Cost Benefit analysis on the Dublin Waste-to-Energy project

Prepared for the Dublin Authorities

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Summary Report

The Dublin Waste to Energy ("DWTE") project is a Public Private Partnership ("PPP") between Dublin City Council and Dublin Waste-to-Energy Limited ("DWTEL") to provide a waste-to-energy ("WtE") plant in the Poolbeg peninsula in Dublin.

The DWTE facility will incinerate residual municipal solid waste ("MSW") and has an effective capacity of 550,000 tonne per annum ("tpa") which will be incinerated to produce electricity. Heat production for the purpose of district heating is not currently planned, but could be included for a future stage of the project. Hence, the project will generate revenues from waste by charging a gate fee and from the sale of electricity.

The realisation of the project is considered to be vital for Ireland to meet the new national and European policy targets to divert waste from landfill and eventually eliminate landfill of municipal waste in Ireland. Realising final treatment capacity in Ireland will be essential to achieve the principle of self-sufficiency and proximity and will complement the realisation of increased recycling effort and pre-treatment projects.

Under the initial Project Agreement, which was signed in 2007, the Dublin Authorities were subject to a "put or pay" obligation. They had to bring 320,000 tonnes of waste to the DWTE facility every year at an agreed price. If less or no waste was provided by the Dublin Authorities, the full obligation would need to be paid nonetheless. At the time, the Dublin Authorities were still collecting waste and it was estimated that the waste volume collected would increase, so a scenario in which no waste volume was provided was not foreseen.

Since 2007, circumstances in the Irish waste market have changed. Private operators entered the municipal waste collection market and, in December 2009, the Irish High Court decided in the Panda case that ownership of municipal waste was not vested with local authorities. Hence, the power to direct municipal waste to the facility was taken away from the Dublin Authorities. As competition increased, the Dublin Authorities eventually exited the waste collection market and could no longer adhere to their "put or pay" obligation.

As a consequence, the Project Agreement with DWTEL was renegotiated and a revised version was drafted. Under the revised Project Agreement, the WtE facility is operated on a commercial basis and the Dublin Authorities are participating financially on commercial terms, expecting a rate of return that a private investor would also have accepted.

It is proposed that the Dublin Authorities would now provide a revenue support that is contingent on the development of the waste market and will benefit from revenues from the electricity market. The proposed waste revenue support to DWTEL is provided in cases where the conditions in the waste market deteriorate compared to what can be expected. The proposed support would be provided for the first 15 years of the project. In return, the Dublin Authorities would get a share of waste revenues where the market improves compared to what is expected for 15 years and would get a significant share of electricity revenues over the entire 45-year project period. Hence, actual returns will depend on the development of the waste market and income from the electricity market.

The future returns to the Dublin Authorities must be assessed under current market circumstances; all costs incurred prior to the renegotiating the revised draft – such as the costs of the acquisition of the site in 2008 – need to be treated as sunk costs.

The Dublin Authorities are now faced with two options: the first is not to proceed with the project; the second is to proceed with it.

Under the first option, the Dublin Authorities would have to accept the loss of sunk costs that have already been incurred and would be liable for compensation payments to DWTEL, but they might be able to sell the land at current value. However, as the current value of the land is low, the overall costs will realistically be well in excess of €100 mln.

The second option is to go ahead with the Project Agreement, which could offer significant returns to the Dublin Authorities. The high potential to realise positive returns is driven by the fact that there is no initial capital outlay by the Dublin Authorities and actual obligations (cash outflows) only occur in case of significant deterioration of waste market circumstances.

What the actual returns to the Dublin Authorities will be depends mainly on three drivers: the gate fee, the waste volume and the electricity market price. The table below shows what returns would be in nine (9) different scenarios. The scenarios are covering low, medium and higher gate fee as well as low, medium and high electricity price assumptions; waste volumes are assumed to be constant at 550,000 tpa, as there is sufficient waste available (according to independent market consultants) in the market for the plant to operate at effective capacity.

Returns are discounted to net current values based on the cost of capital to the Dublin Authorities, which is currently 5.4%. The table indicates that net returns to the Dublin Authorities over the 45 year operating period are likely to be significant. In the most pessimistic scenario, the net current value of returns would be €30.2mln; in the most optimistic scenario it would be €155.3mln. In the most realistic / midpoint scenario, the expected returns would be €92.3mln. So, overall, it seems rational to go ahead with the revised Project Agreement.

Table – Net value of returns to the Dublin Authorities over the 45-year project at a discount rate of 5.4% (in € mln)

		Electricity market price (per MWh)		
Gate Fee*:		Optimistic (€71.2 + 1% real increase)	Standard (€71.2 flat)	Pessimistic (€71.2 + 1% real decrease)
Optimistic:	€110/ton	€155.3 mln	€138.3 mln	€123.8 mln
Midpoint:	€95/ton	€109.3 mln	€92.3 mln	€77.8 mln
Pessimistic:	€80/ton	€61.7 mln	€44.7 mln	€30.2 mln[1]

Further to assessing returns in a selection of nine potential market scenarios, the Dublin Authorities also had a risk assessment carried out. This risk assessment is based on a simulation of 10,000 potential market scenarios, taking into account all potential market circumstances that might be expected. The results of this risk assessment suggest that the probability that the returns to the Dublin Authorities are positive is high (98% - 99%). It should be noted the risks are higher in the first 15 years of operations as that is the period when the Dublin Authorities are exposed to the waste market.

[1] Note: the funding banks have examined a further downside energy case (produced by Baringa, market experts). This Baringa low case is based on very low global energy prices for the next 20 years. The combined Baringa Low Case and €80/t Gate Fee still produces a positive return of €1.2m.

