TECHNITAL

WASTE TREATMENT

COMPANY PROFILE AND STATEMENT OF CAPABILITIES 2023

www.technital.net

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1 Company Profile

About TECHNITAL

Description

TECHNITAL is a private joint stock company established more than 50 years ago (in 1964) and is one of the oldest engineering consultancy companies in Italy. Thanks to its high level of expertise, its dynamic nature and versatility, management autonomy and efficiency and its sophisticated hardware equipment and software libraries, the Company has been awarded large scale international and national projects by major public and private entities and by international funding organizations.

TECHNITAL's headquarters are situated in Verona, Italy. The organization abroad includes 15 between branches and subsidiaries in Algeria, Armenia, Bosnia & Herzegovina, Croatia, Djibouti, Georgia, Iraq, Kenya, Kosovo, Qatar, Tanzania, Trinidad & Tobago, Tunisia, Uruguay and Zambia and a number of local offices which is continuously changing according to the on-going international projects (at the moment there are 4 local site offices).

Services

TECHNITAL is a dynamic company whose sectors of activity cover transport infrastructure (roads and motorways, railways, inland waterways, urban transport, ports and airports), hydraulics (water treatment and desalination plants, dams, aqueducts, sewerage systems, waste water treatment), maritime and coastal engineering, environment, energy (incineration and waste to energy plants, hydroelectric plants, solar plants, biogas plants), waste treatment (recycling plants, dump sites), buildings, architecture and urban planning.

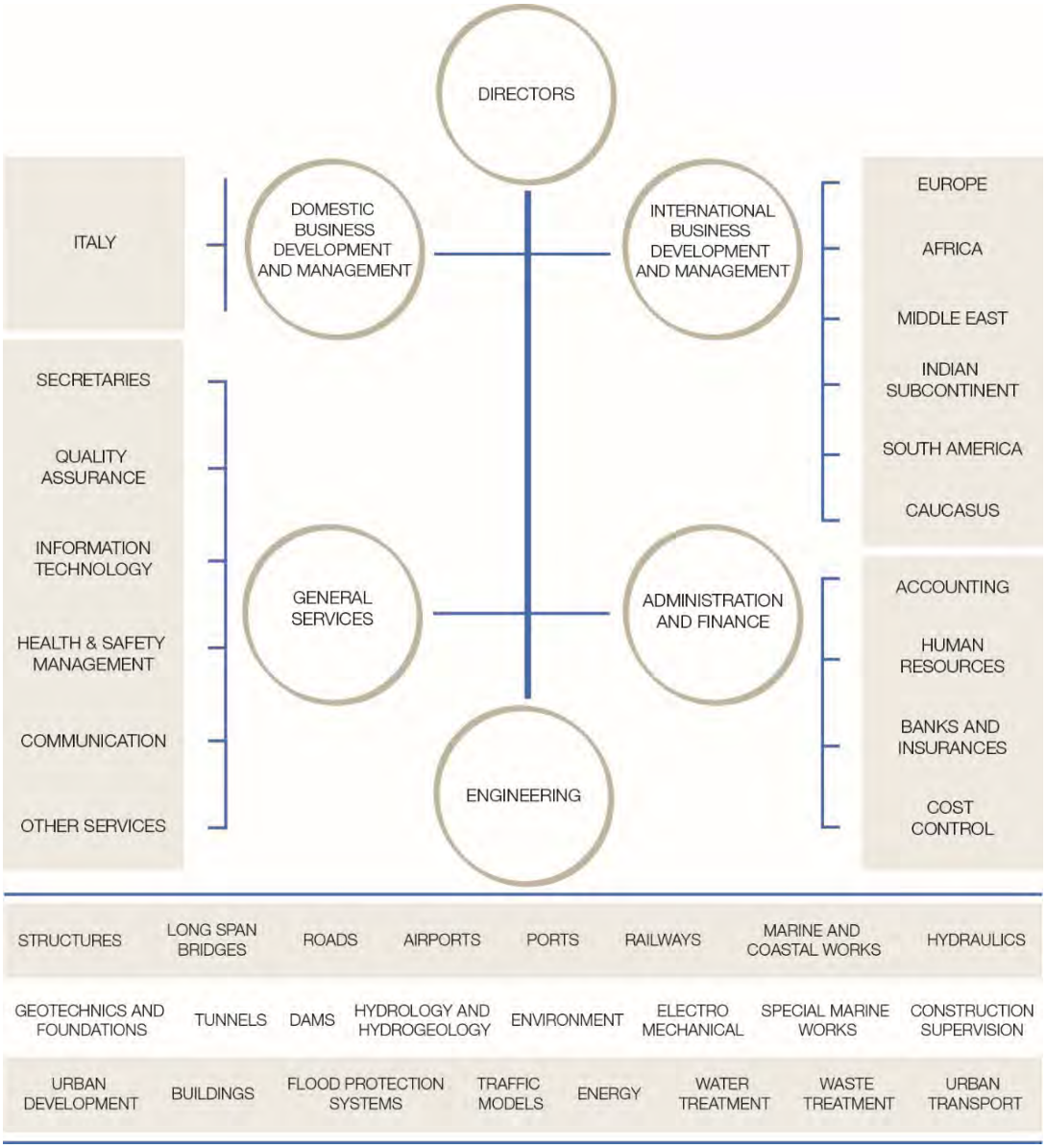
The company covers the full range of services, from planning and feasibility studies through to detailed design, works supervision and technical assistance:

- project management
- planning and economic-financial evaluation of investments
- feasibility studies and technical-economic evaluations
- all levels of design
- environmental impact assessment and studies
- traffic studies
- procurement and assistance with tenders
- construction supervision, quality assurance, testing and commissioning
- co-ordination and supervision of research and laboratory tests
- development of hydrodynamic and hydrogeological analysis and simulations
- development and application of analysis methods and computer modelling.

