸	Increase the proportion of renewable transport fuels in the transport fuel pool by stimulating the market for biofuels.	Ethanol in gasoline incorporated in pure form of ETBE and vegetable oil methyl esters (FAME) in diesel receive benefits through a reduction of taxation. Since 2006, the ethyl esters of vegetable oils (VOEE), the methyl esters of animal oils (EMHA), the methyl esters of waste oils (EMHU) and synthetic biodiesel also benefit from a tax exemption too. Biofuels must confirm to the EU Renewable Energy Directive rules on biofuel GHG and sustainability, including GHG savings of 35% compared to fossil fuel equivalents.	The level of tax reduction varies by fuel and has decreased gradually since 2007. In 2012 and 2013, tax reductions are as follows: ETBE, ethanol and vegetable oil derived FAME have a tax reduction of €14 per hectolitre (100 litre). Biodiesel, hydrogenated vegetable oil, FAME from animal oils and FAME from used cooking oils have a tax reduction of €8 per hectolitre.
Biofuel quota (reduction of the tax on polluting activities (réduction de la taxe générale sur les activités polluantes))³⁰	The national biofuels development plan has set a target of 10% of biofuels in the total fossil fuels production by 2015.	In France, energy products are subjected to a tax on polluting activities, called TGAP (Taxe Générale sur les Activités Polluantes). The quota of biofuels to be blended within conventional fuels is defined for each fuel type.	In case companies are supplying fuel for consumption and do not respect the biofuels quota, they are submitted to a higher rate of the tax on polluting activities (TGAP). The increased rate of TGAP, which amounts to 7% since 2010, is reduced according to the proportion of biofuels contained in the fuel sold. The TGAP on fuels amounts to between €17.29-63.96 according to the fuel type.

²⁸ <http://www.developpement-durable.gouv.fr/La-defiscalisation-partielle-des.html>

²⁹ <http://ldhcibp.wordpress.com/2012/10/10/agrocarburants-le-cadeau-de-54-millions-deuros-au-president-de-la-fnsea/>

³⁰ <http://www.res-legal.eu/search-by-country/france/single/s/res-t/t/promotion/aid/biofuel-quota-reduction-of-the-tax-on-polluting-activities-reduction-de-la-taxe-generale-sur-le/lastp/131/>

3.4 Aquaculture/Wastewater - France

Policy	Ambitions	Policy Measures	Financial Incentives
Assainissement Collectif	Rural wastewater sanitation systems	Any French township of more than 2,000 inhabitants has an obligation to have a municipal waste water treatment plant. Below that number, it is a choice. Many small villages will remain with only a small municipal plant for the village centre and the remainder will be private systems.	
'Plan to Fight Green Algae' (Plan de Lutte Contre les Algues Vertes) 2010-2015 31, 32.	Mitigate the nuisance of green algae washed up on beaches of Bretagne (in 2015 reduce flow of nitrates from 30 to at least 40% compare to 2010) Part of the project aims to establish AD plants which should be developed in the next 3 years.	This programme runs from 2011-2015 and encompasses a raft of measures to reduce nuisance of algae on beaches in Brittany, including research on how green algae grow, analysis of environmental and health risks, support for collection of algae, targets to reduce nitrogen fertilizer use by 30% by 2015 and 60% by 2027 in affected watersheds and infrastructure development to use the algae. AD is supported as a route to generate energy and provide a digestate product which can be used in place of nitrogen fertiliser. The aim is to replace 50% of mineral fertilisers in affected watersheds by digestate between 2010 and 2015. AD of wastes including animal waste, and residual grain is in the plan.	State participation in the program: <ul style="list-style-type: none"> • Knowledge: €200,000 (50%) • Collection: maximum €700,000 (50%) • Experimentation: € 140,000 (30%) • Treatment: platforms (3) €8M (80%) • Operation in 2010: €500,000 (50%) • Methanation conditions to assist twenty projects • Agricultural measures: €16M / year for 5 years. The 2nd call for proposals was in 2012 had a total fund of €4M for development of AD plants. This funding is limited to those localities most affected by green algae.

³¹ <http://www.ademe.fr/bretagne/upload/communiqu/fichier/147fichier.pdf>

³² http://agriculture.gouv.fr/IMG/pdf/plan_lutte_contre_les_algues_vertes_0.pdf

4 EnAlgae policy landscape analysis for Germany

Landscaping of national policies of Germany that can have an impact in algae cultivation revealed a number of strategies, mandates, and economic incentives for biomass energy and bioeconomy. 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 Germany's federal policies that could stimulate investment for algae cultivation.

Production of Energetic Algae (or algae for production of fuels and energy) is a concept currently under development in Germany, and the majority of existing bioenergy and environmental strategies were not found to be actively supportive to energetic algae. The only exception was the national Bioeconomy strategy (2014) that made a clear reference to algae as important marine biomass species for production of biofuels (biomethane and biokerosene). To identify other policies that could affect energetic algae, research was focussed on generic biomass, bioenergy and environmental strategies. Such an example is the National Biomass Action Plan (2009) that encouraged exploitation of unused biomass potentials for energy production, especially those that do not have competitive market uses. Algae clearly fall in this category.

With regard to energy targets, Germany has a primary obligation set in the EU Renewable Energy Directive (RED) to source 19.6% of its energy use from renewables by 2020, including 10% in the transport sector. In response to RED targets, Germany plans to source 38.6% of electricity, 15.5% of heat consumption from renewable sources. In a national level, Germany has developed a strategic framework for building a competitive biobased economy by 2030. Because biomass refining was identified as a strategic pathway for German bioeconomy to reach its targets, a Biorefinery Action Plan was set in 2012. Advanced bioenergy technologies that German policies strategically support, for reducing their emissions and increasing the share of renewables in the energy mix, are primarily biogas, biomethane, and biomass Combined Heat and Power (bio-CHP), and transport biofuels among others. Yet energy technologies for transport biofuel have strong potential to use algae as biomass feedstocks.

Germany plans to support all these strategic energy technologies by providing financial support, and underpinning technology development. Uptake of strategic energy technologies is supported mainly by feed-in tariffs schemes, secured loans, and subsidies.

Critical eligibility criterion for government funding is the compliance with binding sustainability criteria of advanced energy technologies. Since 2010 in order to claim any form of government funding, the energy producers need to provide sustainability certificates for their products (electricity, heat, or fuels). These certificates can be issued by private certification bodies.

In this context, recovery and use of bioheat produced during burning biomass, biogas, or biomethane is very important efficiency aspect and in many cases was identified as a requirement for government financial support (tariffs, subsidies).

In the following section, findings from landscape analysis of German legislation are listed by topic. First are presented the overarching strategies and acts, which are then followed by targeting incentives.

4.1 General Policy Framework - Germany

Policy	Key Measures/Aims
National Renewable Energy Action Plan³³	Germany is obliged to meet an overall target of 19.6% energy from renewable sources by 2020, which is broken down into 38.6% of electricity, 15.5% of heat, and 10% in the transport sector. Germany also has to develop its own Action plan, which outlines, how this goal can be achieved.
National Biomass Action Plan for Germany³⁴2009	This Biomass Action Plan sets out the potential for the use of biomass in Germany, quantifies the biomass share in meeting current demand and identifies available reserves. It also describes the German government's strategies towards promoting bioenergy use in the heating, electricity and fuel sectors, and the measures it intends to take in implementing them. This includes: increased production of heat from biomass, exploitation of unused biomass potentials, reduction/ avoidance of competition of uses, sustainability of biomass production, regulations of biomass imports, increased feeding of bio-methane into natural gas grids, reduction of GHG emissions for biofuels. With this plan the Federal Government is supporting the EU Commission which, in its Biomass Action Plan published in 2005, called upon the EU member states to draw up national action plans for the energy use of biomass.
National Research Strategy BioEconomy 2030³⁵2010	With the "National Research Strategy BioEconomy 2030", the Federal Government is laying the foundation for realizing a vision of a sustainable bio-based economy by 2030 which produces sufficient healthy food to feed the world and supplies quality products made from renewable resources. The Federal Government pursues the aim of harnessing research and innovation to facilitate a structural transition from an oil-based to a bio-based industry which will also offer great opportunities for growth and employment. The research strategy therefore sets five priorities to continue to develop Germany into a knowledge-based, internationally competitive bioeconomy: global food security, sustainable agricultural production, healthy and safe food, industrial use of renewable resources and biomass-based energy sources.
Renewable Energy Heat Act (EEWärmeG)³⁶³⁷ (2009, last amended 2011)	Renewable Energies Heat Act aims to increase the share of renewable energies in heat provision to 14% by 2020. The Act makes the use of renewable energy for space and hot water heating mandatory for new buildings. It also stipulates budget requirements to this end for the Market Stimulation Programme. After the amendment the Act stipulates to use a share of renewable heat or cold, also for existing public buildings undergoing major renovations. New buildings are obliged by the EEWärmeG to use a certain percentage of renewable energy for heating purposes (water and space heating). ³⁸ The minimum percentage depends on the renewable energy technology used, as follows: -Gaseous biomass: 30% (under certain restrictions); -Other biomass installations, use of liquid biomass, ambient heat: 50%. The Federation shall provide need-based funding for the utilisation of renewable energies for the generation of heat and cold of up to 500 million euro per year between 2009 and 2012.

³³ http://ec.europa.eu/energy/renewables/action_plan_en.htm

³⁴ [http://www.erneuerbare-energien.de/unser-service/mediathek/downloads/detailansicht/artikel/bmu-broschuere-nationaler-biomasseaktionsplan-fuer-deutschland-beitrag-der-biomasse-fuer-eine-nachhaltige-energieversorgung/?tx_ttnews\[backPid\]=89](http://www.erneuerbare-energien.de/unser-service/mediathek/downloads/detailansicht/artikel/bmu-broschuere-nationaler-biomasseaktionsplan-fuer-deutschland-beitrag-der-biomasse-fuer-eine-nachhaltige-energieversorgung/?tx_ttnews[backPid]=89)

³⁵ <http://www.bmbf.de/de/1024.php> , <http://www.bmbf.de/pub/biooekonomie.pdf>

³⁶ http://www.gesetze-im-internet.de/bundesrecht/eew_rmeg/gesamt.pdf

³⁷ http://www.bmub.bund.de/fileadmin/bmu-import/files/english/pdf/application/pdf/ee_waerme_2010_en.pdf

³⁸ Renewable Energy Heat Act: <http://www.iea.org/textbase/pm/?mode=re&id=4168&action=detail>

German Roadmap Biorefinery²⁰¹²	It is published by Federal Ministry for Food, Agriculture and Consumer Protection, Federal Ministry for Education and Research, Federal Ministry for Environment, Federal Ministry for Economy. This roadmap outlines the strategy for development and implementation of the biorefinery concept until 2030. It describes the most important biomass value-chains in the context of biorefineries, highlights the research and development needs, pays attention to expected economic results of different biorefinery concepts and summarises the political framework and sustainability aspects that influence this development. The algae lipid biorefinery is one of the described biorefinery concepts.
Biomass Ordinance (BiomasseV)³⁹ (2001, 2012)	This ordinance defines the scope of the Renewable Energy Act in regard to: Clear definition of the “biomass” considered in the EEG For which biomass-application there is a financial incentive Energetic reference values Technical requirements for electricity production from biomass Sustainability requirements for production of electricity from biomass
National Policy Strategy – Bioeconomy⁴⁰ (2014)	It sets priorities for advancing towards a knowledge-based bioeconomy and it highlights areas that require action. The aim is for the guiding principles, strategic approaches and measures to contribute to making use of the areas of potential for the bioeconomy in Germany, and also help to strengthen the structural transition to a biobased economy. The strategic approaches are to be further developed to match the long-term goals and to adapt to new challenges. The degree of success achieved by the strategy is to be examined in a Progress Report. The strategy highlights the potential of algae species for the production of food, platform and fine chemicals, as well as biofuels (such as biomethane through AD and biokerosene, through hydrothermal conversion) and bioenergy (CHP), while it reduces the land competition with terrestrial biomasses.

