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WASTE & CIRCULAR ECONOMY
EXPERIENCE IN BIOGAS PROJECTS

Image: European Parliament

AREAS OF ACTIVITY

> EN / Engineering
> CS / Consulting & Systems
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> **ENV / Environment**
> AA / Advanced Analysis
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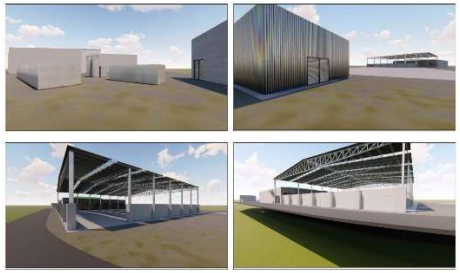
IDOM Consulting, Engineering and Architecture S.A.U.

Detailed Engineering for the construction of the Anaerobic Digestion Plant for the municipality of Xalapa, Veracruz, Mexico



Client: Xalapa City Council
Date: 09/2020 – 12/2020

The overall objective is to develop a detailed design of the complete construction of the Anaerobic Digestion plant for the municipal solid waste generated in Xalapa.
The project capacity of the Plant is:

- Mixed waste: 200 tpd (73,000 tpy)
- Organic waste: 80 tpd (21,900 tpy)

The project consisted on the design of:

- Pretreatment line for mixed waste (73,000 tpy).
- Anaerobic Digestion tunnels for organic waste (21,900 tpy) and valorization of the generated biogas (635 kW)
- Aerobic Stabilization process for the digestate

IDOM developed the following tasks:

- A review of the existing documentation
- Development of preliminary studies for the elaboration of the design, including: (i) soil mechanics, (ii) hydrology, (iii) hydrogeology and (iv) characterization of MSW.
- Design at a detailed engineering level of the Anaerobic Digestion Plant for 200 ton / day (73,000 ton / year) of MSW for the three treatment phases and development of a Technical Annex that will be used to hire a company, or companies, that will carry out the construction and commissioning of the Plant.

Technical assistance / PMC for the construction of waste infrastructures in the province of Gipuzkoa (Spain)

Client: GHK
Date: 07/2016 – 12/2020

GHK (Association for Waste Management Gipuzkoa) is in charge of the management of the Waste of the Province of Gipuzkoa (the Basque Country). Gipuzkoa is one of the three provinces of the Basque Country, and has 706,698 inhabitants (2009) and 373,000 tonnes of Municipal Solid Waste per year. IDOM developed the following tasks:

- Ad-hoc technical advisor
- Review existing basic engineering design of CMG1 (consisting of a MBT - biodrying and WtE plant to a capacity of 200,000 tpa)
- Prepare terms of reference of CMG1 including Incineration Bottom Ash (IBA) maturation plant
- Prepare basic engineering design of CMG2 (consisting of biowaste AD plant to a capacity of 40,000 tpa)
- Prepare terms of reference of CMG2
- Evaluation of tenders and contract negotiation for both CMG1 and CMG2
- Obtain environmental permits for both CMG1 and CMG2
- Works supervision of both CMG1 and CMG2

Plant Engineering

Design build engineering services of the design-build-operate contract of a LFG recovery and power generation system and technical assistance for the operation of the landfill gas and power generation system and the operation of Ghabawi landfill (Amman, Jordan).

Client: Greater Amman Municipality (GAM)
Date: 2011-2016
Project figures: Average of 2,500 t/day deposited in the landfill and initially 1 MWe power plant to be enlarged up to 6 MWe.

IDOM has been awarded to develop engineering services for the DBO contract that will lead to the construction and operation of a LFG to Energy system in Ghabawi Landfill in Amman, Jordan. Services are divided in three stages:

- Phase 1: Supervision of the Design-Build contract for landfill cells 1&2 closure and gas wells installation (157). Pilot plant erection for assessing the feasibility of a power plant and capacity definition. Supervision of LFG extraction tests period (3 months).
- Phase 2: Supervision of the Design-Build contract for LFG to Energy facilities construction. Pre-construction stage (design validation, planning review, QA plan approval). Construction stage (construction documents review and approval, monitor works advance, advise contracting authority…). Commissioning stage (test supervision, inspections, final report). Supervision of operations. Power plant of 1 MWe and subsequent extension up to 5 MWe.
- Phase 3. LFG extraction network enlargement for Cell#3, installation of additional 1 MWe and supervision of operations. Technical assistance for leachate treatment plant, landfill operations and biogas production improvement actions, including leachate recirculation facilities to enhance the LFG generation.
- Detail Design for the construction of the Cell#4 and draft of the Terms of Reference.

