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State of the Art Gas Absorption Solutions

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About Cansolv

Cansolv Technologies Incorporated was formed in 1997 to commercialize and market the CANSOLV® SO₂ Scrubbing System developed at Union Carbide Canada.

Since this date, Cansolv Technologies has demonstrated the capabilities of its regenerable SO₂ control technology in a variety of applications including oil refinery, chemical plants, non-ferrous smelters and combustion gases.

Cansolv Technologies has also maintained a strong Research and Development program focused on improving the CANSOLV SO₂ process, developing a leading CO₂ Capture process, and integrating advanced solvent purification systems. The CANSOLV® CO₂ Capture System now ranks among the world's leading technologies for CO₂ capture and is well positioned to serve the evolving Greenhouse Gas abatement market.

Cansolv Technologies offices are located in Canada (Montreal) and China (Shenzhen).

“We serve customers worldwide, and focus our efforts on providing integrated gas treatment solutions that maximize environmental and economic value.”

CANSOLV[®] SO₂ Scrubbing System

The leading regenerable SO₂ control Technology

Flue gas SO₂ removal has long been dominated by alkali reagent type processes which ultimately convert SO₂ to calcium or sodium sulfate. The aqueous and solid wastes from these processes contribute to dissolved solids in plant effluent streams and landfill tonnage. The CANSOLV[®] SO₂ Scrubbing System avoids both these issues by selectively absorbing SO₂ and regenerating a pure by-product without consuming reagents or creating waste.

This patented technology uses an aqueous amine solution to achieve high efficiency selective absorption of sulfur dioxide from a variety of gas streams. The scrubbing by-product is pure water-saturated SO₂ gas recovered by steam stripping, using low quality heat.

The CANSOLV[®] SO₂ Scrubbing System is regenerable, meaning the chemical absorbent is not consumed in the process. The high costs of consumable absorbents are thus eliminated, and effluents are reduced to a minimum. Furthermore, the high capacity and selectivity of the absorbent reduce capital costs.

BENEFITS OF THE CANSOLV[®] SO₂ SCRUBBING SYSTEM:

- RECOVERY OF MARKETABLE BYPRODUCTS: HIGH QUALITY PURE SO₂, SULFUR OR SULFURIC ACID.
- NO SOLID WASTE / LANDFILLED GYPSUM. NO SOLIDS HANDLING.
- NON-VOLATILE AND LOW TOXICITY SOLVENT.
- VERY LOW SOLVENT DEGRADATION RATE.
- LOW CAPITAL AND OPERATING COST SENSITIVITY TO FLUE GAS SO₂ CONCENTRATION.
- HIGH FLEXIBILITY: TOLERATES LARGE FLUCTUATIONS OF GAS FLOW AND SO₂ CONCENTRATION.
- HIGH RELIABILITY AND LOW MAINTENANCE COSTS.
- SMALL FOOTPRINT.

A flexible technology for a variety of industries

A WIDE RANGE OF APPLICATIONS...

The CANSOLV[®] SO₂ Scrubbing System is a highly flexible system adapted to a large variety of applications, including:

- INDUSTRIAL AND UTILITY BOILER FGD
- FCCU AND FLUID COKER OFF-GASES
- SULFURIC ACID PLANT TAIL GAS
- CLAUS SRU TAIL GAS
- SMELTER AND REFINING OFF-GASES
- CHEMICAL MANUFACTURING PLANT OFF-GASES
- PULP MILL BLOWPIT AND BOILER GAS

