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Uhde’s head office Dortmund, Germany
1. Company profile

Uhde was founded in 1921 and is a company in the Technologies Segment of the ThyssenKrupp Group.

With its highly specialized workforce of more than 5,600 employees and an international network of subsidiaries and branch offices, the Dortmund-based engineering contractor Uhde has successfully designed and built over 2,000 plants throughout the world.

Uhde’s international reputation has been built on the successful application of its motto Engineering with ideas to yield cost-effective high-tech solutions for its customers. The ever-increasing demands placed upon process and application technology in the fields of chemical processing, energy and environmental protection are met through a combination of specialist know-how, comprehensive service packages, top-quality engineering and impeccable punctuality.

In the field of hydrochloric acid electrolysis Uhde offers proprietary technology, which is marketed by both Uhde and Uhdenora (UHDN), a joint venture company founded in conjunction with Industrie De Nora.

Both Uhde and Uhdenora carry out extensive research and development to provide their worldwide customers with an ever better performance in the fields of planning, design, construction and after-sales services for electrolysis plants. Their common aim is to optimize the technology and further reduce energy consumption.

Uhde and Uhdenora can draw on decades of experience in hydrochloric acid and chlor-alkali electrolysis. The companies have constructed more than 220 electrolysis reference plants around the world. Technical experience and flexible market approaches enable Uhde and Uhdenora to effectively meet a wide range of customer requirements.
2. Uhde’s remarkably long experience

We have been active in electrolysis technology throughout the world for more than 50 years. Depending on the wishes of the customers, we can construct new plants, expand existing ones and convert diaphragm plants or mercury plants (pertaining chlor-alkali) to membrane technology.

With more than 100 highly skilled, experienced engineers in our Electrolysis Division you can be sure that our electrolysis plants are of the highest quality. We provide an extensive range of supplies and services to cater for the diverse needs of our customers – whether it is a large lump-sum turnkey project or a feasibility study. Figure 1 and 2 depict Uhde’s unparalleled success story in terms of accumulated contract awards in chlor-alkali and hydrochloric-acid technology. Meanwhile, in the chlor-alkali sector the membrane technology is the solely demanded process. Uhde’s accumulated contracts in this field reached about 19 million tons of caustic soda per year in 2012 which is equivalent to 16.85 million tons of Chlorine per year.

In hydrochloric acid electrolysis the total numbers of awarded contracts (capacity) are one-tenth of this figure and accompanied by a remarkable growth rate.

Throughout the chlorine history of our company we have always had one main focal point: close cooperation with our customers. From the very beginning we have combined our own highly effective electrolysis cells with a thorough knowledge of the overall process chain including the up and downstream processes. In fact, Uhde is the only company in the world to combine the engineering and supply of equipment for the construction of chlor-alkali and hydrochloric acid electrolysis plants with the supply of electrolysis cells.

In addition, our portfolio also includes EDC/VCM and PVC plants to enable customers to process the chlorine produced. Uhde is thus a single-source partner you can rely on.
Customer: Bayer MaterialScience
Location: Caojing, China
Capacity: 215,000 t/year of Cl₂
Process: ODC Technology
Commissioning: 2008
3. Growing oversupplies unbalance hydrochloric acid markets
Chlorine, no doubt, is one of the most important base chemicals. By far the largest share of chlorine produced in industrialized countries today is obtained by chlor-alkali electrolysis. A majority of the world’s chlorine production is used for the chlorination of organic compounds. In such processes only a part of the chlorine remains in the product while the rest is obtained as hydrogen chloride and as hydrochloric acid respectively which is the aqueous solution. For example, in the production of isocyanate by phosgenation of the appropriate amine, a significant portion of reaction chlorine is converted to hydrogen chloride. Due to an expected increase in production capacities a growing dilemma evolves (figure 3).

It is not always possible to find a use for the hydrochloric acid. For instance, a decrease in the demand for vinyl chloride monomer or polyvinyl chloride may not support the supply of hydrochloric acid in direct oxychlorination processes. In general, as the market for hydrochloric acid is saturated and does not grow as necessary, the market price for HCl is under pressure. Hence often neither sale is an option. Because of an increase in environmental awareness and sensitivity, the discharge to waste treatment with additional caustic soda consumption is not a satisfactory solution (see figure 4).

