

**HUGO PETERSEN**  
Verfahrenstechnischer Anlagenbau

**SULPHURIC ACID MANUFACTURE**  
Efficiency First – Technology at its Best

[www.hugo-petersen.de](http://www.hugo-petersen.de)

## The company

HUGO PETERSEN GmbH located in Wiesbaden, origins from the renowned engineering company Hugo Petersen, founded in 1906, in Berlin. HUGO PETERSEN is part of the Chemieanlagenbau Chemnitz (CAC) group and as such can provide full support and security for the development and implementation of small to large scale installations.

Initially using the expertise gained in the classical production of sulphuric acid, from off-gases generated in the refining of metallurgical ores, the company HUGO PETERSEN specialized in the field of manufacture of sulphuric acid, hydrochloric acid and gas cleaning.



Pic. 1:  
Hugo Petersen 1906

HUGO PETERSEN has more than 110 years of experience in the design and operation of sulphuric acid plants and their equipment. Today, HUGO PETERSEN offers a vast range of technology, to this industry. The design, whilst incorporating HUGO PETERSEN's extensive experience, has been developed and optimised through a comprehensive research program, conducted using HUGO PETERSEN'S own pilot plant facilities.

The engineering company has evolved from HUGO PETERSEN - consulting engineers, to an operating entity with a worldwide network of representatives and subsidiary companies.

In the field of Manufacture of Sulphuric Acid, the focus is on planning, designing and supplying plants which use raw materials like elemental sulphur, metallurgical sulphides and the decomposition of spent acid. This also includes the efficient and intensive use of off-gases from metallurgical plants as well the effective energy recovery from sulphur burning plants.

Today, HUGO PETERSEN is in a position to supply the design and the construction of single components, as well as, turnkey sulphuric acid plants of various sizes and capacities.

The know-how in the areas of process engineering, chemistry and plant construction, available here in Wiesbaden, has been upgraded systematically and defines the profile of our dedicated, team oriented staff.

About 50 well trained process technologists and engineers contribute their knowledge and expertise in the fields of mechanical and electronic engineering, as well as material science, to their design work.

### Accurate Planning - the basis for our work

The scope of the tender for a custom designed plant is solely defined by the task, operating requirements and the requirements of our customer.

The thorough evaluation of the ecological and economic factors ensures the best plant specific solution. Proven technology, combined with HUGO PETERSEN's site specific developments, leads to the construction of a plant suitable for the respective application.

HUGO PETERSEN has installed more than 400 turnkey plants and plant components for the manufacture of sulphuric acid, oleum and SO<sub>2</sub>/SO<sub>3</sub>.

Every plant is unique and all plant components have to be finely adjusted. Hence, it is of great advantage, when a single company designs all components.

As plant designer and constructor, we assume the full responsibility for the reliability and performance of our plant design. Individual fabrication and selection of the right materials are a matter of course, as well as the timely supply, erection and commissioning of the plant.

Qualified personnel supervise the erection of our plants, down to the last detail, prepare the final documentation and provide long-term post-implementation support to our clients.

## Sulphuric Acid – keeps the world industry running

Over time, sulphuric acid has demonstrated its importance to humans. Sulphuric acid is and will be a chemical, by which, the global economy is measured.

Between 1990 and 2013, the annual production rose by more than 60%.

In 2009, the global sulphuric acid production decreased to 195 million tonnes, because of the global economic crisis.<sup>[1]</sup> However, the market followed an upward trend; in 2010 and in 2012, annual global production amounted to 230.7 million tonnes.

Asia is the biggest producer of sulphuric acid, accounting for nearly half of global production. China, the US, India, Russia, and Morocco accounted for nearly 61.5% of the total sulphuric acid production. In 2016, the global sulphuric acid market is expected to exceed 267 million tonnes.<sup>[2]</sup>

This short extract shows the importance and the economic indicator behaviour of sulphuric acid.