The potential financial returns the Dublin Authorities can expect to realise are high and the estimated financial risks of entering the revised Project Agreement are low. Thus, it seems to be rational for the Dublin Authorities to proceed to complete the renegotiated Project Agreement.

Further Information

1. History of the Project

Initial developments surrounding the DWTE project began in March 2001. The WtE project was motivated by Ireland's 1996 Waste Management Act and Ireland's 1998 Waste Management Policy "Changing Our Ways". Combined, these policies place a responsibility on local authorities to adopt a waste management plan for the prevention, recovery and disposal of waste with a view to minimise landfill waste and the associated adverse effects of landfill waste on human health and the environment.

A WtE plant with 400-600 ktpa at the Poolbeg site was identified as the best way to realise regional waste policy objectives

Following a comprehensive technical and environmental evaluation, the development of a WtE plant with a capacity of approximately 400,000 – 600,000 tpa at the Poolbeg peninsula was put forward in the Dublin Waste Management Plan 2001 -2005.[2] To realise this objective, the Dublin Authorities decided to procure the operation of a WtE facility of the size needed to meet the policy targets in their region.

The procurement procedure was initiated in 2004. Thirteen groups/consortia responded to the tender request for the WtE plant. The Dublin Authorities initially engaged in negotiations with four applicants, however one bid was subsequently withdrawn and another was non-compliant. Of the remaining two bids, the offer made by ELSAM was found to be the most competitive. Based on a public sector benchmarking study the Dublin Authorities considered that entering into the Project Agreement with ELSAM offered the lowest costs to society as the costs for waste treatment based on such an agreement were estimated to be 45% lower than if the service was provided by the public sector. The project received a value for money opinion from the National Development Finance Agency ("NDFA") supporting the view that ELSAM's offer was cost effective for the Dublin Authorities.

In 2005, ELSAM was acquired by DONG Energy which delayed the development of the project. Subsequently, the special purpose company DWTEL, a joint venture between DONG Energy and Covanta Energy Corporation ("Covanta"), was set up to develop and operate the project on the terms of the winning tender . In September 2007, the Dublin Authorities and DWTEL signed an initial agreement for the development of a WTE facility in the Poolbeg peninsula with an effective capacity of 550,000 tonnes per annum.

The initial Agreement was signed in 2007 and included a "put or pay" clause for 320 ktpa to be provided by the Dublin Authorities

The terms of the initial Project Agreement included a "put or pay" arrangement of 320,000 tonnes of waste annually meaning that, should the Dublin Authorities fail to deliver this annual volume, they would be liable to pay for the shortfall arising at the originally tendered gate fee. At the time of the tender, the Dublin Authorities were still active in the waste collection market and the "put or pay" clause was based on 320,000 tpa as this was the minimum amount of waste, the Dublin Authorities were expecting to collect from households in the Dublin Waste region over the 25-year contract period.

[2] In the second Dublin Waste Management Plan (2005 – 2010), the Dublin Authorities committed to " *… develop a Waste to Energy (Incineration) plant [with] a capacity of approximately 400,000 to 600,000 tons/annum*" (see page 144). According to the Waste Management Plan (2005 – 2010), development of such a facility was *"… a critical element of this Plan [and was] required to meet obligations under the EU Landfill Directive, the Draft National Biodegradable Waste Strategy, and the long-term targets of the Dublin Waste Plan."*

Under the terms of the Agreement the Dublin Authorities also had an obligation to acquire the Poolbeg site and make it available to DWTEL for the 25-year duration of the contract. The land for the Poolbeg site was acquired in 2008 by the Dublin Authorities by means of a Compulsory Purchase Order.

At the time of the 2007 Agreement, the Dublin Authorities believed that they had jurisdiction over municipal waste and that it was their responsibility to collect and ensure treatment of household waste in line with the targets of their waste management policy. The agreement with DWTEL was seen as a means to provide a needed public service. However, in the years after the 2007 Agreement was signed there were significant changes in the Irish waste market which necessitated a reassessment of the Project Agreement.

The main development was the entry of private waste operators in the sector, starting with Panda Waste Services in 2006, which increased competition for municipal waste and reduced waste volumes collected by local authorities. In line with the best practice in other European countries, where ownership of municipal waste is vested with local authorities who hold tenders for waste collection and treatment services, the Dublin Authorities decided to put forward a plan to create competition *for* the waste collection market. This would entail selecting a single operator for the entire region or a number of operators for sub regions via a competitive tender.

In 2009, it was decided in the Panda case that ownership of municipal waste is not vested with local authorities

This decision was challenged by two private waste operators; Panda Waste and Greenstar. In December 2009, in its judgment of the Panda case, the Irish High Court clarified that the Waste Management Act adopted in 1996 did not grant municipalities the ownership of municipal waste, nor did it give local authorities the right to direct waste (Panda case).

As a result of increased competition in the waste collection market and the Panda case, the four Dublin Authorities exited the waste collection market. Dun Laoghaire exited in June 2010, South Dublin and Fingal County Council exited the collection market in 2011, and finally Dublin City Council exited the waste collection market in January 2012.

Thus, the Dublin Authorities, who no longer owned or controlled the supply of waste, could no longer guarantee to deliver 320,000 tonnes of waste per annum to the planned WtE facility. Hence, maintaining the "put or pay" clause in the 2007 Project Agreement would have exposed the Dublin Authorities to considerable financial payments to make up for potential shortfalls on the delivery of waste by the DLA's. To avoid these costs, the renegotiation of the contract was essential.

