Renewable Gas Forum
Irish Green Gas Ltd

KPMG

Renewable Gas Forum Ireland

An Integrated Business Case for Biomethane in Ireland

October 2019

Executive Summary

KPMG research has validated RGFI's ambition to develop a sustainable indigenous biomethane industry in Ireland on a phased basis by 2030, which will stimulate the rural economy and save over 2.6m tonnes of CO2 emissions per annum.

Project Vision

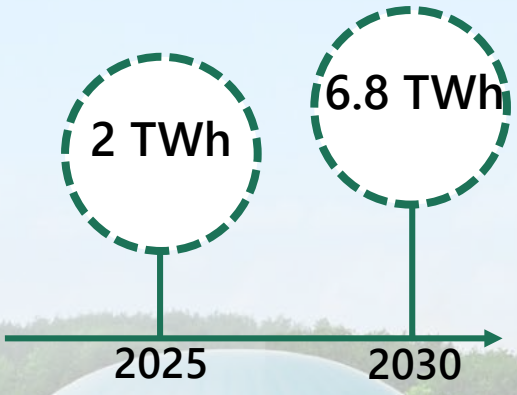
Promoting a circular economy by utilising agri by-products and grassland potential to create energy for homes and businesses whilst promoting sustainable farming practices.

2.6m
tonnes of CO2 saved per annum

227
Agri AD Biomethane Plants plus 15 large commercial waste plants across Ireland

National Biomethane Target

Addressing Action 71 of the Climate Action Plan



12+%
Supporting a trajectory for 20% displacement of natural gas & strengthening Ireland's energy security

Agri Industry Led Model
to stimulate the Rural Economy

3,000+ jobs
created for rural Ireland

Benefit Cost Ratio
1.26

4.8m
tonnes of slurry utilised annually

5.8m
tonnes of additional grass silage required annually

670,000 homes & 27,000
Multinational and Irish businesses rely on the gas network

7t DM/ha to 10-13t DM/ha
Utilising Ireland's agricultural waste and grassland potential

€ 7.5 billion GVA impact
To the period up to 2050
(in 2019 values)

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Further, as our terms of reference do not constitute an audit or review in accordance with Irish auditing standards, they will not necessarily disclose all matters that may be of interest to RGFI or reveal errors and irregularities, if any, in the underlying information.

In preparing this report, we have had access to information provided by RGFI and publicly available information. The findings and recommendations in this report are given in good faith but, in the preparation of this report, we have relied upon and assumed, without independent verification, the accuracy, reliability and completeness of the information made available to us in the course of our work, and have not sought to establish the reliability of the information by reference to other evidence.

Any findings or recommendations contained within this report are based upon our reasonable professional judgement based on the information that is available from the sources indicated. Should the scheme elements, external factors and assumptions change then the findings and recommendations contained in this report may no longer be appropriate. Accordingly, we do not confirm, underwrite or guarantee that the outcomes referred to in this report will be achieved.

We have not compiled, examined or applied other procedures to any prospective financial information in accordance with Irish, or any other, auditing or assurance standards. Accordingly, this report does not constitute an expression of opinion as to whether any forecast or projection of the scheme will be achieved, or whether assumptions underlying any forecast or projections of the scheme are reasonable. We do not warrant or guarantee any statement in this report as to the future prospects of the scheme.

There will usually be differences between forecast or projected and actual results, because events and circumstances frequently do not occur as expected or predicted, and those differences may be material.

Glossary

AD - Anaerobic Digestion

BCR – Benefit Cost Ratio

CBA - Cost Benefit Analysis

CO2 - Carbon Dioxide

CNG - Combined Natural Gas

ETS - Emissions Trading System

EU - European Union

GGCS - Green Gas Certification Scheme

GHG - Greenhouse Gas Emissions

GNI - Gas Networks Ireland

GVA - Gross Value Add

GWh - Gigawatt Hours

Ha – Hectare

kWh - Kilowatt Hour

NI - Northern Ireland

NPV – Net Present Value

PSC - Public Spending Code

PSO - Public Service Obligation

RED II - Renewable Energy Directive 2

RGFI - Renewable Gas Forum Ireland

SEAI - Sustainable Energy Authority of Ireland

TWh - Terawatt Hours

UK - United Kingdom

WEBS - Wider Economic Benefits

Executive Summary

Scope of this Report

Renewable Gas Forum Ireland has commissioned KPMG to support in the development of a business case to present to government in respect of the establishment of policy and economic support for an indigenous Irish biomethane industry.

