

An abstract graphic of a molecular structure, consisting of dark gray circles of varying sizes connected by thin lines, resembling a network or a chemical molecule. It is positioned on the left side of the page, extending from the top to the bottom.

TPI

HIGH PURITY CO₂

**TECNO
PROJECT
INDUSTRIALE**

**CO₂ Recovery
AND PRODUCTION**

HIGH PURITY CO₂ from recovery and production plants

When installing or upgrading your CO₂ production business, join the last state-of-the-art of TPI Technology. A CO₂ Recovery Plant will assure you strategic advantages, producing Food Grade CO₂ directly from your fermentation.

More of 500 worldwide installations proof the TPI plants reliability. TPI's plants are always turn-key supplies with commissioning and start up included all around the world.

CO₂ Recovery from Beer Fermentation



CO₂ Production from Natural Gas



CO₂ Recovery from Chemical Plant



CO₂ Production for Water Desalination



CO₂ Recovery from Fermentation



CO₂ Extraction from Flue Gas



TPI PATENTED SOLUTION for CO₂ purification

In the past 25 years, TPI led many of the improvements to existing technology that now are considered "standards" in CO₂ industry. This development, with TPI's dedication to continuous research, ensures each application is given the latest technology. An example of TPI's enhanced technology is its patented solution for CO₂ purification: the Combined Drying and Purifying System.



The Comby System represents the best solution for fine polishing; it removes any kind of impurities to make a food grade CO₂, ISBT/ EIGA compliant.

The system consists of a twin tower Dryer/Purifier unit, filled with appropriated adsorbing materials, selected specifically on gas analysis to remove contaminants. An atmospheric dew point of minus 10°C or lower (up to minus 60°C if required), is continuously maintained in the CO₂ gas.

CO₂ IN-HOUSE PRODUCTION

In-house production of CO₂ is becoming increasingly strategic, as it can guarantee significant and effective benefits and is the right approach to the issue of Carbon Dioxide supply. Relevant economic savings can be achieved from the cost of in-house production compared to the cost of CO₂ bought on the market. Moreover a CO₂ production plant brings other valuable benefits as:

- Food Grade CO₂ continuous production;
 - Independence from logistic problems in CO₂ supply;
 - Strong emissions reduction.
- This knowledge was transferred in many other fields where TPI plants already operate to provide Food Grade CO₂.

TPI developed its technology to capture CO₂ during its 25 years of experience in beverage (beer, mineral water and soft drinks industry). A CO₂ production plant is based on the combustion of desulphurized natural gas or liquid oil. The controlled combustion of fuel gas in the generator/reboiler produces a flue gas rich in CO₂. The flue gas is delivered to the absorbing tower where CO₂ is absorbed in a MEA solution. The solution, rich in CO₂, is pumped into the stripper where the heated solvent releases carbon dioxide. The stream extracted is 100% CO₂ and can be immediately delivered to a recovery plant to be purified and liquified before storage.

Features

- Capacity: from 100 kg/h up to 3000 kg/h
- Burning fuel: natural gas – Diesel oil
- Relevant cost savings from in-house production



▲ CO₂ Production Plant burning fuel in the boiler

TPI installed across the world many CO₂ Production plants, especially where low cost of CO₂ are needed or bottling factories are far from gas resellers; production plants guarantee a continuous supply of CO₂, meeting the specific requirements of the food sector (ISBT/EIGA).

CO₂ EXTRACTION

TPI's technology to capture CO₂ is independent from the flue gas source. If a flue gas generator (a steam boiler, for instance) is already available at site, the TPI extraction plant can produce Food Grade CO₂ starting by the stream of fumes.



▲ CO₂ Extraction Plant, diverting flue gas from the stack

The flue gases to be purified can be produced by steam boilers, cogeneration motors, coal power stations, methane, biogas or other chemical process where CO₂ percentage ranges from 5 to 70%.

CO₂ CAPTURE – CASE STUDY

TPI technology to capture CO₂ can be applied to gaseous streams coming from each of the following sources:

REDUCING GAS

- from steel plant

SYNGAS production

- Refinery plant
- H₂ production plant

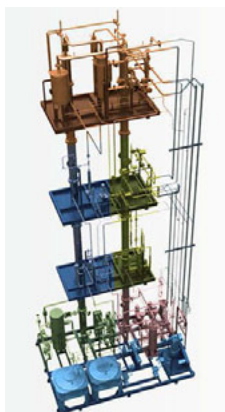
FLUE GAS

- from natural gas or diesel oil combustion

BIOGAS

- Treatment/Upgrading plant

Due to its wide know-how built-up in more than 25 years in CO₂ field, TPI was asked to supply to the Chemical Engineering Dept. of Imperial College (London) the CO₂ capture pilot plant for the new Undergraduate Labs. TPI plant represents the centre piece of Imperial College new teaching and learning centre, where different mixtures of gases are prepared to study the separation process.