Without power to direct waste, the "put or pay" agreement could no longer be met; the Project Agreement was renegotiated in 2012

Negotiations surrounding a revised Project Agreement between DWTEL and the Dublin Authorities began in 2011 and a revised Project Agreement was drafted. The renegotiated Project Agreement now forms the basis of the DWTE project.

2. The Project Agreement in the Current Market

The revised Project Agreement establishes a Public Private Partnership between Dublin City Council, acting on behalf of the Dublin Authorities, and DWTEL under which the Poolbeg plant will be designed, financed, operated and maintained by DWTEL.[3] The facility is expected to process an effective capacity of 550,000 tpa.

The Dublin Authorities now provide support only if the market deteriorates and in return benefit from revenue sharing mechanisms

The duration of the project is 45 years and the Dublin Authorities are no longer subject to "put or pay" clause. Instead, there is a contingent revenue support obligation, called the Authority Contingent Obligation ("ACO"). Under the ACO, the Dublin Authorities will cover part of the waste revenue shortfall below a pre-determined reference level in certain circumstances such that DWTEL cannot realise this target waste revenue. In return, the Project Agreement contains revenue sharing mechanisms which ensure that, if markets develop as expected or improve, the Dublin Authorities receive a significant share of the project's electricity and waste revenues.

Under the revised Project Agreement the DWTE project is a commercial project that will contribute towards achieving new landfill diversion targets contained in Ireland's 2012 Waste Management Policy "A Resource Opportunity". The new Irish waste policy is predicated on the EU waste hierarchy which is based on 5-tiers, namely the prevention, reuse, recycling, recovery, and only as a last resort, the disposal of waste. Ireland's 2012 Waste Management Policy aims for the "virtual elimination of landfill". The targets set by the policy paper imply that by 2020, zero municipal solid waste should be disposed of in landfills in Ireland.

To achieve the landfill diversion and elimination targets the development of higher tier technology and infrastructure that prevents the disposal of residual waste and allows the recovery of energy is imperative. Ireland's 2012 Waste Management Policy states that ideally landfill diversion should be achieved by taking into consideration the principles of self-sufficiency and proximity. This implies that residual waste should be treated close to the source and the export of waste should be minimised.

The project will be operated on a commercial basis and is vital to meet national and European landfill elimination targets

Potential waste recovery infrastructure includes mechanical biological treatment ("MBT") facilities, cement kilns and waste-to-energy plants. However, MBT is only a *pre-treatment* installation which creates new residual waste streams that have to be landfilled unless they undergo further treatment locally or abroad. Hence, as a long-term, sustainable solution to achieve actual elimination of landfill *final* treatment installations, such as WTE facilities, are essential. Cement kilns are another type of final treatment installations but do not provide sustainable solutions as they are dependent on the cyclical nature of the cement industry and cannot accept all waste streams. WTE plants are the more effective solution in achieving long-term landfill diversion and elimination targets.

Currently, there is a need for increased incineration capacity in Ireland. At the moment there is only one commercial grade WtE plant in operation in Ireland; Indaver Ireland's waste-to-energy facility, located at Carranstown, Duleek, County Meath, which commenced operation in September 2011. The Duleek facility provides the same service as the Poolbeg facility, processing approximately 220,000 tonnes of waste annually. The

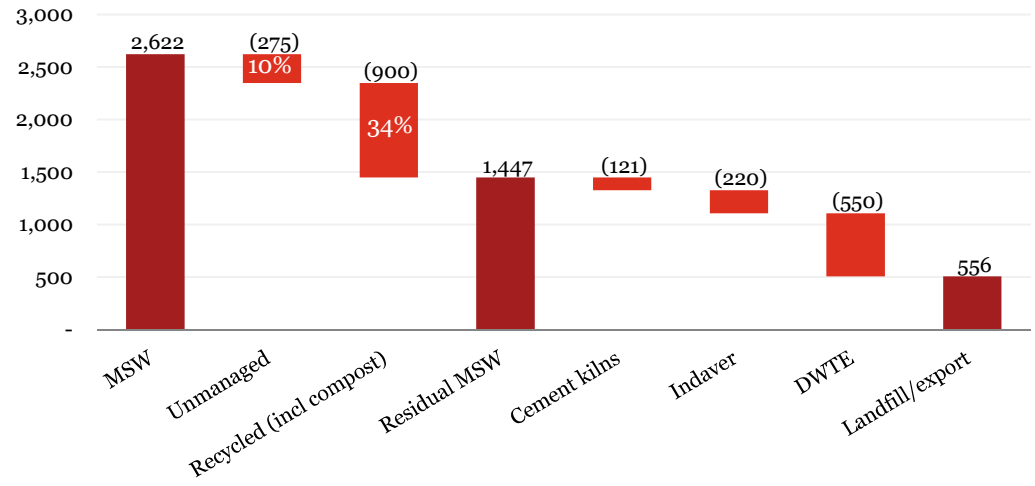
[3] DWTEL is a special purpose company, formed specifically to design, build, finance, operate and maintain the waste incineration project in Dublin. Covanta and DONG Energy are shareholders of DWTEL, owning 75% and 25% of the shares respectively.

DWTE facility has an effective capacity of 550,000 tpa being recovered to energy that would otherwise go to landfill. Given past and anticipated trends in municipal solid waste, the facility is expected to operate at close to full capacity.