TECHNITAL has worked in several countries world-wide: Afghanistan, Albania, Algeria, Angola, Argentina, Armenia, Australia, Austria, Bahamas, Benin, Bolivia, Bosnia & Herzegovina, Brazil, Bulgaria, Burkina Faso, Burundi, Cayman Islands, Colombia, Croatia, Cuba, Cyprus, Czech Republic, Democratic Republic of the Congo, Djibouti, Dominican Republic, Egypt, Ethiopia, Georgia, Germany, Ghana, Greece, Guatemala, Hungary, India, Iraq, Italy, Jordan, Kenya, Kosovo, Libya, Madagascar, Malawi, Malaysia, Mali, Mauritania, Monaco, Montenegro, Mozambique, Nicaragua, Niger, Norway, Panama, Peru, Poland, Qatar, Republic of Haiti, Romania, Russia, Rwanda, Saudi Arabia, Senegal, Slovenia, Somalia, Spain, Sudan, Syria, Tanzania, Togo, Trinidad & Tobago, Turkey, Uganda, Ukraine, U.A.E., United Kingdom, U.S.A., Uruguay, Venezuela, Yemen, Zambia.

Organization and staffing

TECHNITAL's multidisciplinary staff is organized according to the following chart:



TECHNITAL's multidisciplinary staff includes about 250 professional employees covering the various aspects of the engineering services: Transport, Hydraulics, Geotechnical, Marine & Coastal, Environmental Studies & Territorial Analysis, Structures, Electronic Data Processing & Systems Analysis, Quantity Surveying & Cost Estimation, Electromechanics, BIM/CAD/CAE, Works Supervision, etc.

Whenever required for the solution of specific problems, the home group is integrated by external consultants and specialists, both Italian and foreign. Seeking assistance and advice from colleagues, scientists, and academics throughout the world is part of TECHNITAL's policy of aiming for excellence.

Given the firm's considerable international experience, TECHNITAL's staff are perfectly at ease working in the main international languages (English, French, Spanish) and using international engineering codes (BS, ASTM, AASHTO, ASME, API and the like) and contract conditions (FIDIC and others).

Quality control

TECHNITAL's activity is ISO 9001:2015 Quality System Management certified. The company is also certified ISO 14001: 2015 Environmental Quality Management, ISO 45001:2018 Occupational Health and Safety Management System and SA 8000:2014 Social Accountability Management System.

TECHNITAL has developed a company policy regarding quality control which is constantly being updated and applied, taking into account the costs to be sustained to achieve the objectives of quality and maximum benefit for both the Company and the Client. Thanks to its Quality Control System, TECHNITAL is capable of guaranteeing the quality of its services and of ensuring the Client that these services satisfy the required quality standards.

Code of Ethics

Ethical and responsible decision making is very important for the company in terms of risk management and in order to keep actions within the ethical and legal boundaries.

For that reason, the company is adopting a Code of Ethics (available from the web site of the company) and conduct for its Executives and Directors and for all the Employees able to fulfil requirements for responsible decision taking. Such code aims at reducing the possibility of stepping outside behavioral limits set by the company.

The Code of Ethics the company is adopting also meets the Organization, Management and Control Model pursuant to Italian Legislative Decree n. 231/2001.

Sectors of Specialization

TECHNITAL provides high-quality consultancy services in different areas of specialization: Roads and Motorways, Railways and Urban Transport, Airports, Ports and Waterways, Marine and Coastal Engineering, Environmental Engineering, Urban Planning, Buildings and Architecture, Hydraulic Engineering, Water Treatment, Waste Treatment, Energy.

In each of these sectors TECHNITAL provides innovative project solutions to Government Agencies, International Financial Institutions and Private Sector Organizations.

Services provided by TECHNITAL include master plans, feasibility studies, techno-economical evaluations, traffic studies, mathematical and physical modeling, all phases of design from concept to detailed design, environmental impact studies and monitoring plans, tender document preparation and assistance in the procurement of works, construction supervision.

2 Our Experience

Experience in Waste Treatment

TECHNITAL's activities in the field of waste treatment engineering cover a broad range of technologies and systems with special emphasis to dumpsites, waste to energy plants, recycling plants, compost plant and biogas plants.

In this sector, TECHNITAL, counting on its consistent multidisciplinary operative structure and its technical and electronic equipment, has successfully undertaken and completed some important and challenging projects, both in Italy and abroad, particularly where the identification of the best technical-technological solution required the use of experienced experts from different complementary disciplines.

The group of highly specialized engineers can in fact be supported by experts and senior engineers with specific know-how in the following fields:

- hydrology;
- geology and hydrogeology;
- geotechnics;
- structures;
- topographical surveying and mapping;
- mathematical modeling;
- computerized graphic simulations;
- electro-mechanical;
- process engineering;
- ecology;
- agriculture and soil science;
- quantity computation and cost estimates.

The services provided in this field include, among others: hydrological studies; geological and geotechnical studies; field measurements and monitoring; process engineering and process optimization; optimization of resources; structural design; electro-mechanical design; feasibility studies and cost/benefit analysis; environmental impact assessment; cost estimates; technical specifications and Tender Documents; construction supervision and management.

Waste Treatment refers to all measures or infrastructures conceived for the treatment of solid waste generated by urban and industrial activities. After decades of not paying specific attention to this sector, proper waste treatment is nowadays under the spotlight because of the heightened environmental awareness which has led to a keen public interest for sustainable development and to stringent environmental regulations.