In this instance, it is possible to recover the chlorine from the hydrogen chloride by electrolysis and to recycle it rather than obtaining the chlorine by chlor-alkali electrolysis or by chlorine transports which is subject to an array of country-specific restrictions. Therefore hydrochloric acid electrolysis represents an alternative source of chlorine.
Chlorine is used as an oxidizing agent in several organic processes and hydrogen chloride is often generated as a by-product or co-product.

The recovery of chlorine from hydrogen chloride or hydrochloric acid has several advantages:

- Shows general commitment in terms of sustainability, careful use of resources and therefore ecological responsibility.
- Business is made independent from chlorine and hydrochloric acid prices.
- Avoids the development of traditional chlor-alkali plants with significant higher investment costs.
- Interesting for regions with high chlorine demand or excess caustic soda (NaOH); deployment of a chlor-alkali plant would not be expedient because of further NaOH production in saturated markets.
- Eliminates the risks of chlorine transports (as a further alternative).
- No costs related to hydrochloric acid neutralization or disposal.

Uhde offers two different hydrochloric acid electrolysis processes for the recovery of chlorine from hydrogen chloride:

- Membrane electrolyzer technology using the Oxygen Depolarized Cathode (ODC)
and
- Diaphragm electrolyzer technology.
Both processes work with hydrochloric acid feeds. This means if anhydrous hydrogen chloride is present the first step is an absorption process. Further purification or conditioning steps may be deployed.

The ODC principle is based on the reduction of oxygen at the cathode. The reduced oxygen species subsequently form water by the reaction with hydrogen ions originating from the muriatic acid fed to the anode compartment. Here, the chloride ions of this muriatic acid are converted to chlorine by anodic oxidation. The reaction at the cathode is power efficient and takes place at a cell voltage less than those of the traditional diaphragm electrolysis process.

The ODC process saves about 30% of the usual energy consumption and hence reduces the indirect carbon dioxide emission for its production correspondingly. Deviant from the diaphragm process it has to be considered that no hydrogen is produced.

It has to be pointed out as well, that the chlorine formed with the ODC-process is of a very high purity.

In the conventional diaphragm process, the cell elements consist of two electrodes separated by a diaphragm. Both compartments receive an aqueous acid feed. The process consists of hydrochloric acid recycles for anolyte and catholyte. The individual cell elements are assembled similarly to a bi-polar filter press type electrolyzer.

The reaction at the anode of the cell is as above (chloride ions are oxidized and chlorine is produced). At the cathode hydrogen is formed by water decomposition, which can be used as fuel or as raw product for hydrogenation processes after respective conditioning.
5. How to benefit from Uhde's hydrochloric acid competence

Uhde's hydrochloric acid electrolysis processes represent proven technologies. Now more than 1,600,000 metric tons per year of chlorine capacity are already commissioned or contracted. There are various reasons for this success story. The technological competence is reflected in exceptional reliability and availability accompanied by an optimal maintainability and absolute safeness. To highlight Uhde’s capabilities the following are some important aspects of these technologies:

Expertise in materials
One of the most significant factors is the high mechanical robustness as well as the high durability of materials used even under very corrosive process conditions.

Process flexibility & wide operating window
The overall operation of a hydrochloric acid electrolyzer is very simple. The capacity of the hydrochloric acid electrolysis can be easily and quickly adjusted to the up or downstream production requirements. Uhde's hydrochloric acid electrolyzers provide a wide operating window and highest process flexibility and it is consequently a key factor in optimizing the prevailing conditions on site.

Maintenance – friendliness
In addition, the modular concept of electrolyzer design ensures optimum maintenance flexibility, resulting in highest on-stream factors.

Worldwide customer service network
The overall maintenance concept is similar to the chlor-alkali electrolyzer technology, i.e. the customers can rely on a proven and world-wide installed customer service network.

Lab and test facility insights
Additionally, Uhde closely collaborates with Bayer Material Science (BMS) in terms of lab and test facilities. Customers benefit from insights in terms of research, development, optimization of components and quality controls.
6. Membrane electrolysis using Oxygen Depolarized Cathodes (ODC)

6.1 Oxygen Depolarized Cathode (ODC) electrolysis process

This innovative technology has been developed and industrialized by Uhde, Uhdenora and its partners Bayer MaterialScience (BMS) and Industrie De Nora. The principle consists of oxygen, which is firstly reduced and subsequently reacting with the hydrogen ions that migrate through the membrane at the cathode side of the cell. At the ODC the generation of hydrogen is suppressed resulting in an operating voltage lower than approximately 1 volt versus the standard reaction of hydrogen generation, and the consequent energy savings.