IDOM EXPERIENCE IN BIOGAS PROJECTS

Plant Engineering

Landfill gas to energy plant in Artigas landfill (Bilbao, Spain).

Client: BIOARTIGAS (Bilbao City Council and Basque Agency for Energy)
Date: 1992-1998
Project figures:
Present population served by the site: approx. 500.000 inhabitants.
MSW deposited in the site: 220.000 metric tons per year.
Collection well network: 48 units (from 10 to 40 m depth)
Flare: Max. capacity 500 Nm^3/h

IDOM undertook engineering tasks for the LFG plant from 1992 to 1998:

- Feasibility Study for energy recovery from LFG (1992)
- Basic Project for LFG collection network and Energy Plant (1993)
- Technical Assistance for Plant Purchasing (1993): definition of the tender lots, preparation of technical & economic requirements, tender comparison.
- Detailed designs for construction (1993).
- Works supervision and technical assistance for start-up (1994).
- Project and works supervision for LFG collection network extension and power system enlargement (1998): 10 new gas collection wells and the pipe network, cooling system modification for LFG dewatering, new combustion control system for the two existing gas engines and a new engine installation.

Landfill gas to energy plant in San Marcos landfill (San Sebastián, Spain).

Client: BIOSANMARKOS (Local Association of City Councils and Basque Agency for Energy).
Date: 1994-1998
Project figures:
Present population served by the site: approx. 300.000 inhabitants.
MSW deposited in the site: 135.000 metric tons per year.
Collection wells network: 60 units (from 10 to 50 m depth)
Flare: pilot flame (continuous functioning). Max. capacity 600 Nm^3/h.

IDOM undertook engineering tasks for the LFG plant from 1994 to 1998:

- Feasibility Study for energy recovery from LFG (1994)
- Basic Project for LFG collection network and Energy Plant (1995)
- Technical Assistance for Plant Purchasing (1995): definition of the tender lots, preparation of technical & economic requirements, tender comparison.
- Detailed designs for construction (1995-1996).
- Works supervision and technical assistance for start-up (1996).
- Project and works supervision for LFG collection network extension, and flare modifications (1998).

IDOM EXPERIENCE IN BIOGAS PROJECTS

Plant Engineering

Landfill gas to energy plant in Gardelegui landfill (Vitoria, Spain).

Client: BIOGARDELEGUI (formed by Bilbao City Council and Basque Agency for Energy).
Date: 1997-2001
Project figures:
Present population served by the site: approx. 225.000 inhabitants.
MSW deposited in the site: 100.000 metric tons per year.
Collection well network: 40 units (from 10 to 50 m depth)
Flare: pilot flame (continuous functioning). Max. capacity 400 Nm^3/h.

IDOM undertook engineering tasks for the LFG plant construction from the commencement (1997) to 2001:

- Feasibility Study for energy recovery from LFG (1997)
- Basic Engineering for LFG collection network and Energy Plant (2000)
- Technical Assistance for Plant Purchasing (2001): definition of the tender lots, preparation of technical & economic requirements, tender comparison.
- Detailed designs for construction (2001).
- Works supervision and technical assistance for commissioning (2002).

Landfill gas to energy plant in Sasieta landfill (Beasain, Spain).

Client: BIOSASIETA (formed by Local Association of City Councils and Basque Agency for Energy).
Date: 1999-2002
Project figures:
Present population served: approx. 185.000 inhabitants.
MSW deposited in the site: 80.000 metric tons per year.
Collection well network: 21 units (from 10 to 30 m depth)
Flare: Max. capacity 250 Nm^3/h.

IDOM undertook engineering activities for the LFG to Energy plant construction:

- Feasibility Study for energy recovery from LFG (1999)
- Basic Project for LFG collection network and Energy Plant (2000)
- Technical Assistance for Plant Purchasing (2001): definition of the tender lots, preparation of technical & economic requirements, tender comparison.
- Detailed designs for construction (2001).
- Works supervision and technical assistance for start-up (2002).

