Renewable Gas Forum Ireland

Cost Benefit Analysis

KPMG

October 2019

This report contains 13 pages

Cost Benefit Analysis Assumptions

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1 Cost Benefit Analysis Assumptions

This note explains the assumptions used in undertaking the CBA, focusing on employment and estimating GVA. Our Report refers to both a bottom-up and top-down approach to estimating potential benefits of the Scheme – these are both outlined here. Gross Value Added (GVA) relates to the economic contribution of a particular sector or programme to overall national economic output. Wider Economic Benefits (WEBS) capture improvements in economic welfare, as above, and also additionally relate to broader benefits such as agglomeration, output improvements, and tax revenue. In our work we focused on GVA while highlighting WEBS qualitatively.

1.1 General Assumptions

— We assume that there is a direct relationship between employment and GVA/WEBS. In our analysis, we have focused on GVA as a metric, given that there is existing research in this area in Ireland.
— We split stakeholders involved in the Scheme into cohorts, but there will be some crossover between these in practice. We mitigated this by excluding some cohorts when estimating GVA (e.g. slurry providers).
— We were provided with general locations of proposed Central Injection Stations across 8 regions, but the scheduling of these developments has not been determined.
— We assume that the development of Plants will be relatively evenly distributed across the regions, but we note that the market is likely to follow the development of Central Injection Stations.
— The long-term nature of our analysis means that we use average farm sizes – acreage and animals – when examining market impacts. In practice farmers involved in the Scheme may fall either side of these averages. If market participants have larger farms or more animals than averages, forecasted benefits may be lower, but efficiency savings and agglomeration benefits may be higher.
— When comparing the bottom-up and top-down approaches, there are not significant differences between the estimated broader impacts.
— Our analysis relies on a range of sources: Central Statistics Office, Teagasc, Department of Agriculture, Food and the Marine, SEAI, and others.

1.2 Employment and suppliers

We used a number of assumptions to estimate the levels of employment that could be generated through the roll-out.

1.2.1 Construction

- Elsewhere in our Report we show the proposed roll-out profile of 20 GWh, 40 GWh, and commercial waste plants. By 2030, these reach 151, 76, and 15 respectively.
- We consulted with developers on employment numbers. For all facilities, we assumed that an average 10 construction workers would be employed per site. This may be lower for 20 GWh plants and higher on commercial waste plants.
- This suggests employment could reach 350 by 2030, or ~2,400 over the period. When compared to the published SEAI figures,[1] this estimate is on the low side (see table in this document on page 5 – 'SEAI Datapoints' Row B). We considered it appropriate to be conservative.

1.2.2 Operators

- As above, we utilised the proposed number of AD facilities and commercial waste facilities as our baseline.
- We assumed that 1 operator would be employed per 20 GWh plant and 2 operators would be employed per 40 GWh plant and per commercial waste plant.
- On this basis, employment reaches ~330 in 2030 – 150 at 20 GWh plants, 150 at 40 GWh plants, and 30 at commercial waste plants. These values remain constant thereafter. This may be conservative in the context of commercial waste plants.

1.2.3 Silage

- In line with the *CSO Farm Survey 2016*, we use an average farm size of 32.4 ha / 80 ac.[2]
- Using averages, this implies there is a maximum quantity of silage that can be produced on an average farm, which increases the number of farms assumed to be providing silage as a feedstock.
- From consultations we learned that that 50t/ha (~20t/ac) grass silage can be produced.[3] This implies a yield per average farm of ~1,600t grass silage.
- On this basis, 14 and 28 farmers with average sized farms would be respectively providing feedstock to 20 GWh and 40 GWh plants. This may be on the high side in some areas and may be on the low side in other areas. Overall the cohort size could reach ~4,200 by 2030. Assuming best practice in contracting, the outturn may be a smaller-sized cohort.
- In modelling income benefits, a cohort of 3,600 is used.

[1] As shown at p17 of the SEAI Report, *Assessment of Cost and Benefits of Biogas and Biomethane in Ireland.*
[2] https://www.cso.ie/en/releasesandpublications/ep/p-fss/farmstructuresurvey2016/
[3] This is detailed in our own Report.