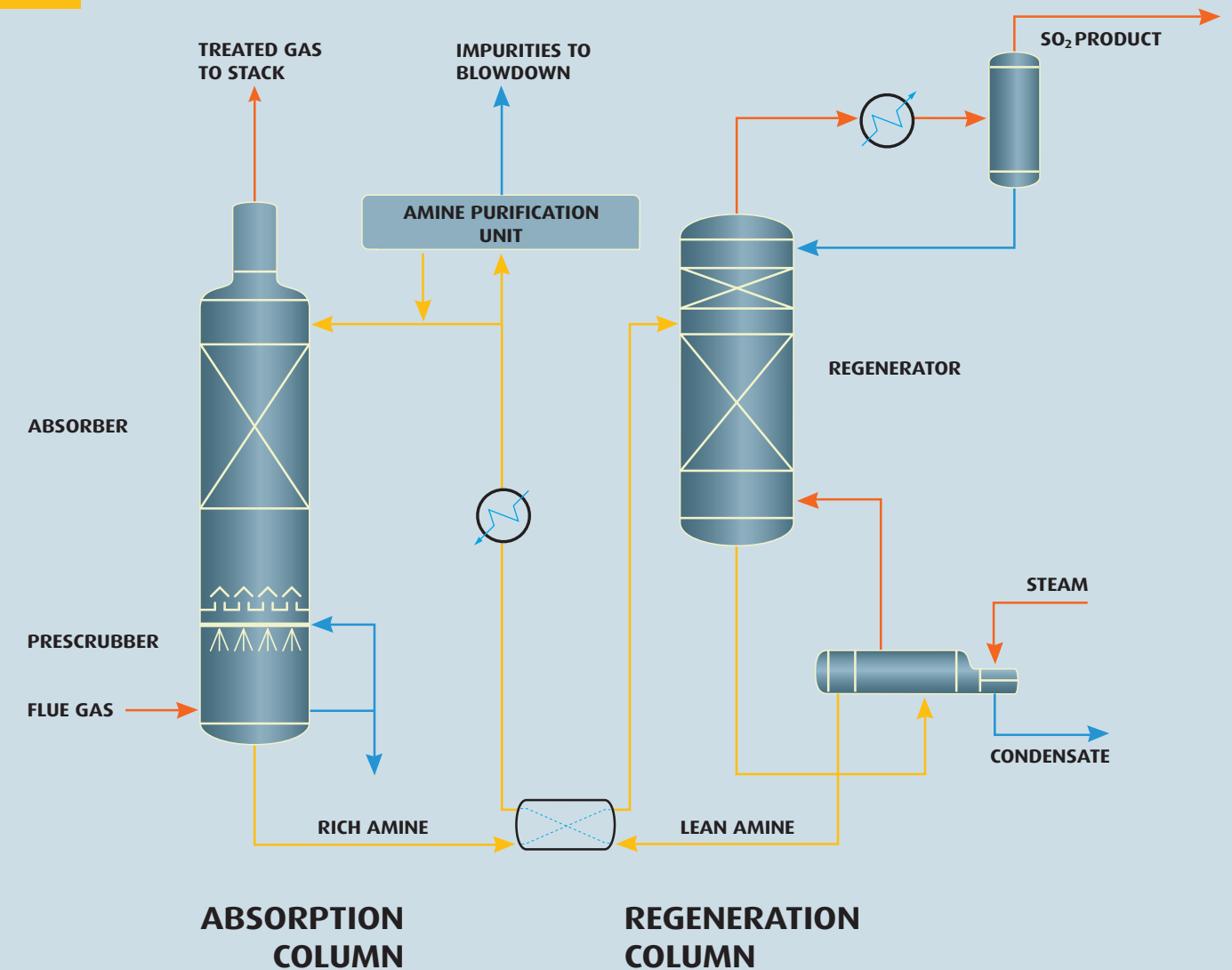
Gas flow rates of current applications range from 5,000 Nm³/h to 950,000 Nm³/h, and SO₂ concentrations from 0.08%vol to 11%vol.

WITH ENGINEERED SOLUTIONS...

One of the unique features of the CANSOLV[®] SO₂ Scrubbing System is the design flexibility to adapt it to various applications. The challenge with every project is to maximize the environmental and economic value. We achieve this through close collaboration with the customer to define the best integration scheme with the processes they are operating on site.

For example, one of the units treating sulfur plant tail gas allows the customer to incinerate high sulfur tars, thus solving the problem of disposal of these wastes. In another sulfur plant the incinerator is fueled by an acid gas stream that bypasses the SRU, and recovered SO₂ is recycled to the SRU thermal stage, thus reducing heat duty and air consumption. This strategy has increased the SRU capacity by 15%.

PROCESS OVERVIEW



1. The feed gas is first quenched and saturated in a water prescrubber. The prescrubber design is selected based on total solids and SO₃ content in the gas and the regulatory requirement to remove them.

2. The gas is then contacted with the lean amine solution in a counter-current column where SO₂ is absorbed. The treated gas exits the absorber with an SO₂ content as low as 10 ppmv, depending on design parameters.

3. The SO₂-rich amine from the absorption column is pumped to the regeneration column via a lean/rich amine heat exchanger for energy recovery.

4. The lean amine solution is regenerated by indirect steam stripping and the SO₂ is recovered as a pure, water-saturated product.

5. The lean amine leaves the stripper reboiler and is pumped back to the absorption column via the lean/rich amine heat exchanger and the lean amine cooler.