1.1 Context

The Renewable Gas Forum of Ireland ("RGFI") is an industry forum representing all sectors of the renewable gas industry from producers to end users. Through consultation with key stakeholders, RGFI has an ambitious vision to assist with Ireland's decarbonisation objectives, aiming to enable the production of up to 6.8TWh of thermal energy from renewable biomethane gas by 2030, which is equivalent to c. 12% of Ireland's current natural gas demand. This target has been chosen as an appropriate compromise between feedstock availability, decarbonisation levels and consumer demand from the manufacturing and processing industry.

To achieve this objective, RGFI plans to collaborate on a consultative basis with government, the food and pharma industry, developers, investors, the rural economy and other relevant stakeholders to establish a financially viable and environmentally sustainable indigenous biomethane industry across Ireland.

The primary means for achieving this objective will be the rollout of mature and proven anaerobic digestion ("AD") technology to produce the required biomethane, which can then be injected into the gas grid ("the Scheme").

In order to achieve RGFI's vision, approximately 227 agri-industry led AD plants, along with circa 15 larger waste AD plants, will need to be deployed by 2030, requiring a capital investment in the region of €1.5 billion, along with appropriate government subvention or external support.

1.2 Cost Benefit Analysis of an Indigenous AD Biomethane Sector

KPMG has undertaken a cost-benefit analysis of the Scheme over a 30-year period and in line with the requirements of the Public Spending Code ("PSC"). The analysis has taken account of a range of quantifiable costs – capital, operating, shadow cost of public funds – and benefits – Greenhouse Gas ("GHG") emissions savings, labour market benefits, and wider economic benefits. These inputs were used to estimate the Scheme's Net Present Value ("NPV") and its Benefit-Cost Ratio ("BCR") over the period 2020-2050 in 2019 values.

KPMG's analysis suggests that the BCR for the Scheme is 0.68 using the standard methodology applied in complying with the PSC. When Wider Economic Benefits ("WEBS") are taken account of, the BCR increases to 1.26. This highlights that while the Scheme's benefits do not exceed its costs from a strictly accounting perspective, there are a schedule of other sought-after positive benefits that the Scheme delivers for the localities and regions in which AD biomethane plants and central injection points are to be located. These are

valid and add justification to any decision to proceed with the Scheme, especially in the context of public policies focusing on regional development and transitioning to a lower carbon economy.

Table 1: Results of the CBA, 2020-2050 (€billion, 2019 values)

Scenario #	1	2	3
	CBA with Shadow Cost of Labour	CBA with Shadow Cost of Labour and with GVA Impacts	CBA without Shadow Cost of Labour and with GVA Impacts
Economic NPV	-3.63	3.90	2.87
Economic BCR	0.68	1.36	1.26

Source: KPMG Analysis

Key benefits of the proposed scheme include:

- Significant decarbonisation across residential, commercial and agricultural sectors;
- Reduces Ireland's reliance on fossil fuel-based energy imports and improves Ireland's security of energy supply;
- Provides rural Ireland and uneconomic farming enterprises with a viable economic alternative, while leveraging Ireland's under-utilised rural resources to address the national decarbonisation challenges;
- Assists in decarbonising Ireland's agriculture supply chain and product lifecycle, further supporting the marketing of Irish agricultural produce;
- Provides agriculture with a viable, competitive and sustainable route to decarbonising the sector that is measurable and verifiable using the Green Gas Certification Scheme ("GGCS"), including better slurry management and chemical fertiliser displacement;
- Ireland's gas network is one of its largest and most important national assets in powering the Irish economy. This scheme provides a credible pathway to preserve and grow the value of this national asset – by replacing 12%+ of current natural gas consumption with low emission renewable gas; and
- An agri industry led AD biomethane approach also provides significant wider economic benefits including the diversification and stimulation of the rural economy and creation of over 3,000 jobs.

1.3 Decarbonising at Lowest Cost

While the production of biomethane from AD is more expensive than its natural gas alternative, it is a mature, proven and well-established technology and if optimised and utilised for the right purposes, can represent the lowest cost solution, or in some instances, the only solution for decarbonising heat demand for some of the most challenging carbon emission points in Ireland.