There is needed incineration capacity in Ireland and sufficient waste flows for the project to operate at full effective capacity

Figure 1 below illustrates that in 2012, 2,622 kilotonnes per annum ("ktpa") of municipal solid waste was produced in the Irish market.[4] Approximately 10% of produced MSW was uncollected or unmanaged and therefore never entered the waste treatment system. Approximately 34% of the produced MSW was recycled, composted or fermented. Hence, the total residual MSW in Ireland in 2012 was about 1,447 ktpa.

Figure 1 – Residual MSW volumes (in ktpa), in terms of 2012 waste figures



Source: EPA, 2012 estimates

In 2012, about 121 ktpa of the 1,447 ktpa of residual MSW was accepted by cement kilns.[5] In addition, the Indaver WTE facility could accept up to 220 ktpa, which implies that even after the effective capacity of the Poolbeg plant of 550 ktpa is subtracted, substantial waste volumes would still need be landfilled or exported. This suggests that there is enough residual waste in the Irish market for the DWTE plant to operate at effective capacity level.

Figure 1 also indicates that even after realisation of the DWTE project, there will still be enough residual MSW for new waste treatment projects to be realised. Specifically, additional final treatment capacity of 556 ktpa would be needed to eliminate the landfilling or export of residual MSW. Alternatively, pre-treatment installations with a total capacity of about 1,390 ktpa would be needed to achieve this target; MBT installations only recover about 40% of the waste volume treated, so a total pre-treatment capacity of about 1,390 ktpa would correspond to a reduction in MSW of 556 ktpa.[6]

[4] MSW includes household waste, commercial waste and waste from cleansing. However, MSW is only a fraction of the market. The total amount of waste (household, commercial and industrial) produced in Ireland in 2012 is estimated to be 19.8 million tonnes. Source: EPA, March 2014

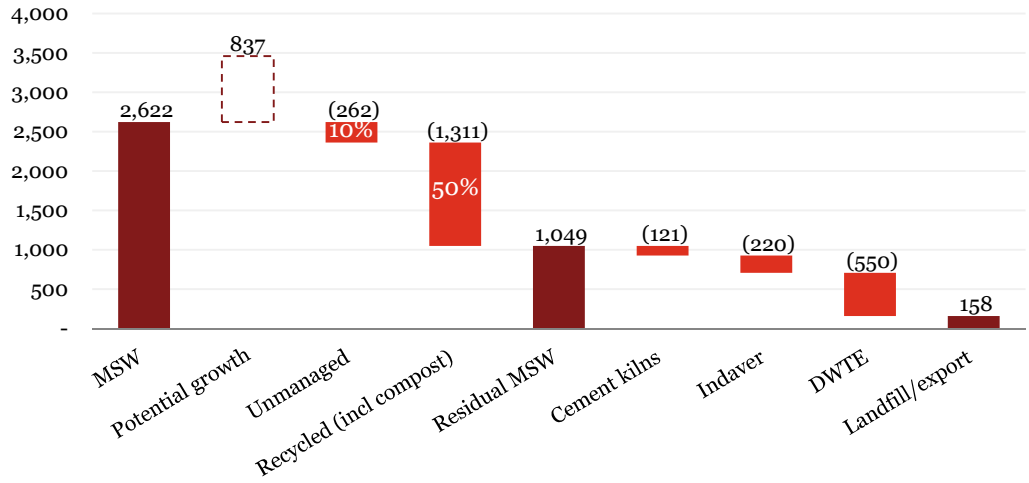
[5] Integrated Pollution Prevention and Control (IPPC) data provided by RPS.

[6] An article by Friends of the Earth, 2008, Mechanical and Biological Treatment (MBT) says that *"for every tonne input to a biostabilisation MBT facility [...] around 0.6 tonnes will be left as residue"*. These numbers are based on an Eunomia study from 2008.

Figure 2 illustrates how residual MSW may look in 2025. The Environmental Protection Agency ("EPA") assumes that waste production will increase by 837 ktpa over the coming 13 years (from 2012 to 2025).[7] However, critics might argue that this prediction is too optimistic as international waste markets are generally seeing a decoupling of economic growth and waste production. Hence, in Figure 2 the conservative assumption is made that waste production will stay constant at 2012 levels going forward and ignores the EPA predicted growth. It is then assumed that Ireland will reach the target European level of recycling of 50% for 2020.[8] The figure shows that, taking these developments into account, it is likely that there will still be excess waste in the market in 2025 if the DWTE project is developed.

Figure 2 – Residual MSW volumes (ktpa), in terms of 2025 waste figures

In 2025, there will still be enough residual MSW. The plant complements new pre-treatment projects and thereby helps increase recycling rates



Source: EPA, 2012 estimates and forecast for 2025

Hence, even in the future – taking into account the realisation of new pre-treatment projects for recycling, fermenting or composting of MSW – there will still be significant residual MSW for the DWTE plant to operate at effective capacity. Moreover, while it may seem counterintuitive, waste recovery plants are complementary to recycling efforts as not all waste can be recycled, hence final treatment is still required for non-recyclable waste. Having local final treatment installations can therefore help to realise new recycling and pre-treatment installations. Consequently, European countries where there is significant WtE capacity typically also have the highest recycling rates.

In addition to being critical to achieving Irish landfill diversion targets, the DWTE project is also important from a European perspective. In July 2014, the Commission adopted a new waste policy package titled "Towards a circular economy: A zero waste programme for Europe". The Commission's zero waste programme places a ban on the landfilling of all recyclable and biodegradable waste by 2025. Meeting these goals will require an increase in the capacity of final treatment plants at the European level in order to process residual waste streams.