6. A slipstream of the amine is purified to prevent accumulation of Heat Stable Salts (HSS).

7. The by-product SO₂ can be converted to various sulfur products such as liquid SO₂, sulfuric acid or sulfur.

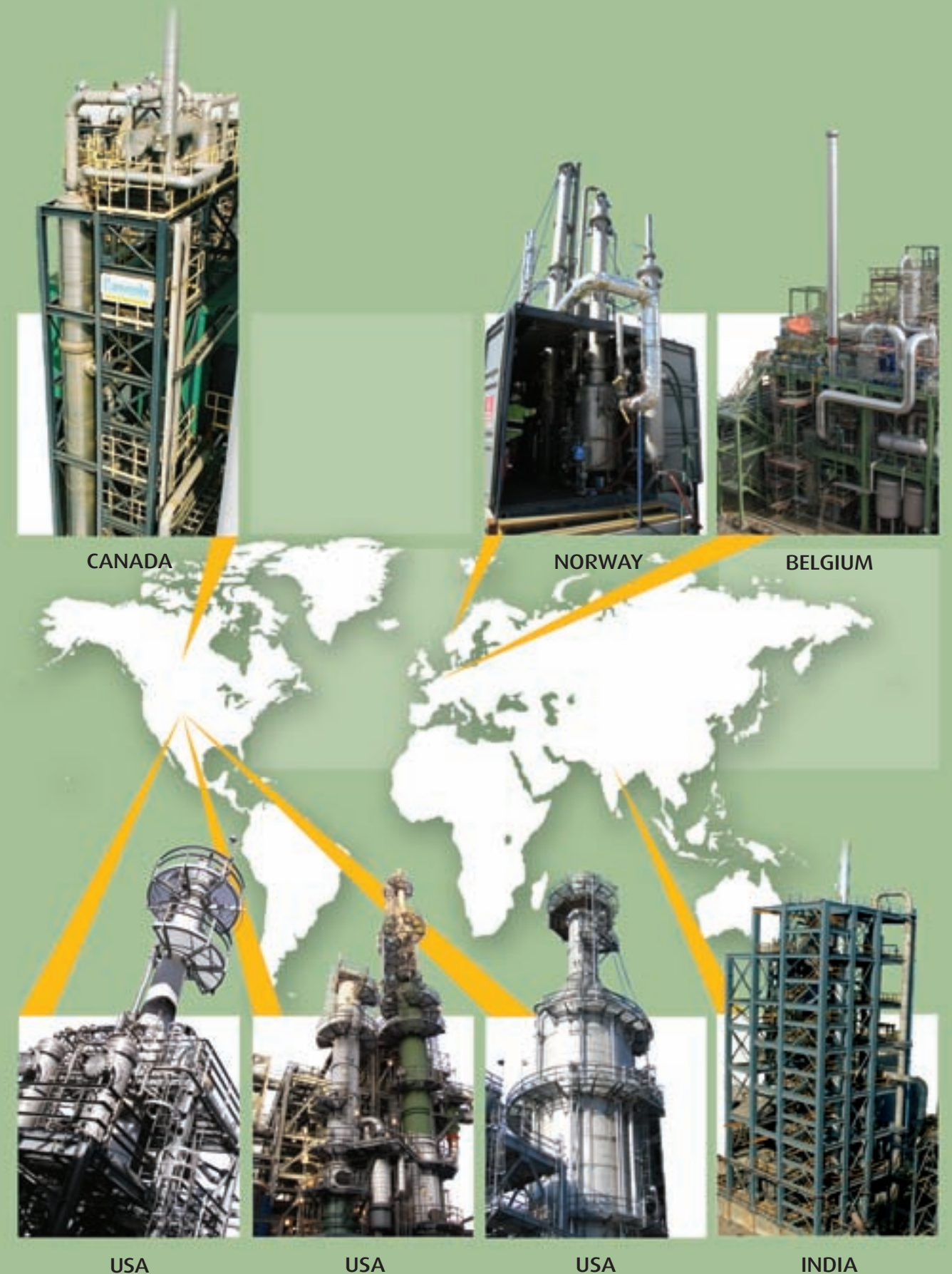
LEGEND >> GAS PHASE: — LIQUID PHASE: — AMINE: —