At the same time, the approach to waste treatment is not anymore solely a matter of minimization of negative impact, as waste can generate revenues and be seen as a resource for recycling and energy generation. In other words, again a way to limit the world resource consumption.

The sector is very dynamic and evolves according to the continuous change of the globe conditions. In fact, while every human activity and development exerts an impact on the natural world, the engineers have to learn about how to minimize project footprints, apply better practices and more balanced approaches.

In this specific field of waste treatment, the Company has experience related both to the design/works supervision of new site/plants and to the upgrade of existing ones. In effects, it is

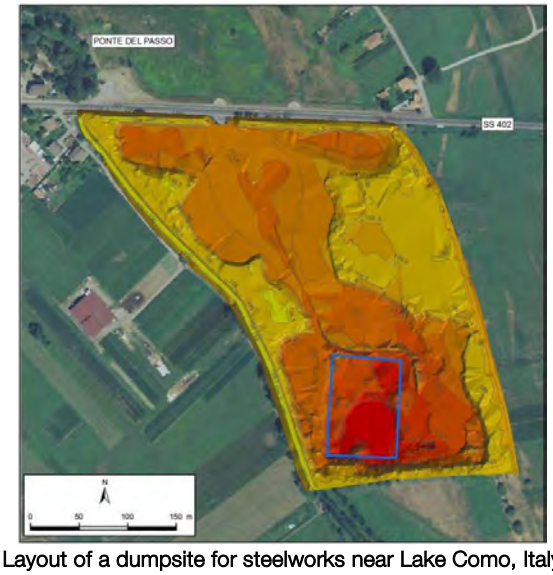
known that the waste treatment technology is quickly developing and upgrading for the reasons mentioned before and, as a consequence, the features of the site/plants have to be upgraded too.

Here below are some pictures of the implemented landfills and dumpsites.

Environmental recovery and extension of dumpsite for non-hazardous urban waste at Torretta di Legnago: The first project is the intervention for the recovery and extension of the dumpsite for non-hazardous urban waste in Torretta di Legnago (Italy). The project concerns the permanent sealing and environmental recovery of the areas already used as dumpsite in order to guarantee the extension of the operating life and the reception of daily collections of urban solid waste. The section of this dumpsite was previously occupied by the Tartaro river, which dried up after the deviation of the river into the Bianco canal.

Torretta di Legnago dumpsite works, Italy

Environmental recovery of a dumpsite for steelworks near Lake Como: Another important case study is the project for the environmental recovery of a dumpsite for steelworks nearby the Lake Como (Italy). The project site is located inside a natural reserve protected by European Regulations (Directive 92/34/CEE and Directive 79/409/CEE). The site is about 7.500 m2 and from 1972 to 1992 it was filled with wastes from steelworks. The project objective is the environmental recovery of the site through capping and collection of rainwater to prevent infiltration. The design activities took into consideration the criteria provided in national and international scientific literature (e.g. US EPA) and national laws and regulations, particularly in relation to isolation of the waste, minimization of the rainwater infiltration and of the erosion, prevention of local settlings, and reduction of maintenance activities.



Layout of a dumpsite for steelworks near Lake Como, Italy

In addition to the above, it is worth to mention:

- Upgrading of the Tortona sanitary landfill, Italy
- Upgrading of the Novi Ligure sanitary landfill, Italy
- Biogas migration from closed landfill Baraccone – Casale Monferrato, Italy
- Environmental updating and setting of the site of Borsano, Italy

Here below are some pictures of the waste to energy plants.

Waste Pre-Selection and Waste to Energy Plant of "Silla 2" in Milan, Italy: Silla 2 is a waste to energy plant located in the north-west of Milan and it was designed and built for thermal waste incineration and co-generation of power and heat for district heating.

At its full capacity the plant can generate sufficient amount of heat to meet the requirements of 15,000 families living in the nearby districts. Also, the plant generates sufficient power to meet annual power requirements of 80.000 families. The flow capacity is of 60 tons/hour while the power capacity is of about 60 MW.

The most reliable and innovative technologies were implemented to assure the lowest environmental impact concerning emissions to the atmosphere, noise level, liquid and solid waste, and associated vehicle traffic. Special attention was paid to the implementation of control systems aimed at keeping the low impact values achieved unchanged.

Silla 2 (Milan) waste to energy plant

Here below the **Leghorn waste to energy plant** is pictured. Similar to the previous plant in this case the energy recovery is made through steam powered turbo-alternator which leads, this time, to a power capacity of 11 MW. The flow capacity is of 230 tons/day.

Leghorn waste to energy plant

Here below is a picture of the **Busto Arsizio waste to energy plant** with a flow capacity of 21 tons/hour and power generation of almost 10 MW.