Electrolysis
The anode chamber is fed with 14% (wt.) hydrochloric acid solution. Anodic oxidation takes place and chlorine is formed while hydrochloric acid is consumed. At the outlet of the anode chamber the depleted hydrochloric acid is recovered together with chlorine in the electrolyzer header. The generated chlorine is separated from the depleted aqueous hydrochloric acid solution and collected in the chlorine header. The hydrochloric acid outlet solution is routed to the anolyte tank. A certain portion of water as well as H⁺ and Cl⁻ ions are transferred through the membrane to the cathode compartment (figure 6). The cathode chamber is fed with oxygen.

At the ODC the oxygen is cathodically reduced and reacts with H⁺ ions coming from the anode chamber and water is formed. The oxygen leaving the cathode chamber is fed to the oxygen recycling unit. The acidic water generated in the cathode compartment is also recycled. The electrolyser is operated with overpressure of 200 mbarg on the anode side to ensure optimum contact between the membrane and the ODC. The pressure in the anode and cathode compartments is automatically controlled. In case of overpressure in the anode chamber, wet chlorine gas is vented to a waste gas system. Also, automatic cathode pressure control is carried out and oxygen gas can be fed to a waste gas system in case of over-pressure.

Anolyte circulation
The depleted hydrochloric acid leaving the anode chamber flows to the anolyte tank. From here it is pumped back to the electrolyzer, a small portion of this stream is sent back to the hydrochloric acid absorption unit. The concentration of the hydrochloric acid which is fed to the electrolyser is automatically controlled by mixing hydrochloric acid 37% (wt.) from the hydrochloric acid absorption unit with the depleted circulating hydrochloric acid. Heat exchangers for cooling and heating ensure the proper temperature of the fed hydrochloric acid during all stages of operation.

![Figure 5](block-diagram-hydrochloric-acid-odc-electrolysis.png)

**Figure 5**
Block diagram – hydrochloric acid ODC electrolysis
Catholyte system
A small portion of the oxygen gas leaving the electrolyzer cathode chamber is purged via pressure control to a waste gas system in order to avoid the accumulation of nitrogen and other trace pollutants in the oxygen cycle. Most of the oxygen from the cathode can be recycled via an oxygen recycle unit which removes hydrogen to minimize the overall oxygen consumption. The recycled oxygen is mixed with fresh oxygen before entering the electrolyzer cathode chamber. The acidic condensate generated at the cathode can be sent to waste water treatment or recycled back to the anolyte system.

Absorption
The purpose of this process is the conditioning of the anhydrous hydrochloric acid gas. According to the concept, either demineralized water or hydrochloric acid 12.5% (wt.) is used as an absorbent in order to produce hydrochloric acid 37% (wt.) at 30–35 °C.

Anhydrous hydrogen chloride gas is led in a falling-film column where the temperature is controlled by carrying away the absorption heat. The heat transfer within the absorber pipes has to be adjusted by the thickness of the liquid film. A minimum penetration is ensured by a constant liquid circulation in the range between 25 to 100%.

Therefore the raw acid of the absorber is stored in a buffer tank and a partial flow is fed to the absorber by means of circulation pumps. As organic compounds and chlorine have to be considered, a share of the circulated fluid is being treated in a stripper.

The 37% (wt.) hydrochloric acid, which is generated in the sump, is removed continuously and stored after filtration including e.g. active carbon filters. The waste gas of the stripper contains the majority of the organic compounds and chlorine respectively. It has to be treated in a scrubber for instance.

Product treatment
Once the wet chlorine gas has been cooled and filtered, it is either fed directly to the consumer plant or it is dried and compressed before either being directly routed back to the chlorine consumer to close the loop of chlorine recycle, or liquefied for storage in tanks.

As the oxygen content in the chlorine is lower than 20 ppm (wt.), the chlorine can be sent directly to downstream consumers, i.e. a chlorine liquefaction and evaporation unit is not required.