SATISFIED CUSTOMERS WORLDWIDE

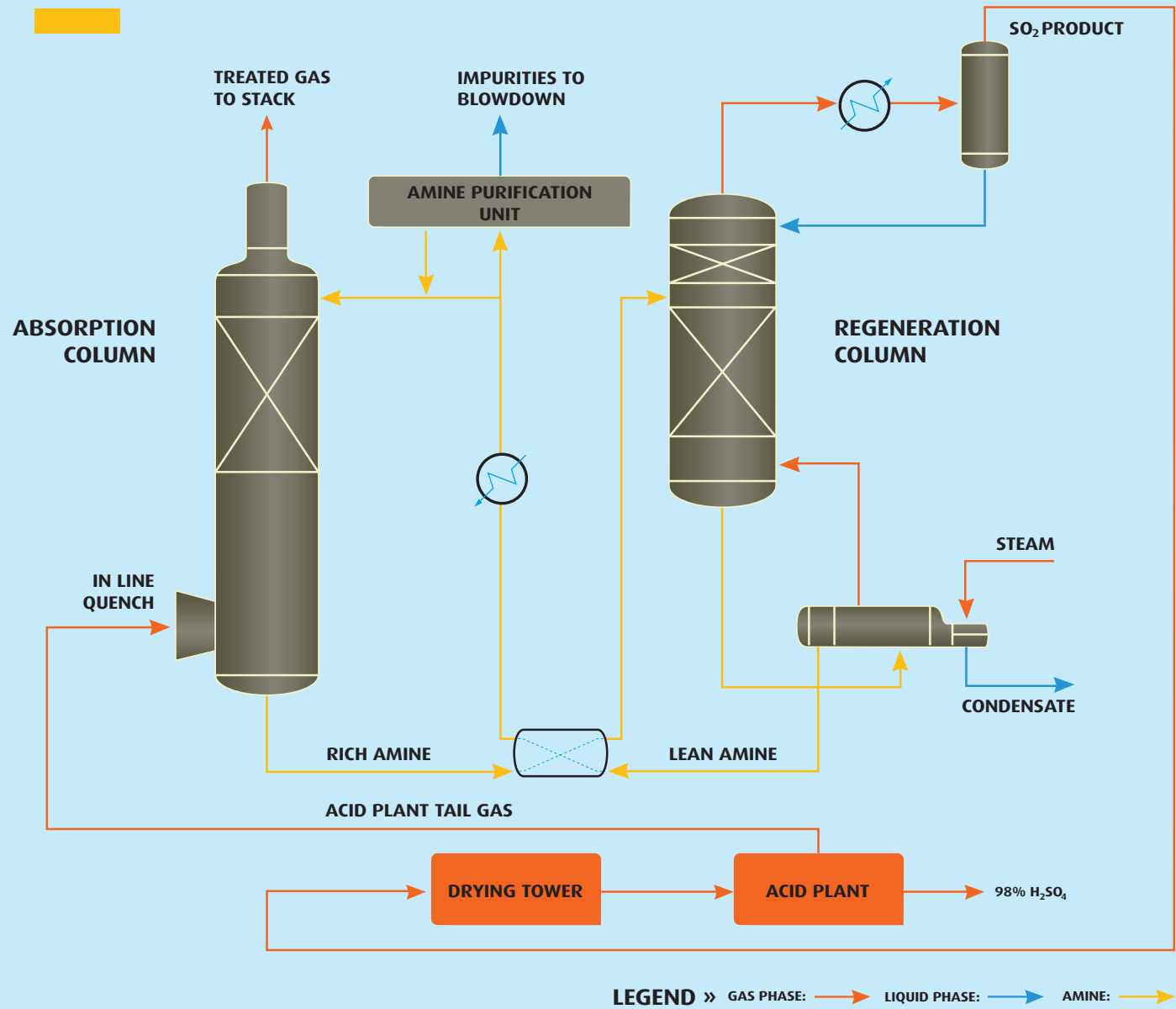
APPLICATION	LOCATION	GAS FLOW (Nm ³ /h)	INLET SO ₂	FINAL EMISSIONS (ppmv)	START-UP DATE
Sulfur Recovery unit	Belgium	12,000	1%	10	2002
Sulfur Recovery unit	USA	20,000	4%	< 140	2006
Sulfur Recovery unit	Canada	18,000	2%		2009
Fluid Catalytic Cracking unit	USA	740,000	800 ppmv	25	2006
Fluid Coker	USA	430,000	0.2%	25	2006
Zinc Smelter	Canada	4,000	7% – 10%	30 - 45	2002
Lead Smelter	India	35,000	0.1% – 11%	150	2005
Lead Smelter	China	30,000	0.1% – 10%		2009
Copper Smelter	China	40,000	0.09% – 2%		2007
Coal-Fired Cogen Boiler	China	960,000	0.4%		2008
Sulfuric Acid plant	USA	40,000	0.5%	< 15	2002
Sulfuric Acid plant	China	35,000	0.4%		2009
Spent catalyst	Canada	50,000	0.9%		2007
Spent catalyst	USA	195,000	0.5%		2009

"It can be misleading to compare the CANSOLV SO₂ absorption technology with an end-of-pipe environmental treatment process. It is in fact a win-win engineered solution that allows process plants to both reduce emissions and save capital. We expect to save millions by taking advantage of this technology to build smaller and simpler acid plants."

Lucy Rosato, former Chief Executive Officer, Noranda Income Fund



CANSOLV® SO₂ SCRUBBING SYSTEM FOR SULFURIC ACID PLANT APPLICATIONS



The CANSOLV® SO₂ Scrubbing System is particularly suitable to Acid Plant Tail Gas treatment, and presents numerous advantages over the installation of a second absorption stage:

- ✦ ULTRA LOW EMISSIONS CAN BE ACHIEVED (DOWN TO 10 PPM IF REQUIRED).
- ✦ NO REQUIREMENT FOR COSTLY CESIUM PROMOTED CATALYST.
- ✦ CATALYST EFFICIENCY DROP (LOWER CONVERSION) DOESN'T AFFECT EMISSIONS.
- ✦ ACID PLANT OPERATION CAN BE MAXIMIZED BY MAXIMIZING GAS FLOW WITHOUT INCREASING EMISSIONS.
- ✦ ALL THE CAPTURED SO₂ GAS IS RECYCLED TO THE ACID PLANT, MAXIMIZING ACID PRODUCTION.

CASE STUDY 1 Refinery Acid Plant Tail Gas Treatment, California.

A CANSOLV® SO₂ Scrubbing System was designed to reduce the SO₂ emissions from the tail gas of a spent acid recovery plant from 3,100 ppmv (8,870 mg/Nm³) to 50 ppmv (145 mg/Nm³).

An existing fiberglass tower was retrofitted for use as a combined quench system and SO₂ absorber. The gas is quenched in the lower section of the tower and then flows through a chimney tray into the SO₂ absorber for SO₂ removal. The recovered SO₂ is returned to the front end of the acid plant for sulfuric acid production.