IDOM EXPERIENCE IN BIOGAS PROJECTS

Plants Construction and Operation

Landfill gas to energy plant in Areosa landfill (Cerceda - A Coruña, Spain).

Client: SOGAMA (Environmental Entity of Galicia).
Date: 1998-2008
Project figures:
Present population served: approx. 600.000 inhabitants.
MSW deposited in the site: 250.000 metric tons per year.
Collection wells network: 64 units (from 15 to 40 m depth)
Flare: pilot flame (continuous functioning). Max. capacity 600 Nm^3/h.

IDOM undertook engineering tasks for the LFG plant construction from the very beginning, and was in charge of Plant construction. IDOM also operated the LFG to Energy plant up to September 2008. The tasks developed for IDOM are:

- Feasibility Study for energy recovery from LFG (1999). Including LFG sampling and analysis, and LFG production estimation for ten year span.
- Basic Engineering for LFG collection network and Energy Plant (2000)
- Plant Purchasing (2001).
- Detailed project for construction (2001) and permitting.
- Plant construction and start-up (2002).
- LFG plant operations supervision and technical assistance (May 2002-September 2008), including design for the LFG collect network extension, maintenance procedures for LFG generators and other plant equipment, inventory of Greenhouse Gases Emissions for the landfill, optimization of flare unit operation, engine exhaust gases control.

Detailed Design

Detailed engineering services for landfill gas collection network and extraction system in Gongora landfill (Pamplona, Spain)

Client: MANCOMUNIAD COMARCA DE PAMPLONA (Union of Municipalities).
Date: 2011-2012
Project figures: Final power plant capacity will be increased to produce 2,1 MWe

IDOM has been awarded to prepare all the detailed design of the extension of the biogas network in Gongora Landfill. The works include:

- Gas wells network design for the future four new cells.
- Design of the pipe network to carry biogas from wells to Control Station (manifolds).
- New full-equipped Automatic Regulation and Measurement Station (Flow, gas composition, temperature, pressure).
- Line connecting Control Station with Main Extraction Centre, including extension of extraction capacity (new blowers) and re-bumping of control system.
- Connecting line between Main Extraction Centre and Power Station.

IDOM EXPERIENCE IN BIOGAS PROJECTS

Plants Construction and Operation

Detailed project for landfill gas to energy plant in Valdemingómez landfill (Madrid, Spain).

Client: CESPA, SUFI, S.A, VERTRESA.
Date: 2001-2003
Project figures: Valdemingómez Landfill was the biggest landfill in Spain for decades, before it was closed in 2002. Its surface is more than 100 hectares and there was a network of about 280 gas extraction wells. The plant is able to produce 18,9 MWe of electricity running on LFG and natural gas (up to 10% of the landfill gas).

IDOM received a contract for the detailed engineering of the LFG energy recovery by means of gas engines and steam turbine. The project consisted in:

- Gas cleaning system: hydrogen sulphide elimination (double scrubber system with base-acid system).
- Cooling system for LFG dewatering.
- Landfill gas pumping, storage (double membrane gas holder) and distribution system.
- Natural gas cofuelling (up to 10% of LFG energy content).
- 8 gas engines x 2124 kWe plus boiler and 1 steam turbine x 1960 kWe

IDOM EXPERIENCE IN BIOGAS PROJECTS

Plants Construction and Operation

Landfill gas collection and flaring system in Argalario landfill (Barakaldo, Spain).

Client: IHOBE (Environmental Entity for the Basque Country).
Date: 2004-2016
Project figures: Argalario landfill is a closed disposal site where some 650.000 tons of municipal solid waste were deposited over 15 years.

IDOM assessed the pipe network and wells, measuring gas composition (main and trace elements), flow and gas temperature. The control system and equipment (valves, pumps, sampling and analyzing devices, flare, PLC) was also assessed. IDOM drafted a report with the main results and recommendations to be implemented.
Following the previous report IDOM prepared a detailed scheme to improve the whole collection system and change the main equipment of the flaring unit, establishing the basic parameters for the control system. A support fuel system was added to the plant in order to ensure the continuous functioning of the flare and that all hazardous compounds are burned.
More recently IDOM has provided technical assistance to assess the gas treatment system due to the rapid depletion of gas generation in the old landfill. Several alternatives have been considered and a biofiltration system (biological oxidation of the methane) has been defined (2011). IDOM has provided the client with technical assistance to prepare the Terms of Reference for purchasing a biofiltering system, has supervised the installation and commissioning of the LFG treatment plant and has provided supervision support for the operation.
The implementation of the new treatment line took place during the first half of 2013. The monitoring of the operation of the biofiltration system is currently being carried out (within the framework of the Environmental Management works of the Argalario site, which Idom has carried out continuously since June 2009 until the present).