1.2.4 Slurry

— In line with the *CSO Farm Survey 2016*, we use an average of 62 cattle per farm. Through consultations, we assume cattle produce 1.6 tonnes of slurry per month, and collection is possible for 6 months p.a., meaning that 9.6 tonnes of slurry can be collected annually. This is reduced by ~10% to account for slurry density. This implies that an average farm produces ~560 tonnes of slurry annually.

— Based on these inputs and requirements from plants, there would be a need for 3.3 and 6.6 slurry providers per plant annually. Overall the cohort size could reach ~1,000 by 2030, but there may be some crossover with silage producers.

— We note that these slurry providers have not been taken account of in estimating GVA. The rationale is that their economic benefit would be sufficiently captured by the multiplier for silage providers.

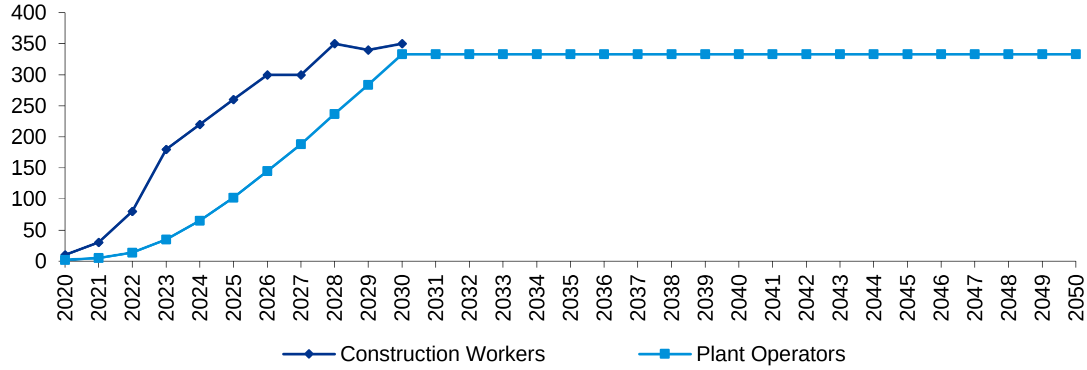
1.2.5 Tanker drivers

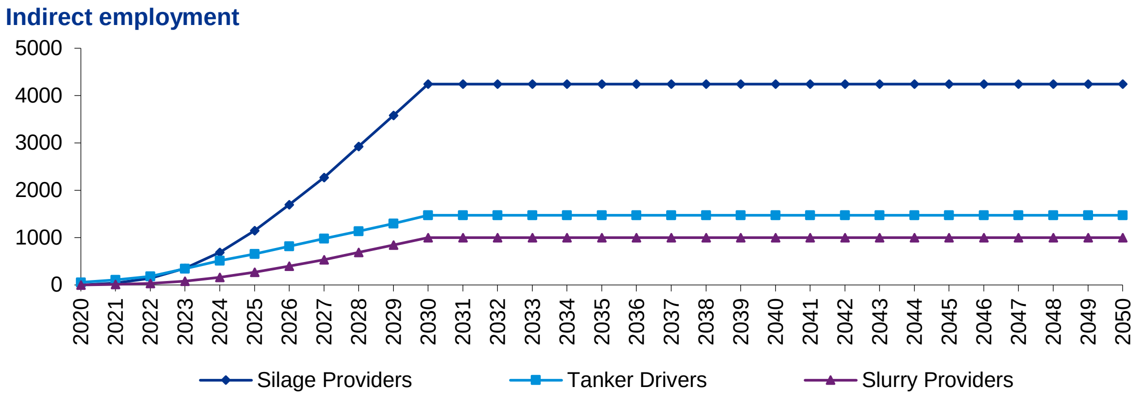
— Our Report highlights that GNI has outlined its ambition to develop Grid Injection Stations to support the growth of the network. We were provided with data on the proposed rollout. This would see 1 550 GWh Station being developed p.a. until 2022, rising to 2 thereafter. Each Station would require 4 modules with a capacity of 138 GWh each, requiring 8.75 40ft tankers.