## Technology – Dedication makes the difference

The technology to manufacture sulphuric acid may be old, but the manufacture of the chemical most used in the world, still needs commitment and dedication. The focus today and in future will be, more than ever, on energy efficiency and environmental performance.

In sulphur burning plants the generation of steam, (heat energy) from the  $\text{SO}_2$ -conversion, is a proven benefit of the process concept, whereas this occurs rarely in metallurgical plants, due to the low  $\text{SO}_2$  concentration.

Here the world will see a major boost in development, together with a higher  $\text{SO}_2$ -concentration from roasters and smelters, the energy recovery will be the technical key, in plant design.

A further area for heat utilization will be the air drying and mainly the  $\text{SO}_3$ -Absorption. Through the use of the absorption heat, the efficiency of a sulphuric acid plant, will be increased by at least 30%!

Further possibilities will arise, whether

- the production of low pressure steam
- direct electricity
- or only hot water

is used.

The aim will be to seek customised solutions, with regard to energy use.

Here, general solutions are not the answer; solutions will be adapted to corporate infrastructures – many factors play a role, such as:

- the target emission level – can this level be achieved catalytically (if not, are concepts for the purification of natural gas necessary)?
- the availability of adsorbents and absorbents
- product recovery
- cost-efficiency

Pressure for improved environmental sustainability, will increase, because of increasing environmental awareness and a shortage of fossil energy.

## Vision and Mission

Here HUGO PETERSEN's dedication comes to the fore.

Our vision fits exactly to the needs of the sulphuric acid industry.

### Efficiency First

**Not only do the things right, but also, do the right things**



Fig. 2: Patent 'Kammerregulator' 1905

The founder, Hugo Petersen was, from the beginning, ambitious to improve operations to reduce emissions, through his invention of the patented "Kammerregulator" for the classical lead-chamber process. The unit improved the control of the performance of the lead-chamber and hence the emission of noxious gases.

In 1923, he replaced the lead-chambers with irrigated towers, achieving a 6-fold increase in performance, over the original design.



Fig. 3: Tower Plant 1923

Nowadays, sulphuric acid is produced by the well-known double contact process, which is

based on the oxidation of  $SO_2$  to  $SO_3$  using a vanadium pentoxide catalyst, introduced by BAYER AG in 1964. Since then, the conversion efficiency has increased from 97.5% to 99.5%

HUGO PETERSEN supplies plants and equipment which ensure conversion rates of more than 99.92% and with its vast experience in gas cleaning it is possible to attain  $SO_2$ -free gases.

Our specialists handle every customer's request individually. The engineering company, HUGO PETERSEN, is free to select processes and measures to be taken for each application, as we have the full range of technology, in-house.

Emissions are one factor for environmental sustainability, energy is another.

Nowadays, plants built by HUGO PETERSEN are able to recover nearly 100% of energy.

The in-house developed concept of ENER<sup>REC</sup> together with our methodology tool, THRC-Total Heat Recovery, are the best examples for HUGO PETERSEN's aim in making sulphuric acid plants more efficient. These tools and technology do not necessarily, only cover one area of the acid plant, no - the energy source is the sulphuric acid plant. The

integrated energy recovery, from conversion and absorption and the integration of clients with even neighbouring plant installations; these are the intelligent concepts, for the future.

But development does not stop at the process concept; the design of tailor-made and sulphuric acid specific equipment, was always part of our engineering work. Good examples are the recent improvements in our converter and heat-exchanger designs and not to forget, our technical concepts for compacting plant installations, which have already received positive feedback from our competitors.

HUGO PETERSEN set new standards, at the beginning of the 20<sup>th</sup> century, for the manufacture of sulphuric acid, with the PETERSEN Tower Plant Process, which replaced the outdated lead chamber process.

Due to our extensive knowledge of metallurgical and chemical processes, HUGO PETERSEN can offer customized solutions to our customers.