RESULTS

Since the unit's startup in September of 2002, performance has exceeded the targeted design conditions. The average SO₂ concentration in the feed gas exceeds the design value and the SO₂ emissions from the CANSOLV SO₂ absorber consistently average 10 ppmv (29 mg/Nm³).

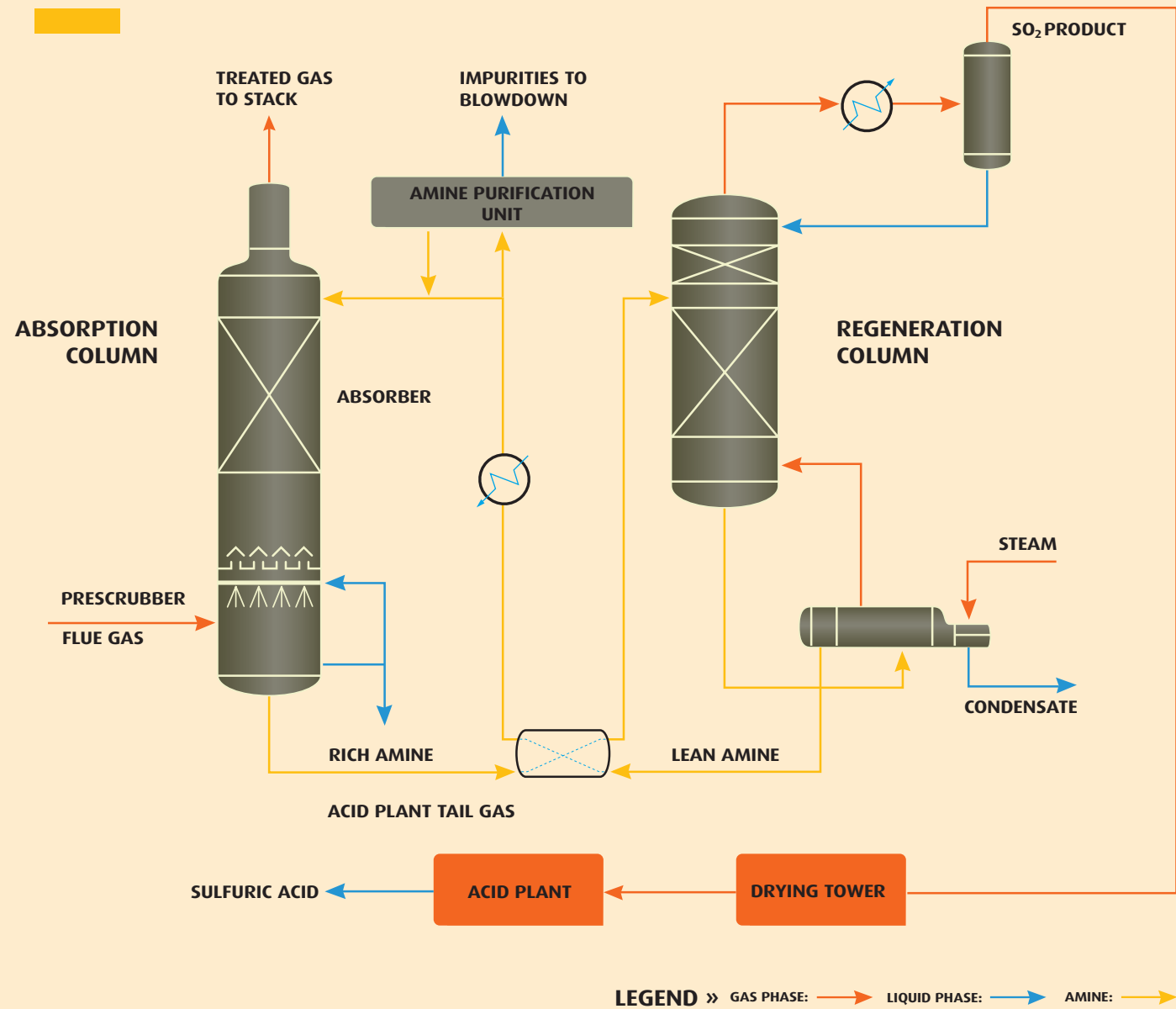
The plant has been pushed up against its front end combustion limit.



Operating conditions

Flowrate	Nm ³ /h	40,000
Absorber inlet SO ₂ concentration	%vol	0,5
Absorber outlet SO ₂ concentration	ppmv	design: 50, actual : 10
Steam Consumption	t/tSO ₂	6

CANSOLV® SO₂ SCRUBBING SYSTEM FOR HIGH SULFUR FUEL COMBUSTION APPLICATIONS



ADVANTAGES:

- UNIQUELY SUITED TO HIGH SULFUR FUEL COMBUSTION FGD (COAL, BITUMEN, PET COKE).
- AVOIDS EXCESSIVE USE OF ALKALI REAGENTS AND PRODUCTION OF GYPSUM WASTE.
- COMPLETE SEPARATION OF ASH CONSTITUENTS FROM SULFUR BYPRODUCT ALLOWS PRODUCT SO₂ OR SULFURIC ACID TO MEET THE HIGHEST QUALITY STANDARDS.