— As the roll-out increases the number of modules and tankers increases. By 2030 there would be circa. ~90 new tankers required per annum. We assumed that each tanker requires 2 tanker drivers. For commercial waste facilities, we assumed that there would be 2 additional employees involved in collection. In the latter case, this may be on the low side given the scale of these plants.

— On this basis, we estimated employment in the tanker cohort annually, with total employment reaching ~1,470 in 2030.

Direct employment





1.3 Bottom-up: Payment Estimates

Using the forecasted employment figures shown above, we estimated the level of payments and revenue that are related to the development and operation of the Scheme in 2030. By 2030, these are assumed to be a minimum of €424m, but could be higher if slurry providers are paid, if savings related to lower fertiliser costs are included, and if benefits of digestate are taken account of. In this case, the benefit would be €620m. We note that we did not utilise these bottom-up estimates in our CBA modelling – they are instead shown for context and comparability.

Minimum revenue related to construction and operation (2030)

	Plants/Jobs	Cost/Payment	2030 Value (€m)
Development of Plants	35	Varies[4]	189.0
Construction Workers	350	40,000[5]	14.0
20 GWh Operator	150	40,000[6]	6.0
40 GWh/CW Operator	180	50,000	9.0
Silage Providers	3,600	45,000[7]	162.0
Slurry Providers	1,000	-	-
Tanker Drivers	1,470	30,000[8]	44.0
Total	**-**	**-**	**424.0**

[4] Total capital and overhead costs for 20 GWh plants and 40 GWh plants amount to ~€8m and ~€15.4m respectively. This excludes the ca
[5] Relates to Q1 2019, based on average weekly earnings. https://www.cso.ie/en/releasesandpublications/er/elcq/earningsandlabourcostsq12019finalq22019preliminaryestimates/
[6] As outlined in the main body of our Report.
[7] Based on an average farm size, as above, and a payment of €28/t. We note that an additional payment of €5/t is anticipated being provided for an additional 3,000t per 20GWh plant and for an additional 6,000t per 40 GWh plant.
[8] Based on the most recent estimate from jobs website Indeed.com. https://ie.indeed.com/salaries/truck-driver-Salaries

1.4 Top-down: Broader Benefits

To allow for the determination of the overall wider economic benefits resulting from the rollout of the Scheme, detailed evidence-based research was undertaken considering best practice approaches, methodologies and definitions of economic multipliers and *multiplier effects*[9]. We also undertook primary research with stakeholders and analysed existing data published by the SEAI.

Below we set out the basis for assumptions used in estimating wider economic benefits for the purpose of the CBA. Our approach to this was top-down. Tables showing these are provided below.

- We examined existing SEAI work on four potential biogas scenarios – *waste, increased biomethane, all AD feedstocks, exploratory*. We took the view that the proposed roll-out model would be similar in scale to the 'All AD feedstocks' scenario and may be similar to 'Exploratory' in some respects.
- The analysis sets out the wider economic impacts of biogas deployment under the four scenarios (p17, table 3.8). These include both employment and GVA effects and are categorised as 'construction jobs', 'operational jobs', 'GVA from construction', and 'GVA from operation'. Both direct effects and indirect effects are shown.
- For each scenario, we estimated the level of GVA generated per employee by dividing the former by the latter, arriving at a €-value multiplier per job.
- Specific figures are given for most indicators, but a range is given for 'GVA from operation'. We examined this using a low point, midpoint, and high point.
- This approach showed that there are few significant differences between the multipliers identified for each of the four scenarios (see rows K, L, T, U, V). This suggests that although the scenarios differ, their relationships with GVA are similar. It is reasonable to assume that the proposed AD roll-out could result in similar multipliers.
- We used the average for the multipliers across the four scenarios for 2050 and we deflated these by 1% per annum back to 2020, in order to reduce a risk of inflated multipliers.
- We applied these deflated multipliers to our estimated levels of employment generated through the roll-out profile.
- Note that we assumed that direct employment relates to construction workers and plant operators (captured in direct effects). We assumed that all other employment is indirect – especially silage providers and tank operators – as these will be in the supply chain.
- We excluded slurry providers when grossing up for GVA. First, feedstock will be provided at low cost. Second, there is likely to be crossover between slurry and silage cohorts. The return of digestate to this cohort and to silage providers is an