³⁹ Biomass Ordinance: <http://www.gesetze-im-internet.de/bundesrecht/biomassev/gesamt.pdf>

⁴⁰ http://www.bmel.de/SharedDocs/Downloads/EN/Publications/NatPolicyStrategyBioeconomy.pdf?__blob=publicationFile

4.2 Bioenergy - Germany

Policy	Key Measures/Aims	Mechanism	Financial Incentives
Biomass Power Sustainability Ordinance (BioSt-NachV)⁴¹ (2009/2010)	This ordinance is intended to ensure that all biomass used for electric power generation and heating is produced in compliance with binding sustainability criteria.	As of 1 January 2010 eligibility (with regard to bioliquids) for basic tariff pursuant to the EEG will be tied to documentation of compliance with the defined sustainability requirements. Relevant monitoring is carried out by private certification bodies.	Proof of sustainability will, from 1 January 2010, be a necessary prerequisite to receive the basic remuneration and bonuses under the Renewable Energies Act (Erneuerbare-Energien-Gesetz - EEG). Consequently, bioliquids that are produced in non-sustainable ways will in future no longer be eligible for the pertinent payment framework under the EEG.
Renewable Energy Sources Act (EEG) (2009, last amended 2012)^{42,43,44}	The act aims to increase the proportion of electricity from renewable energy sources in total energy supply from at least 35% in 2020 to at least 80% by 2050 and to integrate these quantities of electricity in the electricity supply system.	The most important measure to promote electricity from renewable sources is the <u>feed-in tariff</u> . The tariff levels will decrease every year to provide an incentive to reduce costs through technological innovation. New plants will receive the tariff level applicable on the day they are put into operation, and this tariff level will apply for the entire payment period, i.e. for 20 years. In regard to the use of biomass, it includes electricity from biogas, biomethane and solid biomass CHP. Capacity limits: Electricity generated by a biomass plant put into operation after 31 December 2013 will be eligible only if the installed capacity does not exceed 750 kW. Generators will receive the full tariff only if a certain percentage (usually 60% for biomethane plants and 100% for biowaste plants) is generated by CHP, or if the amount of manure used to produce the biogas is at least 60 mass percent. Liquid biomass is ineligible for the biomass feed-in tariff.	The amount of tariff for a given plant is the tariff level as defined by law minus the degression rate, which depends on the year in which the plant was put into operation. Biomass FiT: 6–14.3 €ct per kWh (according to plant size), plus (if applicable) bonus of 2.5 – 8 €ct per kWh for use of special substances. Biogas from biomass: 6–25€ct per kWh (according to plant size and fuel).

⁴¹ <http://www.gesetze-im-internet.de/bundesrecht/biost-nachv/gesamt.pdf>

⁴² <http://res-legal.de/en/search-for-countries/germany/legal-source/land/deutschland/instrument/premium-tarif-gruener-bonus/ueberblick/rechtsquelle.html?bmu%5BlastPid%5D=43&bmu%5BlastShow%5D=1&bmu%5BlastUid%5D=33&cHash=4f104238b52d37f1cf211fb4f83cf298>

⁴³ <http://international.fnr.de/renewable-resources/legal-framework/the-renewable-energy-sources-act-eeq/>

⁴⁴ <http://www.res-legal.eu/search-by-country/germany/single/s/res-e/t/promotion/aid/feed-in-tariff-eeq-feed-in-tariff/lastp/135/>

Premium tariff I (market premium)⁴⁵	The act aims to increase the proportion of electricity from renewable energy sources in total energy supply from at least 35% in 2020 to at least 80% by 2050 and to integrate these quantities of electricity in the electricity supply system.	Instead of receiving the feed-in tariff for electricity from renewable sources, a plant operator may choose to sell his electricity directly, and claim the so-called market premium from the grid operator. The amount of the market premium shall be calculated each month. Biogas, biomethane, and biomass are eligible. The following restrictions apply: Electricity from biomethane is eligible only if generated by CHP. Liquid biomass is ineligible for the tariff. No maximum capacity for large biogas plants. Unlike the feed-in tariff, the market premium will still be available for large biogas plants (capacity > 750 kW) put into operation after 31 December 2013.	The amount of the market premium is calculated every calendar month and includes the following elements: 1. The difference between the feed-in tariff for the specific technology as set out in the EEG and the average stock market price, which is calculated every month ex post and corrected by a factor reflecting the stock market value of the specific technology. 2. On top of the market premium, eligible plant operators receive a so-called management premium which covers the costs for variations of the actual grid exports compared to the forecast and for stock market participation.
Premium tariff II (Flexibility premium)⁴⁶	On-demand renewable electricity (not regular) from biogas is supported from this premium scheme. This premium may be received on top of and separately from the market premium and only for biogas.	The flexibility premium shall be paid for a period of ten years. Eligibility criteria are as for Premium tariff I plus: All electricity generated by a plant shall be sold directly for the purpose of claiming the market premium or for other purposes. Plants shall be equipped with technical devices that enable the grid operator to increase and reduce output by remote means at any time. The rated annual capacity of a plant shall amount to at least 0.2 times the installed capacity of the plant.	The amount of the flexibility premium is calculated every calendar year.
Loan (KfW Financing Initiative Energiewende)⁴⁷	Support investments on purchasing and setting up renewable electricity projects.	The KfW Financing Initiative Energiewende gives low interest loans for investments in installations for electricity production from biomass and biogas in accordance with the EEG. It is a long-term loan with an interest period of up to 20 years including a repayment-free start-up period of maximum 3 years. The plant operator or investor signs a contract with the bank (Hausbank) specifying the terms of contract.	The credit amount may vary between minimum EUR 25 million and maximum EUR 100 million for the investment project covering up to 50% of the investment costs in case of direct credits granted by a consortium of banks which the KfW is part of. The terms and conditions of the loan including interest rates for direct credits depend on the terms agreed. Interest rates are fixed over 10 years. For loans exceeding 10 years, the interest rate will be redefined after 10 years. Commitment fees amount to 0.25% per month.

⁴⁵ <http://www.res-legal.eu/search-by-country/germany/single/s/res-e/t/promotion/aid/premium-tariff-i-market-premium/lastp/135/>

⁴⁶ <http://www.res-legal.eu/search-by-country/germany/single/s/res-e/t/promotion/aid/premium-tariff-ii-flexibility-premium/lastp/135/>

⁴⁷ <http://www.res-legal.eu/search-by-country/germany/single/s/res-e/t/promotion/aid/loan-kfw-financing-initiative-energiewende/lastp/135/>

Loan (KfW Renewable Energy Programme – Standard)⁴⁸	Support investments on purchasing and setting up renewable electricity projects (biomass and biogas).	Biomass or biogas plants erected abroad are eligible for the loan if they are constructed close to the German border and thus, indirectly have an impact on the improvement of the environment in Germany, or if the investment is done abroad by a German company. It is a long-term and low-interest loan (effective interest rate of 1.0% per year) with a fixed interest period of 5 or 10 years including a repayment-free start-up period (KfW Renewable Energy Programme Standard).	Up to 100% of the investment costs eligible for financing (without VAT), however, not more than EUR 25 million per plant/project. It is a long-term and low-interest loan with a fixed interest period of 5 or 10 years including a repayment-free start-up period. A fixed interest period of up to 20 years can be granted.
Loan (KfW Renewable Energy Programme-Premium)⁴⁹	KfW provides low-interest loans and grant repayment support	KfW provides low-interest loans with grant payback support for the development and expansion of heat installations/plants. The installations need to be erected in Germany and have to be operating for at least 7 years. A combination with other support is not possible, if not otherwise stated. Eligible projects can be: Plants for the purification of biogas to natural gas quality and biogas pipelines for non-purified biogas. Plants with automatic feeding for the burning of solid biomass for thermal use >100 kW nominal heat output including hot water storage. CHP using solid biomass including buffer storage	Biomass plants with automatic feeding grant repayment of €20 per kW installed nominal heat output, max. €50,000 per plant. Innovation support can be granted in case of: 1) additional hot water storage capacity (€ 30 per kW installed nominal heat output) or 2) extra low emission (€ 40 per kW installed nominal heat output). Both support schemes can be cumulated; however, the maximum support is € 100,000 per plant. CHP with a maximum nominal heat output ≤ 2000 kW receive €40 per kW if electrical efficiency is >10% and overall efficiency is >70%. Biogas pipelines for biogas that has not been purified to biomethane with a length of 300m including gas compressors etc. are supported for up to 30% of eligible net investment costs.

⁴⁸ <http://www.res-legal.eu/search-by-country/germany/single/s/res-e/t/promotion/aid/loan-kfw-renewable-energy-programme-standard/lastp/135/>

⁴⁹ <http://www.res-legal.eu/search-by-country/germany/single/s/res-hc/t/promotion/aid/loan-kfw-low-interest-loan/lastp/135/>

Subsidy (Investment Support, BAFA)⁵⁰	<p>Provides investment support is given for heat produced in existing buildings.</p>	<p>Installations in new buildings are only eligible if process heat is used. The investment support is divided into basic support, bonus support and innovation support. Installations need to be erected in Germany and have to be operating for at least 7 years. A combination with other support schemes is possible.</p> <p>The following technologies are supported:</p> <p>Plants with automatic feeding for the burning of solid biomass for thermal usage ≤ 100 kW nominal heat output.</p> <p>Low emission logwood boilers ≤ 100 kW nominal heat output</p> <p>Secondary measures for emission reduction and efficiency of plants with ≤ 100 kW nominal heat output.</p>	<p>Basic support:</p> <p>Plants with a capacity between 5kW – 100kW using wood pellets: € 36 per kW installed capacity at least: € 1,400 pellet boilers with water bag; € 2,400 pellet boiler; € 2,900 pellet boiler with new buffer storage volume of at least 30 l / kW</p> <p>- Plants with a capacity between 5kW – 100kW (with buffer storage volume of at least 30 l / kW) using wood chips: € 1,400 per plant</p> <p>Low emission logwood boilers with a capacity between 5kW – 100kW: € 1,400 per installation</p> <p>Bonus:</p> <p>Efficiency bonus is 0.5 times the basic support but only for Installations with a capacity between 5kW – 100kW using wood pellets. In case of simultaneous installation of solar collectors the bonus support of € 500 is granted.</p> <p>Innovation support:</p> <p>Installation or retrofitting firing solid biomass with < 100 kW nominal heat output: €750 and for newly erected installations €850.</p>
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⁵⁰ <http://www.res-legal.eu/search-by-country/germany/single/s/res-hc/t/promotion/aid/subsidy-investment-support/lastp/135/>

4.3 Biofuels - Germany

Policy	Aim	Mechanism	Financial Incentives
Biofuels Sustainability Ordinance (Biokraft-NAchV)⁵¹	According to the ordinance, all biofuels must comply with the binding sustainability criteria, as of January 2011.	The biofuels must be certified by accredited institutions. It must be proven that all sustainability requirements have been met in the entire production process (including GHG reduction of 35% compared with fossil-based equivalent)	Biofuels that do not fulfil the sustainability standards cannot profit from tax reduction or biofuel quota
Biofuel quota act (BioKraft QuG)^{52,53} (2007)	It is order and regulation of admixture of biofuels to (fossil-based) transportation fuels. By 2015, emissions have to be reduced by 3%, by 4,5% from 2017 on and by 7% from 2020 onwards. From 2015, a greenhouse gas reduction quota will replace the biofuel quota.	The mechanism obliges companies importing or producing petrol, gas or diesel fuels to ensure that biofuels make up a defined percentage of the company's total annual sale of fuel. Obligated fuel suppliers may assign this obligation to other companies. The minimum share of biofuel can be fulfilled by: blending biofuel with diesel fuel (share of 4.4% until 31.12.2014) or gasoline (share of 2.8% until 2014), circulating pure biofuel, adding biomethane to natural gas fuel. The minimum share of biofuels as part of the total volume of diesel and gasoline (overall quota) shall be 6.25% until 2014. From 2015, a greenhouse gas reduction quota will be introduced, where the allowed share of greenhouse gases discharged from diesel and gasoline is being reduced in form of a quota, meaning that the usage of biofuel is only indirectly stimulated.	If a provider fails to fulfil the quota a penalty is charged based on the amount of biofuel that has been missed. The amount of the penalty varies, depending on whether the provider was supposed to replace diesel-fuel or petrol-fuel. For the gasoline quota, the fine is € 43 per gigajoule, for diesel and the overall quota the fine is €19 per gigajoule.
Tax regulation mechanism (Reduced tax rate for biofuels)	The tax relief for biofuels varies depending on the type of biofuel and is only granted if the produced biofuel does not fall under the biofuel quota obligation.	Conventional biofuels (biodiesel, vegetable oil fuel) are eligible for proportional tax redemption until end of 2012. Second generation biofuels, biogas, bioethanol fuel (E85) are tax deductible until 2015. Pure fuels exempted from this rule are: Synthetic hydrocarbons or synthetic hydrocarbon mixtures which are obtained by thermochemical conversion of biomass. Alcohols that have been produced through biotechnological processes to reveal cellulose.	According to the Biofuel Quota Authority, the tax relief is calculated as the difference between the amount of tax set out in §2 EnergieStG and the eligible relief. Tax relief is granted only in case of pure biofuels containing the following substances: 1) fatty acid methyl ester (1000 l): €21.40 2) vegetable oil (1000 l): €21.40

⁵¹ <http://www.gesetze-im-internet.de/bundesrecht/biokraft-nachv/gesamt.pdf>

⁵² http://www.zoll.de/DE/Fachthemen/Steuern/Verbrauchssteuern/Energie/Besonderheiten/Biokraftstoffquote/Allgemeines/Biokraftstoffquotengesetz/biokraftstoffquotengesetz_node.html

⁵³ <http://www.res-legal.eu/search-by-country/germany/single/s/res-tt/promotion/aid/biofuel-quota-3/lastp/135/>

5 EnAlgae policy landscape analysis for Ireland

Landscaping of national policies of Ireland that can have an impact in algae cultivation revealed a number of strategies, mandates, and economic incentives for biomass energy and green economy. 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.