CASE STUDY 2 Coal-Fired Boilers, China.

A CANSOLV® SO₂ Scrubbing System will treat flue gas from four 60 MW industrial cogeneration coal-fired boilers, for a total gas flowrate of 960,000 Nm³/h.

To provide full flexibility to the FGD unit, flue gases from each boiler will be treated in a dedicated absorber, and the SO₂ laden solvent from the four absorbers will be regenerated in a common stripper.

Flue gas from each CFB is cooled to 130 °C in a combustion air preheater, and is then de-dusted in electrostatic precipitators (ESP). It is then directed to the CANSOLV® SO₂ Scrubbing System. The CANSOLV unit is designed for SO₂ emissions of 400 mg/Nm³. Lower emissions can be achieved by adjusting steam input to the stripper.

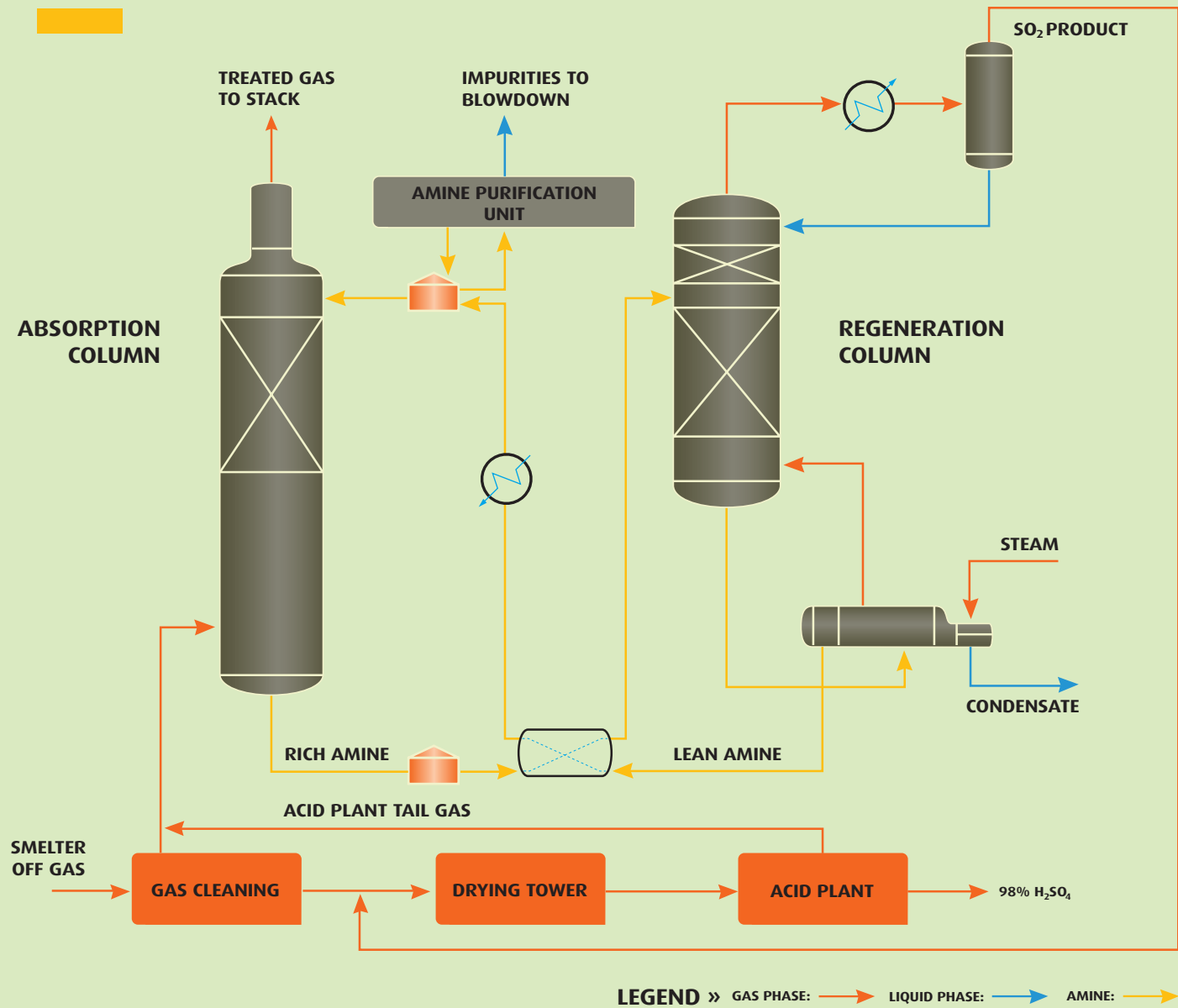
Choosing the CANSOLV® SO₂ Scrubbing System will enable the customer to burn high sulfur coal. Major economic benefits will result from both the lower cost of the coal and the increased sulfuric acid production.