[9] There are numerous published research and reports documenting general and sectoral employment and income based economic multipliers. Stevens, B., Lahr, M., (1988), *'Regional Economic Multipliers: Definition, Measurement, and Application'*, Regional Science Research Institute. Coughlin, C., Mandelbaum, T., (1991), *'A Consumer's Guide to Regional Economic Multipliers'*, Economic Research. Department of Public Expenditure and Reform, (2015), *'Public Capital Programme 2016 to 2021: Labour Intensity of Public Investment'*, Irish Government Economic and Evaluation Service.

effective benefit as it reduce demand for other fertilisers. We assumed that this would be captured in the multipliers.

- An argument could be made that silage and slurry providers yield direct effects. We were cautious about assuming this, as the contractual relationships are more likely to be akin to supply-chain relationships.
- Altogether, using the source datapoints, back-solving, and grossing up based on estimated employment, this approach yielded estimated direct and indirect GVA.
- We compared our GVA estimates to SEAI's GVA estimates under its scenarios, exclusive of construction-based GVA to improve comparability.
- The SEAI estimated GVA in its 'All AD feedstocks' at ~€440m and the 'Exploratory' scenario at ~€555m in non-construction GVA in 2050 (rows E + S). We estimated GVA exclusive of construction at ~€530m in 2030 (when roll-out is complete). If the lower GVA figure of ~€440m is used, the BCR for this Scheme falls to 1.15, but remains positive.
- We compared the above GVA estimates to recent published GVA estimates for a range of other firms and sectors within the Irish economy. These include: Allergan (€300m),[10] the golf sector (€200m),[11] AirBnB (€700m),[12] Intel (€900m),[13] Irish Horse Breeding and Racing (€1.8 billion).[14] In the context of the above published figures, our total estimated GVA for 2030 of €600m – and ~530m exclusive of construction impacts – does not appear unrealistic given the geographic spread of the Scheme and the level of involvement by the wide range of stakeholders discussed in the Report.

SEAI datapoints[15]

				SEAI Scenarios			
	Row	Indicator	Metric	Waste	Increased biomethane	All AD feedstocks	Exploratory
Published SEAI datapoints				Direct effects			
	A	Construction job-years	(all installations)	13,304	19,158	52,930	68,693
	B	Construction jobs	(all installations)	1,330	1,916	5,293	6,869
	C	Operational jobs	(in place in 2050)	340	796	3,404	4,301
	D	GVA from construction	€M (all installations)	327	471	1,302	1,690
	E	GVA from operation	(€M in 2050, single year estimate)	32	74	317	400
				Indirect effects			
	F	Construction job-years	(all installations)	7,786	11,211	30,975	40,199
	G	Construction jobs	(all installations)	779	1,121	3,097	4,020
	H	Operational jobs	(in place in 2050)	92 to 169	215 to 395	918 to 1,691	1,160 to 2,136

[10] https://www.businessworld.ie/technology-news/Allergan-annoünes-Irish-65m-investment-and-63-new-jobs-in-Westport-572296.html
[11] https://www.golfnet.ie/News%20Listing%20Assets/CGI%20Report%20Economic%20Impact.pdf
[12] https://irishtechnews.ie/impact-of-airbnb-in-ireland-valued-over-e700-million/
[13] https://www.intel.ie/content/dam/www/public/emea/ie/en/images/company-overview/infographic-16x9.png
[14] https://www.hri.ie/uploadedFiles/HRI-Corporate/HRI_Corporate/Press_Office/Economic_Impact/HRI%20Report.pdf
[15] SEAI, *Assessment of Cost and Benefits of Biogas and Biomethane in Ireland*, page 17

	I	GVA from construction	€M (all installations)	191	276	762	989
	J	GVA from operation	(€M in 2050, single year estimate)	9 to 16	20 to 37	85 to 157	108 to 199