CO₂ RECOVERY PLANTS FROM FERMENTATION

TPI Recovery and Purification plants supply Food Grade CO₂ starting from any kind of source (beer or sugar cane fermentation, natural wells or chemical industry by-product). Whether a standard plant can't perfectly fit customers specification, TPI is able to design a customized solution based on a wide knowledge of worldwide operative conditions. Thanks to the innovative purification process of activated carbons, TPI's technology removes any kind of impurities and smells, to make a CO₂ ISBT/EIGA compliant. TPI's technology incorporates in the liquefaction unit a stripper column where uncondensable impurities are reduced to acceptable levels. This innovative technical solution enhances the plant recovery capacity up to 99,99 % of the delivered CO₂. TPI's innovative technology in beverage gas quality has resulted in projects tested and verified with more than 500 installations in breweries, mineral water and soft drink companies throughout the world.



Features

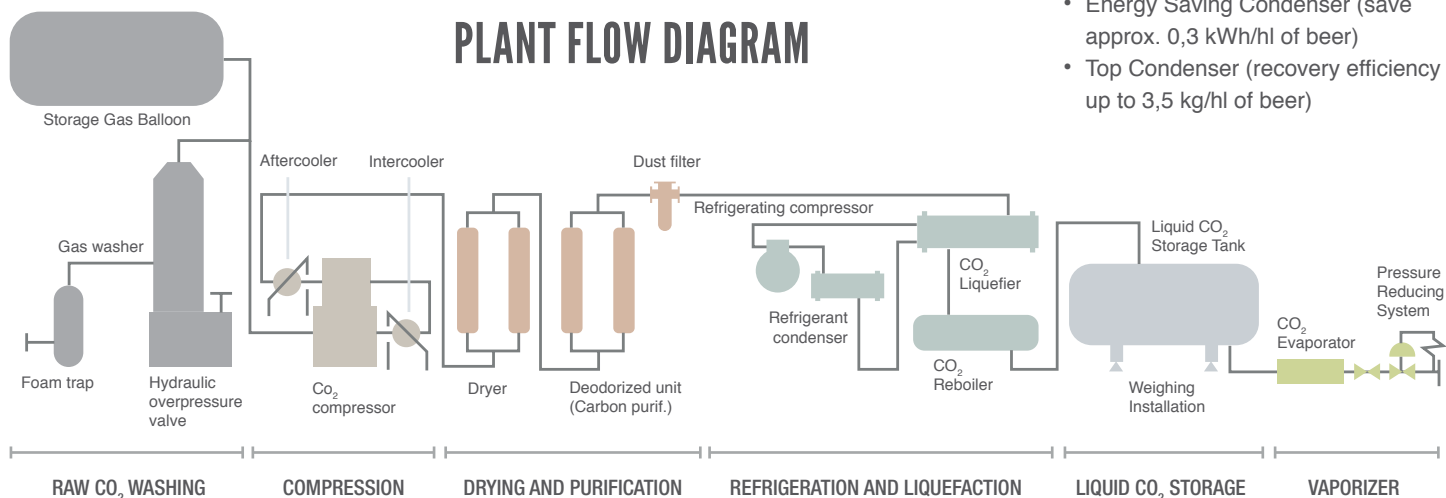
- CO₂ Food Grade ISBT/EIGA compliant
- Capacity from 50 up to 4000 kg/h
- Savings from inhouse fermentation
- Continuous production
- Full automatic management

A COMPLETE PORTFOLIO of CO₂ plants and single equipment

Based on its 25 years of experience in the beverage market, TPI can supply Recovery, Production or Extraction plant as well as each single unit: Foam Traps, Washing Towers, CO₂ Compressors, Dryer and Purifier, Liquefaction units, Refrigeration packages, Cryogenic storage tanks and Vaporizers. TPI is strongly focused on customers requirements as they are the main opportunities to grow and to improve its production quality. Many of the latest improvements has been developed starting from customers' requests as for:

- Energy Saving Vaporizers (save 0,03 kWh/kg of evaporated CO₂)
- Energy Saving Condenser (save approx. 0,3 kWh/hl of beer)
- Top Condenser (recovery efficiency up to 3,5 kg/hl of beer)

PLANT FLOW DIAGRAM



- Step 1** – Raw gas, from fermentation or other source, is conveyed to the CO₂ Recovery Unit and proceeds to Foam Trap and Water Washer.
- Step 2** – CO₂ is compressed by a non-lubricated two stages Compressor and passed through a Molecular Sieve Dryer to remove moisture.
- Step 3** – Gaseous CO₂ goes to the Activated Carbon Automatic Purifier and to the fine filter to remove smelling and any other kind of impurity.
- Step 4** – The purified gas is sent to the Liquefier where any remaining trace of uncondensable gases is removed by reboiler/stripper system.
- Step 5** – The liquid CO₂ is fed to the Storage Tank and, after being vaporized in an Air Heated Evaporator, it's delivered to the bottling line.

