

# Financing an AD project



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## IS Anaerobic Digestion (AD) feasible in Ireland under the current policy framework?

The main cost components for operating a digester are:

- Investment costs.
- Operation and maintenance costs.
- Insurance and taxes.
- Intake and end use of co-digested manure.

### INVESTMENT COSTS

Costs will depend on:

- Digester volume m<sup>3</sup>
- CHP capacity (kWe)
- Pumps, mixers, flare, heat exchanger within the digester
- Grid connection
- Earthworks
- Civil works, engineering, planning
- Automation, visualisation

- Pre-mixing well, dry matter input, fluid matter input, sanitation/disinfection tank may be required in some situations.

- Silo and manure bag storage volume m<sup>3</sup>
- Weightbridge
- Feeding system
- Separator, sorting system
- Biogas storage volume m<sup>3</sup>
- Insulation type
- Return heat pipes
- Other equipment such as gas cooling and cleaning (desulphurisation, condensate trap), leak detector. The investment cost can vary depending on system and size between 4000 — 6,000 €/kW for the whole plant including CHP unit. The CHP unit for itself costs, depending on kind of engine and capacity, app 500—1,000€/kW.

### FINANCING

For the purpose of an initial cost-benefit analysis, it is sufficient to assume that the annual costs of the investment are discounted at a single discount rate (generally over the same period as the technical lifetime of the installation). The technical lifetime of a digester is be-

**Table 1** Calculation of costs and benefits based on 5,000m<sup>3</sup> cattle manure and 1,000m<sup>3</sup> (800t) agricultural waste

Annual Costs	Calculation method	Example	€/year
Annuity of investment costs	Total investment costs x annuity %. Net of SEI grant aid	€900,000 - 20% SEI grant x 9.6%	€69,120
Operation and maintenance of Digester, spare parts digester and pumps/mixer etc	Total installation costs x 4%	€900,000 x 4%	€36,000
Operation and maintenance of CHP	Operational h/yr c. (0.8 to 1.1) €/hr	8,000 hrs/yr x 1.10/hr	€10,000
Insurance and Tax	Total installation costs x c.(0.5 to 1)%	€900,000 x 0.7%	€6,300
Labour	Total h/day x 365 x (5-20)/hr	0.75 h/day x 365 x 15hr	€4,106
Net intake substrates	Sum of intake costs, transport and nutrient use	€3/t x 800t	€2,400
Total Annual Costs			€ 127,926
<b>ANNUAL BENEFITS</b>			
Gate fee		800t x €50	€40,000
Electricity Sales	CHP capacity (kW) x operational hours x feed-in tariff (kWh) minus 10% for use on site	150 x 8000 hr - 10% = 1,080,000 x 0.12 ct/kWh	€129,600
Heat Use	25 % of produced kWh th used for 3.5 ct/kWh (40kW thermal capacity of CHP unit)	180 kWh x 8000 hr x 25% @ 3.5ct/kWh	€12,600
Savings on chemical fertilizer/better quality manure	Amount of manure (t/yr) x savings (/t manure).	5,000 t/yr x €8.70/t	€43,700
Total Annual Benefits			€225,900
Annual profit	Annual benefits - annual costs	€225,900 to €127,926	€97,974
Paybacktime	Total investment costs x (1 - subsidy %) / annual benefit	€900,000 to 20% / (€97,974/yr + €69,120/yr)	7.3 years

tween 10 and 20 years — an average of 15 years is generally used. The annual percentage of investment cost for a discount rate of 5% (bank lending rate) would be 9.6% for 15 years.

An investment of €900,000 for an installation, with a technical lifetime of 15 years, will, at a discount rate of 5% have annual costs of €900,000 x 9.6% = €86,400. A grant from SEI for that plant system would be €180,000 (30% of €4,000/kW x 150 kWe). So, the annuity of investment costs (5% over 15 years) would be €69,120 per year.

### OPERATION AND MAINTENANCE COSTS

The annual costs of operation and maintenance are approximately 3% to 5% of the investment costs. This excludes the maintenance cost

## Example: Calculation of investment cost

TABLE 1 shows an example calculation of the investment costs for the digestion of 5,000m<sup>3</sup> of cattle manure 1,000m<sup>3</sup> of agricultural waste (from grains) and 3000m<sup>3</sup> canteen/food waste presumed gate fee €50/tonne.