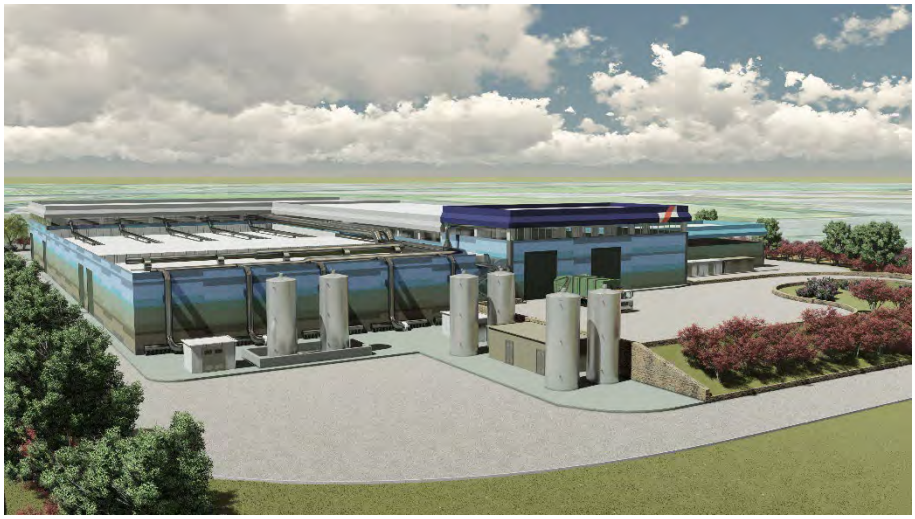
Busto Arsizio waste to energy plant

The **waste to energy plant of Lecce** has been designed for a flow capacity of 13 tons/hour and a power generation of 9 MW.

Lecce waste to energy plant

The company has also undertaken a number of projects in the field of recycling plant and more specifically compost plants.

In Campania Region (Italy), Technital has undertaken two projects for the compost production facility from the biodegradable waste: in **Casal del Principe and in Cancello e Arnone**. For both projects, Technital has developed the detailed design of new 30.000 tons plants compost production. The plants have a capacity of: 24.000 tons/year of biodegradable waste; 6.000 tons/year of lignocellulosic (green) biomass, needed for the degradation of the waste.



Casal del Principe compost plant, Italy

Cancello ed Arnone compost plant, Italy

Another important project is the detailed design for the upgrading of the waste plant in **Spiritu Santu – Olbia** in Italy.
The existing plant consists of different waste treatment processes: recycling materials platform; mechanical-biological treatment plant; plant for compost production from Organic Fraction of Municipal Solid Waste (OFMSW); 120.000 m2 landfill.
The project consists in the detailed design of: a new landfill with a capacity of 150.000 m3; an anaerobic digestion plant fed mainly with OFMSW; update of the compost plant; expansion of recycling platform; renovation of the mechanical-biological treatment plant; realization of a new inert material treatment plant.

Spiritu Santu waste treatment plant, Italy

Full details of the main projects are given in the following table and related project sheets.

TABLE A – COMPANY'S EXPERIENCE (For titles in **bold** type see project sheets in Appendix A)

PROJECT	CLIENT	PERIOD		ACTIVITIES	COST OF SERVICES €	COST OF WORKS €
		FROM	TO			
WASTE DUMPSITES						
Flue Gas Line of The Bio-Platform in Sesto San Giovanni (Milan)	CAP HOLDING S.p.A.	09/2021	Ongoing	Detailed Design	52,740	4,823,348
Detailed Design of The Bioplatform in Sesto San Giovanni (Milan)	CAP HOLDING S.p.A.	05/2021	01/2023	Detailed Design	443,248	37,665,215
Detailed design of the environmental recovery of the dumpsite of Malagrotta (Rome) – Italy	E. Giovi s.r.l.	05/2021	12/2022	Detailed Design of the environmental recovery of the dumpsite	499,500	400,000,000
Environmental recovery and extension of dumpsite for non-hazardous urban waste at Torretta di Legnago, Italy	Legnago Servizi S.p.A.	10/2007	07/2016	EIA, preliminary, final and detailed design, works supervision	1,595,800	34,138,800
Environmental recovery of a dumpsite for steelworks near Lake Como, – Italy	Infrastrutture Lombarde S.p.A.	07/2012	05/2014	Preliminary, final and detailed design, technical assistance	79,400	599,400
Upgrading of the Tortona Sanitary Landfill, Italy	SRT S.p.A.	02/2008	10/2013	Preliminary, final and detailed design, EIA, works supervision and technical assistance.	279,940	11,100,000
Upgrading of the Novi Ligure Sanitary Landfill, Italy	SRT S.p.A.	02/2008	03/2013	Preliminary, final and detailed design, EIA, works supervision, technical assistance	304,754.50	10,200,000
Biogas migration from closed landfills - Baraccone– Casale Monferrato. Italy	COSMO S.p.A.	05/2012	08/2012	Technical assistance	20,000	n.a.
Environmental updating and setting of the site of Borsano, Italy	Infrastrutture Lombarde S.p.A	03/2010	07/2011	Final and detailed design	195,845	3,016,833
WASTE TO ENERGY PLANTS						
Updating of the Fume Treatment System of "Silla 2" Waste to Energy Plant in Milan, Italy	AMSA S.p.A.	04/2006	05/2009	PMC	687,000	12,800,000
Waste to Energy Plant of Leghorn, Italy	A.Am.P.S. Spa	01/2004	12/2004	Detailed design	2,460,000	85,400,000

PROJECT	CLIENT	PERIOD		ACTIVITIES	COST OF SERVICES €	COST OF WORKS €
		FROM	TO			
Waste Pre-Selection and Waste to Energy Plant of "Silla 2" in Milan, Italy	AMSA Spa	01/1999	12/2003	PMC	7,000,000	175,000,000
Waste to Energy Plant of Busto Arsizio, Italy	ACCAM SpA	01/1987	12/2002	Preliminary design, EIA, works supervision	1,400,000	35,000,000
Waste to Energy Plant of Lecce, Italy	Municipality of Lecce	01/1998	12/1998	Detailed design	1,280,000	32,000,000
COMPOST PLANTS						
Detailed design of a compost production facility from biodegradable waste in Cancello ed Arnone (Caserta - Italy)	Campania Region	05/2020	Ongoing	Detailed Design	280,000	19,202,000
Detailed design of a compost production facility from biodegradable waste in Casal di Principe (Caserta - Italy)	Campania Region	05/2019	08/2022	Detailed Design	304,000	13,500,000
Detailed design upgrade review of the I.P.P.C waste plant in Spiritu Santu – Olbia (Italy)	Industrial Consortium of Gallura Province	09/2018	02/2019	Detailed Design	115,000	24,500,000
WASTE COLLECTION SYSTEMS						
Engineering Design Services related to Automatic Solid Waste Collection System and Solid Waste Facility for Phase 1 Konza Techno City – Kenya	KoTDA (Konza Technopolis Development Authority)	08/2018	07/2021	Preliminary, Detailed Design	588,000	33,539,040