[7] See updated forecasts on the EPA website of 4 April 2013: http://www.epa.ie/irelandsenvironment/environmentalindicatorsdashboard/predictedgrowthinmunicipalwaste/

[8] Directive 2008/98/EC on waste (Waste Framework Directive)

3. Cost Benefit Analysis for the Dublin Authorities

In this section, we explain how returns to the Dublin Authorities under the revised Project Agreement can be assessed and what expected returns are in different market scenarios.

When assessing returns to the Dublin Authorities, their investment decision needs to be compared to the decision a private investor in a similar position would make. Hence, all costs incurred previously, such as the cost of the acquisition of the land, relocation of existing business and other project costs, need to be treated as sunk costs; a private investor would do the same. At the time of the renegotiation, the Dublin Authorities had already acquired the Poolbeg site, so any costs related to the acquisition need to be treated at €0 (zero) cost when making a decision to proceed with or not proceed with the DWTE project.

With the renegotiated Project Agreement, the Dublin Authorities now have two options: the first is not to proceed with the DWTE project and the second is to proceed with it.

Option 1: Do not proceed with the project

The first option, not to proceed with the project, would imply accepting sunk costs in excess of €100 mln

In the event that the Dublin Authorities do not proceed with the project, they would have to accept the loss of historical sunk costs of about €100 mln spent on the project to date. In addition, they would most likely have to pay a liability to DWTEL for discontinuing the project. The only return the Dublin Authorities could expect to realise in case they do not proceed with the Project Agreement would be from selling the land that has already been acquired. Based on the most recent valuation from January 2014, the current value of the land is estimated to be around €6 mln.[9]

Hence, in the event that the Dublin Authorities decided not to proceed, a loss that is likely to be well in excess of €100 mln would need to be accepted.

Option 2: Proceed with the revised Project Agreement

The second option is to proceed to complete the renegotiated Project Agreement. To assess the likely returns to the Dublin Authorities from going ahead, all clauses of the revised Project Agreement that generate cash flows from the Dublin Authorities to DWTEL (cash outflows) or the other way around (cash inflows) need to be taken into account.

As mentioned previously, the revised Project Agreement includes a contingent revenue support obligation under which the Dublin Authorities will pay a share of the revenue shortfall in certain circumstances where anticipated waste revenues cannot be realised and waste revenues fall below a reference level. In return for the ACO, there is a waste revenue sharing mechanism in case the waste market improves and revenues increase above the reference level. The entire duration of the contract is 45 years. The ACO and the waste revenue sharing are in place for the first 15 years of the Project Agreement only. For the last 30 years, DWTEL will operate on a full commercial basis, without support by the Dublin Authorities.

[9] On 21 January 2014, the Dublin Authorities had the land value estimated by the City Valuers Office, which valued the land at €6mln, based on the average cost of industrial land in the Dublin area per acre.

In addition to the waste revenue sharing, there is also an electricity revenue sharing mechanism whereby the Dublin Authorities receive a significant part of the electricity revenues generated by DWTEL above a strike price over the entire 45 years of the project.[10] The strike price is significantly below the current electricity market price, so that the returns to the Dublin Authorities from the electricity revenue sharing over the lifetime of the project are expected to be substantial compared to the potential payments that could be made under the ACO in the first 15 years.

The second option, proceeding with the project, implies significant potential returns, but they will vary depending on market developments

It is important to understand that the project has qualified for the renewable energy feed in tariff (REFIT) scheme. Under the REFIT scheme the project will earn a guaranteed fixed price (indexed to inflation) for circa 57% of the electrical output of the plant for the first 14 years of operations. As the REFIT guaranteed price is currently 20% above the wholesale market price, the REFIT revenue accounts for about 60% of the energy revenue during the ACO period, thus greatly reducing the exposure of the project to wholesale energy prices.

The expected returns to the Dublin Authorities from the ACO, waste revenue sharing and electricity revenue sharing depends on three drivers; the waste gate fee, the waste volume and the electricity market price. To assess the expected returns to the Dublin Authorities, all probable market developments that may affect these three drivers need to be taken into account.

In addition, there are other financial clauses in the Project Agreement that generate cash outflows or inflows for the Dublin Authorities. However, the financial impact of these clauses is much lower than the impact of the ACO and revenue sharing mechanisms. Hence, the impact of other financial clauses is included in the return calculations by the Dublin Authorities by means of a base case scenario.

Returns to the Dublin Authorities under the revised Project Agreement – taking into account the ACO, revenue sharing mechanisms as well as all other financial clauses – can be expressed in terms of nominal net cash flows generated over the entire 45-year contract period. However, this is not the way a private investor would assess returns. A private investor would discount the expected annual cash flows by a discount rate which corresponds to an acceptable rate of return on investment for a project. This methodology of reporting returns is known as Net Present Value ("NPV") method, as it assesses the NPV of cash flows to the Dublin Authorities over the 45 years at the current value.

To apply the NPV method, the discount rate that is normally applied corresponds to the investor's cost of capital. The NDFA advises on all PPP projects in Ireland, including advising on an appropriate discount rate for PPP projects. The current NDFA advised rate is 5.4%; this rate reflects the long-term cost of government funding, taking into consideration the risks of these PPP projects to the State. The NDFA rate is a good benchmark for the cost of capital of the Dublin Authorities, reflecting the fact that a public body has lower capital costs and hence lower risks of investment than a private operator.[11]

[10] We are using the term "electricity revenue sharing" only because there are currently no plans to generate heat at the DWTE facility. Contractually, the revenue sharing applies to all energy revenues (electricity or heat) generated at the facility.

