

# EVOLVE

TECHNOLOGIES

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The innovation & license company  
of Maire Tecnimont.



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## 1. INTRODUCTION

**As the world market leader in design, licensing and development of urea plants for the fertilizing industry, we apply our expertise and experience in several markets; fertilizers, emission reduction technologies and all technologies for the integration of urea and adjacent processes.**

### **Your reliable urea partner**

For more than 70 years, we have been at the forefront of development and innovation in urea production technology. We have licensed more than 250 urea plants worldwide and have carried out more than 100 revamp projects. This has allowed us to gain knowledge that has helped us to excel in our field. We can ensure that your plants are safe, require a minimum amount of equipment and run efficiently and sustainably for an extensively long time.

Stamicarbon's headquarters are in Sittard, The Netherlands, with representative offices in Russia and China and a sales office in the USA. Together with our excellent network of reputable partners we can provide all the technology, equipment, products and related services you will need for operation of your fertilizer plant.



## 2. MAIRE TECNIMONT GROUP

**Stamicarbon is the leading technology provider and licensing company of the Maire Tecnimont Group, a technology-driven multinational Group working for the transformation of natural resources into innovative products at the crossroad between the energy and the manufacturing industries. Maire Tecnimont Group is an international leader in the Engineering & Construction (E&C), Technology & Licensing and Energy Business Development & Ventures markets, with specific competences in plants, particularly in the hydrocarbon segment (Petrochemicals, Fertilizers and Oil & Gas refining), as well as in Power Generation and Infrastructures.**

### **Focus on innovation**

Maire Tecnimont is a multinational Group with a highly technological DNA, cultivating excellence to gain high level performance. Thanks to its well rooted advanced skills and knowledge, the Group has gained an unrivalled reputation and a significant track record in managing and completing numerous successful, complex, turnkey projects in different environments worldwide.

### **40 countries, one Group**

The Group, listed on the Milan Stock Exchange since 2007, is headquartered in Milan, and is present in over 40 countries. It controls 50 operating companies around the world and can count on 5,500 employees, along with approximately 3,000 additional Electrical & Instrumentation professionals.



**LAUNCH™**  
CREATING YOUR PLANT

**ADVANCE™**  
OPTIMIZING YOUR PLANT

**EVOLVE™**  
UPGRADING YOUR PLANT

### 3. STAMI UREA: A FULL LIFE CYCLE PHILOSOPHY

**Our engagement and commitment does not stop after signing the contract and building your plant. We have developed an extensive technology, product and service portfolio for urea plants. We distinguish ourselves from the competition with our high quality standards and our Full Life Cycle philosophy.**

With continuous support through the whole life cycle of your plant, regardless of what state your plant is at, we offer you bespoke technological solutions, products and/or services that match your requirements. We offer a set of three series that suit a wide range of real world specifications. We call these our LAUNCH, ADVANCE and EVOLVE series.

Your plant's life cycle starts with launching the design, executing the engineering, procurement and finally, construction of your plant. After the LAUNCH phase of the plant, you enter into the next stage - ADVANCE. Our products and services optimize the plant's performance. Furthermore, we provide you with the knowledge and latest designs in urea technology to upgrade your plant to EVOLVE to the next level.



# UPGRADE YOUR PLANT



**EVOLVE CAPACITY™**

**EVOLVE ENERGY™**

**EVOLVE EMISSION™**

**EVOLVE™**  
UPGRADE YOUR PLANT

#### 4. UPGRADE YOUR PLANT TO THE NEXT LEVEL OUR EVOLVE SOLUTIONS

Stamicarbon's EVOLVE solutions provides you with the means to upgrade your plant to the next level. Our EVOLVE solutions ensures that your aging plant complies with changes in legislation and stays competitive by adapting to changes in market conditions.

We offer three main revamp solutions that can be tailored to your specific needs:

**1. EVOLVE CAPACITY™**

Significantly increasing your plant output, from 10% up to 100%

**2. EVOLVE ENERGY™**

Significantly lower steam utilization and optimal use of feedstock consumption

**3. EVOLVE EMISSION™**

Reducing emissions according to international standards

Stamicarbon has successfully completed more than 100 revamp projects at all types of urea plants. Thanks to a combination of state-of-the-art technologies and expert know-how, we can immensely improve plant performance and/or capacities.