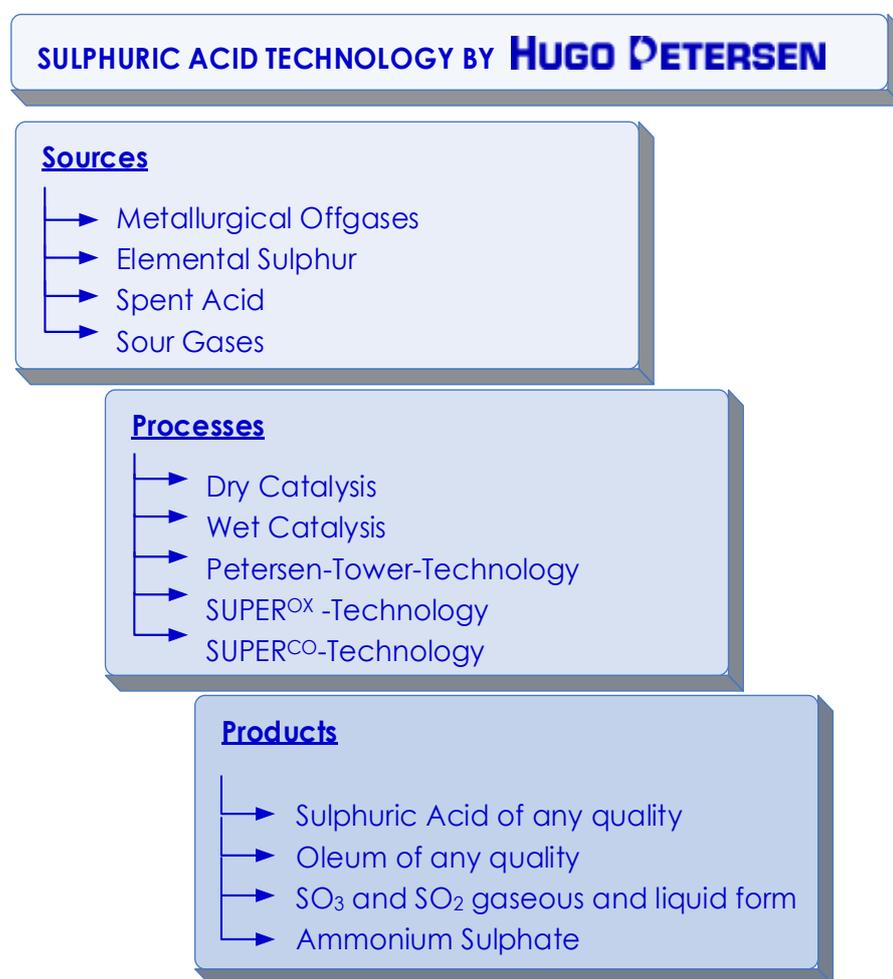


Fig. 1: HUGO PETERSEN Process Overview

In the above overview, only the key processes are shown. More specific methods have been developed by HUGO PETERSEN, such as:

## Special Processes

Special Processes here are those that afford a special efficiency in separation and meet specific requirements, but which also target energy recovery.