[11] The European Commission applied a discount rate of 10% to assess what returns to the Dublin Authorities should be if they were a private investor. An acceptable rate for a private investor investing in a similar project under similar conditions would correspond to the Weighted Average Cost of Capital for a similar project in Ireland; the lower bound estimate is 10% and the upper bound estimate is 12%. The 10% rate was deemed to be more appropriate as the support provided by the

Thus, if the NPV the Dublin Authorities can expect to realise under the renegotiated Project Agreement is positive applying a 5.4% discount rate, expected returns are higher than the Dublin Authorities own cost of capital.

As explained above, actual returns to the Dublin Authorities vary with market developments and mainly depend on three variables: the gate fee, the waste volume and the electricity price. Table 1 on the next page shows what the returns to the Dublin Authorities would be from a selection of nine (9) market scenarios, taking into account different gate fee and electricity prices. The waste volume is assumed to be constant at effective capacity of 550,000 tpa over the years as there is sufficient waste volume available in the Irish market for the facility to operate at full capacity; any increase in competition for waste volume over the 45-years will be reflected in lower gate fees to attract more waste.

The return figures are based on the latest version of the financial model underlying the revised Project Agreement. The nine scenarios are covering low, medium and higher gate fee as well as low, medium and high electricity price assumptions:

- The lowest possible gate fee at current market conditions is assumed to be €80 per ton (pessimistic), the highest potential gate fee is assumed to be €110 per ton (optimistic); the midpoint of €95 per ton is probably the most realistic scenario.

- The lowest possible electricity market price is assumed to be €71.2 per MWh in the first year which would then decrease with 1% in real terms per annum (pessimistic), an upper bound of electricity market price is assumed to be €71.2 per MWh with 1% real increase per annum (optimistic); a more realistic scenario might be in the middle, assuming that the electricity price remains flat at €71.2 per MWh over the 45-year contract period (standard).

Potential returns under the project can be substantial; in the most pessimistic scenario, expected returns would still be about €30 mln

The table shows that even in the most pessimistic market scenarios, with the lowest realistic gate fee of €80 per ton and an electricity price of €71.2 per MWh assuming 1% annual electricity price deflation, the expected returns to the Dublin Authorities over the course of the 45-year project would still be positive. Taking into account a discount rate of 5.4%, corresponding to the current NDFA rate, the current net value of returns to the Dublin Authorities would be €30.2 mln.

In the most optimistic scenario, the net present value of returns to the Dublin Authorities from proceeding with the Project Agreement would be €155.3 mln. These figures are taking into account all financial clauses of the Project Agreement.

Dublin Authorities to DWTEL does not require an initial capital outlay but is contingent; hence a lower risk is implied.

Table 1 – Net value of returns to the Dublin Authorities over the 45-year project at a discount rate of 5.4% (in € mln)

	Electricity market price** (per MWh)		
Gate Fee*:	Optimistic (€71.2 plus 1% real increase per annum)	Standard (€71.2 flat, 0% reals increase per annum)	Pessimistic (€71.2 with 1% real decrease per annum)
Optimistic: €110/ton	€155.3 mln	€138.3 mln	€123.8 mln
Midpoint: €95/ton	€109.3 mln	€92.3 mln	€77.8 mln
Pessimistic: €80/ton	€61.7 mln	€44.7 mln	€30.2 mln[12]

* Gate fees are assumed to increase by 2% real per annum (inflation)

**The Electricity market price scenarios are within the range of the long term average prices as projected by independent energy market experts, Baringa.

This suggests that the Dublin Authorities are very likely to realise substantial returns under the revised Project Agreement. In the most realistic of the nine scenarios, assuming a gate fee of €95 per ton and a constant real electricity market price of €71.2 per MWh, the expected returns to the Dublin Authorities under the financial model are €92.3 mln.

These figures suggest that cash inflows to the Dublin Authorities from the electricity revenue sharing, which is in place for the entire 45 years of the project, are substantial. Support to DWTEL under the ACO, which could lead to cash outflows to the Dublin Authorities in pessimistic scenarios, is only in place for the first 15 years; any potential cash outflows are offset by cash inflows from electricity revenue sharing over the remaining 30 years.

Thus, looking at the potential returns the Dublin Authorities can expect to realise under the revised Project Agreement, it seems rational to go ahead with the project.

The European Commission also reviewed the terms of the Project Agreement and the participation of the Dublin Authorities in the project based on an economic assessment under the Market Economy Investor Principle (MEIP). This investigation was applied in the context of a State aid investigation following a complaint by a local competitor. Under the MEIP test, the Commission analysed whether the expected returns to the Dublin Authorities are in line with returns a private operator of similar size would accept for a similar commercial project under normal market circumstances. The investigation demonstrated that this was the case, so the Commission concluded that the project does not constitute state aid as defined in Article 107 of the Treaty of the Functioning of the European Union.[13]

[12] Note: the funding banks have examined a further downside energy case (produced by Baringa, market experts). This Baringa low case is based on very low global energy prices for the next 20 years. The combined Baringa Low Case and €80/t Gate Fee still produces a positive return of €1.2m.

[13] The non-confidential version of the Commission's decision, which will be made available under the case number SA.36591 in the State Aid Register, was not published yet at the time this business case was written. However, the press release by the Commission of 7 May 2014 can be found on http://europa.eu/rapid/press-release_IP-14-529_en.htm

Conclusion on returns to the Dublin Authorities

Under the renegotiated Project Agreement, the Dublin Authorities have two options: either do not proceed with the project or proceed with it.

In the most realistic scenario, expected returns would be about €90 mln, so it seems rational to go ahead

In case it was decided not to proceed with the project, sunk cost that are likely to be well in excess of €100 mln would need to be accepted.