**INCREASE  
CAPACITY**

# EVOLVE™ INCREASE CAPACITY

Significantly increasing your plant output, from 10% up to 100%



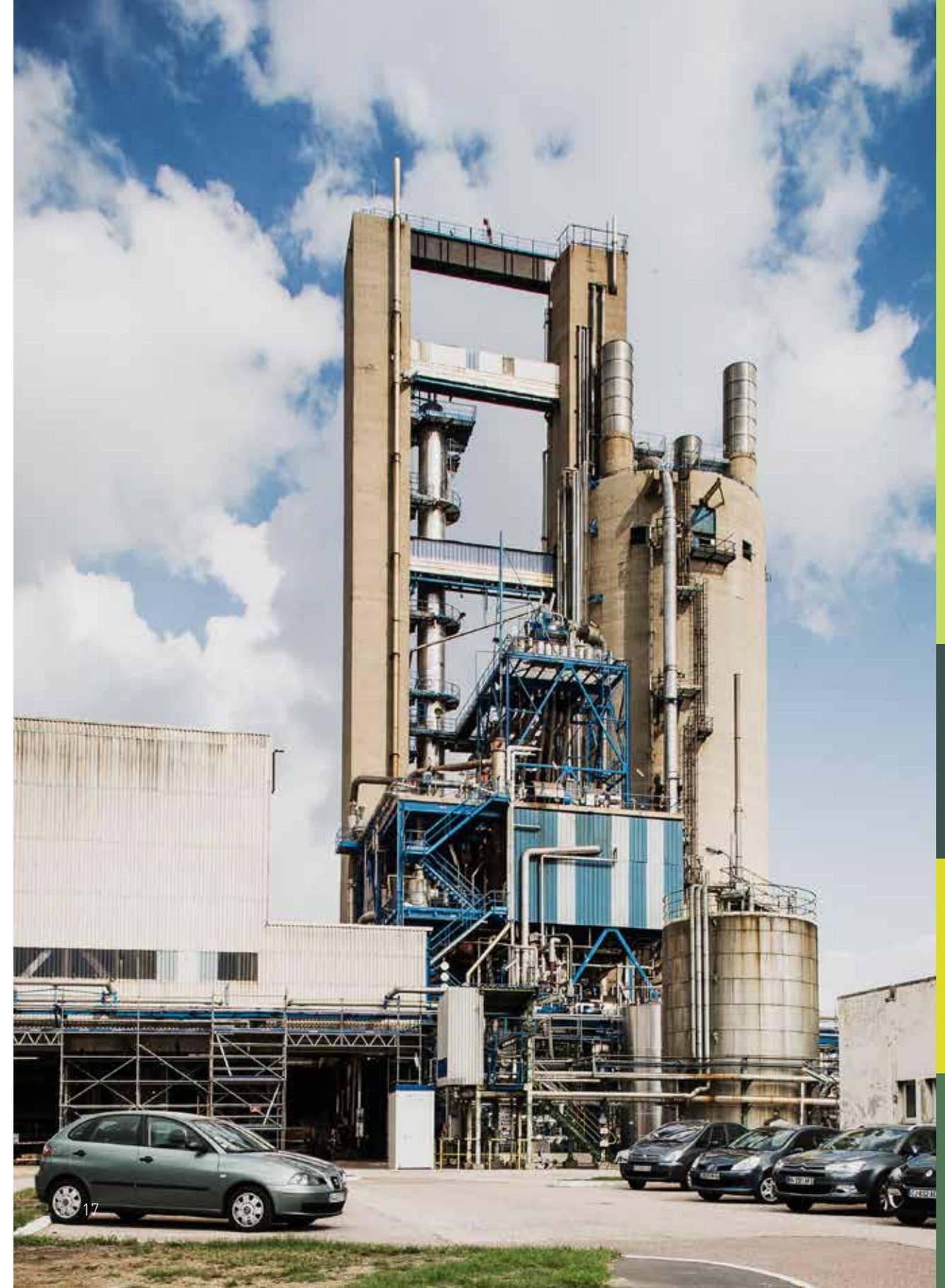
**One of the revamp solutions to increase the capacity is debottlenecking your plant. To which extent this needs to happen, depends on the availability of feed stocks, utilities and particular plant limitations. We have developed several debottlenecking solutions that enable us to meet your exact requirements. Hybrid combinations of these solutions can be chosen as well.**

**Debottlenecking will enable you to:**

- take full advantage of the plant's design margins
- boost urea production with the same number of people and basic infrastructure
- reduce total fixed and operating costs, lowering the price of the urea produced
- improve the plant's competitive advantage

EVOLVE CAPACITY™ DESIGNS:	EXPECTED CAPACITY INCREASE* %
EVOLVE CAPACITY™ More-In More-Out Design	10 - 30
EVOLVE CAPACITY™ Double Stripper Design	30 - 40
EVOLVE CAPACITY™ MP Add-On Mega Capacity Design	30 - 50
EVOLVE CAPACITY™ Pool Condenser/Reactor Design	50 - 100

\*The reference for the given capacity increase is the nameplate capacity; actual achievable increase in plant capacity depends on the original design margins of the large capital equipment.