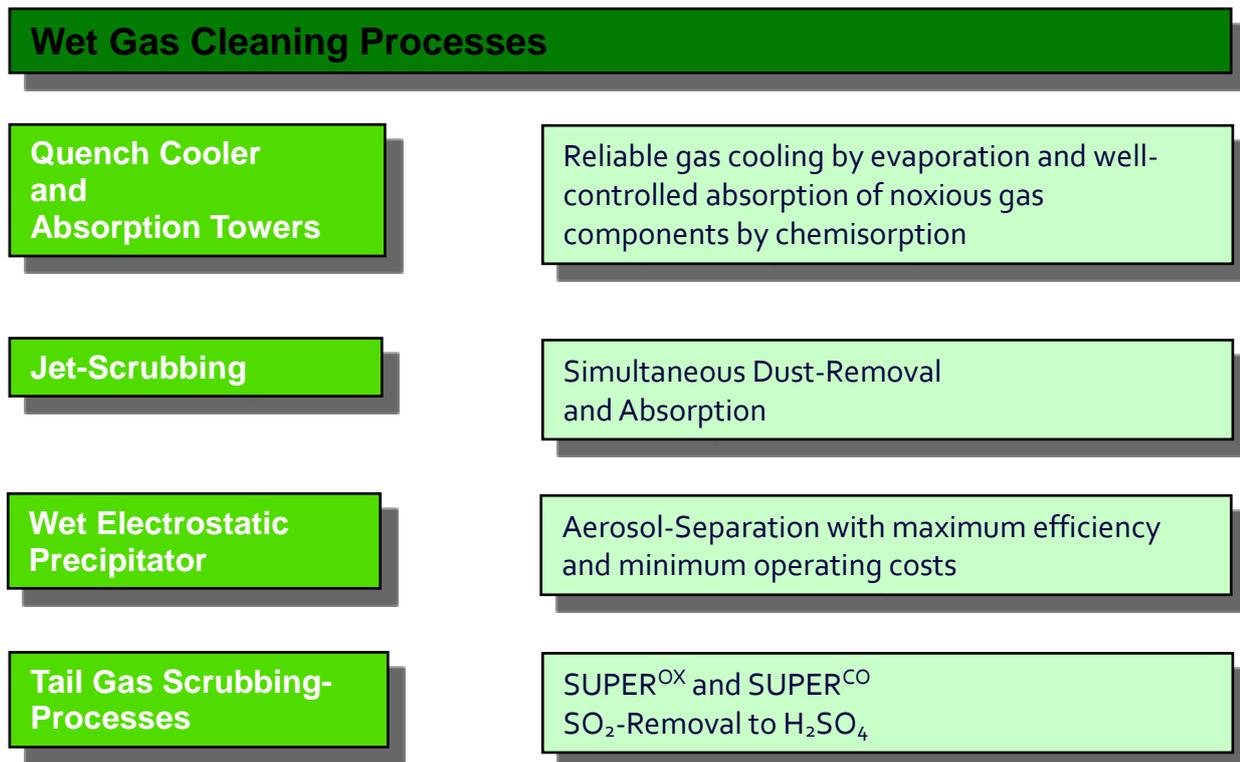


Fig. 2: HUGO PETERSEN Process Overview Wet Cleaning Processes

HUGO PETERSEN plants and components, whether installed as a single unit or combined in a process chain, always comply with the requirements and needs for plant capacities ranging from 10 to 5,000 tpd Mh; convincing evidence of HUGO PETERSEN quality. Whether the plants produce sulphuric acid, oleum and/or SO<sub>2</sub>/SO<sub>3</sub>-gases/liquids, HUGO PETERSEN supplies the optimal concept.

The disposal of by-products, the physical-chemical treatment or evaporation of wastewater and the recovery of valuable materials, complete our product range, which is in accordance with the philosophy of HUGO PETERSEN:

## Sulphuric Acid Manufacture – Custom Made

## Special Processes

**SO<sub>2</sub><sup>RICH</sup>**

generates from weak SO<sub>2</sub>-containing gases an SO<sub>2</sub>-rich gas for further utilization

**SULF<sup>ALTA</sup>**

treatment of SO<sub>2</sub>-containing gases with more than a 12 vol. %.

**SUPER<sup>OX</sup>**

highly efficient SO<sub>2</sub>-separation process based on sulphuric acid and H<sub>2</sub>O<sub>2</sub>.

**SUPER<sup>CO</sup>**

activated-coke process for the conversion of SO<sub>2</sub> into sulphuric acid.

**MERCUR<sup>EX</sup>**

Mercury separation for the highest grades of sulphuric acid.