In case it was decided to proceed with the projects, returns to the Dublin Authorities could be substantial but the actual value of returns would depend on the development of market circumstances and three drivers in particular: the gate fee, the waste volume and the electricity price. Taking into account nine potential market developments which capture a range of possible optimistic and pessimistic market scenarios suggests that returns to the Dublin Authorities from the project can be substantial. In the most realistic scenario, the net value of returns to the Dublin Authorities at a discount rate of 5.4% would be €92.3 mln. The lowest bound of returns would be €30.2 mln (most pessimistic scenario) and the upper bound would be €155.3 mln (most optimistic scenario).

Hence, it is rational for the Dublin Authorities to go ahead with the renegotiated Project Agreement. Doing so is likely to generate significant returns and a rate of return that is significantly higher than the costs of capital which are 5.4%.

Important Notice

This document has been prepared for Dublin City Council, Dun Laoghaire/Rathdown County Council, Fingal County Council and South Dublin County ("the Dublin Authorities"), by PricewaterhouseCoopers Advisory N.V. and PricewaterhouseCoopers in Ireland ("we", "PwC"), with input from McCann FitzGerald and the RPS Group ("RPS").

This document has been prepared only for Dublin City Council, on behalf of the Dublin Authorities, and solely for the purposes and on the terms agreed with Dublin City Council. We accept no liability (including for negligence) to anyone else in connection with this document.

RPS has provided input on the Irish waste market and Irish waste policy, as well as the financial modelling that underlies this assessment.

This report contains analyses based on public information from various sources and confidential data made available by Covanta Energy Corporation and other parties part of the Dublin Waste-to-Energy project. PwC has not performed an audit, verification or independent validation of the aforementioned data and thus does not undertake any responsibility or liability and does not give and must not be interpreted as to be giving any explicit or implicit assurance for the accuracy or the completeness of the data used in this report.

Appendix A. - Risk Assessment

The analysis above is based on a selection of nine potential market scenarios. However, there are many more market scenarios that could occur. In order to assess the riskiness of entering the Project Agreement to the Dublin Authorities, asked for a separate risk assessment analysis. This analysis takes into account all up- and downside market scenarios that could potentially occur over the course of the 45-year project.

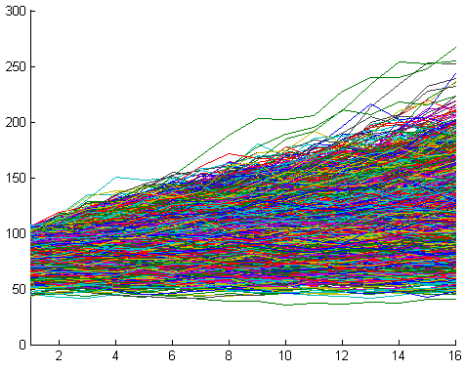
As explained, returns to the Dublin Authorities are mainly driven by the ACO, waste revenue sharing and electricity revenue sharing mechanisms. Returns arising from other financial clauses are a fraction of potential net returns and impose less risk.

To assess the risk of returns to the Dublin Authorities, a model with simulation of 10,000 different potential market scenarios is used

Hence, to assess the risk of returns to the Dublin Authorities, the main variables that need to be considered are the gate fee, the waste volume and the electricity price. To model all potential developments of these three variables, a Monte Carlo simulation model was used. This model simulates 10,000 potential developments of the gate fee, waste volume and electricity prices and calculates the average expected returns to the Dublin Authorities across all these scenarios. The Dublin Authorities believe that a simulation gives a better idea of the actual value of the returns that can be expected. This methodology is also commonly applied by private investors to assess potential returns to an investment.

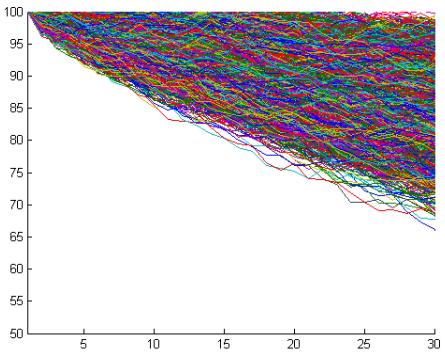
In the base case scenario of the simulation, the following assumptions are made:

Figure 3 - Gate fee



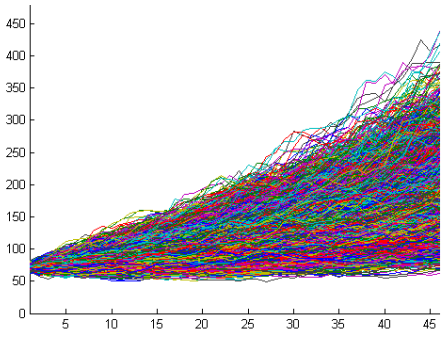
Gate fee: In the first year, the gate fee is assumed to be between €30 per ton and €110 per ton with an average of €83 per ton. After year 1, the gate fee varies randomly year-on-year with a standard deviation of 5%-point and a 2%-path of inflation (see Figure 3 on the left-hand side). The gate fee was only modelled for the first 15 years, as the ACO is only in place for this time. After year 15, returns to the Dublin Authorities do not depend on the gate fee.

Figure 4 – Capacity utilisation



Capacity utilisation: Waste volumes are assumed to be constant at 100% effective capacity utilisation (€550,000 tpa) over the first 15 years of the Project Agreement. After year 15, the waste volume is assumed to decreases annually with an average of 2,750 tpa and a standard deviation of 5,000 tpa. At the end of the contract, in year 45, the effective capacity is assumed to be at 85% on average with a minimum of 70% and a maximum of 100% (see Figure 4 on the left-hand side).