The Irish market has a long history is harvesting wild seaweed and using it for production of food, feed, and products for many decades. Production of Energetic Algae (or algae for production of fuels and energy) is a concept under development in Ireland. Yet seaweed is considered a strategic marine biomass resource. For example, In Harnessing Our Ocean Wealth Plan (2012), seaweed is highlighted as an important resource for production of a variety of market products like food and bioproducts and bioenergy, and the Irish Government plans to strategically support algae R&D and algae business creation nationwide. Nevertheless, apart from this strategy, the grand majority of existing bioenergy and environmental strategies were not found to be actively supportive to energetic algae. To identify policies that could affect energetic algae, research was focussed on generic biomass, bioenergy and environmental strategies.

With regard to energy targets, Ireland has a primary obligation set in the EU Renewable Energy Directive (RED) to source 16% of its energy use from renewables by 2020, including 10% of transport. In response to RED targets, Ireland plans to source 42.5% of electricity and 12% of heating and cooling energy consumption from renewable sources. Ireland sees renewable energies as a part of an overarching Green Economy development strategy. Main targets in Irish policy are reduction of GHG emissions, increasing the share of renewables in the energy mix and job creation. For reaching these three targets Ireland strategically supports innovation and technology uptake activities for anaerobic digestion, biomass CHP, biomass combustion, biomass co-firing, and transport biofuels, as well as technologies that increase energy efficiency, and recover waste and wastewater. All these energy technologies have strong potential to integrate with algae at many levels.

Ireland plans to support all these strategic energy technologies by providing financial support to new investment, funding R&D, and incubating clusterization of industries, with universities, and public organizations among other measures. Further on, uptake of strategic energy technologies is supported mainly by feed-in tariffs schemes, green certificates, tax regulations, and mandated quotas.

In the case of green transport, biofuel quotas are eligible to purchase tradable green certificates. When biofuels are produced from biodegradable waste, residue, non-food cellulosic material, lignocellulosic material, or algae, the volume of biofuel counts as double and thereby receives double financial support.

In the following section findings from landscape analysis of Ireland legislation are listed by topic. First presented are the overarching strategies and acts, which are then followed by targeted incentives.

5.1 General Policy Framework – Ireland

Policy	Key Measures/Aims
Sustainable development – A strategy for Ireland⁵⁴ 1997	The principal purpose of the Strategy is to provide a comprehensive analysis and framework, which will allow sustainable development to be taken forward more systematically in Ireland. It considers forestry, marine environment, industry, energy, transport and tourism.
Bioenergy Action Plan 2007⁵⁵	The bioenergy action plan outlines a range of measures, across a number of relevant government departments, introduced or to be introduced, in order to increase the uptake of renewable energy in Ireland. Measures include, for the electricity sector, setting a target of 33% renewable electricity by 2020, expanding the REFIT scheme to ensure 30% co-firing in peat power stations by 2015 and extending the REFIT scheme to facilitate waste to energy projects. For the transport sector, a biofuel target of 5.75% was set for 2010, and 10% for 2020. A biofuel obligation scheme was planned to help deliver 2010 and 2020 targets. A target of 5% renewables in the heating sector by 2010 was set, increasing to 12% by 2020. Increased support for renewable heat was announced for the commercial sector, including support for solar and wood chips.
National Climate Change Strategy 2007 to 2012⁵⁶	This builds upon the first National Climate Change strategy of 2006. It sets out how Ireland will meet its 2008-2012 commitment. It will identify the implications of these measures and what other methods are being researched and developed to meet a 2020 commitment. It has a cross-sectorial approach to addressing climate change, and includes measures in the Energy White Paper and Budgets.
Delivering a Sustainable Energy Future for Ireland^{57, 58} - Energy White Paper	Sets out the Irish governments targets for renewable electricity, heat and biofuels by 2010 and 2020. Renewable Energy generation was planned to contribute 15% by 2010 and 40% by 2020 to total electricity generation, biofuels had targets of 3% by 2010 and 10% by 2020 of total transport fuels supplied, renewable heat 5% by 2010 and 12% by 2020. For biomass electricity specifically, a target of 30% biomass co-firing at three state-owned peat power generation stations was set by 2015.
Building Ireland's Smart Economy- A Framework for Sustainable Economic Renewal⁵⁹ 2008	The strategy is to: <ul style="list-style-type: none"> • Address the current economic challenges facing the Irish economy by stabilising the public finances, improving competitiveness, assisting those who lose their jobs, and supporting Irish business and multinational companies; • Invest heavily in research and development, incentivise multinational companies to locate more R&D capacity in Ireland, and ensure the commercialisation and retaining of ideas that flow from that investment; • Implement a 'new green deal' to move Ireland away from fossil fuel-based energy production through investment in renewable energy and to promote the green enterprise sector and the creation of 'green-collar' jobs; • Develop first-class infrastructure that will improve quality of life and increase the competitiveness of Irish business.
National Renewable Energy Action Plan - 2009⁶⁰	Ireland's overall target is to achieve 16% of energy from renewable sources by 2020. The NREAP indicates the measures by which this target will be met. The Government has set a target of 12% renewable heat, 10% biofuels and a target of 42.5% electricity consumption from renewable sources by 2020.

⁵⁴ <http://www.environ.ie/en/Publications/Environment/Miscellaneous/FileDownload,1825,en.pdf>

⁵⁵ <http://www.teagasc.ie/energy/Policies/BioenergyActionPlan.pdf>

⁵⁶ <http://www.environ.ie/en/Publications/Environment/Atmosphere/FileDownload,1861,en.pdf>

⁵⁷ <http://www.dcenr.gov.ie/NR/rdonlyres/54C78A1E-4E96-4E28-A77A-3226220DF2FC/30374/EnergyWhitePaper12March2007.pdf>

⁵⁸ <http://www.teagasc.ie/energy/Policies/IrishEnergyPolicyWhitePaper.asp>

⁵⁹ http://www.taoiseach.gov.ie/attached_files/BuildingIrelandsSmartEconomy.pdf

⁶⁰ <http://www.dcenr.gov.ie/NR/exeres/0B956228-14AC-4BA0-B795-EDD53EBA19FB.htm>

Developing the Green Economy in Ireland - Key Actions⁶¹ - 2009	<p>The green economy can make a significant contribution to Ireland's economy by creating employment and export opportunities in areas such as renewable energy, energy efficiency and consultancy, waste management, recovery and recycling, and water and wastewater treatment. What's required to deliver the opportunity?</p> <ol style="list-style-type: none"> 1) Promote green sectors that can drive exports and jobs in Renewable energy, energy efficiency, waste, water and wastewater; 2) Create world-class research centres in niche areas; 3) Developing the Green Economy in Ireland 4) Remove basic hurdles to the green economy.
Harnessing Our Ocean Wealth Plan 2012⁶²	<p>This is an Integrated Marine Plan (IMP), setting out a roadmap for the Government's vision, high-level goals and integrated actions across policy, governance and business to enable marine potential to be realised. Implementation of this Plan will see Ireland evolve an integrated system of policy and programme planning for our marine affairs.</p> <p>Three high-level goals, of equal importance, based on the concept of sustainable development have been developed.</p> <p>Goal 1 focuses on a thriving maritime economy, whereby Ireland harnesses the market opportunities to achieve economic recovery and socially inclusive, sustainable growth.</p> <p>Goal 2 sets out to achieve healthy ecosystems that provide monetary and non-monetary goods and services (e.g. food, climate, health and well-being).</p> <p>Goal 3 aims to increase our engagement with the sea. Building on our rich maritime heritage, our goal is to strengthen our maritime identity and increase our awareness of the value (market and non-market), opportunities and social benefits of engaging with the sea.</p> <p>Seaweed is highlighted as an important resource for production of a variety of market products like food and bioproducts, and is planned to be strategically supported by Irish Government for R&D and business creation in Ireland.</p>
Our Sustainable Future - A framework for sustainable Development for Ireland⁶³ 2012	<p>The overall aim of Our Sustainable Future is to provide for the integration of sustainable development into key areas of policy, to put in place effective implementation mechanisms and deliver concrete measures to progress sustainable development. The objectives of the Framework are to:</p> <ul style="list-style-type: none"> • Identify and prioritise policy areas and mechanisms where a sustainable development approach will add value and enable progress towards the strategy aims. • Highlight and promote existing sustainable practices that, with the correct support, can underpin sustainable development more generally. • Strengthen policy integration, coherence and co-ordination and bring a long term perspective to decision making. • Set out governance mechanisms which ensure effective participation within government and across all stakeholders. • Set out clear measures, responsibilities and timelines in an implementation plan. • Set out how progress is to be measured and reported on through the use of indicators. • Incorporate adequate and effective monitoring, learning, and improvement, into the Framework process.

⁶¹ http://www.djei.ie/publications/trade/2009/developing_the_green_economy_in_ireland_key_actions_02.12.09.pdf

⁶² <http://www.dcenr.gov.ie/NR/rdonlyres/FE4B123A-94AC-451E-B80A-E8F9BD079E3D/0/HarnessingOurOceanWealthReport.pdf>

⁶³ <http://www.environ.ie/en/Environment/SustainableDevelopment/PublicationsDocuments/FileDownload,30454,en.pdf>

Action Plan for Jobs 2012⁶⁴

The Action Plan for Jobs is a plan designed to help rebuild Ireland's broken economy, through reform and innovation to fulfil the ambition to have 100,000 more people in work by 2016 and 2 million people in work by 2020. This is not a strategy document, it is a working document. The Action Plan for Jobs will address seven principal areas:

- Building competitive advantage – Innovation, Costs, Skills & Infrastructure
- Supporting indigenous start-ups
- Attracting inward entrepreneurial start-ups
- Exploiting sectorial opportunities, including in manufacturing, Green Economy, Agri-Food, Business Process Outsourcing/Shared Services, Education Services, and Construction among others.

For meeting its targets, the plan prepares a list of actions that need to be set, like among other measures:

- Building a new Green Economy framework,
- Support the development of new market products,
- Seek to attract a new range of “green” related financial products and services to Ireland,
- Support clustering and other industry-led initiatives to increase collaboration among Irish companies and multinationals, academic institutions and State bodies to develop opportunities in emerging sectors, like water and wastewater treatment and energy management,
- Focus public investment in research and development so as to build critical mass in a number of areas of direct relevance to the Green Economy.