While biomethane can be used to decarbonise a wide range of sectors, such as electricity, heat and transport, given that demand for its use is likely to exceed production volume, it is important that it is targeted at the sector where it has the most impact.

KPMG research[1] and third-party[2] studies indicate that the optimum deployment of biomethane is in the displacement of fossil fuels where limited other cost-effective decarbonisation options exist including domestic heating (9% of Ireland's GHG emissions) and industry (9% of Ireland's GHG emissions).

While biomethane can also be utilised effectively in other sectors, such as transport, there remain numerous other feasible and competitive alternatives for that sector such as electrification, compressed natural gas ("CNG") and biofuels, which may represent more appropriate decarbonisation solutions in the short-term.

1.4 Economic Funding Model

The production of biomethane through AD is more expensive than its fossil fuel equivalent and as such requires financial support.

In considering the optimal approach to sector funding, RGFI has sought to balance the need to appropriately incentivise and compensate stakeholders, while minimising the economic cost to consumers.

RGFI and KPMG have analysed the required support for the development of the AD biomethane industry and estimate that total income of circa €8.9 c/KWh is required for farm-scale 20GWh plants and €8.2 c/KWh for larger 40GWh plants. This is comparable to the UK, Germany and France[3] experience and is broadly consistent with SEAI estimates.

Whilst it is acknowledged that exchequer funding is not a long-term viable option for the sustainability of the industry, RGFI believes that Government needs to provide the right policy direction and economic signals that it wants to support and encourage the establishment of an AD biomethane industry. Accordingly, RGFI suggests implementing a scalable phased funding model which evolves to support a growing and maturing AD biomethane industry, while minimising consumer cost and limiting long-term government subsidy requirements. The proposed funding solutions include:

- Given the timescales involved in introducing a long-term funding scheme for the sector, RGFI is proposing an interim funding solution which can be introduced efficiently and allow the sector to mobilise in the short-term. This interim funding solution, to cover the incremental cost of biomethane gas, could include exchequer funding from carbon tax revenues, utilisation of an existing scheme such as Support Scheme for Renewable Heat, or an alternative cost socialisation mechanism. It is proposed that this interim funding supports up to 280GWh per annum (enough for 14 farm scale 20GWh plants, or 4% of total ambition) which would be of sufficient scale to justify gas injection and supply chain investment. The average annual cost of this mechanism would be €17.2m (including VAT).

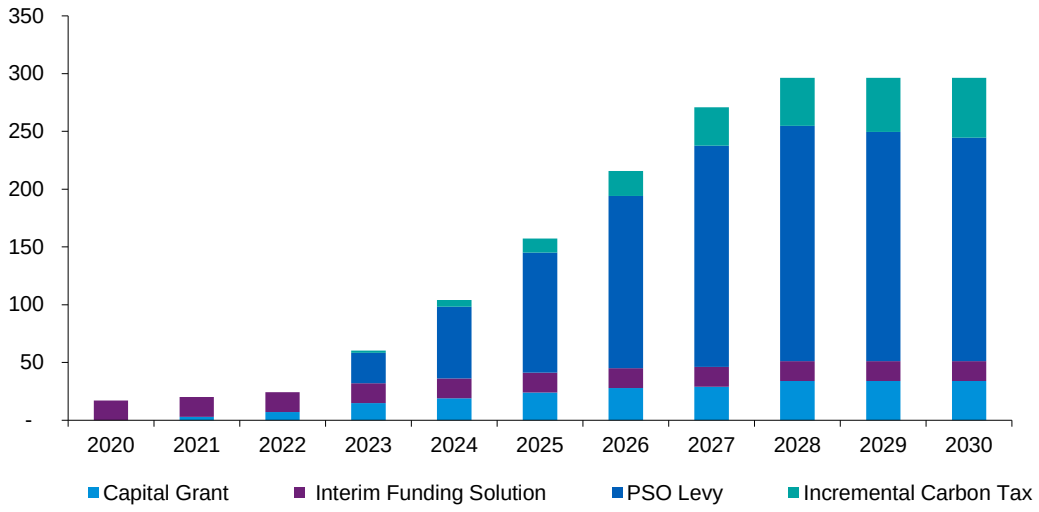
- Beyond the establishment of this initial portfolio of AD biomethane plants, the introduction of a Gas PSO levy could provide the support necessary to establish the wider sector and fund the biomethane production for a 15-year period, while also ensuring the cost is appropriately socialised across gas consumers. This Gas PSO could sit alongside the existing carbon tax structure and would reduce over time as the carbon tax increases. KPMG's analysis assumes incremental carbon tax revenues (above the existing €26 / tn level) are ring fenced to support the biomethane scheme.