Appendix A – Company's Experience

Waste Dumpsite

ENVIRONMENTAL RECOVERY AND EXENSION OF DUMPSITE FOR NON-HAZARDOUS URBAN WASTE AT TORRETTA DI LEGNAGO

Location:	Torretta di Legnago, (Italy)
Client:	Legnago Servizi S.p.A:
Services:	EIA, Preliminary and Detailed Design; work supervision
Period:	10/2007 - 10/2016
Construction cost:	€ 34,138,800

Project Description:

The intervention concerns the permanent sealing and environmental recovery of the areas used as dumpsite in the years 1982-1990. The first section of this dumpsite occupied the former riverbed of the Tartaro river, which dried up after the deviation of the river into the Bianco canal. The riverbed had a natural slow-permeability surface cover which, according to the legislation of the 1980's, was suitable for receiving urban waste. When the first riverbed section was filled, the dumpsite was extended into a second riverbed section and subsequently in the area to the north between the old riverbed and the Bianco canal until the expected exhaustion of this area in Dec. 2008. Moreover, the project is intended to guarantee the dumpsite a further operating life of 8 years to receive the daily collections of urban solid waste. Following the analysis of the existing situation and the comparison of the two alternative solutions allowed by Italian law - the making safe by complete sealing or by the removal of the sources of contamination – the latter alternative was chosen, involving the removal of 595,316 m^3 of waste from the old riverbed and its conveyance to the extended dumpsite area, together with some 87,224 m^3 of cover material.

The removal of the waste material will be carried out cell by cell, each cell bounded on two sides by the river banks and on the other two sides by the excavation front and a closing clay dyke. In this way contamination of the areas by the percolated overflow of the dumpsite is kept to a minimum. The excavation will be carried out in two phases: the first half from above, positioning the digger and the trucks on top of the dumpsite, and the other half from below with the digger inside the cell being excavated and the trucks outside it in the area already recovered. The excavation will therefore be done mechanically using grabbers capable of gathering up the waste material leaving behind most of the water contained in the voids of the material removed. The waste material will be loaded onto trucks. The new dumpsite must receive approx. 500-600 m^3/day of recovered material from the first riverbed section plus the daily volume of solid waste from the neighbouring areas.

According to the indications of Le.Se. S.p.A., the normal volumes of USW to be conveyed annually to dump are equivalent to 120,000 t/year, of which 96,000 t/year dry material for dumpsite and 24,000 t/year of organic material to be conveyed to the composting plant and recycled as daily cover material (BD). Assuming the unit weight of the dry USW is 0.75 t/m^3, the useful volume of the dumpsite annually occupied by ordinary USW can be estimated to be around 128,000 m^3. The dumpsite therefore needs to be extended for a total of 1,620,000 m^3, considering the volume deriving from the clearing and recovery of the first section plus the regular waste conveyance. These volumes were defined according to an arrangement approved by the competent authorities. These volumes were defined according to an arrangement approved by the competent authorities.

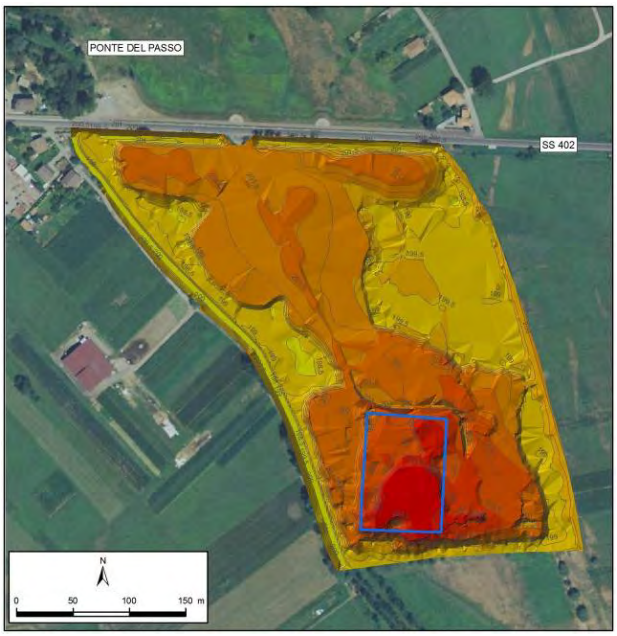
Technital also designed the monitoring system for checking the environmental parameters before, during and after the recovery and construction works.

ENVIRONMENTAL RECOVERY OF A DUMPSITE FOR STEELWORKS CLOSE TO LAKE COMO

Location:	Lombardy Region, Italy
Client:	Infrastrutture Lombarde S. p. A
Services:	Preliminary, final and design, Environmental feasibility study, landscaping design, monitoring plan of underground waters, technical assistance
Period:	07/2012 – 05/2014
Construction cost:	€ 599,400

Project Description:

The project site is located close to Lake Como (Lombardy region) and it is inside a natural reserve protected by European Regulations (Directive 92/34/CEE and Directive 79/409/CEE). The site is about 7.500 m^2 and from 1972 to 1992 it was filled with wastes from steelworks. The project objective is the environmental recovery of the site through capping and collection of rainwater to prevent infiltration.