Figure 5 – Electricity price



Electricity price: The electricity market price starts at an average market price of €71.2 per MWh in 2015, but can vary from this value by about €3 per MWh. After year 1, the electricity market price follows a random growth path with a standard deviation of 4%-points per annum and an average inflation path of 2% (see Figure 5 on the left-hand side).

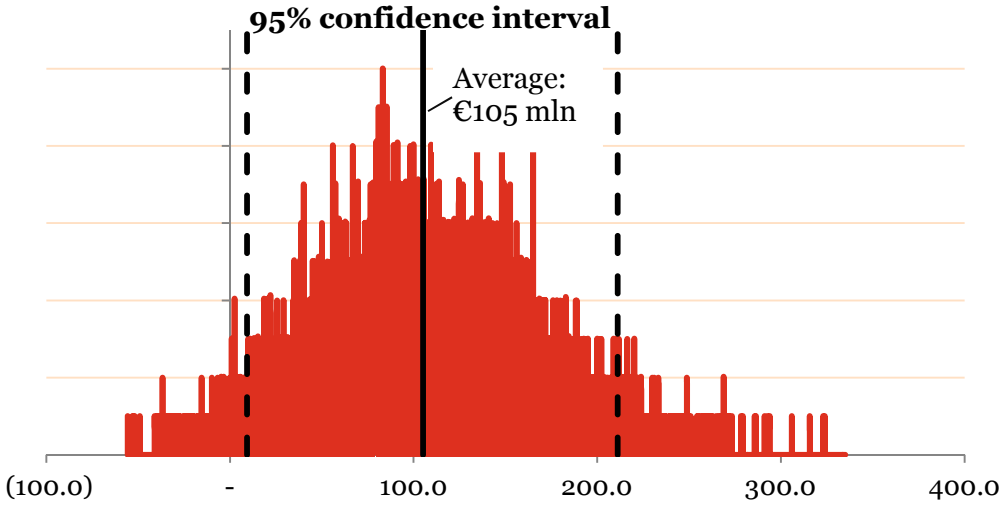
The simulation model for the gate fee, waste volume and the electricity market price covers a much wider range of potential market scenarios than the nine scenarios in the previous section. The main difference is that the simulation also takes into account a potential drop in waste volumes after year 15; the previous section assumed that there would always be sufficient waste available for the facility.

Figure 6 below shows that even taking into account 10,000 potential scenarios instead of nine potential scenarios, the average expected returns to the Dublin Authorities across all these scenarios are still very close the most realistic scenarios in the previous section.

There is a 95% chance that returns from the ACO and revenue sharing mechanisms alone will lie between €1 mln and €211 mln

The average expected net current value of returns to the Dublin Authorities at a discount rate of 5.4% are around €105 mln across the 10,000 simulations. This estimate can however not be taken as a certain expected value, as running the simulation model again might lead to slightly different 10,000 scenarios and hence and different average value. The 95% confidence interval of expected returns is much more relevant, as it suggests that there is a 95% chance that returns to the Dublin Authorities under the Project Agreement will be between €1 mln (lower bound) and €211 mln (upper bound).

Figure 6 – Distribution of net returns under the ACO and revenue sharing mechanisms in 10,000 potential scenarios (in NPV at 5.4% discount rate)



Costs and revenues arising from all other financial clauses that are independent of the three drivers are not simulated. However, as there is still some contingency risk in these

cash flows, the risk of net cash flows from other financial clauses is included by means of a two scenarios: a worst case and best case scenario, both of which are added to the expected net cash flows from the 10,000 individual simulations.

The chance that returns will be positive at cost of capital of 5.4% is 98-99%, so the risk seems to be low

Table 2 below shows that, even taking into account all 10,000 potential scenarios for returns under the ACO and the revenue sharing mechanisms as well as the worst and best case scenario for returns under other financial clauses, expected returns to the Dublin Authorities are still substantial. The average expected returns across all 10,000 scenarios lie between €101.3 mln (worst case of other financial clauses) and €111.5 mln (best case of other financial clauses). More interestingly, the probability that the actual current value of returns to the Dublin Authorities is positive is significantly high; 98.1% in the worst case and 99.0% in the best base respectively.

Table 2 – Average net expected returns across 10,000 scenarios (in €mln) nominal terms and at current net value (5.4% discount rate)

NPV (in €mln)	NDFA: 5.4%	Probability NPV>0
Average expected returns (including other potential cash flows best case)	€111.5 mln	99.0%
Average expected returns (including other potential cash flows worst case)	€101.3 mln	98.1%

Thus, the chances that returns to the Dublin Authorities from the ACO and the revenue sharing mechanisms will be positive are very high. Having a positive NPV at a discount rate of 5.4% implies that the actual rate of return to the Dublin Authorities will be higher than the cost of capital of 5.4%.

Hence, it appears to be rational for the Dublin Authorities to go ahead with the revised Project Agreement; doing so can be expected to lead to significant returns to the Dublin Authorities. What the net current value of expected returns would be exactly depends on the development of market circumstances, but the probability that the rate of return will be higher than the current cost of capital of 5.4% (NPV>0) lies around 98 – 99%.

Overall, the risk of continuing with the revised Project Agreement seems low, driven by the fact that there is no initial capital outlay by the Dublin Authorities and actual obligations are contingent on market circumstances. Hence, entering the Project Agreement seems to be a rational choice.