Reaction mechanism
Anode:
\[ 4 \text{HCl}_{\text{aq}} \rightarrow 4 \text{H}^+ + 4 \text{e}^- + 2 \text{Cl}_2 \]
Cathode:
\[ 4 \text{H}^+ + 4 \text{e}^- + \text{O}_2 \rightarrow 2 \text{H}_2\text{O} \]
Total:
\[ 4 \text{HCl}_{\text{aq}} + \text{O}_2 \rightarrow 2 \text{Cl}_2 + 2 \text{H}_2\text{O} \]
6.2 Functional description of the ODC element

The anodic reaction in a cell equipped with ODC is as follows: hydrochloric acid is fed to the anode compartment; the chloride ions are oxidized at the anode while the hydrogen ions migrate through the ion exchange membrane towards the cathode chamber. In a diaphragm cell the anodic reaction would be the same.

In contrast to the anodic compartment, the reaction in the cathode compartment in an ODC cell and a diaphragm cell are rather different. With ODC, oxygen is fed to the cathode, is reduced cathodically and react with the hydrogen ions that migrate through the membrane, thus producing water. At the outlet excess oxygen and water leave. The water has two sources – the water made by the cathode side reaction and the water that pass the membrane together with the hydrogen ions and a small amount of acid (figure 7).

6.3 Element and electrolyzer design

The bipolar membrane electrolyzer structure is completely metallic and is based on the filter press concept. The anode compartment is made of titanium alloy whereas the anode mesh is made of a special coated titanium alloy and it is welded directly onto the compartment structure.

Between the two chambers a membrane is placed. This membrane is pressed against the oxygen depolarized cathode (ODC) by the differential pressure existing in the two compartments. The ODC is pressed against the cathode current conducting mesh by the same differential pressure.

Between 20 and 90 elements can be connected in series and pressed together to form one rack. Gaskets between the membrane and the half shells ensure leak tightness of the filter press. Usually two racks are connected in series to form one single electrolyzer.

6.4 Technical data

<table>
<thead>
<tr>
<th>Operating data</th>
<th>Current density</th>
<th>up to 5 kA/m²</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Power consumption</td>
<td>1070 kWh/mt Cl₂ at 5 kA/m²</td>
</tr>
<tr>
<td></td>
<td>Oxygen consumption</td>
<td>175 Nm³/mt Cl₂</td>
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<td></td>
<td>Active area per element</td>
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<td></td>
<td>Service life:</td>
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<tr>
<td></td>
<td>– Membrane</td>
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<tr>
<td></td>
<td>– ODC</td>
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</tr>
<tr>
<td></td>
<td>– Anode coating</td>
<td>approx. 4 years</td>
</tr>
<tr>
<td></td>
<td>– Cathode coating</td>
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</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Feedstock and Product quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrochloric acid as feed to electrolyzer:</td>
</tr>
<tr>
<td>– Concentration:</td>
</tr>
<tr>
<td>– Total organic content as chlorobenzenes</td>
</tr>
<tr>
<td>– other than chlorobenzenes</td>
</tr>
<tr>
<td>Chlorine (after drying):</td>
</tr>
<tr>
<td>– Cl₂</td>
</tr>
<tr>
<td>– H₂</td>
</tr>
<tr>
<td>– H₂O</td>
</tr>
<tr>
<td>– O₂</td>
</tr>
</tbody>
</table>
Figure 8
ODC electrolyzer—bipolar element
On the left hand side you can see the anode whereas the cathode is shown on the right hand side. This section of an industrial scale bipolar element also shows the current conducting mesh of the anode as well as of the cathode. Beneath is the complete view of the element.

Roughly 70 elements produce 10,000 tons of chlorine per year. Usually two racks are connected in series to form one single electrolyzer. The shown two electrolyzers produce about 50,000 tons of product per year.
7.1 Diaphragm electrolysis process

The process for the electrolytic decomposition of aqueous hydrochloric acid by means of diaphragm process was developed jointly by the former Hoechst AG and Bayer AG as well as Uhde GmbH. This cooperation is continued between Bayer MaterialScience, Uhdenora and Uhde. The process consists of hydrochloric acid recycles for anolyte and catholyte, an absorption unit, product treatment, and the electrolyzer. The cell elements consist of two graphite electrodes separated by either a PVC or PVC/PVDF diaphragm. The individual cell elements are assembled similar to a filter press type bi-polar electrolyzer.