The design activities took into consideration the criteria provided in national and international scientific literature (e.g. US EPA) and national laws and regulations, particularly in relation to isolation of the waste, minimization of the rainwater infiltration and of the erosion, prevention of local settlings, and reduction of maintenance activities.

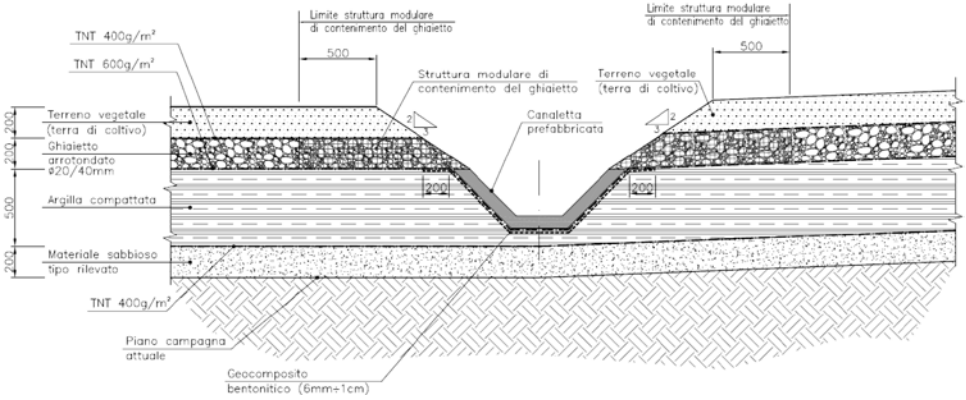
The interventions carried out included removal of the vegetation cover, disposal of the capping and of the drainage network, landscaping (re-vegetation).

The capping is made of: minimum of 20 cm of sand for regularizing the terrain, geotextile 400 g/m^2, 50 cm of compacted clay, geotextile 600 g/m^2, 20 cm of rounded gravel (Ø 40-60 cm) (i.e. the drainage layer), geotextile 400 g/m^2, and 20 cm of topsoil for the landscaping.

The compacted clay is the waterproofing layer; it permits reaching the permeability of 10^{-9} m/s. The layer has been combined with a bentonite geocomposite (permeability of 10^{-11} m/s) where the thickness of 50 cm needed to be reduced.

The collection of rain water will be performed through the drainage layer and to the network of prefabricated ducts (486 m length), laid on the clay layer, to deliver the water to a ditch located along the west side of the site.

Given the location of the site, the landscaping activities represented an essential element of the project. Native species were re-introduced in the site, according to local regulations and to the Master Plan of the natural reserve in which the site is located.



Waste to Energy Plants

UPDATING OF THE FUME TREATMENT SYSTEM OF MILAN SILLA 2 WASTE INCINERATOR

Location:	Lombardy, Italy
Client:	AMSA Spa – Milan
Services:	Project and Construction Management, Management, estimate and accounting of works, Safety coordination during execution.
Period:	04/2006 - 05/2009
Construction cost:	€ 12,802,744

Project Description:

The existing advanced fume treatment system, completed in 2002, is made up of a two-stage de-dusting line with electrostatic filter and bag filter, a de-acidification dry reactor with powder calcium hydroxide dosing and a non-catalytic reduction system for nitric oxide with urea injection in the combustion chamber (SNCR).

The new project will provide for the installation of a catalytic system for high abatement levels of nitric oxide (SCR) and the replacement of calcium hydroxide with sodium bicarbonate as alkaloid reagent.

These updating works are required in order to keep the waste incineration plant running to ensure waste disposal.

Project Figures:

Wet fumes for treatment	NM^3/h	129,000
Nitric oxide (NO_x) emissions	mg/Nm^3	<50
Hydrochloric acid (HCl) emissions	mg/Nm^3	≤4
Hydrofluoric acid (HF) emissions	mg/Nm^3	≤0.25
Ammonia (NH_3) emissions	mg/Nm^3	≤5

LEGHORN WASTE TO ENERGY PLANT (WASTE INCINERATOR)

Location:	Leghorn – Tuscany, Italy
Client:	A.Am.P.S. Spa – Leghorn
Services:	Detailed design
Period:	01/2004 – 12/2004
Construction cost:	€ 85,400,000.00

Project Description:

Project Figures:

-	Flow capacity	t/day	230
-	Waste LHV	kJ/kg	15,000
-	Thermal capacity	MW	40
-	Steam generation	t/h	50.3
-	Power	MW	10.7

The line includes:

- grate furnace with radiation boiler
- fume recirculation;
- fume dedusting by means of electrofilter and bag filter;
- acid gas removal with wet-type system;
- catalytic reduction system for nitric oxide;
- chemical-physical treatment of process waste;
- energy recovery through steam powered turbo-alternator;
- sludge treatment;
- computer-controlled supervision and monitoring system.

WASTE TO ENERGY PLANT SILLA 2

Location:	Milan, Lombardy (Italy
Client:	AMSA S.p.A. – Milan
Services:	Project and construction Management, management, estimate and accounting works
Period:	1999 - 2003
Construction cost:	€ 175,000,000.00

Project Description:

The plant lies north-west to Milan, near Figino, and was built to replace the existing incinerator (named Silla 1).
It was designed and built for thermal waste incineration and co-generation of power and heat for district heating.