# EVOLVE™ INCREASE CAPACITY

## Case study 01



### The challenge

An HP stripper needed to be replaced. This moment was used to increase the production output with 5%, saving 20% on HP steam consumption, without modification of HP piping and with a payback period of max. 5 years.

### The solution

By using Safurex® STAR material in the HP stripper, some major advantages were achieved. Heat exchange surface of the HP stripper tubes increased by 15%, without the need to modify HP piping.

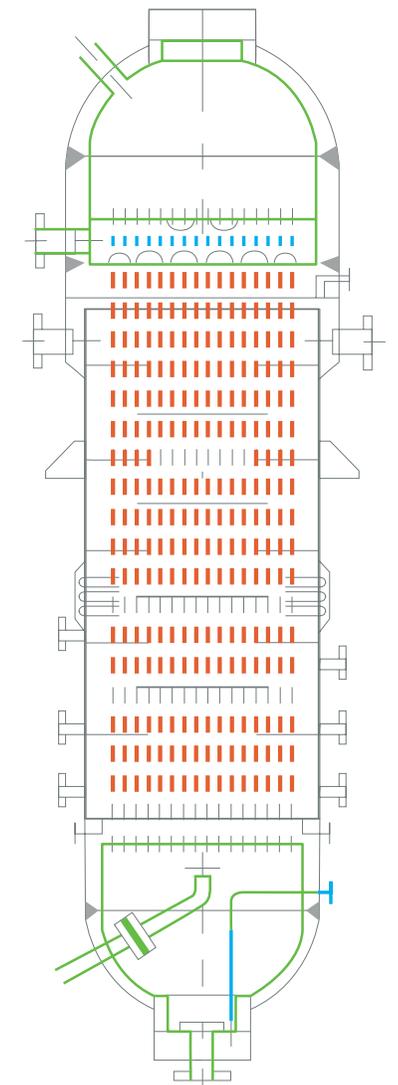
The weight of the the new Safurex® HP stripper, with a 15% larger heat exchange area, was lower compared to the original HP stripper with 25.22.2 tubes. To accomplish this, no structural modification and fortifications were required. By using Safurex® in the HP stripper, the oxygen content of the urea synthesis section was reduced, which results in a higher conversion or load.

The use of the Safurex® STAR HP stripper allows for an increase of the production capacity. In order to achieve the required amount of energy saving, the combination was made with Adiabatic flash technology, which consists of an adiabatic flash step with heat recovery. In combination with the heat integration, this resulted in realizing the required amount of energy saving.

A complementary effect is that the urea solution is further concentrated and purified during pre-evaporation. The result is that the urea solution has less ammonia, which makes it suitable for AdBlue®/DEF production. In addition, the water content was decreased, leading to a more efficient way of the melamine production and an increase of output.

### The result

The replacement of the HP stripper has been used to optimize the performance of the urea plant. In a regular turnaround, the required modification can be made and installed in order to achieve the desired 5% additional capacity and 20% energy saving, while having a payback period under 5 years.



- Safurex Infinity∞
- Safurex Star\*
- Safurex Degree°

6.



**DECREASE  
EMISSIONS**

# EVOLVE™ DECREASE EMISSIONS

Reducing emissions according to international

**As communities and authorities enforce ever stricter emission standards, we have pro-actively developed several technologies to improve the Safety, Health and Environmental (SHE) aspects of all urea plants. In modern urea plants, the finishing section is usually the main source of ammonia emissions. Whether the finishing section of your urea plant uses prilling or granulation, we can reduce ammonia emissions to meet international standards.**

## The MicroMist Venturi Scrubber

As emission standards become increasingly stringent, there is a constant demand for more effective pollution control technologies. In addition, the operating costs of running pollution control equipment can be substantial, and so there is a simultaneous demand for economically efficient emission control technologies.

The MicroMist Venturi Scrubber is a high-efficiency scrubbing technology which allows high submicron particulate matter ( $< 1.0 \mu\text{m}$ ) and efficient ammonia collection, while producing concentrated blowdown streams. By using this technology, urea dust emissions as low as  $10 \text{ mg}/\text{Nm}_3$  can be obtained.