FROM ANY KIND OF SOURCE to many application fields

CO₂ can be recovered from many different sources:

- Beer fermentation
- Ethanol production / Sugar Cane fermentation
- Bioethanol production
- Natural Wells
- By-product of NH₃ production
- Syngas
- Ethylene oxide production
- Spent Sulphuric Acid neutralisation

Depending on product requirements, the CO₂ produced by TPI's Recovery Plants can be used for different services:

- as gaseous CO₂ for beverage carbonation
- as liquid for filling CO₂ cylinders
- for production of dry ice blocks and pellets.



PLANT PERFORMANCE

Inlet CO₂

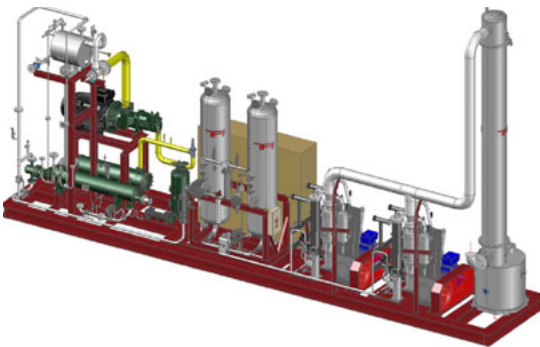
- | | |
|--|-----------------|
| • Raw gas purity | >99 % vol. |
| • Ethanol | 4000 ppm w/w |
| • Hydrogen sulphide (H ₂ S) | 7,5 ppm w/w max |
| • Dimethylsulphide DMS (C ₂ H ₂ S) | 1,7 ppm w/w max |
| • CO ₂ pressure from source | 1013 mbar (a) |
| • CO ₂ inlet temperature | Ambient |

Outlet CO₂

- | | |
|-----------------------------|---|
| • CO ₂ Purity | >99,998 % vol. (O ₂ < 5 ppm v/v) |
| • Operating pressure | 16-18 bar |
| • Electric installed power | 2,2 kW per kg of CO ₂ produced |
| • Washing water consumption | 1 l/h per kg of CO ₂ produced |
| • Refrigerants available | R507 – R404 – R717 Ammonia |

With a stripper system installed, it is possible the recovery of CO₂ with an inlet purity of 95% obtaining outlet purity >99,99%.

JUST ONE SKID UP TO 1000 kg/h



A STANDARD MODEL FOR EVERY NEED

	CO ₂ Capacity	Inst. Power	Washing water	Cooling water	Balloon size	Storage tank
Model	kg/h	KW	lt/h	m ³ /h	m ³	tons
RCF-10	100	22	200	0,2	10	10
RCF-30	300	55	300	0,3	15	20
RCF-50	500	110	500	0,5	20	30
RCF-70	700	160	800	0,8	20	50
RCF-100	1000	220	1000	1	30	2x50
RCF-150	1500	320	1500	1,5	40	2x50
RCF-200	2000	400	2000	2	50	2x100
RCF-300	3000	600	3000	3	70	2x130
RCF-500	5000	1000	5000	5	100	2x150

TPI's TEST FACILITY





TECNO PROJECT INDUSTRIALE

TECNO PROJECT INDUSTRIALE is an Italian company which provides solutions for the Industrial Gas Markets from Beverage Industry to any other Gas Application since 1987.

Specialized in gas treatment and purification - biogas, biomethane, carbon dioxide, compressed air, nitrogen, hydrogen, nitrous oxide and any other gas - TPI has been the leader in many of

the improvements to existing technology that now are standards in CO₂ industry. These developments, together with TPI's dedication to continuous improvement, ensure each application is given the latest technology.

Compression, purification, deoxidation, production and recovery of gas are the main fields where TPI developed its know-how and technology.

Each improvement is based on data that TPI engineers collected during installation and commissioning of more than 500 plants all over the world.

A just-in-time service for Spare Parts from the After Sale Service ensures the proper operation of TPI equipment wherever installed. Pre-assembled units can be tested at TPI's workshop in simulated on-site condition.

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