The following formula is used to calculate the size of digester required:

- Digester = [manure (m<sup>3</sup>/yr) + co-substrate (m<sup>3</sup>/yr)] x retention days
- Volume (m<sup>3</sup>) is 365
- The retention time is 40 days.
- (5,000 + 1,000 + 3000) x 40/365 = 1,000 m<sup>3</sup>

The following formula is used for calculating post digestion (restricted spreading time) storage:

- Size of = Animal input x Required storage time — size of digester (m<sup>3</sup>)
- Storage (m<sup>3</sup>) substrate (m<sup>3</sup>/yr) (months)
- (5,000 + 1,000 + 3000) x 2/12 — 1,000 m<sup>3</sup> = 500 m<sup>3</sup>
- The costs for this project could vary from €800,000 — €1m, depending on the amount of bells and whistles you want to incorporate in the investment. In the following, an investment sum of €900,000, including CHP, and grid connection is assumed.

of the CHP unit, which can be arranged in a separate contract. The costs for maintaining a CHP unit is calculated with a realistic sum of €10,000 per year. The CHP unit would be a 150 kWe six cylinder four stroke gas engine.

The required labour for the operation of a digester is approximately 30 minutes to one hour per day for inserting the co-substrate, checking the plant, together with maintaining the digester and CHP unit. The costs of valuation of this type of labour will range from €15 to 20 per hour.

### INSURANCE AND TAXES

The annual cost for insurance of the installation is about 0.5% to 1% of the total installation costs.

### CO-DIGESTED MANURE

The annual costs will include the intake of manure and or/ co-substrates from an external source (including costs of transport). In some cases, these costs may be negative (that is, an income). This example assumes 800 tonne of co-substrate is transported on to the farm at €3 per tonne.

In addition to intake costs, some indirect costs, such as additional transport costs from the digester to the field/end, use €0 to €10/t. Savings could be made in the future by the higher availability of nutrients in digested manure, giving a higher value to the digestate. A value can be given to nitrogen (N) of €0.90/kg, phosphorus (P) of €2.5/kg and potassium (K) of €1.00/kg.

### ELECTRICITY

It is assumed that the electricity is fed into the grid as sustainable electricity. This will be the case in most situations. The rate payable for renewable electricity is €120 MWh or 12c/kWh.

In Germany, the rates are over 20c/kWh, and greater for certain plant systems and input materials, if the input material, is mainly slurry (30% mass weight), using bioenergy crops or installing new technology and utilising the generated heat.

This tariff is guaranteed for 15 years in Germany, giving greater confidence for potential investors.

### THE GRID

Large contingency costs have to be included in the business plan to account for grid connections, because the actual connection costs can only be calculated with a full application. If upgrades to the substations are necessary, costs could prove prohibitive and render the project unviable.

It is hard to comprehend how projects of the scale of AD developments, in the context of other renewable projects, such as wind, where the grid connection for a wind farm would be 10 times or greater than the Maximum Export Capacity (MEC) of an AD plant, could trigger huge unforeseen network infrastructure costs.

AD will provide a continuous base load electricity supply, whereas wind turbines will only supply electricity

when the wind blows.

### HEAT

The residual heat can substitute for conventional production of heat. It is possible that not all of the residual heat produced by the CHP unit can be used, owing to variation in heat demand during the year. Farms or companies with a sufficient heat demand will, in most cases, be able to use 50% to 60% of the residual heat. This largely depends on the type of farm and input material of the digester and heat exchanger of the CHP unit. A sow or poultry unit would have a bigger heat demand. In the case above, 25% of the produced heat is used externally.

The saving on the conventional heat production will be in the order of €5 to €15GJ, depending on the fuel used for heat supply and its cost.

### BENEFITS

In general, an AD plant generates three types of revenue, profiting from the production and utilisation of biogas and the improved fertilizing characteristics of the digested substrate. In some cases, where specific waste streams are used as a co-substrate, a fourth revenue component may result from charging a gate fee or waste removal fee.

The major part of the income from operating an AD plant results from the value of the gate fee (depending on the gate fee) and generated electricity. The example above assumes a gate fee of €50/tonne; this could vary.



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Tullamore**

**Thursday,  
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Topics covered include;

- Market Drivers in Ireland
- Getting Started in Biogas
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- Feedstocks for on-farm AD

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