## Benefits

- Easy installation due to modular design
- Meets new stringent emission regulations
- Demonstrated high performance collection of submicron particulate
- Best available turndown ratio
- High quality, low maintenance components
- Suitable for revamping or retrofitting existing scrubbers
- Proven track record

## 6.2 EVOLVE™ DECREASE EMISSIONS

### Case study 01

#### The challenge

Stamicarbon received the challenge to lower the emissions of two melt plant absorbers (the LP absorber operating at 4 bara and the atmospheric absorber) to 30 mg/Nm<sub>3</sub> or lower. To obtain such low emission standard, even the 'usual' tricks, like higher operating pressure in the LP absorber and using chilled water on both absorbers, cannot do the job. The partial pressure of ammonia even under those conditions is simply still too high to reach 30 mg NH<sub>3</sub>/Nm<sub>3</sub>.



#### The solution

Our solution was to convert the ammonia in the overhead vapour of the two absorbers into something that dissolves well in water without a vapour pressure. That was done by treating the two combined absorber overhead vapour streams with an acidic solution in a so-called acidic scrubber, converting the ammonia into ammonia salt. In the case of Yara Sluiskil, nitric acid was used, resulting in a small export stream of ammonium nitrate in water, which could be processed OSBL, but on site.

#### The result

The overhead vapour from the acidic scrubber reached an ammonia content of < 20 mg/Nm<sub>3</sub>, which was even lower than the required < 30 mg/Nm<sub>3</sub>.



## 6.3 EVOLVE™ DECREASE EMISSIONS

### Case study 02



#### The challenge

Our challenge was to lower dust emissions to 10 mg/Nm<sub>3</sub> in order to meet new stringent emission regulations. There needed to be a scrubber installed that displays a high performance of submicron particulate collection, with low maintenance requirements.