⁶⁴ <http://www.djei.ie/publications/2012APJ.pdf>

5.2 Power Generation - Ireland

Policy	Ambitions	Policy Measures	Financial Incentives
Renewable Energy Feed in Tariff (REFIT3)⁶⁵	Aims to incentivise the addition of 310 MW renewable energy to the Irish electricity grid.	REFIT 3 offers support for biomass categories including anaerobic digestions, biomass CHP, biomass combustion and biomass co-firing. Parasitic energy demand is not supported. Projects must be operational by the end of 2015. The support for any particular project cannot exceed 15 years and may not extend beyond 31/12/2030. REFIT 3 covers 310 MW of certain biomass-related categories, divided as follows: 50 MW of anaerobic digestion (including AD CHP), 100 MW of biomass CHP, and 160 MW of biomass combustion (including biomass co-firing with peat)	Ensure a guaranteed price for each unit of electricity exported to the grid by paying the difference between the wholesale price for electricity and the REFIT price. AD-CHP ≤ 500 kW €c 15.7/kWh AD-CHP > 500 kW €c 13.63/kWh AD (non CHP) ≤ 500 kW €c 11.53/kWh AD (non CHP) > 500 kW €c 10.48/kWh Biomass-CHP ≤ 1500 kW €c 14.68/kWh Biomass-CHP > 1500 kW €c 12.58/kWh Biomass (non CHP) combined with energy crops €c 9.5/kWh; and with other biomasses €c 8.91/kWh Tariffs are altered annually in line with inflation (CPI).
Tax regulation mechanisms (Taxes Consolidation Act 1997)⁶⁶	The scheme aims to facilitate the growth of electricity generation capacity using RES.	Tax relief scheme for corporate investments in certain renewable energy projects (such as solid biomass for electricity). It has been periodically extended and was recently extended until 31 December 2014. The scheme is open for applications on a continual basis.	The tax relief is based on part or the entire sum invested by a company in new shares of a renewable energy project. The capital expenditure, for the purpose of calculating the amount admissible for the tax relief, is capped at 50% of such expenditure (excluding lands) or at €9.5 million on any individual project, whichever is the lesser. Additionally, investments by a company or group are capped at €12.7 million per annum and the shares shall be held for at least 5 years by the corporate investor, otherwise the tax relief shall be withdrawn.
Bio-Energy Scheme⁶⁷ (2010)	The aim is to increase the amount of Miscanthus and short rotation coppice grown in Ireland which could be used for production of bioenergy (heat and energy).	The current scheme (2010-2012) provides establishment grants to overcome some of the costs associated with ground preparation and planting energy crops. The minimum allowable area per applicant is 3 hectares and the maximum is 30 hectares.	50% of the approved costs associated with establishing the crop, subject to a maximum payment rate of €1,300 per hectare, with the balance to be invested by the applicant. Also eligible for EU energy crop premium and single farm payment.

⁶⁵ <http://www.dcenr.gov.ie/NR/rdonlyres/718E8541-7ADD-4FB2-A471-B6081C435625/0/REFIT3BiomassTermsandConditions2012.pdf>

⁶⁶ <http://www.res-legal.eu/search-by-country/ireland/single/s/res-e/t/promotion/aid/tax-regulation-mechanisms-taxes-consolidation-act-1997/lastp/147/>

⁶⁷ <http://www.agriculture.gov.ie/farmingsectors/crops/bioenergyscheme/>

RES-H building obligations⁶⁸	<p>New buildings are required to comply with renewable energy requirements of Part L of the Building Regulations, contributing to the renewable heat target. New dwellings, a reasonable proportion of the energy consumption to meet its energy performance shall be provided by renewable energy sources.</p> <p>The Building Regulation Technical Guidance Document 2011 refers to the minimum level of renewable technologies to be used in order to comply with regulation L3 (b) as follows: 10 kWh/m²/annum contributing to energy use for domestic hot water heating, space heating or cooling; or 4 kWh/m²/annum of electrical energy; or a combination of these which would have an equivalent effect.</p>
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5.3 Biofuels - Ireland

Policy	Ambitions	Policy Measures	Financial Incentives
Biofuels Obligation Scheme (BOS)⁶⁹	Obligated companies should ensure that biofuels make up 4%v/v of transport fuels on the market. The proportion of biofuels in the fossil fuel mix will increase over time, to 8% v/v from start 2015; 10% v/v from start 2018; and 10.5% v/v from 2019.	<p>One Biofuel obligation (BOS) certificate will be issued with every litre of biofuel. Two BOS certificates will be issued for every litre of biofuel meeting the criteria of the scheme produced from biodegradable waste, residue, non-food cellulosic material, ligno-cellulosic material or algae.</p> <p>Obligated parties with a shortfall in BOS Certificates may purchase surplus certificates from other parties in order to fulfil their obligation.</p> <p>Since 1st February 2012, sustainability criteria, as set out in the RED apply to biofuels⁷⁰.</p>	<p>BOS certificates can be traded on the market. 'Buy-out price' or penalty for suppliers not meeting their obligation will be €0.45 per certificate not achieved.</p> <p>A levy of €0.02 per litre both for mineral oil and biofuels is payable to National Oil Reserves Agency (NORA).</p>

⁶⁸ <http://www.res-legal.eu/search-by-country/ireland/single/s/res-hc/t/policy/aid/res-h-building-obligations-12/lastp/147/>

⁶⁹ http://www.nora.ie/regulations_legislation/biofuels_obligation_scheme.450.474.html

⁷⁰ <http://www.irishstatutebook.ie/2012/en/si/0033.html>

6 EnAlgae policy landscape analysis for the Netherlands

Landscaping of national policies of the Netherlands that can have an impact in algae cultivation revealed a number of strategies, mandates, and economic incentives for climate change, sustainability, biomass energy, and biobusiness. Many of the identified policies are in fact response mechanisms to EU-level overarching strategies and targets, but the Netherlands has set its own priorities and strategies in order to reach its national and EU targets. For example, consumers in the Netherlands can receive a tax benefit if they invest in a green fund. In return, banks offer green loans at lower interest rates to 'green projects' using the extra liquidity generated by the consumers' investments. Such projects need to have a positive environmental impact in the categories of agriculture, sustainable resources, renewable energy etc.

Production of Energetic Algae (or algae for production of fuels and energy) is a strategic concept currently under development in the Netherlands, and in the last 5 years considerable efforts have been undertaken to bring algae cultivation and biorefining technologies from a concept to the market. A number of algal policies and algal financial support schemes have been identified. First of all, algae cultivation and biorefining is included in the [Environmental List 2014](#) (Milieulijst) that lists all commercial activities that are eligible to receive a tax refund on relevant investments. Also, Topsector energie, an instrument of Dutch Enterprise Agency, has a series of specialised financial support instruments that aim at assisting SMEs to bring new algae technologies to the market. One of them, the 'MIT Scheme Top Sectors Chemicals and Energy', assists SMEs to bring technologies for biorefining biomass like seaweed and micro-algae from a concept to the market, via subsidising technology feasibility analysis and technology research & development. For example, in 2009 the Dutch Small Business Innovation Research (SBIR) funded 100% of the feasibility analysis and the R&D phase of a project called 'Cultivation and harvesting of seaweeds'. The project budget was €1.32 million and lasted for 4 years⁷¹.

Apart from landscaping policies explicitly supporting energetic algae, to identify policies that could affect energetic algae, research was focussed on generic biomass, bioenergy and environmental strategies. With regard to energy targets, the Netherlands has a primary obligation set in the EU Renewable Energy Directive (RED) to source 14.5% of its energy use from renewables by 2020, including 10% of fuels in transport. In response to RED targets, Netherlands plans to source 37% electricity and 8.7% renewable heat consumption from renewable sources. At national level, the Netherlands have developed a strategic framework for building a competitive biobased Dutch economy by 2030 that is embedded in a trajectory plan for 2050.

Because sustainable development was identified as a strategic pathway for the Dutch bioeconomy, a 'Sustainability Agenda: A Green Growth Strategy for the Netherlands' was initiated in 2011. According to this agenda, priorities in focal points for creating a sustainable society are raw material and product chains, sustainable use of land and water, food, and climate change among others.

Advanced bioenergy technologies that Dutch policies strategically support, for reducing their emissions and increasing the share of renewables in the energy mix, are primarily biomass power and bio-CHP, biomass gasification, water treatment and AD among others. Yet all these energy technologies have strong potential to use algae in their value chain. The Netherlands plan to support all these strategic energy technologies by creating support policies, providing financial incentives, and funding subsidies for underpinning technology development and demonstration. Moreover, uptake of strategic new energy technologies is supported mainly by feed-in tariffs schemes, tax reliefs, secured loans, and subsidies.

⁷¹ <http://www.ecofys.com/en/press/ecofys-launches-trial-module-for-seaweed-cultivation-in-offshore-wind-farm>

In the following section findings from landscape analysis of Dutch legislation are listed by topic. First are presented the overarching strategies and acts followed by targeting incentives on bioenergy, biorefining, biofuels, and the environment.

6.1 General Policy Framework - Netherlands

Policy	Key Measures/Aims
Dutch Environmental Management Act - 1993	This Act creates the possibility to incorporate energy efficiency requirements into environmental licenses or permits. The Environmental Management Act, the transposition of the IPPC Directive into national legislation, states that every installation having a licensing obligation, has to integrate energy efficiency according to the ALARA principle, i.e. As Low As Reasonably Achievable. This created the possibility to incorporate energy efficiency requirements into environmental licenses or permits. Companies that participate in the Benchmarking agreement, the LTAs and/or the EU ETS are automatically granted compliance with the relevant energy- or CO ₂ -related requirements of the EMA permits.
Groen beleggen en financieren' (Green Loan), 2005	Consumers can receive a tax benefit if they invest in a green fund. In return, banks offer green loans at lower interest rates to so-called 'green projects' using the extra liquidity generated by the consumers' investments. These projects need to have a positive environmental impact in the categories of nature, bio-agriculture, agriculture, sustainable resources, recycling, renewable energy, energy saving, sustainable construction, sustainable mobility, or the sustainable water cycle. In 2011, the approved amount of support was € 0.5 billion.
Covenant agricultural sector, 2008	Voluntary agreement on clean and efficient agricultural sectors incl. energy efficiency and renewables in agriculture. The goal is a reduction of CO ₂ emissions by 4.5 mega tonnes per year.
Energy Innovation Agenda⁷², 2008	The Energy Innovation Agenda covers the period 2008-2012 and sets in trajectory the 2020 targets. It is complementary to the 'Clean and Efficient' work programme. It sets targets by 2020 for 20% renewable energy (including biomass), 5.75% biofuels in road transport in 2010, thereafter increasing further to a least 10% in 2020 (this latter condition depending on sustainability, cost-effectiveness and the availability of 2nd-generation biofuels), around 500 MW extra electricity/heat capacity by using biomass and an aspiration for 2nd generation technology to be used on a large scale. By 2050 the targets are for 1000 PJ/year from biomass, from a mature biorefining sector. The innovation activities here are focussed on the following areas: Green Feedstock, New Gas, Sustainable Electricity Supply, Sustainable Mobility, Efficiency in the Chain, Built Environment, Glasshouse as an Energy Source.
Clean and Efficient: New Energy for Climate Policy, Schoon en Zuinig, 2008⁷³	This is the roadmap which outlines how carbon emissions will be met in the Netherlands by 2050. The Netherlands targets are linked to the EU ambition of 80-95% CO _{2e} reductions by 2050 compared to a 1990 baseline. Targets for 2020 are more concrete and consist of three principal targets: <ul style="list-style-type: none"> • 30% reduction in CO_{2e} in 2020 against 1990 baseline • 20% of Dutch energy consumption in 2020 should be from renewable sources such as wind, solar and/or bio • Aim to reduce energy consumption by 20% in 2020 compared to the 1990 level (2% annual energy savings).
National Renewable Energy Action Plan, 2009⁷⁴	The Renewable Energy Action Plan for the Netherlands outlines how the country will achieve a 14.5% total energy demand from renewables. This target is to be met in the following proportions: 37% electricity, 8,7% heat and cool, 10.3% transport.
Green Deal⁷⁵ 2011	A Green Deal is an agreement between the national Government and companies, local governments and private individuals to stimulate sustainability in exchange for conditionally eliminating bottlenecks in regulation. Projects supported by the Green Deal can then be imitated by others, helping increase the impact of the Green Deal. A further round of Green Deal projects is planned for 2012, and will support projects in the following areas: energy, raw materials, mobility and water. In 2012, about 75 new deals have been signed, bringing the total to 150.
Sustainability Agenda: 'A Green Growth Strategy for the Netherlands' in 2011⁷⁶	The agenda sets out the government's aim to create a more sustainable society, and it enumerates main priorities and the main actions it would take to create a greener economy. Priorities in focal points: Raw material and product chain, Sustainable use of land and water, Food, Climate change, Mobility, and Cross-cutting actions.