Hydrochloric acid cycles
Concentrated aqueous hydrochloric acid is fed to the electrolyzer in a temperature range of 65–70 °C. The process has hydrochloric acid recycles for anolyte and catholyte. The two compartments receive aqueous acid feeds of different concentrations, the anode compartment of approx. 23% (wt.) the cathode one of approx. 21% (wt.). Inside the cell the products chlorine and hydrogen are generated. Depleted hydrochloric acid with a concentration of 17% (wt.) leaves both compartments of the cell. The anolyte acid flows through the anode chambers connected in parallel and the catholyte acid flows similarly through the cathode chambers. Any solid impurities are retained by filters while the heat balance of the process is maintained using heat exchangers. A partial stream of the 17% (wt.) acid feedstock is diverted from the catholyte recycle, re-concentrated with hydrogen chloride to approx. 28% (wt.) in the absorption unit, and then fed back to both electrolyte cycles.

Absorption
The absorption unit operates as an adiabatic process. Here the depleted acid produced by electrolysis flows countercurrent to the rising hydrogen chloride gas, thereby raising the acid concentration to approx. 28% (wt.). The heat liberated by the process is dissipated by the vaporization of water within the column. Due to the relatively low partial pressure of hydrogen chloride, the gas will be almost completely absorbed by the dilute solution of hydrochloric acid so that nearly pure water vapor is released at the top of the absorption column.

The water vapor is then condensed in a cooler and returned to the column. Any organic impurities present in the hydrogen chloride will normally be expelled with the vapors at the top of the column. If greater quantities of impurities are present in the feed gas, it is expedient for these impurities to be partially removed upstream of the absorption section using appropriate means, such as scrubbing or cooling and condensation. The concentrated hydrochloric acid solution may also be treated by adsorption using activated carbon.

Product treatment
Once the wet chlorine gas has been cooled and filtered, it is either fed directly to the consumer plant or it is dried and compressed before either being directly routed back to the chlorine consumer to close the loop of chlorine recycle, or liquefied for storage in tanks.

Hydrogen is a valuable byproduct of the process and can be supplied to hydrogen consumers, such as hydrogenation plants once it has been cooled and scrubbed with caustic soda.
7.2 Functional description of the diaphragm cell

Hydrochloric acid is fed to the anode compartment; the chloride ions are oxidized at the anode while the hydrogen ions pass through the ion exchange membrane and migrate to the cathode chamber. The hydrochloric acid exits depleted from 23 to 17%.

At the cathode hydrochloric acid is fed. Chloride ions migrate to the anode chamber where chlorine is built. At the cathode hydrogen is formed which leaves the cell. The hydrochloric acid exits depleted from 21 to 17%.

7.3 The diaphragm cell design

The electrolyzer consists of e.g. 36 elements (35 normal and 2 end frames) assembled in a filter-press type manner. The decomposition of hydrochloric acid takes place on the vertical, bipolar graphite electrodes which are connected in series to form electrolysis elements subdivided by diaphragms. The diaphragm acts as the separating device between the anode and the cathode compartment of the individual element. The effectiveness of the diaphragm as a separation device between the anode and the cathode compartments defines the current efficiency of the individual element. The diaphragm is almost impermeable for gases whereas liquid and ions can pass easily allowing high current densities in the process. Chlorine gas is liberated on the anode side and hydrogen on the cathode side. In order to improve gas discharge, the electrodes are provided with a large number of vertical slots. The individual electrodes are fitted into frames made of synthetic material resistant to hydrochloric acid and chlorine. The diaphragms are made of special PVC or PVC/PVDF cloth the cathode side. In order to improve gas discharge, the electrodes are provided with a large number of vertical slots. The individual electrodes are fitted into frames made of synthetic material resistant to hydrochloric acid and chlorine. The diaphragms are made of special PVC or PVC/PVDF cloth.

7.4 Technical data

**Operating data**
- Current density: up to 5 kA/m²
- Power consumption: 1670 kWh/mt Cl₂ at 5 kA/m²
- Active area per cell: 2.5 m²
- Amount of cells per electrolyzer: up to 36
- Service life:
  - Diaphragm: approx. 4 years
  - Graphite electrode: approx. 10 years

**Feedstock and Product quality**
- Aqueous hydrochloric acid as cell room feed:
  - Concentration: ≥ 23/21% (wt.)
  - Total organic content: ≤ 1 ppm (wt.)
  - O₂: ≤ 1 ppm (wt.)
- Chlorine (after drying):
  - Cl₂: ≥ 99.5% (vol.)
  - H₂: ≤ 0.5% (vol.)
  - H₂O: ≤ 10 ppm (wt.)
  - O₂: ≤ 200 ppm (wt.)