[1] KPMG, 2018, Decarbonising Domestic Heating in Ireland
[2] Navigant, 2019, Gas for Climate: The optimal role for gas in a net zero emissions energy system, https://www.gasforclimate2050.eu/files/files/Navigant_Gas_for_Climate_The_optimal_role_for_gas_in_a_net_zero_emissions_energy_system_March_2019.pdf
[3] Various

- In order to reduce the impact of the PSO levy on consumers, it may also be appropriate for Government to provide upfront capital grants to the AD biomethane plant. This could potentially come from the Department of Agriculture, Food & the Marine to cover capital spend on regulatory requirements for farm-related infrastructure components such as slurry management, digestate storage, and pasteurisation equipment, which will have wider benefits across the farm enterprise. Assuming a capital grant of €1m per AD biomethane plant, the total cost of the PSO levy per domestic consumer to meet the 2025 2TWh target would be €3.4 inc. VAT per month, peaking at c.€5.7 inc. VAT per month in 2028 once 4TWh has been achieved. This is below the peak electricity PSO levy of €8.73 inc. VAT per month.

- In the longer-term, once the sector has reached an appropriate level of maturity, KPMG believe policy support could switch from a Gas PSO levy (with appropriate grandfathering protections) to a supplier obligation model, which would obligate an increasing proportion of renewable gas biomethane within gas supply volumes. While ensuring market demand for biomethane gas, this methodology would ensure competition and market forces determine the long-term pricing dynamics of the biomethane market. For the purposes of KPMG's analysis, they have assumed the PSO supports up to 4TWh of generation annually.

Figure 1: Total Amount of Annual Support Required for the industry (€'millions)



Source: KPMG Analysis

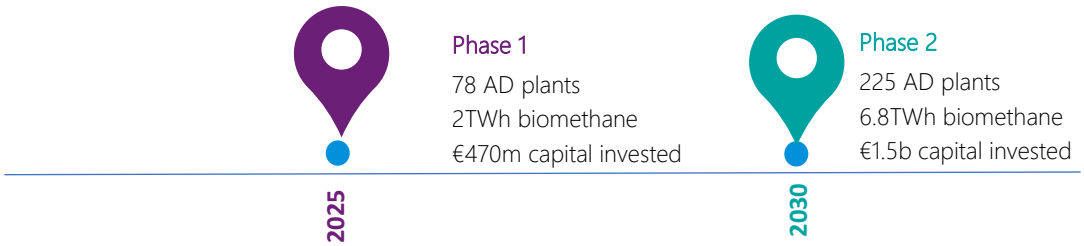
1.5 Scale of Ambition

The RGFI is seeking to stimulate the development of a sustainable, indigenous biomethane industry in Ireland on a scalable phased basis which by 2030 will displace more than 12% of current Irish natural gas consumption and over 2.6[4] million tonnes of CO2 emissions per annum.

The 2025 Phase 1 target, along with medium-term 2030 Phase 2 target, is outlined below:

[4] This includes CO2 emission savings from carbon sequestration of 21%, which will be validated in due course.