⁷² <http://www.agentschapnl.nl/sites/default/files/bijlagen/Brochure%20Energy%20Innovation%20Agenda.pdf>

⁷³ http://www.google.co.uk/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&ved=0CDEQFjAA&url=http%3A%2F%2Fwww.rijksoverheid.nl%2Fbestanden%2Fdocumenten-en-publicaties%2Fbrochures%2F2010%2F11%2F25%2Fnew-energy-for-climate-policy%2F11br2007g486-2008122-154154.pdf&ei=bFtyUrbMDYG50QXYzYHYDg&usq=AFQjCNGY0ogPq7E_jYfZYp6fhJU0JtKeQ&sig2=Q1oP5NEdvs38sEL_AnI7qg&bvm=bv.55819444.d.d2k

⁷⁴ http://ec.europa.eu/energy/renewables/action_plan_en.htm

⁷⁵ <http://www.government.nl/issues/energy/green-deal>

Climate policy en route to 2020 (8 June 2011)	The strategy contains a combination of different policies, such as covenants for actions, legislation, subsidies, and fiscal stimuli for different sectors. For example, in the agricultural sector it sets up the goal of reducing CO ₂ emissions by 4.5 mega tonnes per year. By 2020, 200 PJ of renewable energy from biomass shall be produced each year.
Climate Letter 2050 - Klimaatbrief 2050⁷⁷ (2011)	The Climate Letter 2050 set out the challenges facing the Netherlands on the road to a competitive, climate-neutral Europe in 2050.
Second Sustainability Outlook (2011)⁷⁸	Analysed how the Netherlands can reach out to pursue sustainability in their borders by analysing current policies. This study also endeavoured to find the most favourable combination of objectives from all the themes (policy fields), resulting in a map of the Netherlands for 2040. The map provides a development perspective that integrates the many different policy goals within a single spatial framework. Finally, the map was analysed and used for suggesting future instruments that need to be introduced in short term and long term in order for the country to reach sustainability targets by 2050. Analysis showed that the pursuit of a sustainable Netherlands requires a more far-reaching integration of current policies. To accommodate the current demand for land, while ensuring that future generations inherit a high-quality living environment, Netherlands needs a more coherent, long-term vision. The sustainability of the physical environment can be broken down into the following main themes: climate change, biodiversity (diversity of plant and animal life), traffic and transport, attractive living environments, international business location, and cluttering of the landscape.
Innovation Contracts 2012⁷⁹	Companies, research institutes, universities and the government collaboratively drafted several contracts intended to stimulate innovation and improve the competitiveness of the Netherlands economy. These contracts, referred to as 'innovation contracts', were signed in April 2012. In these contracts, measures, plans, deals and targets are described and agreed upon and cover fundamental or applied research. Through innovation, the contracts aim to add value to the Netherlands' future economy by improving its competitiveness. Starting in 2013, the government co-funds innovation and research by TKIs and invests € 0.25 for every euro invested in the TKI by a company. The nine top sectors that have contracts are: chemicals, horticulture and its raw materials, water, agro-food, life sciences, high-tech systems and materials, energy, logistics and the creative industry.
Energieakkoord voor duurzame groei - National Energy agreement 2013⁸⁰	The agreement includes among others: A reduction in total energy consumption by an average of 1.5% per year; An increase in the share of renewable energy (4% in 2013) to 14% in 2020; A further increase of this share to 16% in 2023; At least 15,000 full-time jobs, largely to be created within the next few years; An upper limit to the use of biomass in power plants; A lobby in Brussels for the revival of the ETS from 2020; The closure of five coal-powered energy plants; And a 17 % reduction of carbon in the transport sector, although final plans remain to be developed.
Climate Agenda: Resilient, prosperous and green⁸¹ - 2013	The Climate Agenda outlines an approach focused on assembling a broadly-based coalition for climate measures and on a combined approach to climate adaptation (by designing a resilient physical environment and preparing society for the consequences of climate change) and mitigation (by reducing greenhouse gas emissions). It incorporates concrete goals and ambitions for 2030 and explores and paves the way for the next steps towards 2030 and 2050.
Local Climate Agenda 2011-2014	This instrument aims to facilitate knowledge and information exchange between the central government and local authorities in order to increase local community participation in the field of climate and sustainability. Most local authorities implement their own policies and instruments to achieve the CO ₂ reduction target.

⁷⁶ http://www.esdn.eu/pdf/country_profiles/NL%20Attachment%203%20-%20Sustainability%20Agenda%202011.pdf

⁷⁷ <http://www.rijksoverheid.nl/documenten-en-publicaties/brieven/2011/11/18/klimaatbrief-2050.html>

⁷⁸ <http://www.pbl.nl/en/publications/2010/Netherlands-in-the-Future-Second-Sustainability-Outlook>

⁷⁹ <http://iepd.iipnetwork.org/node/370>

⁸⁰ <http://www.energieakkoordser.nl/>

http://content1b.omroep.nl/urishieldv2/l27m4c1939ea2d8d0599005271191f000000.5611bc80f2a72ed729f02c450f936e31/nos/docs/270813_energieakkoord.pdf

⁸¹ <http://www.government.nl/issues/environment/documents-and-publications/reports/2014/09/24/climate-agenda-resilient-prosperous-and-green-summary.html>

6.2 Bioenergy – Netherlands

Policy	Ambitions	Policy Measures	Financial Incentives
Environmental investment allowance (MIA)^{82, 83} 1991	Support environmental friendly investments. Entrepreneurs can with support from MIA/Vamil invest in biorefinery, biochemistry, and cultivation of natural fibers like algae and duckweed.	Conditions are: 1) the business asset must be on the Environmental List (<i>Milieulijst</i>) drawn up each year by the Ministry of Infrastructure and the Environment, and 2) there must be an co-finance of at least 450 EUR per calendar year. Algae cultivation and biorefining are included in Environmental List 2014 .	Offers a tax refund on environmental investment whereby up to 36 % of total investment costs can be deducted from the taxable profit. For 2013, the sum of €101m is available.
Energy Investment Allowance - Energieinvesteringsaftrek (EIA)⁸⁴ - 1997	Stimulate energy efficiency	Provides a fiscal incentive to stimulate energy efficient systems and sustainable technologies which result in a lower energy use.	The amount of tax credit may be up to 44% of the total investments made in renewable energy or energy efficiency technologies within one year. The level of funding depends on the source of energy and type of technology. At least €2,300 and no more than €113m must be invested within one year. Investments of less than €450 are not considered.
Sustainable Energy Incentive Plus Scheme - Stimuleringsregeling Duurzame Energieproductie (SDE+)^{85 86} - 2011	This scheme stimulates the production of cost-effective renewable energy installations.	Provides a fiscal incentive for companies to fill the gap between the cost level of comparable fossil based energy and the cost level of the renewable energy for a period up to 15 years. It is designating a guaranteed price for electricity and heat from biomass, geothermal, solar, wind, and hydro. For Tariffs for bioenergy are in the case of energy coming from AD, thermal conversion, waste and sewage treatment, and for heat from existing waste incineration and existing digesters. Support is available through a tendering scheme only, and the 'least expensive' forms of technology may apply earlier.	A capped budget of €1.5bn will be available for new installations as from 1st July 2011. This is equivalent to approximately €100m per year. The guaranteed prices depend upon technology type and feedstock and can vary throughout the year. <ul style="list-style-type: none"> Renewable heat and CHP: AD heat: €14.7 /GJ; AD-CHP: €19.4-26 /GJ; Fermentation of manure heat: €19.4-2.6 /GJ; Vegetable matter: €8.2 /GJ; AD of manure with CHP: €19.4-31.1 /GJ; Thermal conversion heat: €6.3 /GJ; Thermal conversion CHP: €18.7 /GJ; Wastewater treatment/sewage treatment heat: €0.070-0.096 /GJ; Green gaseous fuels AD Biomethane €0.4828-0.594 /Nm³⁸⁷; AD Biomethane from manure: €0.4828-0.74 /Nm³; Biomass gasification: €0.4828-1.0345 /Nm³; Wastewater treatment/Sewage treatment solo green gas: €0.312 /Nm³

⁸² <http://www.answersforbusiness.nl/subsidy/environmental-investment-allowance>

⁸³ <http://www.rvo.nl/subsidies-regelingen/biobased-economy-en-miavamil>

⁸⁴ <http://www.agentschapnl.nl/subsidies-regelingen/energie-investeringsaftrek-eia>

⁸⁵ <http://www.agentschapnl.nl/subsidies-regelingen/sde>

⁸⁶ http://www.agentschapnl.nl/sites/default/files/English_brochure_SDE%2B_2013_%28kleur_version%29.pdf

⁸⁷ Nm3 = normal cubic meter

Demonstration energy innovation subsidy (DEI project) - Topsector energie⁸⁸	Public resources available for innovation for demonstration projects aimed at accelerating commercialization are from Topsector Energy for exports.	Eligibility criteria: Eligible projects that conserve energy, and will generate renewable energy or encourage their use. Renewable resources eligible are energy from biomass, landfill gas, sewage treatment and biogas among others. The project is implemented by a company or by a partnership in which at least one company is incorporated. At least 70% of the eligible costs must be attributable to the demonstration. The project duration is 4 years.	The amount requested should be more than €125,000, and not more than €4m. The budget for this new energy innovation scheme increases from €25min 2014, €35m in 2015, €45m in 2016 to €50m from 2017 structurally.
Tender 1&2 - BBE Cost Reduction electricity and heat 2014 - Topsector energie^{89 90}	The purpose of this tender is to support research and development projects that lead to a reduction in the cost of production of electricity and heat from biomass with a practical application before 2023. In addition, demonstration projects and the focus should be on validation of the first practical application of new technology.	The project is implemented by a partnership consisting of at least two companies. The project is focused on research and development or the first application of a new technology (demonstration project). In a research / development project run in a laboratory environment and / or pilot plant experiments that lead to a new process or product. In a demonstration project applies a new technology for the first time in a practical environment. The project fits within one of the following program lines: Biorefinery, Chemical and biotechnological conversion technology, Co-firing, High energy carriers. At least 40% of the funding comes from the private sector. The duration of the project is four years. Projects focused on the refining of aquatic biomass (algae and seaweeds) are <u>not</u> eligible.	To get 25 - 60% subsidy, the entire project has a maximum of €1m.