At its full capacity the plant can generate sufficient amount of heat to meet the requirements of 15,000 families living in the nearby Gallaratese district and the new Rho-Pero fair- grounds. Also, the plant generates sufficient power to meet annual power requirements of 80.000 families.

The most reliable and innovative technologies were implemented to assure the lowest environmental im- pact concerning emissions to the atmosphere, noise level, liquid and solid waste, and associated vehicle traffic. Special attention was paid to the implementation of control systems aimed at keeping the low impact values achieved unchanged.

Project Figures:

- Number of lines n. 3
- Flow capacity t/h 60.42
- Waste LHV kcal/kg 11,000
- Thermal capacity MW 184.6
- Steam generation t/h 225
- Power MW 59

BUSTO ARSIZIO WASTE INCINERATOR

Location:	Busto Arsizio (Varese) – Lombardy, Italy
Client:	ACCAM SpA – Busto Arsizio
Services:	Preliminary design, Environmental Impact Study, Management, estimate and accounting of works.
Period:	1987 – 2002
Construction cost:	€ 35,000,000

Project Description:

The plant has two parallel lines with common waste feed ditch, solid waste processing lines and auxiliary services. From the waste feeding hoppers to furnaces to the atmospheric emissions from the chimney stack, the plant is wholly managed by an automated system controlled by operators from the control room.

Each treatment line has a combustion chamber with horizontal moving grates, a steam generator, a fume purification system (including non-catalytic reduction system for nitric oxide with urea injection, absorption reactor with calcium and activated carbon suspension for acid gas treatment and removal of micro-polluting compounds, de-dusting system by means of a bag filter and the absorption process with a soda solution) and a fume evacuation system (with a fan, a heat exchanger and a stack). Each line is also provided with thermal cycle with a turbo-alternator and air condenser.

Project Figures:

▪ Number of lines	n.	2	
▪ Flow capacity	t/h	21	
▪ Waste LHV	kcal/kg		2,200
▪ Thermal capacity	MW	53.7	
▪ Steam generation	t/h	55	
▪ Power	MW	9.2	

WASTE TO ENERGY PLANT OF LECCE

Location:	Lecce - Puglia, Italy
Client:	Municipality of Lecce
Services:	Detailed design
Period:	1998
Construction cost:	€ 32,000,000.00

Project Description:

The project developed the plant on two parallel lines with common waste feed ditch, as well as solid waste treatment plants and auxiliary services.

Each line includes:

- combustion chamber with grate system;
- steam generator;
- fume purification system;
- fume evacuation system;
- thermal cycle with a turbo-alternator and air condenser.

Project Figures:

- Number of lines n. 2
- Flow capacity t/h 13
- Thermal capacity MW 26.5
- Power MW 9.2

Compost Plants

DETAILED DESIGN OF A COMPOST PRODUCTION FACILITY FROM BIODEGRADABLE WASTE IN CASAL DI PRINCIPE

Location:	Casal di Principe (Caserta) – Italy
Client:	Campania Region
Services:	Detailed design
Period:	05/2019 – 08/2022
Construction cost:	€ 13,483,318.10

Project Description:

The Campania Region has decided to improve the treatment of biodegradable waste generated inside the region through the construction of treatment plants and producing high quality compost. The goal is to satisfy the whole demand of the Region and to close the waste treatment cycle. This will guarantee its self-sufficiency, complying with the highest environmental standard and economic sustainability of the system.

The Company has been awarded with a project for developing the waste-recycling capacity in Campania Region. The Company is required to provide a range of services including preliminary design, detail design, studies and surveys for the realization of new treatment plants or the restoration/renovation of existing plants.

Within this Framework Agreement, the Company has undertaken the detailed design of a new 30.000 tons plant for the production of compost from biodegradable waste originated from waste sorting in the Casal di Principe municipality.

The plant capacity will include:

- 24.000 tons/year of biodegradable waste
- 6.000 tons/year of lignocellulosic (green) biomass, needed for the degradation of the waste.

A preliminary environmental authorization has been undertaken. Such authorization might require, on the basis of site-specific requirements, an Environmental Impact Assessment.

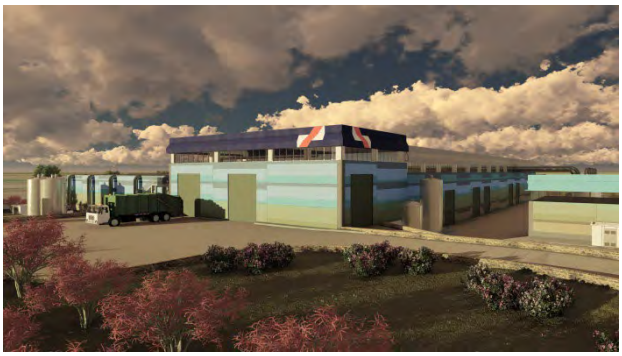
The main objective is the recycling of biodegradable waste with the production of high-quality compost, thus requiring the certification from national Consortium of Compost Producers. The process is made of some operations, including mechanical selection, which produce the following fractions:

- High-quality compost;
- not recyclable scrap, to be disposed of in a disposal facility;
- plastic and metal fractions, to be forwarded to appropriate recycling facilities.

The plant is provided with a rainwater first flush system.

The waste will be delivered to the plant with appropriate vehicles, which will be weighted at the plant entrance for the registration; then, the vehicles will reach the destination where the waste will be unloaded in specific storage areas. All the areas where the waste is stored are provided with air-aspiration system, which transports all the exhausted air to a chemical and biological treatment system, composed of 3 scrubbers and a biofilter.