Figure 2: Timeline for Phase 1 and Phase 2

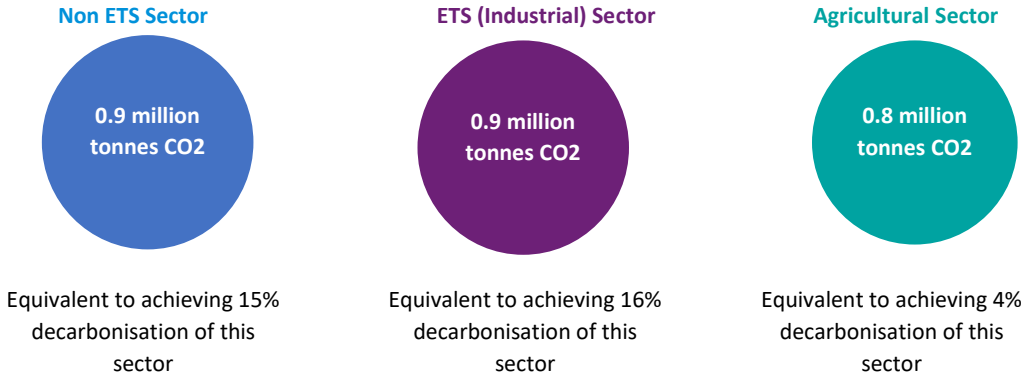


Source: KPMG Analysis

RGFI considers the proposed scale to be ambitious, appropriate and achievable, and in line with the Northern Ireland ("NI") experience which saw c.80 farm-scale AD plants successfully built during its first five years of development. Furthermore, the long-term target remains modest compared to other European countries such as France which are proposing targets of 30TWh by 2030.

Alongside significant economic benefits, the estimated annual CO2 emission savings associated with the Scheme by 2030 are outlined below:

Figure 3: Annual CO2 emissions savings by sector[4]



Source: KPMG Analysis

1.6 Market Demand for AD

Based on consultation with industry, gas consumers and the agricultural community, there is strong appetite for the establishment of an indigenous biomethane industry in Ireland.

With nearly two thirds of farming enterprises in Ireland either uneconomic or at a break-even level[5], there is significant demand for alternative and diversified farming opportunities. In particular, uneconomic beef and tillage farmers have expressed appetite to diversify their land into high yielding crop production (e.g. grass silage), however currently don't have sufficient confidence of a long-term market for this increased output. Such farmers recognise that a robust AD biomethane industry would provide the security and certainty of demand they require, while assisting in the decarbonisation of the wider agricultural sector.

[5] Teagasc, 2018, National Farming Survey 2018

There is also demand for renewable gas from the manufacturing, processing and commercial sectors, with many industrial businesses committed to mandatory targets in reducing their GHG emissions under the EU ETS mechanism. Given the profile of their industrial heat load, renewable biomethane is the only viable and available alternative for many businesses to decarbonise their heat requirements without impacting their overall operations. The use of indigenously sourced renewable gas has the potential to offset the significant ETS emission levels from these industries whilst strengthening Ireland's position as a world leader in attracting foreign direct investment.

Gas consumers which have pledged their support for the establishment of an indigenous AD biomethane sector include Danone, Dairygold Co-operative, Diageo, Pernod Rickard, Johnson and Johnson and Wyeth.

Finally, GNI, a member of RGFI, which operates the Irish Gas Network, has outlined its support for renewable gas and in particular its ambition to invest in a network of gas injection points and related infrastructure to support the growth of the sector.

1.7 Proposed Commercial Approach

It is feasible to produce biomethane from a wide variety of feedstocks, including municipal and commercial waste, as well as organic and agricultural materials, across a variety of plant sizes. RGFI has sought to develop the optimal commercial model for the roll-out of a robust Irish AD biomethane industry.

While large-scale commercial waste AD biomethane plants will have an important role to play in the development of the sector, the significantly increased costs of operating and maintaining waste plants, as well as the relatively limited volume of suitable waste materials available, means they require only modestly lower financial support, while being unable to provide the scalable solution required to make a meaningful decarbonisation impact.

Accordingly, KPMG's analysis suggests that the early establishment of an agricultural industry led approach represents the Irish scenario most capable of supporting the development of a robust long-term sustainable industry which has the capacity to make a meaningful impact on Irish decarbonisation.

RGFI's optimal scenario would see the roll-out of agricultural AD biomethane plants across rural Ireland producing biomethane for injection into the gas grid. They would be located based on geographic proximity to feedstock and gas injection points and be developed at a scale sympathetic to their local environment and operator capacity (primarily farm-scale 20GWh and 40GWh plants). Gas would be transported to the grid either through direct pipe connection or using road truck transportation, depending on distance. The AD biomethane plants would be fuelled primarily using agricultural waste and dedicated crops (including grass silage, clover and beet), produced from the increased productivity of currently underutilised land and through the diversification of existing loss-making farming enterprises.

Clustering and standardisation of equipment, structures and dedicated funding packages would drive economies of scale, regulatory compliance and efficient deployment, while minimising the economic funding required to support the industry.

A co-ordinating entity (to be established) would guide, govern and support the sector's development to ensure that best practices developed over the past decades in other jurisdictions are adopted and applied to ensure that Ireland implements an AD biomethane sector which bypasses the early and challenging years experienced by most countries when establishing a new indigenous industry.