**Reaction mechanism**

**Anode:**
\[ 2 \text{Cl}^- \rightarrow \text{Cl}_2 + 2 \text{e}^- \]

**Cathode:**
\[ 2 \text{H}^+ + 2 \text{e}^- \rightarrow \text{H}_2 \]

**Total:**
\[ 2 \text{HCl}_{aq} \rightarrow \text{Cl}_2 + \text{H}_2 \]
One of the electrolyzers deployed at CUF-QI, Portugal

Figure 11
Diaphragm cell – cross section and single element
Our customer services in the field of electrolysis do not stop on plant completion, but also include:

- Consultancy visits
- Technical exchange meetings
- Chlorine Symposium
- Optimization of plant performance
- Full service electrolyzer maintenance
- Benchmarking
- Remembraning/recoating support
- Exchange of diaphragms/electrodes
- Revamps
- Delivery of spare parts

Our regular consultancy visits to customers keep them informed about the latest technical developments or revamping activities, and by organising and supporting technical exchange meetings and symposia, for example the Chlorine Symposium held every 3 years at Uhde’s head office in Germany, we promote active communication between customers, partners and our own specialists. This enables our customers to benefit from the development of new technologies and the exchange of experience as well as troubleshooting information. We monitor, analyse and optimise plant performance during the entire lifetime of a plant, applying our integrated performance analysis system Uhde Integrator™, which consists of three different levels:
Level 1:
- Element administration program Uhde Administrator™
  This program is used to administrate cell components and to record and analyse cell assembly data as well as operating data.

- Uhde data acquisition terminal Uhde Scan™
  This unit reads information on the electrolysis cell compartments from a barcode and transfers this information to the Uhde Administrator™. It also offers forms for documentation and administration purposes.

Level 2:
- Single element analyser Uhde Evaluator™
  This system monitors and safeguard cell element voltages and analyses membrane and coating performance.

Level 3:
- Remote condition monitoring
  Data acquired with the Uhde Evaluator™ can be sent by automatic data transfer to Uhde to permit further analysis by our specialists in Germany.
9. Services for our customers
Uhde is dedicated to providing its customers with a wide range of services and to supporting them in their efforts to succeed in their line of business.

With our worldwide network of local organisations and experienced local representatives, as well as first-class backing from our head office, Uhde has the ideal qualifications to achieve this goal.

We at Uhde place particular importance on interacting with our customers at an early stage to combine their ambition and expertise with our experience.

Whenever we can, we give potential customers the opportunity to visit operating plants and to personally evaluate such matters as process operability, maintenance and on-stream time. We aim to build our future business on the confidence our customers place in us.

Uhde provides the entire spectrum of services associated with an EPC contractor, from the initial feasibility study, through financing concepts and project management right up to the commissioning of units and grass-roots plants.

Our impressive portfolio of services includes:

- Feasibility studies/technology selection
- Project management
- Arrangement of financing schemes
- Financial guidance based on an intimate knowledge of local laws, regulations and tax procedures
- Environmental studies
- Licensing incl. basic/detail engineering
- Utilities/offsites/infrastructure
- Procurement/inspection/transportation services
- Civil works and erection
- Commissioning
- Training of operating personnel using operator training simulator
- Plant operation support/plant maintenance
- Remote Performance Management (Teleservice)

Uhde’s policy is to ensure utmost quality in the implementation of its projects. We work worldwide to the same quality standard, certified according to: DIN/ISO 9001/EN29001. We remain in contact with our customers even after project completion. Partnering is our byword.

By organising and supporting technical symposia, we promote active communication between customers, licensors, partners, operators and our specialists. This enables our customers to benefit from the development of new technologies and the exchange of experience as well as troubleshooting information.

We like to cultivate our business relationships and learn more about the future goals of our customers. Our after-sales services include regular consultancy visits which keep the owner informed about the latest developments or revamping options.

Uhde stands for tailor-made concepts and international competence. For more information contact one of the Uhde offices near you or visit our website:

**www.uhde.eu**