IDOM EXPERIENCE IN BIOGAS PROJECTS

Feasibility Studies

Alternatives study on feasible uses of landfill biogas (Gongora landfill, Spain).

Client: MANCOMUNIAD COMARCA DE PAMPLONA (Union of Municipalities).
Date: 2011

IDOM undertook the assessment of the alternatives evaluation to define the most adequate system to use landfill gas produced in Gongora Landfill as an energy resource. Feasibility has been considered from several points of view: technical, economy and environmental conditions have been assesses for that particular site.
Technologies evaluated have been: fuel for heating (industry and district heating), fuel for electricity production with gas engines and gas turbines, biogas upgrading for gas network injection, biogas upgrading for fuel for vehicles, biogas for use in fuel cells.
IDOM prepared the model for biogas production foreseen in order to determine the size of the installations.

Degasification test and feasibility study in Igorre landfill and Jata landfill (Basque Country, Spain).

Client: GARBIKER
Date: 2001-2003

IDOM designed the installations to develop a pilot campaign for the assessment of the energy production capacity of the LFG generated in the two mentioned landfills: wells (distribution and technical features), pipe network, pumping system and flaring station, measurement and testing means (for composition, flow, temperature) and in situ tests.
IDOM supervised the works to build the infrastructure in both landfills, supervised two sampling campaigns and dealt with the leachate problems in the wells. IDOM prepared a final report, including LFG production estimation, and established the basic design of the two LFG to Energy plants.
Capital investment and production cost estimates were prepared. Feasibility Study included Financial Rate of Return (FRR) and Net Present Value (NPV) calculations

IDOM EXPERIENCE IN BIOGAS PROJECTS

Feasibility Studies

Feasibility study for Ca Na Putxa landfill (Ibiza-balearic Islands, Spain).

Client: HERBUSAR
Date: 1999

IDOM carried out the Feasibility study for LFG extraction and energy production in the principal waste landfill of Ibiza.
IDOM performed "in situ" assessment of the landfill situation, LFG generation estimation, LFG extraction network, equipment and facilities definition. Use of liquified natural gas was assessed as a supporting fuel.
Capital investment and production cost estimates were prepared. Feasibility Study included Financial Rate of Return (FRR) and Net Present Value (NPV) calculations.

Feasibility study for Curva de Rodas landfill (Medellín, Colombia).

Client: Basque Agency for Energy (Spain) & EE.VV. de Medellín (Colombia)
Date: 1998

Feasibility study for LFG extraction and energy production in the biggest landfill in the metropolitan area of Medellín.
Tasks undertaken by IDOM included "in situ" assessment of the landfill situation, LFG generation estimates, LFG utilisation alternatives (gas engines, gas turbines, boilers, purification and automobile use, household use).
IDOM designed the LFG extraction network (40 wells and a pumping station for 1.500 Nm^3/h), and the equipment and facilities required to use the LFG as fuel for gas engines (3 engines x 535 kWe).
Capital investment and production cost estimates were prepared. Feasibility Study included Financial Rate of Return (FRR) and Net Present Value (NPV) calculations

IDOM EXPERIENCE IN BIOGAS PROJECTS

Feasibility Studies

Due diligence of the project for the degasification of the Bordo Poniente landfill (Mexico).

Client: BANCOMEX, MERRIL LYNCH, SEM
Date: 2015
Project figures: Bordo Poniente has 412 hectares and it is estimated that more than 80 million tons of MSW, generated for decades by the inhabitants of Mexico DF, are stored.

Review and validation of the technical documentation prepared by the concessionaire of the exploitation: Sistemas Eléctricos Metropolitanos (SEM), through its subcontractors (ELECNOR, ACCESGAS, and others), for the collection and use of the biogas produced at the landfill, In order to generate electricity, as a step prior to the financial approval of the banks and public institutions involved. The project included the assessment of:

- Proposal for sealing and closure works
- LFG extraction and treatment system
- Electricity generation system with Internal Combustion Engines
- Transformers, cabins and electricity transport
- Auxiliary systems (water supply, air instrument, system control

Feasibility study in four small landfills for energy use (Basque Country, Spain).