**Tail-Scrubbing**

Any further ab-/adsorption method for the fixation of SO<sub>2</sub> at the tail-end of SAPs

Fig. 3: HUGO PETERSEN Special Processes

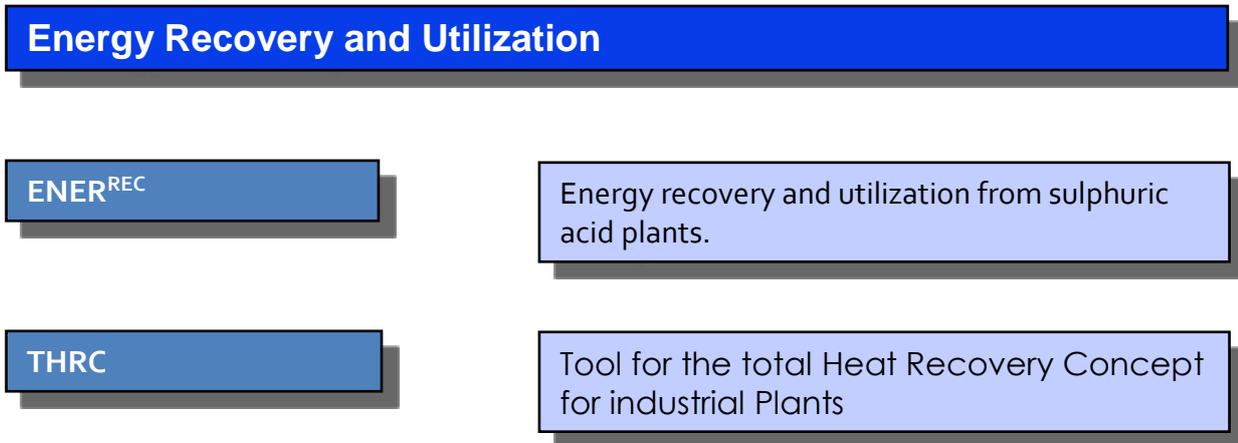


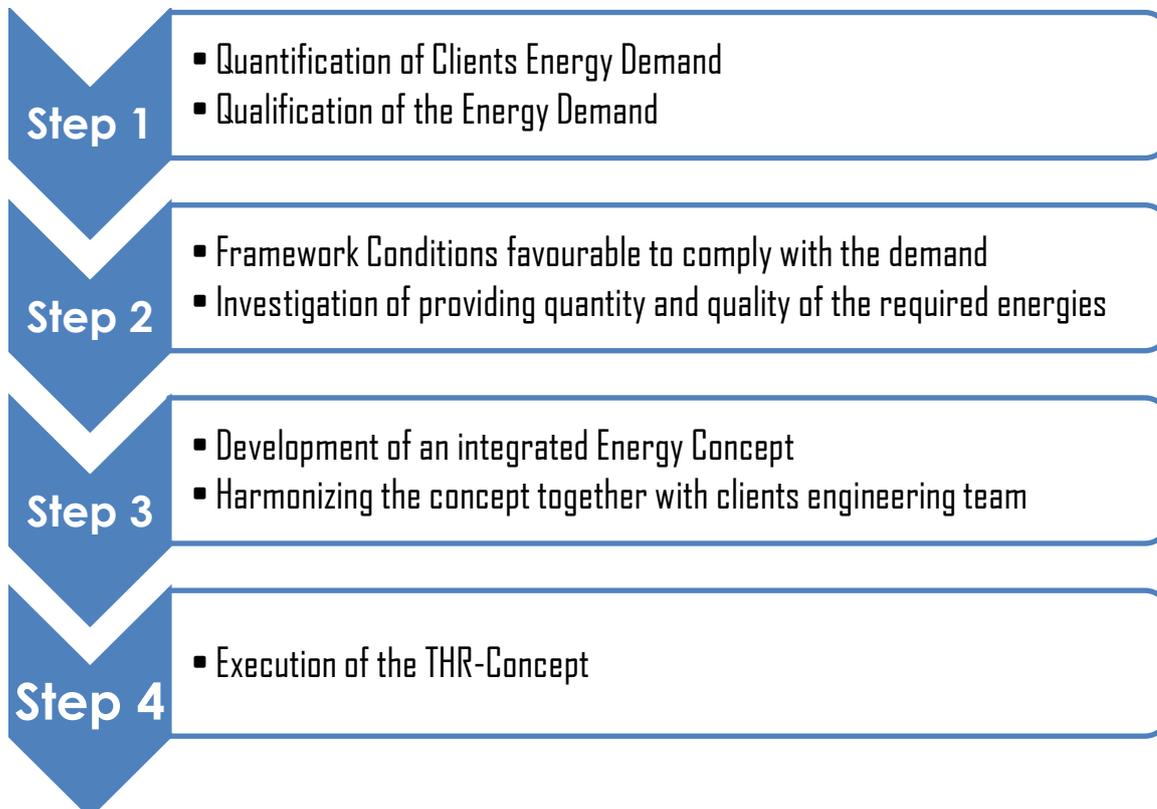
Fig. 4: HUGO PETERSEN Energy Recovery and Utilization