⁸⁸ <http://www.rvo.nl/subsidies-regelingen/tender-demonstratie-energie-innovatie>

⁸⁹ <http://www.rvo.nl/subsidies-regelingen/tender-1-bbe-kostprijsreductie-elektriciteit-en-warmteproductie>

⁹⁰ <http://www.rvo.nl/subsidies-regelingen/tender-2-bbe-kostprijsreductie-elektriciteit-en-warmteproductie>

6.3 Biomass refining - Netherlands

Policy	Ambitions	Policy Measures	Financial Incentives
Tender Innovation BBE (BBE-I) 2014 Topsector energie ⁹¹	The purpose of this tender is the development of new bio-based products and processes. This should lead to an energy application or a reduction in energy consumption compared to conventional fossil routes.	Tenders can request subsidy for innovative research and development projects. These should focus on catalytic chemical conversion of biomass and/or biotechnological conversion. There must also be a cascade, or a more sophisticated and integrated use of biomass (biorefining). The project is implemented by a partnership of at least two companies. This partnership may be supplemented with other entrepreneurs, research institutes and / or other public or private parties. The duration of the project is four years. Projects focused on the refining of aquatic biomass (algae and seaweeds) are not eligible.	To get participants 25 - 60% subsidy. The maximum is € 500,000, - for the entire project. At least 40% of the funding comes from the private sector.
MIT Feasibility Study-Topsector energie ^{92, 93} 2014	Help SMEs develop ideas into business models.	SME entrepreneurs are subsidized for carrying out a feasibility study. A feasibility study will advance the technical and economic risks and opportunities of a proposed innovation map. A feasibility study consists mainly of desk research, think of literature, patent search, inventory of available technology and potential partners, market research and competition analysis. Desk research is sometimes supplemented with some preliminary lab experiments. This fund includes innovation theme '5C: Process', '10B: Biorefinery', and '11B: Conversion technologies', that include as top sectors processes for unlocking, processing, separation and purification of bio-based raw materials including seaweed and micro-algae as well as products for the food, pharmaceutical and chemical industries.	The subsidy amounts to 40% of eligible costs, the maximum grant €50,000 per feasibility study. Only the costs of SME entrepreneurs are eligible. The term of a feasibility study is a maximum of one year.
MIT Scheme Top Sectors Chemicals and Energy incl. Theme Biobased - Topsector energie ^{94, 95} 2014	MIT R&D collaboration is focused on the innovation of products, processes or services and is directed to SMEs.	An SME can apply for R&D collaboration. The project consists of industrial research and/or experimental development, joint account and risk undertaken by a partnership of at least two Dutch SME entrepreneurs. The MIT R&D cooperation projects in 2014 were given under a tender system. This means that received applications are ranked on the basis of an assessment of tender criteria. The tender criteria listed on this page. This fund includes innovation themes '5C: Process', '10B: Biorefinery', and '11B: Conversion technologies', that include processes for biorefining bio-based raw materials including seaweed and micro-algae for food, pharmaceutical and chemical industries.	The subsidy amounts to 30% of eligible costs (maximum €200,000) per innovation and a maximum of €100,000 per participant. Only the costs of the SME entrepreneurs are eligible. The term of an MIT R&D collaboration is 2 years. The overall budget for 2014 is €8 million. R&D budget is divided into: General €8,000,000; Agri & Food €1,913,600; Water €897,100; Chemistry €1,216,500; Biobased €1,350,000; Energy €500,000.

⁹¹ <http://www.rvo.nl/subsidies-regelingen/tender-bbe-innovatieprojecten-bbe-i>

⁹² <http://www.rvo.nl/subsidies-regelingen/mit-regeling-topsectoren-chemie-en-energie-incl-thema-biobased>

⁹³ http://www.rvo.nl/sites/default/files/2014/03/MIT-2014_bijlage-J_6-Chemie-Biobased-Energie.pdf

⁹⁴ <http://www.rvo.nl/subsidies-regelingen/mit-regeling-topsectoren-chemie-en-energie-incl-thema-biobased>

⁹⁵ http://www.rvo.nl/sites/default/files/2014/03/MIT-2014_bijlage-J_6-Chemie-Biobased-Energie.pdf

6.4 Biofuels - Netherlands

Policy	Ambitions	Policy Measures	Financial Incentives
Transport biofuels act - Nederlands Beleid Biobrandstoffen. (Dutch National Biofuels Policy)⁹⁶ 2011	Increase the amount of renewable fuels in transport.	Obligation of a certain percentage of biofuels in the fuel mix in accordance with the targets set by the EU Renewable Energy Directive – 10% by 2020. Interim targets have been set at 4.5% in 2012, 5.0% in 2013 and 5.5% in 2014, although there are proposals to amend these targets to 5.25% by 2012, 6.25% by 2013, 7.5% by 2014, 8.75% by 2015 and 10% 2016-2020 inclusive ⁹⁷ . Biofuels must meet EU sustainability requirements as stipulated under the EU RED.	Companies meeting their biofuel targets can trade biofuel tickets with companies which have not met their obligation. The value of biotickets is based upon supply and demand.

6.5 Water, wastewater & Aquaculture - Netherlands

Policy	Key Measures/Aims
Policy Note on Aquaculture (2001) - Beleidsnota Viskweek	Contains the Fish Product Board's view (Produktschap Vis) on the development of the Dutch aquaculture sector.
Water Act (2009) - Waterwet⁹⁸	The Water Act integrates the following eight existing water management statutes: Water Management Act; Surface Waters Pollution Act; Marine Waters Pollution Act; Groundwater Act; Public Works Management Act (sections relating to waterways); Public Works Act 1900 (sections relating to waterways). Furthermore, sections from the Soil Protection Act relating to waterbeds are incorporated into the Water Act.
SBIR⁹⁹ - Cultivation of seaweeds and harvesting 2009-2013¹⁰⁰	Under SBIR, contracts are awarded in a three-phase competition: feasibility, research phase and commercialisation. A unique feature is that the contracting authority fully funds the first 2 phases, and the resulting intellectual property remains with the company. In 2009 the Dutch Ministry of Economic Affairs funded a project for cultivation of seaweeds and harvesting by €1.32 million. Phase 1 lasted 2009-2012 and phase 2 in 2012-2013. The project was about developing systems for cultivation and harvesting seaweeds, with the aim of the seaweeds to work as a source of renewable raw material.

⁹⁶ <http://www.agentschapnl.nl/programmas-regelingen/nederlands-beleid-biobrandstoffen>

⁹⁷ Personal Communication with NL Energy and Climate Agency, Agentschapnl, 26th April 2012.

* Installations that have run within another subsidy regime and have ended the lifespan under this regime can continue addressing subsidy under the SDE program.

⁹⁸ <http://www.helpdeskwater.nl/algemene-onderdelen/serviceblok/english/legislation/>

⁹⁹ <http://mapeer-sme.eu/programmes-for-smes/search-in-the-online-database/dutch-sbir-small-business-innovation-programme-NL2>

¹⁰⁰ <http://www.rvo.nl/subsidies-regelingen/sbir-teelt-en-oogst-van-zeewieren>

7 EnAlgae policy landscape analysis for the UK

Landscape analysis of national and regional policies of the UK that can have an impact in algae cultivation revealed 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 policies at country and regional level that could stimulate investment for algae cultivation.

Production of Energetic Algae (or algae for production of fuels and energy) is a new concept in the UK, and existing bioenergy and environmental strategies few schemes were found to be actively supportive to energetic 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 the UK has a target to reduce its emissions by 34% by 2020, and 80% by 2050. To empower market 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 emissions and increasing the 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. Also underway, is a major Electricity Market Reform (due by 2016) that envisages supporting sustainable renewable electricity technologies, at a minimum cost for the consumer.

As regards to cultivation of energy crops, there was a capital investment grant available for new land plantations that closed in 2013. Fifty percent of the cost for planting and cultivating short 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 section findings from landscape analysis of UK legislation are listed by topic. First are presented the overarching strategies and acts, which are then followed by targeting incentives.

7.1 General Framework - UK

Policy	Key Measures/Aims
Climate Change Act 2008 ¹⁰¹	Aims to reduce CO ₂ 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 ¹⁰²	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 4 demonstrations 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 ¹⁰³	Outlines how the UK will facilitate decarbonisation of UK energy economy by 2050 for meeting 80% CO ₂ 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 ¹⁰⁴	Under the EU Renewable Energy Directive , 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 ¹⁰⁵	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 Paper 2011 ¹⁰⁶ (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/tCO ₂ in 2013, increasing to £30/tCO ₂ in 2020 and £70/tCO ₂ 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) an emissions performance standard set at 450g CO ₂ /kWh, encouraging carbon capture from coal fired power stations.

¹⁰¹ <http://www.legislation.gov.uk/ukpga/2008/27/contents>

¹⁰² http://webarchive.nationalarchives.gov.uk/20100509134746/http://www.decc.gov.uk/en/content/cms/publications/lc_trans_plan/lc_trans_plan.aspx
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/47613/3702-the-carbon-plan-delivering-our-low-carbon-future.pdf

¹⁰⁴ https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/47871/25-nat-ren-energy-action-plan.pdf

¹⁰⁵ https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/48128/2167-uk-renewable-energy-roadmap.pdf

¹⁰⁶ https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/48129/2176-emr-white-paper.pdf

Renewables Action Plan (RAP) for Scotland 2009 ¹⁰⁷	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 envisages decarbonisation of energy by focusing in Energy efficiency, Low carbon vehicles, CCS, and renewable heat sectors. RAP wants 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 ¹⁰⁸	<ul style="list-style-type: none"> • 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 meet our 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 natural environment 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 ¹⁰⁹ - 2011	<p>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.</p> <p>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.</p>

¹⁰⁷ <http://www.scotland.gov.uk/Resource/Doc/278424/0083663.pdf>

¹⁰⁸ https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69505/pb13709-waste-water-nps.pdf

¹⁰⁹ <http://www.water.org.uk/home/policy/positions/the-future-of-water-resources>

7.2 Bioenergy Strategy - UK

Policy	Key Measures/Aims
Biomass Strategy 2007 ¹¹⁰	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 ¹¹¹	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 ¹¹²	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) ¹¹³	Outlines a strategic framework for use of bioenergy from biomass and wastes for 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) ¹¹⁴	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.

¹¹⁰ http://www.biomassenergycentre.org.uk/pls/portal/docs/PAGE/RESOURCES/REF_LIB_RES/PUBLICATIONS/UKBIOMASSSTRATEGY.PDF

¹¹¹ <http://www.defra.gov.uk/publications/files/anaerobic-digestion-strat-action-plan.pdf>

¹¹² <http://wales.gov.uk/docs/desh/publications/101014bioenergyprogressen.pdf>

¹¹³ https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/48337/5142-bioenergy-strategy-.pdf

¹¹⁴ http://www.decc.gov.uk/en/content/cms/meeting_energy/heat_strategy/heat_strategy.aspx

7.3 Power Generation - UK

Policy	Ambitions	Policy Measures	Financial Incentives
Renewables Obligation (RO) ¹¹⁵	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) ^{116, 117}	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 , 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.

¹¹⁵ http://www.decc.gov.uk/en/content/cms/meeting_energy/renewable_ener/renew_obs/renew_obs.aspx

¹¹⁶ http://www.decc.gov.uk/en/content/cms/meeting_energy/renewable_ener/feedin_tariff/feedin_tariff.aspx

¹¹⁷ <https://www.ofgem.gov.uk/ofgem-publications/58855/fit-generator-guidance.pdf>

Electricity Market Reform: Contracts for Difference - 2011	<p>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. CfDs are intended to shift the electricity market price risk from the generator to the consumer, reducing risk and the cost of capital for investors.</p>	<p>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.</p>
Renewable Heat Incentive (RHI) ^{118, 119, 120, 121}	<p>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.</p>	<p>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 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.</p> <p>Solid biomass must be wood, straw, agro-industrial residues, food or other wastes, or sewage sludge.</p> <p>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).</p>

¹¹⁸ https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/48041/1387-renewable-heat-incentive.pdf

¹¹⁹ <https://www.ofgem.gov.uk/ofgem-publications/83036/rhiguidancedocumentvolonesept2013edits-consultationver.pdf>

¹²⁰ <https://www.ofgem.gov.uk/ofgem-publications/83034/rhiguidancedocumentvoltwosept2013edits-consultationver.pdf>

¹²¹ <https://www.ofgem.gov.uk/publications-and-updates/guidance-volume-one-two-and-fuel-measurement-and-sampling-guidance>

¹²² 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.

Renewable Energy Guarantee of Origin (REGO) ¹²³	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 ¹²⁴ - 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

¹²³ <http://www.ofgem.gov.uk/Sustainability/Environment/REGOs/Pages/REGOs.aspx>

¹²⁴ <http://www.naturalengland.org.uk/ourwork/farming/funding/ecs/>

7.4 Biofuels - UK

Policy	Ambitions	Policy Measures	Financial Incentives
Renewable Transport Fuels Obligation (RTFO) ^{125, 126, 127}	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.	<p>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.</p> <p>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.</p> <p>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).</p> <p>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.</p>	In January 2014 RTFC auctions were put on hold due to lack of market demand. The last RTFC price was 10p/l.