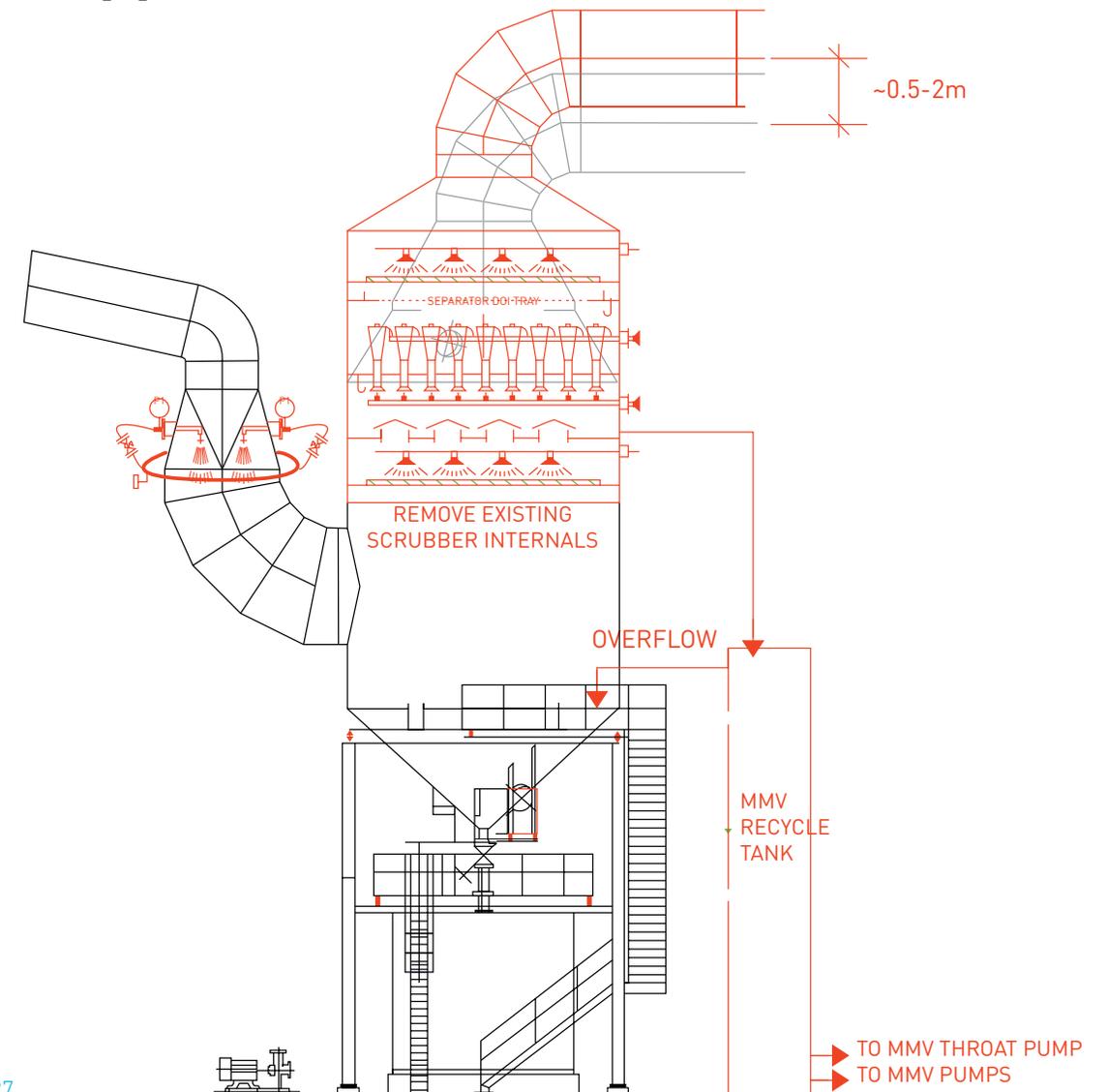
#### The solution

The urea plant had to meet the newly imposed lower emission values. We did this by retrofitting the MicroMist Venturi scrubbing technology on the existing granulator scrubber of the urea plant. In order to achieve this, the existing Venturi section was widened and replaced with quench spray nozzles. After that, the separator vessel was retrofitted to contain the MMV section, which was installed as a modular insert. A retrofit consists of leaving the base of the existing scrubber and replacing the upper part with a new, MMV section inclusive of the needed internals.

#### The result

An outlet urea dust emission significantly lower than 10 mg/Nm<sub>3</sub> was achieved at stable plant operations. Since no ammonia scrubbing is required, no additional stage was required in this case.

#### Retrofit of an existing Venturi scrubber by the replacement of the equipment in red:





# REDUCE ENERGY

7.1

# EVOLVE™ REDUCE ENERGY



Significantly lowers steam utilization and optimal use of feed stock consumption

**Our continuous innovations in urea melt production technology and urea granulation technology reduces energy consumption in your urea plant, ensures lower construction costs and increases production efficiency.**



## 7.2 EVOLVE™ REDUCE ENERGY

### Case study 01



#### **The challenge**

Decrease the energy (high-pressure steam) consumption of a traditional CO<sub>2</sub> stripping plant with 10% and use the opportunity to debottleneck the plant and realize a capacity increase of about 5%. Part of the debottlenecking goals is to reduce the plant emissions.

#### **The solution**

The starting point of the design process was a plant assessment and study, giving an overview of the plant status quo and debottleneck opportunities. The outcome of this study was discussed with the client to ensure a tailor-made revamp solution.

The solution comprises of:

#### **Energy consumption decrease**

We introduced a (medium-pressure) adiabatic flash section in the existing process line. In the existing plant, an excess of (low-value) low-pressure steam was produced. By applying the adiabatic flash technology, this excess of low-pressure steam was minimized by utilizing a process-process heat exchanger. In this heat exchanger, the heat of condensation of condensing carbamate vapors is used to concentrate urea solution, resulting in steam savings in the evaporation section. By increasing the efficiency of the HP stripper (and thus decreasing the steam consumption of the HP stripper) more carbamate vapors can be produced in the adiabatic flash section, leading to more process-to-process heat exchange and thus further reduction of the steam consumption. Based on the outcome of the plant study results, the optimum operating window was defined and included in the design.

#### **Capacity increase**

The capacity increase was achieved by introducing a bypass line directly from the reactor in the synthesis section to the newly build adiabatic flash section; an outcome of the performed plant study was that the HP stripper was maximally loaded and the bottleneck for further capacity increase. Bypassing the HP stripper and bringing reactor liquid directly to the adiabatic flash section produces more carbamate vapors in the adiabatic flash section, resulting in further decrease of the energy consumption.

#### **Emission reduction**

The emission reduction was achieved by introducing an atmospheric flash section in the existing process line. By introducing this atmospheric flash section, more unconverted reactants are recycled back to the synthesis section before reaching the evaporation section and (over)loading the wastewater section, leading to a reduction of the plant emissions.

#### **The result**

The revamp was engineered, installed and taken into operation, one year after finalizing the process design package. A high-pressure steam reduction of more than 20% was achieved. Also, the capacity increase goal of 5% was met as well as significant reduction of the plant emissions. The revamp was successfully applied due to the tailor-made design, the investment costs required to meet all project goals were minimized.

# GET CUSTOMIZED ADVICE

**Whether you are looking to increase your aging plant's capacity, minimize its emissions or lower its energy consumption, Stamicarbon can assist you with customized advice and tailor-made solutions that will give you the best results.**

Get in touch with us today to schedule a consultation:

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ENABLING THE  
WORLD TO FEED  
ITSELF AND  
IMPROVING THE  
QUALITY OF LIFE



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