## THRC – the aim for total heat Recovery and utilization

How THRC works

This in- house tool is an intelligent way to identify optimal heat recovery and energy utilization

It has the following methodology:



**Target achieved!**

Energy concepts, with improvements in the energy recovery and utilization by 35% have already been installed and have shown, over the years, a valuable increase in performance.

The following diagram shows the improvement of the energy balance

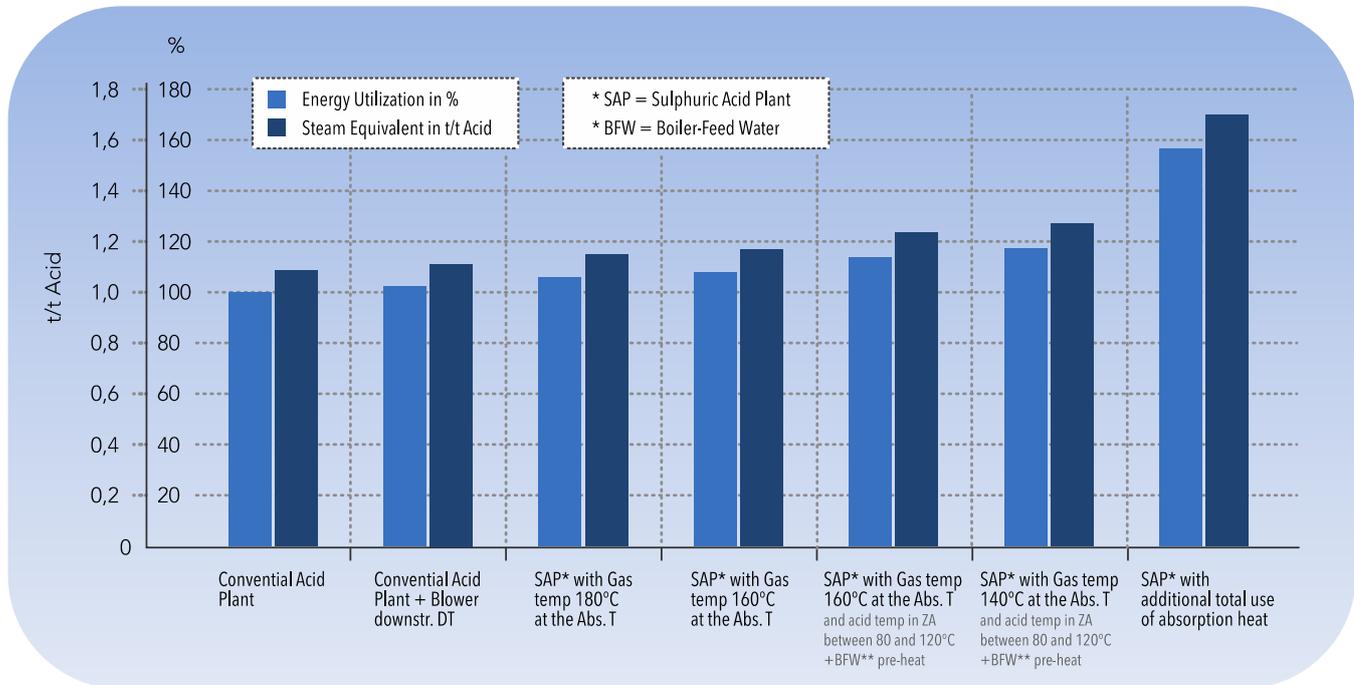


Fig. 5: HUGO PETERSEN Improvement in Energy Recovery with THRC

HUGO PETERSEN Sulphuric Acid Technology is not limited to a certain plant size. Our engineering department supplies concepts and solutions for all plant sizes. The customer profits from the experience of HUGO PETERSEN, gained from engineering, erecting, commissioning and supervising large-scale plant units. Constant attention to quality and reliability of our process units, in operation, certify the high standard of our products.