¹²⁵ <http://www.dft.gov.uk/topics/sustainable/biofuels/rtfo/>

¹²⁶ <https://www.nfpas-auctions.co.uk/etoc/news.html#rtfo>

¹²⁷ https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/301079/part-2-c-and-s-guidance-yr7.pdf

8 EnAlgae policy landscape analysis for Luxembourg

Landscaping of national policies of Luxembourg that can have an impact in algae cultivation revealed a number of strategies, mandates, and economic incentives for biomass energy and bioeconomy. 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 Luxembourg's policies that could stimulate investment for algae cultivation.

Production of Energetic Algae (or algae for production of fuels and energy) is a concept currently under development in Luxembourg, and all existing bioenergy and environmental strategies were not found to be actively supportive to energetic algae. To identify policies that could affect energetic algae, research was focussed on generic biomass, bioenergy and environmental strategies.

With regard to energy targets, Luxembourg has a primary obligation set in the EU Renewable Energy Directive (RED) to source 11% of its energy use from renewables by 2020, including 8 10% in the transport sector. . In response to RED targets, Luxembourg plans to source 8.5% of heat, 11.8% of electricity consumption from renewable sources.

Advanced bioenergy technologies that Luxembourgian policies strategically support, for reducing their emissions and increasing the share of renewables in the energy mix, are primarily biogas, biomass Combined Heat and Power (bio-CHP), and transport biofuels. While both transport biofuel technologies and biogas have strong potential to use algae as biomass feedstock. Luxembourg plans to support these strategic energy technologies by providing financial support. Uptake of strategic energy technologies is supported mainly by feed-in tariffs schemes, and subsidies. Subsidies for purchasing equipment for production renewable electricity and heat (like biomass CHP and biogas) vary between 20-65% of the total costs, with the top-end rates being allocated for SMEs.

For Luxembourg, critical eligibility criteria for funding for renewable energy projects are the security of the environment and the compliance with binding sustainability criteria. To be eligible for government support, biofuel and bioliquid quotas have to satisfy 35% GHG reductions (compared to fossil fuels) up until 2016, 50% reductions from 1 January 2017, and 60% reductions from 1 January 2018 (in line with EU RED). Failure for biofuel quotas to satisfy sustainability criteria will incur pollution tax.

In the following section findings from landscape analysis of Luxembourgian legislation are listed by topic. First presented are the overarching strategies and acts, which are then followed by targeting incentives.

8.1 General Policy Framework – Luxembourg

Policy	Key Measures/Aims
National Renewable Energy Action Plan ¹²⁸	A target of 11% energy from renewable sources in gross final consumption of energy by 2020. A sectoral target of 8.5% renewable heating and cooling, 11.8% of renewable electricity, and 10% renewable transport.

8.2 Bioenergy – Luxembourg

Policy	Ambitions	Policy Measures	Financial Incentives
Règlement grand-ducal du 8 février 2008 relatif à la production d'électricité basée sur les sources d'énergie renouvelables ^{129 130} (Feed in Tariff)	Promotion of electricity generation from renewables (solid biomass and biogas).	The tariff is guaranteed for a period of 15 years, starting on the first day of the electricity export. Renewed or extended biogas stations are entitled to 20 years of feed-in tariff Biogas (generation of less than 2,500 kW) and biomass (less than 5 MW) are both supported under this scheme.	Biogas: €ct 12 per kWh for biogas plants with a nominal electric capacity > 500 kW and ≤ 2,500 kW; €ct 13 per kWh for biogas plants with a nominal electric capacity > 300 kW and ≤ 500 kW; €ct 14 per kWh for biogas plants with a nominal electric capacity > 150 kW and ≤ 300 kW; €ct 15 per kWh for biogas plants with a nominal electric capacity ≤ 150 kW (Art. 10 RGD du 8 février 2008) Solid biomass: €ct 12.5 per kWh for biomass plants with a nominal electric capacity > 1 MW and ≤ 5 MW; €ct 14.5 per kWh for biomass plants with a nominal electric capacity ≤ 1 MW Since January 2014 the new regulation is expected to increase the feed-in tariffs for biogas and biomass up to 31% compared to above rates.

¹²⁸ http://ec.europa.eu/energy/renewables/action_plan_en.htm

¹²⁹ <http://www.legilux.public.lu/leg/a/archives/2008/0016/2008A0260A.html>

¹³⁰ <http://www.res-legal.eu/search-by-country/luxembourg/single/s/res-e/t/promotion/aid/feed-in-tariff-9/lastp/163/>

Subsidy I (Régime d'aides pour la promotion de l'utilisation rationnelle de l'énergie et la mise en valeur des énergies renouvelables)¹³¹	Promotion of production of renewable electricity and heat	Investments in renewable electricity generation are subsidised by the state, which awards investment grants up to a certain maximum. New support conditions were introduced from 1 January 2013 for investments made between 1 January 2013 and 31 December 2016. According to the new regulation, <u>only PV installations</u> are eligible for subsidy. Transitional measures apply for projects already ongoing and their invoice is issued between 1 January 2013 and 31 December 2014. Under certain conditions, these projects can still benefit from the support scheme in force during 2012. Eligible projects already ongoing in 2012: Micro-CHP plants with a nominal capacity between 1 and 6 kW using a renewable energy source are eligible under certain conditions, including that: <ul style="list-style-type: none"> the plant has a yearly global efficiency of at least 85% and a yearly use of a minimum of 5000 hours the plant shall comply with the standards VDI 3985 and VDI 2067 	For biomass micro-CHP plants: The subsidy amounts to 25% of the eligible costs, subject to a maximum of € 3,000. The following expenses are eligible: CHP modules, additional needed devices and installation costs.
Subsidy II (Régime d'aide à la protection de l'environnement et à l'utilisation rationnelle des ressources naturelles 2010)¹³²	Promotion of electricity generation from renewables.	Companies investing in renewable electricity generation are eligible for investment grants.	Grants may cover up to 45% of the additional costs arising from the use of renewable energy (biomass, and biogas) as compared to non-renewable sources. The grant may increase by 20 % for small enterprises and by 10 % for medium-sized enterprises.
Subsidy III (Régime d'aide en faveur des classes moyennes)	Support companies investing in renewable energies for the production of electricity	There is no restriction regarding the eligible renewable energy technologies. However, investments in renewable energies shall be strictly necessary in order to comply with environmental requirements or adapt production methods with the aim of protecting the environment. Applications shall be submitted to the competent authority within two years after the eligible investment was made.	Grants may cover up to 40% of the eligible investment costs. The grant may increase by 10 % for small and medium-sized enterprises. Moreover, the grant may increase by 10 % if the installed renewable energy plant allows the self-sufficient supply to a community of beneficiaries.

¹³¹ <http://www.res-legal.eu/search-by-country/luxembourg/single/s/res-e/t/promotion/aid/subsidy-i-regime-daides-pour-la-promotion-de-lutilisation-rationnelle-de-lenergie-et-la-mise-en-lastp/163/>

¹³² <http://www.res-legal.eu/search-by-country/luxembourg/single/s/res-e/t/promotion/aid/subsidy-ii-regime-daide-a-la-protection-de-lenvironnement-et-a-lutilisation-rationnelle-des-lastp/163/>

8.3 Biofuels – Luxembourg

Policy	Ambitions	Policy Measures	Financial Incentives
Droits d'accise autonomes sur les produits énergétiques. Loi du 17 Décembre 2010. ¹³³¹³⁴	Increase amount of biofuels in transport fuel pool.	The providers of petrol or diesel fuels have to ensure that biofuels make up at least 3.75% of the company's total annual sale of fuel.	If fuel suppliers fail to fulfil the quota, they shall pay a pollution tax amounting to EUR 1,200 per 1,000 Litre of biofuels that was not blended with the annual amount of petrol or diesel products sold.
Règlement grand-ducal du 27 février 2011 fixant les critères de durabilité pour les biocarburants et bioliquides ¹³⁵	Ensure the sustainability of Biofuels	Transposes the EU RED sustainability requirements into Luxembourg law. Until 31 December 2016 at least 35%; - From 1 January 2017: at least 50%; - From 1 January 2018: at least 60% for biofuels and bioliquids produced in installations where the production has started on or after 1 January 2017. Biofuels should not be derived from sensitive environments.	None compliance means biofuels do not count towards targets and therefore incur pollution tax (as above).

¹³³ <http://www.legilux.public.lu/leg/a/archives/2010/0228/2010A3676A.html>

¹³⁴ <http://www.res-legal.eu/search-by-country/luxembourg/single/s/res-t/t/promotion/aid/biofuel-quota-9/lastp/163/>

¹³⁵ <http://www.legilux.public.lu/leg/a/archives/2011/0041/2011A0590A.html>

9 EnAlgae policy landscape analysis for Switzerland

Landscaping the national policies of Switzerland, that could have an impact in algae cultivation, revealed a number of strategies, mandates, and economic incentives for climate, biomass energy and bioeconomy. Switzerland is not a member state of the European Union, and it does not intend to become so in the near future. However, with its strategic position in central Europe, and its market position in green electricity production, several trade treaties have been made with the EU. Moreover Switzerland has signed the Kyoto Protocol according to which by 2020 the country has to reduce GHG emissions by 20% from the 1990 level.

Production of Energetic Algae (or algae for production of fuels and energy) is a concept currently under development in Switzerland, and existing bioenergy and environmental strategies were not found to be actively supportive to energetic algae. To identify policies that could affect energetic algae, research was focussed on generic biomass, bioenergy and environmental strategies.

With regard to overall energy targets, Switzerland wants to decrease the consumption of fossil fuels by 20% and increase the portion of renewable energies of the total energy consumed by 50% until 2020 (from 16.2% to around 24%). For this, Switzerland has developed a strategic framework for building a competitive green economy. It runs a Swiss Energy Programme where focuses on awareness-raising, information, advice, education and training, and quality assurance in various focal points, like energy efficiency and renewable energy. For this, it has allocated financial resources every year available for the program that is CHF 30 million (€25.8 million) for 2012 and up to CHF 55 million (€45.6 million) for 2015.

Switzerland has also set its own Energy priorities and strategies up until 2050. Key technologies that Switzerland wants to invest for reducing emissions and increasing the share of renewables in the energy mix, are primarily biogas from agricultural or other wastes, and green electricity from 'non-crops'. All these energy technologies have strong potential to use algae as biomass feedstocks especially if algae are produced on brownfield sites and in conjunction with wastewater or flue gas bioremediation. For all the supported advanced green technologies there are available feed-in-tariffs schemes, tax exemptions, and state loan guarantees available by the federal Swiss government.

Switzerland gives first priority to land use for food production and is particularly sceptical of energy crop concepts for production of energy and transport fuels. Energy crops require agricultural land and can be competitive to food and feed production. Therefore strategic biomass energy resources are agro-industrial residues, wastes as well as wood that Switzerland can readily source without dedicating additional agricultural land for energy purposes. In line with prioritising efficiency in biomass use, biorefineries are underlined as strategic pathways. Finally, environmental and social responsibility is strategic objective for the Swiss economy.

In the following section, findings from landscape analysis of Swiss legislation are listed by topic. First are presented the overarching strategies and acts, which are then followed by targeting incentives.