Operating conditions

Flowrate	Nm ³ /h	960,000
Absorber inlet SO ₂ concentration	ppmv	4,200
Absorber outlet SO ₂ concentration	ppmv	140 (400 mg/Nm ³)
Revenue from acid sales	USD/year	6,000,000

CANSOLV® SO₂ SCRUBBING SYSTEM FOR METALS SMELTING AND REFINING APPLICATIONS



The CANSOLV® SO₂ Scrubbing System is the perfect solution for the extremely challenging applications of the metals industries, which use batch processes that generate highly variable gas flows and SO₂ concentrations:

- THE CANSOLV® SO₂ SCRUBBING SYSTEM IS SUITABLE FOR AN EXTREMELY LARGE RANGE OF SO₂ CONCENTRATION (0.1 TO MORE THAN 10%VOL).
- THE CANSOLV ABSORBENT CAN BE USED TO BUFFER LARGE SO₂ CONCENTRATION VARIATIONS AND DELIVER A STEADY SO₂ FLOW TO A DOWNSTREAM ACID PLANT.
- NO NEED FOR DOUBLE ABSORPTION IN A DOWNSTREAM ACID PLANT. A SINGLE CONTACT ACID PLANT TAIL GAS IS HANDLED BY THE CANSOLV UNIT FOR ULTRA-LOW EMISSIONS.

CASE STUDY 3

Lead smelter, India.

This unit captures off-gas from a batch lead smelter. The concentration of SO₂ varies one hundred fold during the process cycle (from 11% at peak down to 1000 ppmv) so very high turndown on absorbent flow is required. Fluctuations in incoming SO₂ are managed by varying the volume of rich amine, allowing the regeneration side to operate at constant flow, delivering pure SO₂ at a steady rate to a downstream acid plant.



Operating conditions

Gas Flowrate	Nm ³ /h	Min: 6,000 / Max: 25,000
Absorber inlet SO ₂ concentration	%vol	Min: 0.1 / Max: 11
Absorber outlet SO ₂ concentration	ppmv	100
Recovered SO ₂ flowrate	t/h	3.5

PROJECT EXECUTION



EQUIPMENT PROCUREMENT

MODULARIZED SKID MOUNTED UNITS

PERSONNEL TRAINING

TROUBLESHOOTING ASSISTANCE

ENGINEERING

Using up-to date simulation and design tools, and relying on long-term partnerships, our teams of high-level professionals can provide a complete range of engineering services:

- PRELIMINARY FEASIBILITY STUDIES
- ENGINEERING STUDIES
- PROCESS DESIGN PACKAGES
- COMPLETE DESIGN OF MODULARIZED UNITS

PROCUREMENT

EQUIPMENT PROCUREMENT

Cansolv Technologies can supply all main components of the CANSOLV system or complete modularized units, through a network of strategic suppliers. Extensive modularization saves on site costs and shortens schedules, giving customers flexibility in project execution.

COMMISSIONING AND START-UP ASSISTANCE, PERSONNEL TRAINING

Through extensive training of the operators, and assistance throughout commissioning and start-up, Cansolv Technologies makes sure that the CANSOLV® SO₂ Scrubbing System is a trouble-free unit from the day it comes online.

CUSTOMER ASSISTANCE

PROCESS MONITORING AND OPTIMIZATION ASSISTANCE: Cansolv Technologies helps customers' personnel analyze the CANSOLV unit operational parameters and optimize operating conditions for minimum emissions and energy consumption.

ANALYTICAL ASSISTANCE:

Cansolv Technologies provides support to customers' laboratory personnel as well as analytical services in its own lab equipped with state-of-the art instruments (automatic titrators, Gas Chromatography, Ionic Chromatography, High-Pressure Liquid Chromatography coupled to Mass Spectroscopy).

TROUBLESHOOTING ASSISTANCE.

Cansolv personnel are dedicated to rapidly provide answers and solutions to customers' concerns and problems, from Cansolv's offices in Montreal, or on site if required.

CO₂

CANSOLV® CO₂ CAPTURE SYSTEM

Cansolv Technologies has built on its experience with diamines to develop specific absorbents for CO₂ capture. Operating on the same principle as the CANSOLV® SO₂ Scrubbing System, the CANSOLV® CO₂ Capture System is a world leading CO₂ capture technology.

It is suitable for capturing CO₂ from boiler flue gas for small-scale applications such as PCC production, acidification and bulk CO₂ distribution. It is also one of the most promising technologies for large scale CO₂ capture for sequestration in deep saline aquifers or for Enhanced Oil Recovery applications.