SEAI datapoints back-solved

				SEAI Scenarios			
	Row	**Indicator**	**Metric**	**Waste**	**Increased biomethane**	**All AD feedstocks**	**Exploratory**
Back-solved SEAI datapoints		***Direct effects***					
	K (D/A)	*GVA per construction job*	*(all installations)*	*0.25*	*0.25*	*0.25*	*0.25*
	L (E/C)	*GVA per operational job*	*(€M in 2050, single year estimate)*	*0.09*	*0.09*	*0.09*	*0.09*
		Indirect effects					
	M (I/G)	*GVA per construction job*	*(all installations)*	*0.25*	*0.25*	*0.25*	*0.25*
	N (H, LOW)	*Operational jobs (low)*	*(in place in 2050)*	*92*	*215*	*918*	*1,160*
	O (H, HIGH)	*Operational jobs (high)*	*(in place in 2050)*	*169*	*395*	*1,691*	*2,136*
	P (H, MID)	*Operational jobs (midpoint)*	*(in place in 2050)*	*131*	*305*	*1,305*	*1,648*
	Q (J, LOW)	*GVA from operation (low)*	*(€M in 2050, single year estimate)*	*9*	*20*	*85*	*108*
	R (J, HIGH)	*GVA from operation (high)*	*(€M in 2050, single year estimate)*	*16*	*37*	*157*	*199*
	S (J, MID)	*GVA from operation (midpoint)*	*(€M in 2050, single year estimate)*	*13*	*29*	*121*	*154*
	T (N/K)	*GVA per operation job (low)*	*(€M in 2050, single year estimate)*	*0.10*	*0.09*	*0.09*	*0.09*
	U (O/L)	*GVA per operation job (high)*	*(€M in 2050, single year estimate)*	*0.09*	*0.09*	*0.09*	*0.09*
	V (P/M)	*GVA per operation job (midpoint)*	*(€M in 2050, single year estimate)*	*0.10*	*0.09*	*0.09*	*0.09*

Multipliers

				SEAI Scenarios			
	Row	**Indicator**	**Metric**	**Waste**	**Increased biomethane**	**All AD feedstocks**	**Exploratory**
Multipliers used in model		**Direct effects**					
	K (AVE.)	GVA per construction job	2020, deflated 1% p.a. from 2050	0.18			
	L (AVE.)	GVA per operational job	2020, deflated 1% p.a. from 2050	0.07			
		Indirect effects					
	M (AVE.)	GVA per construction job	2020, deflated 1% p.a. from 2050	0.18			
	V (AVE.)	GVA per operational job	2020, deflated 1% p.a. from 2050	0.08			

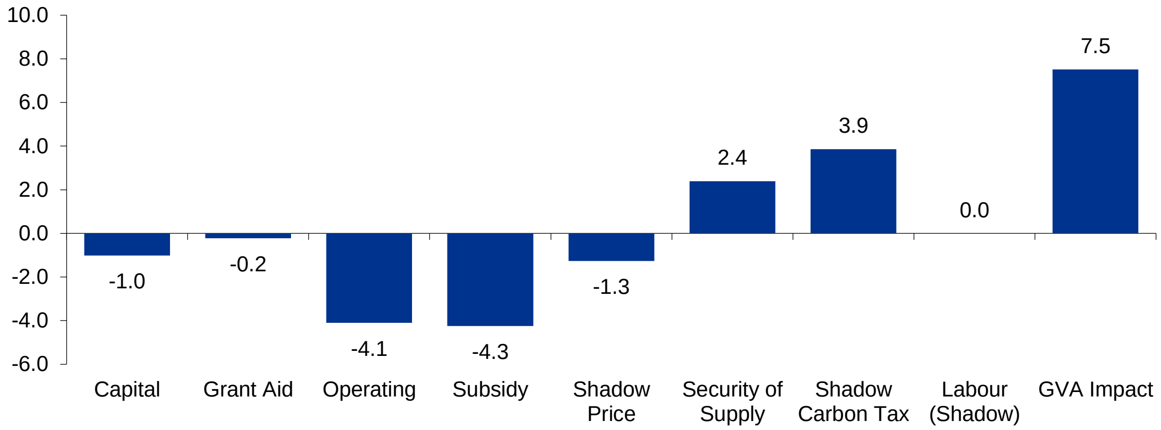
1.5 Results

Below we set out our results as presented in our Report and in addition the flow of costs and benefits under each scenario.