The plant layout allows the waste transport vehicles only in a specific area, where the waste is unloaded and operating machines take care of the movement inside the plant, thus reducing the accidental dispersion of waste out of the storage areas.
The wheels of all the vehicles will be automatically washed before exiting the waste storage building.



The green biomass is transported in the same building, on different storage areas, through a specific access, functionally separated. The biomass will be transported with a mechanical shovel to a shredder machine, which will deliver the shredded biomass to an area where it will be mixed with biodegradable waste.
The mixture will be nourished to the biological treatment area, which is divided into three sections:

- accelerated biooxidation in bioreactors;
- primary maturation in aerated piles;
- secondary maturation in piles which are frequently turned inside out.

Bioreactors will be realized in concrete, with airtight doors in order to keep the oxidation parameters under control. The air will be forced through the waste from underneath the pit and the whole phase will last 18 days.

After the bio-oxidation phase, the mixture will be transported, with a mechanical shovel, to the primary maturation area, which is strategically designed facing the bioreactors, reducing to the minimum the transportation of waste inside the plant.
In this area, the mixture is placed in piles on a pavement similar to the one in the bioreactor, with air force to flow from the bottom through the whole piles, thus reducing potential anoxic areas.
This phase will last 42 days; after, the mixture is transported to a sorting machine, which will select and separate bigger fractions to be disposed of. The resulting material will be moved to the secondary maturation area, where will be stored for the time necessary to complete the 90 days process.

In the secondary maturation area, the material is stored and mixed up with a windrow turner which will guarantee a perfect aeration of the piles in order to complete the aerobic degradation of the material.
Once completed, the mixture will be nourished to a fine scrap sorting machine/windsifter, which will produce:

- stabilized compost to be stored and destined to the market;
- other organic material which will be separated from plastic scraps and will be used again in the process.

REVIEW OF THE DETAIL DESIGN OF THE FUNCTIONAL ADAPTATION OF THE I.P.P.C WASTE PLANT IN SPIRITU SANTU

Location:	Spiritu Santu, Olbia – Sardinia Region, Italy
Client:	Industrial Consortium of Gallura Province
Services:	Detailed Design Review
Period:	10/2018 – 01/2019
Construction cost:	Euro 24,547,553

Project Description:

The existing plant consists of different waste treatment processes:

- Recycling materials platform
- Mechanical-biological treatment plant
- Plant for compost production from Organic Fraction of Municipal Solid Waste (OFMSW)
- 120.000 m^2 landfill

The Clienthas developed a detailed design for: :

- A new landfill with a capacity of 150.000 m^3 (Section A of the plant)
- An anaerobic digestion plant fed mainly with OFMSW (Section H)
- Update of the compost plant (Section D)
- Expansion of recycling platform (Section E)
- Renovation of the mechanical-biological treatment plant (Section B)
- Realization of a new inert material treatment plant (Section L).

The Environmental Authority asked some clarification, three modifications to the proposed design and a general review of the design. Technital was appointed to perform such activities and, in particular, to study the modifications requested and to edit the design in order to comply with the detail level of the design.

Section A:

The new landfill extends for about 30.000 m^2 on a hillside south of the existing plant. The project requires additional excavation of 75.200 m^3 to reach the maximum waste storage capacity of 150.000 m^3 foreseen by the regional plan for waste treatment.

The rock underneath the area is formed by granite and there is not a stable aquifer; nevertheless, superficial circulation of infiltrated rainwater in the granite fractures is observed. Therefore, the Environmental Authority asked for a modification to account for potential circulation and avoid any potential contact with the waste to be disposed of, and asked for a general review of the landfill design.

A solution was studied consisting of a double layer of mineral material to be placed on the bottom of the excavated surface. The first layer is 2m thick made of fine sand from granite processing with a low permeability: it is a material usually disposed of, with no additional use. With this modification, the design aims to utilize as much as possible existing material stocks in order to avoid the external supply.
Above this layer, an additional layer 1m thick of clay with k $\leq 10^{-9}$ m/s. The clay is covered with a layer of drainage material made with a specific treatment from the excavated granite. The whole design of the landfill has been reviewed to take into account this modification of the bottom and an additional modification requested by the Authority regarding the final capping.

Section H:

The anaerobic digestion plant will be located north of the existing plant and performs a wet anaerobic digestion process with collection of biogas and upgrading to obtain a high-value biomethane.

The plant will be mainly fed with OFMSW, animal by-products, wood by-products and sewage sludges, among other products, for a total input of 40.000 tons per year. It extends for about 29.000 m^2, and it is constituted by two digesters with a diameter of 28 m and a height of 8 m able to produce 10.900 tons/y of digestate and 3.010.000 Nm^3/y of biomethane.

Section D:

The digestate produced by the plant is sent to the composting plant (Section D) located in the existing operational area of the site, via an underground pipeline, designed by Technital, which hosts, in addition to the digestate, the filtered liquid and collected rainwater. The digestate is aerobically treated in accordance with the guidelines for the production of mixed compost improver. The review of the design regarding the composting plant consisted in the verification of the capacity of the plant to host the digestate and the design of its operation during the digesters maintenance.

Section B-E:

The whole section which operates the mechanical-biological treatment has been improved in order to accept more waste from recycling collection and comply with the requirements of Italian national consortia for recycling.

Section L:

In a portion of the existing plant, has been designed an inert material treatment plant able to accept waste from construction industry and from the excavation of rock. The material is cleaned of foreign fractions, shredded and sorted by particle size class. This plant is used in the early stages of the realization of the other sections in order to improve the utilization of the excavated material for other uses within the plant, for the new sections as well as for the existing ones, reducing the external supply of inert material.

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