HUGO PETERSEN expertise, ranges from powerful single components to complex technology combined in turnkey plants.

## Equipment Development

HUGO PETERSEN technology is also characterized by a variety of in-house developments in sulphuric acid technology.

Here are a few representative ones:

- PTS Petersen Turbulence Scrubber Scrubbing
- PJET Petersen Jet Scrubber Jetscrubbing
- PES Petersen Electro-Stat Wet Electrostatic Precipitator
- Intenso Smelter to melt sulphur
- DynSon-Injector for sulphur combustion
- OXY-Reactor for sulphur combustion
- MBRF-Heat Exchanger
- Stainless steel converter
- Anodic-protected acid coolers
- Liquid Distributor

## Evidence that counts

With this brochure, we want to provide you with an overall view of the wide spectrum of HUGO PETERSEN products. For more detailed information on our individual products and processes, please contact us .

At this point, we would like to present you with a selection of typical HUGO PETERSEN solutions that have been supplied to customers all over the world, showing you that our process technologists and engineers are a group of dedicated people who love to work at the highest technological level and on various demanding projects. Technically, as well as economically, our plants and components for sulphuric acid manufacturing are leading the way ahead.

If you are interested in special applications, operating data or more information first hand, we will gladly present you with our references. Our customers will be glad to confirm the reliability and quality of our products, as well as our positive cooperation with the customer.

## Wet gas cleaning for metallurgical sources

Turbulence Scrubber, Wet-Electro-Static-Precipitator



Pic. 4: Cleaning off gases by means of absorption and aerosol removal downstream of pyro-metallurgical processes in non-ferrous industries.



Pic. 5:

Gas Cleaning in a Regen Plant The high-performance PES - wet electrostatic precipitator is used for the removal of aerosols and dusts.



Pic. 6: Complex multistage wet scrubbing unit installed at a metallurgical plant.

## Contact Plants



Pic. 7: 2,000 tpd Sulphuric Acid DC-Plant based on sulphur burning with THRC



Pic. 8: World's Largest Oleum Plant with a capacity of 1,500 tpd



Pic. 9: Complete revamped Sulphuric Acid DC-Plant (600 tpd)



Pic. 10: Revamp of S-based from 1,500 tpd to a 2,200 tpd



Pic. 11: Cu-smelting based metallurgical DC-plant original 900 tpd and lately revamped to 1,500 tpd



Pic. 12: Pyrrhine roasting/S-based combi plant of 1,500 tpd



Pic. 13: Wet-Gas-Cleaning Plant down a Mo-roasting plant



Pic. 14: MBRF-Heat-Exchanger for Zn-Roasting Plant



Pic. 15: Stainless-Steel-Absorption-Towers



Pic. 16: Anodic-Protected-Acid-Coolers



Pic. 17: Stainless-Steel-Converter

## Special Processes

### Tail-Gas Scrubbing



Pic. 18: SUPER<sup>OX</sup>-Processes downstream sulphuric acid plants



**HUGO PETERSEN**  
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**HUGO PETERSEN GmbH**  
Rheingastr. 190-196, Geb. K330  
65203 Wiesbaden  
Deutschland

Tel.: +49-611-9627820  
[contact@hugo-petersen.de](mailto:contact@hugo-petersen.de)

Fax: +49-611-962 9099  
[www.hugo-petersen.de](http://www.hugo-petersen.de)

**ENGINEERING IS OUR PASSION**