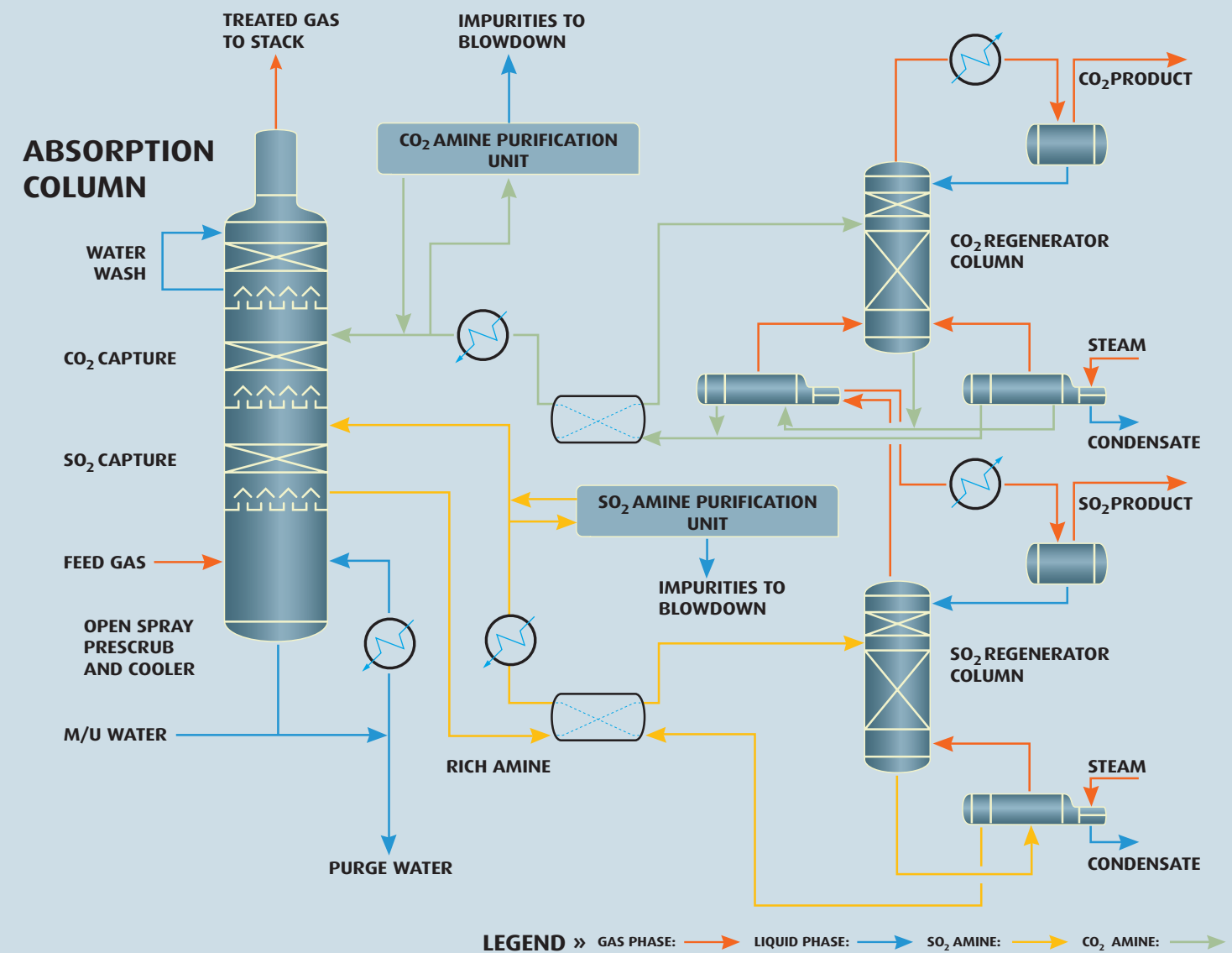
After more than five thousand hours of piloting on flue gases from coal and natural gas combustion, the first commercial applications are expected before 2010.

Features of CANSOLV® CO₂ capture System:

- LOW REGENERATION ENERGY.
- SOLVENT RESISTANT TO SO₂ AND O₂.
- SOLVENT RESISTANT TO OXIDATIVE DEGRADATION.
- CAN BE INTEGRATED WITH THE CANSOLV® SO₂ SCRUBBING SYSTEM TO PROVIDE A COMPLETE SO₂ – CO₂ CAPTURE SOLUTION.



CANSOLV INTEGRATED SO₂-CO₂ SYSTEM



By taking advantage of the strong synergies between the CANSOLV® SO₂ Scrubbing System and the CANSOLV® CO₂ Capture System, Cansolv Technologies is able to propose an integrated SO₂ – CO₂ capture solution with unique benefits:

- 80% OF HEAT USED FOR SO₂ STRIPPING IS RECYCLED FOR CO₂ STRIPPING REDUCING UNIT CO₂ CAPTURE COSTS.
- SULFUR DIOXIDE EMISSIONS BROUGHT DOWN TO ZERO.
- SULFUR DIOXIDE TOLERANCE OF CANSOLV CO₂ SOLVENT MAKES PROCESS RELIABLE AND FLEXIBLE.
- ALLOWS CO₂ CAPTURE FROM HIGH SULFUR FUELS WHERE CO₂ CONCENTRATION IS HIGHER AND UNIT CAPTURE COSTS ARE LOWER.

CONTACT US

TO GET MORE INFORMATION ABOUT OUR
TAILORED GAS ABSORPTION SOLUTIONS.

SO₂



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