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	3.9	2.87
Economic BCR	0.68	1.36	1.26
Comment	Scheme does not pass CBA, when traditional methodology and parameters of the Public Spending Code are applied.	This is presented to show PSC framework + GVA/WEBS. There is likely to be some duplication between shadow cost of labour and GVA. This scenario is assumed to be a high case.	This substitutes the shadow cost of labour, required per the PSC, with GVA/WEBS. The BCR is mainly driven by indirect operational benefits through the supply chain.

Scenario 1: CBA with Shadow Cost of Labour, 2020-2050 (2019 values)

Flow of Costs and Benefits (€ billion)



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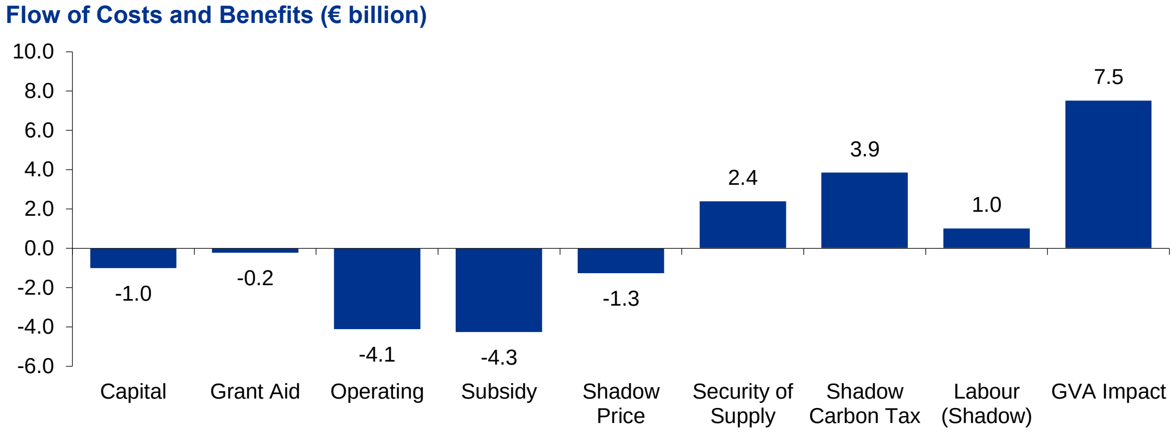
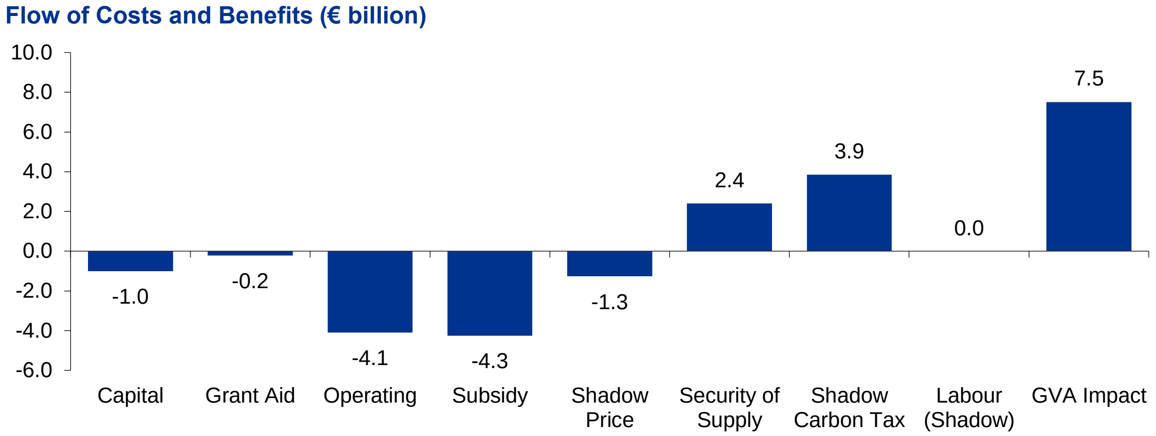
<u>Scenario 2: CBA with Shadow Cost of Labour and with GVA Impacts, 2020-2050 (2019 values)</u>



<u>Scenario 3: CBA without Shadow Cost of Labour and with GVA Impacts, 2020-2050 (2019 values)</u>



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