Client: Basque Agency for Energy.
Date: 1998

Feasibility study for LFG extraction and energy production in four small Municipal Solid Waste landfills located in several areas of the Basque Country. Tasks developed by IDOM included “in situ” assessment of the landfill situation, LFG generation estimates, LFG extraction network, equipment and facilities definition.
Capital investment and production cost estimates were prepared. Feasibility Study included Financial Rate of Return (FRR) and Net Present Value (NPV) calculations.

Other Related Studies

Due diligence of waste treatment facilities in Portugal.

Client: FCC
Date: 2014

Empresa Geral de Fomento (EGF) looks for a concessionaire to operate its waste management assets in Portugal. The objective of this contract for the realization of a Technical and Environmental Due Diligence (TEDD) is to identify the risks, investments and operating expenses of the existing infrastructures for a period of 20 years. The purchase will involve the acquisition of exclusive rights for the management of wastes generated in 11 subsidiary companies in Portugal, which generate approximately 60% of the total amount of waste produced in the whole country. Among the existing infrastructures is a Waste Energy Recovery Plant, 14 Biological Mechanical Treatment plants, 30 landfills and 5 transfer stations.

The scope includes:

- Technical review of 11 concession contracts and contracts between concessionaires and municipalities
- Detailed analysis of the availability and characteristics of the licenses of all infrastructures
- Environmental Audit and estimation of potential penalties coming from the non-compliance with environmental standards figuring in the issued licenses
- Technical proposals to mitigate or reduce non-compliances including cost estimates
- Review of the Strategic Plan developed by FCC at the non-binding stage of the tender process
- Technical & Environmental Due Diligence of all infrastructures based on the documentation available in a dataroom (more than 8,000 documents) and site visits to two infrastructures: WTE Plant - VALORSUL and MBT & MRF Plant in Coimbra (ERSUC)

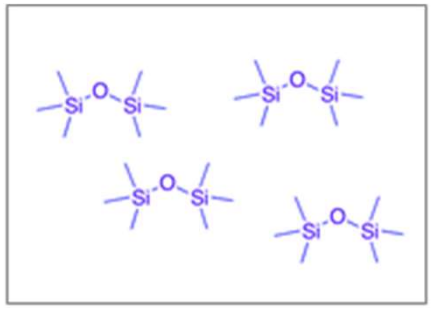
Other Related Studies

Study of the use of biogas as automotive fuel

Client: JAR BIOGAS
Date: 2012

The objective of the study is to determine the feasibility of using biogas obtained from the anaerobic digestion of agricultural and livestock waste, as well as biogas from a landfill as fuel for vehicles. The biogas is treated to obtain a gas basically consisting of methane (biomethane).
In its development, technological alternatives developed at an industrial level, its applicability, technical and environmental requirements, the adaptation needs of a fleet of vehicles and an estimation of investment and operation costs were studied.

Siloxane elimination from lfg to fuel for gas engines



Client: GUASCOR I+D
Date: 2001

IDOM developed a theoretical study on the presence of siloxanes in the LFG. This study was the base for the design of an installation for elimination of this damaging compound.
Several potential suppliers were consulted for economic evaluation of the designed system.

Other Related Studies

Safety assessment on LFG migration in San Marcos landfill (San Sebastián, Spain)

Client: MANCOMUNIDAD DE SAN MARCOS
Date: 1999

IDOM developed two campaigns of measurement of the presence of LFG (methane) in the surroundings of San Marcos Landfill, as well as its presence in the landfill facilities (access control facilities, garage, LFG plant, LFG wells and pipelines, leachate collectors and treatment plant...).
Results were collated and analyzed, allowing the specification of corrective measures to improve the safety of the landfill.

Feasibility study for heat utilisation from the LFG engines for greenhouses heating in San Marcos landfill (San Sebastián, Spain).

Client: BEHEMENDI
Date: 1997

Feasibility study for the utilisation of the residual heat obtained from gas engines running on LFG in San Marcos Landfill. Heat from the cooling system of the engines is used to warm the air inside three greenhouses places over concrete slabs in the upper platform of the closed landfill.