9.1 General Policy Framework – Switzerland

Policy	Key Measures/Aims
Swiss Energy Policy 2007 ¹³⁶	The Swiss energy policy is based on the four pillars: energy efficiency, renewable energies, the replacement and new construction of large-scale power plants, as well as foreign energy policy. This policy is operationalized by action plans that foresee to decrease the consumption of fossil fuels by 20% and to increase the portion of renewable energies of the total energy consumed by 50% by 2020 (from 16.2% to around 24%). The action plans envisage limiting the increase in energy consumption between 2010 and 2020 to 5%, with a stabilisation of energy consumption thereafter.
Energy Strategy 2050, 2011	The “Energy Strategy 2050” was adopted, laying out a roadmap towards a significant reduction in final energy use and a stabilization of electricity use. The medium-term (2034) policy measures will focus on improving energy efficiency, increasing renewable energy generation – especially hydropower but also other renewable sources –, and natural gas, except nuclear energy. The corresponding legislative proposals are due for public and parliamentary consultation in fall 2012 and spring 2013, respectively. The new legislation should then enter into force in the beginning of 2015.
Swiss Energy Programme - EnergieSchweiz ¹³⁷	EnergieSchweiz is the central platform for networking, coordination, information and knowledge exchange between the various actors in the fields of energy efficiency and renewable energy. The program focuses on awareness-raising, information, advice, education and training, and quality assurance in various focal points. It is primarily aimed at the removal of barriers that prevent the exploitation of energy efficiency measures and renewable energy potential. EnergieSchweiz support on the one hand, the legal requirements, the funding and the economic instruments in energy and climate policy. On the other hand, the program promotes innovative projects, partnerships, advisory initiatives and other targeted activities, the implementation of voluntary initiatives taken in households, communities and the economy. In view to the best possible support and to complement the other measures of the Energy Strategy 2050, the emphasis is to be realigned and the financial resources of the program of CHF 30 million in 2012 to CHF 55 million in 2015 be increased.
CO2 Act ^{138,139} revised 2013	It sets an emissions reduction target for 2020 and sets out various measures for buildings, transport and industry. If the interim targets are not achieved, specific measures may be tightened. Greenhouse gas emissions in Switzerland should be reduced by 20% from their 1990 level by 2020. This means a reduction of approximately 11 million tonnes of CO2 equivalent. Households and companies also contribute to the savings. If the interim goals (see CO2 Ordinance, Art. 3) are not achieved, the Federal Council can tighten regulations on thermal and motor fuels.
Swiss climate policy 2000, valid until 2012 ¹⁴⁰	The CO2 Act served as the legal framework for implementing the international commitments undertaken by Switzerland under the Kyoto Protocol. The Act took effect in 2000 and set out reduction targets for the 2008 to 2012 period that were in line with the international provisions. The fully revised version came into force on 1 January 2013. However, specific provisions of the previous version of the Act will remain in effect for an interim period.

¹³⁶ http://www.reegle.info/countries/switzerland-energy-profile/CH#energy_framework

¹³⁷ <http://www.energieschweiz.ch/de-ch/utilities/ueber-energieschweiz.aspx>

¹³⁸ <http://www.bafu.admin.ch/klima/12325/12329/index.html?lang=en>

¹³⁹ <http://www.admin.ch/opc/de/classified-compilation/20091310/index.html#a35>

¹⁴⁰ <http://www.bafu.admin.ch/klima/00493/index.html?lang=en>

Biomass strategy Switzerland¹⁴¹	<p>Strategic objectives:</p> <ul style="list-style-type: none"> • Biomass produced in helping countries widen safety of supply. • The necessary land culture biomass, including the production food, is preserved. Avoid the effects of foreclosure. • The biomass is produced, transformed and used for an optimal use of resources. • Biomass generates added value by using cascades. • Biomass is used according to the principle closed ring. • Natural resources are vital and must be preserved. • Social Responsibility is counted
Position paper biogenic fuels¹⁴²	<p>An agricultural production of biogenic fuels on a large scale is not desirable in Switzerland. It would have consequences for the local food and feed production, which would have to be replaced by increased imports. Food and feed production is the priority in Switzerland. Biofuels from waste like biogas from municipal and agricultural waste is seen as a good solution for the environment in Switzerland.</p>

¹⁴¹ [www.bfe.admin.ch/php/modules/publikationen/stream.php?extlang=fr&name=fr_135968628.pdf&endung=Strat%E9gie%20de%20la%20Suisse%20en%20mati%E8re%20de%20bio](http://www.bfe.admin.ch/php/modules/publikationen/stream.php?extlang=fr&name=fr_135968628.pdf&endung=Strat%E9gie%20de%20la%20Suisse%20en%20mati%E8re%20de%20bio%20masse)

¹⁴² <http://biotreibstoff.wordpress.com/tag/positionspapier-biogene-treibstoffe/>

9.2 Bioenergy - Switzerland

Policy	Key Measures/Aims	Mechanism	Financial Incentives
Feed-in tariff (2008) ¹⁴³ Kostendeckende Einspeisevergütung (KEV)	The increased use of domestic and renewable sources for the generation of electricity is one major aim according to art. 1 c of the Energy Act (EnG).	Green electricity generators (biomass and biogas) can earn feed-in tariffs for a period of up to 20 years. The amount of funding differs depending on the technology used and the installed plant capacity. Tariffs for biomass plants are composed of a base payment and different kinds of bonuses. The feed-in tariff is paid by the national grid operator Swissgrid. Agriculture bonus: A bonus for agricultural biomass is granted if: 1. Manure or manure in combination with crop residues and/or other residual materials is used and; 2. The share of agricultural co-substrates and/or energy crops is not exceeding 20% of the fresh mass.	Biogas: The maximum amount of funding is 0.24 CHF/kWh (0.20 €/kWh) for sewage gas and 0.20 CHF/kWh (0.167 €/kWh) for landfill gas. Biomass: The amount of the base payment is calculated pro-rata in dependence of the equivalent capacity of the plant according to the following performance categories: ≤ 50 kW 0.28 (23 €/kWh) ≤ 100 kW 0.25 (20.8 €/kWh) ≤ 500 kW 0.22 (18.3 €/kWh) ≤ 5 MW 0.185 (15.4 €/kWh) > 5 MW 0.175 (14.6 €/kWh) Agriculture bonus: The amount of agriculture bonus is calculated pro-rata in dependence of the equivalent capacity of the plant according to the following performance categories: ≤ 50 kW 0.18 (15 €/kWh) ≤ 100 kW 0.16 (13.3 €/kWh) ≤ 500 kW 0.13 (10.8 €/kWh) ≤ 5 MW 0.045 (3.7 €/kWh) > 5 MW 0
CO2 tax exemption on biofuels for heat production ¹⁴⁴		The CO2 tax is levied on all fossil fuels (eg oil, natural gas). The CO2 tax is reported on the invoices for fuel purchases. The CO2 tax is levied on fossil fuels (oil, natural gas, coal, petroleum coke and other), when used for heat production, for the production of light in thermal plants for electricity production or for the operation of combined heat and power generation plants. On wood or biomass no tax is levied.	Since 2014, CO2 tax is 60 CHF per ton of CO2, equivalent to 16 cents per litre of extra light heating oil.

¹⁴³ <http://www.res-legal.eu/search-by-country/switzerland/single/s/res-e/t/promotion/aid/feed-in-tariff-1/lastp/396/>

¹⁴⁴ <http://www.bafu.admin.ch/co2-abgabe/12357/index.html?lang=de>

Technology fund 2013¹⁴⁵	<p>The technology fund was created by the federal government to promote innovative technologies that reduce greenhouse gases and the consumption of resources, support the use of renewable energies and increase energy efficiency.</p>	<p>The federal government can guarantee loans for companies that are developing and marketing new technologies to reduce greenhouse gases, promote the use of renewable energies and conserve natural resources.</p> <p>These companies receive a confirmation of the guarantee when they are approved. The guarantee is made to banks or other suitable lenders. Interested companies should submit their development and operations tenders to the agency by April 28, 2014</p>
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¹⁴⁵ <http://www.bafu.admin.ch/klima/12325/12354/index.html?lang=en>

10 Summary of NW Europe country reports for landscaping policies

In the period 2012-2014 national and regional policies of eight countries of the NW European region were landscaped for identifying policies and economic incentives that could have an impact on the commercialisation of energetic algae concepts (micro- and macro-algae). The countries that were scoped were Belgium, France, Germany, Ireland, Luxembourg, Netherlands Switzerland, and the United Kingdom. With exception of Switzerland, the seven other countries are full members of the European Union (EU). Data were collected via desk-based work using online available information in national-, regional-, and EU-level web-pages. Policy data for the NW European region were not easily accessible, as policy documents were stored in websites of ministries or websites of national or regional government organizations e.g. funding bodies etc. Moreover policies were typically communicated in local languages and few were available in other languages.

Many of the identified national and regional policies in this landscape analysis were in fact response mechanisms to overarching strategies and targets of EU or international agreements (e.g. UN Kyoto Protocol). Nevertheless, all countries set their own priorities and strategies in order to reach the targets. The analysis revealed that the national strategies that energetic algae could fall under were sustainable development and climate change, biobased economy, bioenergy, and environment and waste. One level under these strategic frameworks there was an orchestration of roadmaps, action plans, and a plethora of activities that aimed at reaching the primary targets.

Algae were acknowledged in many national strategies (see Germany, Netherlands, Ireland,) as an important biomass resource for biobased economy, although there was some confusion whether energetic algae is an energy crop or a waste resource. The lack of clarity in classifying algal biomass affects how energetic algae projects and their products are supported by policies and economic instruments. For example, in the UK while energy crop projects were economically supported by the UK Government, algae biomass was not eligible for support. On the other hand, in Ireland fuels from macro-algae (seaweed) could receive double green certificates, due to their high sustainability performance. Finally in Bretagne, France, there was a regional economic scheme that supported regional development and construction of AD projects for green algal blooms. The scheme aimed at mitigating the environmental nuisance arising from excess wild green algae production in Bretagne coastline. In the last case, algae were considered a water pollutant.

An important aspect that affects whether a biomass source is favoured for energy production is the sustainability performance in a lifecycle perspective. In the EU Renewable Energy Directive (RED) sustainability criteria are described only for biofuels. In a national level, all eight countries had set criteria for environmental and social sustainability of bioenergy. For Switzerland, Germany, Netherlands, the UK, Belgium, and Luxembourg sustainability performance was very high on their national priorities. In Germany critical eligibility criterion for government funding for advanced energy technologies was the compliance with binding sustainability criteria.

One sustainability criterion that is particularly important for energy crops, yet not for algae, is the agricultural land footprint. In countries like Switzerland, Belgium, Netherlands and Luxemburg agricultural land use was prioritised for food production, and thereby energy crops were often not supported concepts. However, algae do not necessarily need agricultural land to grow. They can be produced in marine environment (coastline, off-coast, or archipelago) or inside special bioreactor facilities placed e.g. on brownfields. Thereby algae are not a typical energy crop.

Strategic advanced bioenergy production technologies that the NW European region prioritised to support for reducing the GHG emissions and increasing the share of renewables in the energy mix, were primarily biomass power, biomass CHP, and AD. Except these three technologies, there are numerous other

technologies that one or another country prioritises to support, but the above three technologies are currently actively supported by all eight NW European countries. For reference, other bioenergy technologies include biomass gasification, advanced biofuels, and wastewater treatment. From a technology perspective, AD is the technology most compatible with algae, although algae combustion for power or CHP could also fit. Policies mainly support bioenergy technologies by creating support policies, providing financial incentives, and funding subsidies for underpinning technology development and demonstration.

In identified targeted energetic algae policies, a technology that was strategically connected to algae is anaerobic digestion (AD) for production of biogas and biomethane. In fact AD can connect to algae two-fold. On one hand, algae biomass can feed AD for biogas production, acting as feedstock. On the other hand, algae (micro- and macro-algae) can act as wastewater treatment method filtering CO₂ and nutrients while algae grow. Both configurations were found to be supported by national policies.

The energy crop vs. waste classification of algae is very relevant in connection to AD technology. AD typically uses a mixture of feedstocks for feeding the production of biogas, like food crops, food waste, straw, manure, sewage, or algae. AD is a mature technology in the NW European region, with Germany having more than 1,000 AD plants. Although most of the AD plants in NW European region use a mixture of feedstocks, not all AD feedstocks are eligible for government subsidies. Some countries' policies were found to prioritise feeding AD with food or agricultural wastes, for example the Netherlands, Switzerland, and France, while other countries like Germany were found to encourage exploitation of unused biomass for bioenergy production, and especially biomass that does not have competitive market uses.

Among the eight countries' policies that were landscaped, the most innovative energetic algae policies were found in Ireland and in the Netherlands. Ireland primarily is scoping macro-algae, while Netherlands supports both micro- and macro- algae. Other countries like Germany, France, or the UK (see e.g. RHI) have made considerable efforts to include energetic algae and algae advanced energy technologies in their strategies and existing economic support tools.



EnAlgae is a four-year Strategic Initiative of the INTERREG IVB North West Europe programme. It brings together 19 partners and 14 observers across 7 EU Member States with the aim of developing sustainable technologies for algal biomass production.

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