1.8 Feasibility and Sustainability of the Scheme

Ireland has been identified in numerous studies as the EU country with the highest potential to develop AD biomethane given its abundance of appropriate agriculture resources[6]. In particular, Ireland has strong potential to significantly increase its production of grass silage, an ideal AD feedstock, without a permanent change of land use or impacting existing agricultural systems, while also more efficiently managing the nearly 40 million tonnes of slurry produced annually.

Various recognised researchers, including Teagasc, have demonstrated that by utilising guided best practice approaches, Ireland can increase its current national average yield of grass silage of 7t dry matter/ha to average yields of 10t – 13tn dry matter/ha, which is more than sufficient for the 5.8 million tonnes or 116,000 hectares[7] of land required for this scheme. DAFM have outlined that in their opinion there is circa 1m hectares of underutilised pasturelands in Ireland. In order to assist farmers transitioning to improved yields, it is proposed that government works alongside organisations to assist in re-seeding the land and other one-off land improvement and land management techniques.

Furthermore, a mix of grass silage, together with animal slurry, meets the new sustainability criteria in the EU Renewable Energy Directive 2 ("RED II"), while also generating significant ancillary benefits. The use of underutilised pasturelands and increase in additional grass production, would not threaten Ireland's hedgerows, and would increase the biodiversity of land use in participating areas through to the wider use of multi-grass varieties such as ryegrass and redclover.

The recently introduced GGCS will verify and validate the operation and sustainability of practices and land management in the sector. This is a fully transparent, verifiable and accountable scheme that applies calculation methodology in compliance with RED II, Carbon Disclosure Project, World Resource Institute and GHG Protocol for GHG mandatory reporting, providing essential confidence and reassurance on the sustainability and carbon intensity savings achieved and accountability in the National Inventory of GHG savings.

RGFI note that under current Eurostat (SHARES) reporting methodologies and Renewable Energy Directive I, grid injected biomethane intended for heat purposes is not 100% accountable for national accounting purposes (RES-H). However, under the new Renewable Energy Directive II, and further to recent communications, RGFI is confident that work to rectify this for Eurostat (SHARES) is underway by the EU Commission. Given that the first reporting under RED II guidelines (for the year 2021) will not be until 2023, there remains ample time to implement the required changes.

1.9 Conclusion and Policy Recommendations

Having consulted with the relevant Government departments, agencies, industry, and representative bodies and undertaken detailed economic, policy and industry analysis, KPMG believes that RGFI's vertically integrated business case represents a credible proposition to underpin national policy and economic support for an indigenous biomethane industry in Ireland. The business case delivers on a significant number of national policy objectives including the Government's Action Plan for Rural Development, the Nitrates Action Plan, DAFM's Code of Good Agricultural Practice and the Climate Action Plan and is built on a proven technology and economic model and represents a strategic national opportunity for Ireland.

[6] European Commission, 2017, Optimal Use of Biogas from Waste Streams
[7] Assuming 50 tonnes/hectare

Based on KPMG's analysis, RGFI proposes a number of key policy recommendations which they believe are required to support the delivery of the integrated business case:

- Government needs to clearly articulate its commitment to developing a long-term sustainable biomethane industry in Ireland from 2020 to provide confidence to participants who want to invest or participate in the sector;
- The Government should set binding targets of 2TWh of biomethane injection into the grid by 2025, and 6.8TWh by 2030, while not limiting longer-term ambitions and communicate this to the European Commission as part of the National Energy and Climate Plan;
- While policy should encourage the development of both waste and agriculture industry led AD biomethane sectors, agricultural plants provide the most scalable option for Ireland and should be supported from 2020 or at the earliest opportunity;
- It is imperative that the government put in place tariff support which is measured and appropriate and recognises the need to appropriately compensate stakeholders based on the different scale and feedstock mix of the various AD biomethane plants;
- It is recommended that RGFI, GNI and Teagasc be appointed to help lead a co-ordinated and standardised approach to guide the development of the sector to ensure best practice is adopted and economies of scale realised. This would replicate the successful French model; and
- A whole of government approach needs to be taken to ensure all relevant key stakeholders, including planning, environmental and agricultural policy makers adopt a joined-up approach to facilitating the appropriate and timely development of the sector.