Stamicarbon’s Plant Assessment that evaluates the opportunities to increase capacity and/or decrease operational costs and/or decrease emissions
When it comes to recognizing opportunities related to plant performance, a plant assessment is the essential starting point. It is only through a comprehensive analysis that Stamicarbon’s engineers can determine the status of the plant and give advice on improvements.

Stamicarbon’s plant assessment, the ADVANCE CONSULT™ Process is of great value to your plant when you want to:

• Transform an operational bottleneck into a sustainable overall solution
• Analyze the plant status to determine the possibilities available to advance your plant

To operate your plant at a sustainable and consistently high level, Stamicarbon provides expert advice on innovative processes and optimal equipment conditions for achieving high-quality outputs in the long term. Stamicarbon evaluates the feasibility of further improving plant performance, production and energy consumption by troubleshooting and optimizing process conditions.

Having analyzed the data, a bespoke model is put together offering an extensive overview of your plant’s performance. This lays the foundation for the formation and implementation of creative improvements.

Objectives:
• Increase capacity
• Decrease emissions
• Decrease operational costs

The process includes:
• Determining the current material balances
• Identifying sections operating at maximum load
• Identifying equipment which constantly operates close to design limits, needs replacement, or essential upgrades in the future
• Providing recommendations to rectify areas of concern (for example, LP steam venting)
• Advising how to improve your plant’s performance including using proven debottlenecking concepts to take full advantage of all design margins so as to produce more urea and reduce emission figures.
## Figures of Mass Balance | Urea plant

### Normal operation

<table>
<thead>
<tr>
<th>PROCESS STREAM</th>
<th>CO₂</th>
<th>NH₃</th>
<th>reactor outlet</th>
<th>Stripper outlet</th>
<th>Final product</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urea crystals</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>82279,0</td>
</tr>
<tr>
<td>Urea</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Biuret</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO₂</td>
<td>kg/h</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NH₃</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H₂O</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N₂</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H₂</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CH₄</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>O₂</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Formaldehyde</td>
<td>kg/h</td>
<td></td>
<td></td>
<td></td>
<td>250,0</td>
</tr>
</tbody>
</table>

| Total                | kg/h | 64245,3 | 47200,7 | 274610,3 | 155928,5 | 83333,3 |

### Temperature
- °C
  - 40,0
  - 30,0
  - 182,4
  - 173,0
  - 60,0

### Pressure
- bar
  - 1,01
  - 17,7
  - 141,2
  - 144,2
  - 1,01

### Density
- kg/m³
  - 1,624
  - 595,9
  - 975,3
  - 1127
  - 731,1

### Volume 1
- m³/h
  - 39568,1
  - 79,2
  - 281,6
  - 138,3
  - 114,0

### Volume 2
- Nm³/h
  - 34593,3
  - -
  - -
  - -
  - -

### Viscosity
- mPa.s
  - 0,016
  - 0,128
  - 0,720
  - 0,905
  - -

### Molecular weight
- kg/kmol
  - 41,6
  - 17,0
  - 26,3
  - 32,0
  - 59,8

### Specific heat
- kJ[kg.°C]
  - 0,906
  - 4,894
  - 5,361
  - 4,988
  - 1,758

### Compres. factor
- -
  - 0,994
  - -
  - -
  - -

### Cp/Cv
- -
  - 1,292
  - -
  - -
  - -

### Thermal conduct.
- W/m.°K
  - 0,019
  - 0,476
  - 0,452
  - 0,846
  - 1,291

### Percentages (PPM where appropriate)

<table>
<thead>
<tr>
<th>Urea crystals</th>
<th>% by</th>
<th>mol</th>
<th>weight</th>
<th>weight</th>
<th>weight</th>
<th>weight</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>98,7</td>
</tr>
<tr>
<td>Urea</td>
<td>%</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>53,7</td>
</tr>
<tr>
<td>Biuret</td>
<td>%</td>
<td>91,3</td>
<td>-</td>
<td>32,8</td>
<td>2205 ppm</td>
<td></td>
</tr>
<tr>
<td>CO₂</td>
<td>%</td>
<td>73</td>
<td>1049 ppm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NH₃</td>
<td>%</td>
<td>7,3</td>
<td>99,5</td>
<td>31,2</td>
<td>8,6</td>
<td>25 ppm</td>
</tr>
<tr>
<td>H₂O</td>
<td>%</td>
<td>2781 ppm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N₂</td>
<td>%</td>
<td>1,1</td>
<td>100 ppm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H₂</td>
<td>%</td>
<td>-</td>
<td>100 ppm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CH₄</td>
<td>%</td>
<td>-</td>
<td>100 ppm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>O₂</td>
<td>%</td>
<td>-</td>
<td>100 ppm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Formaldehyde</td>
<td>%</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>50 ppm</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3000 ppm</td>
</tr>
</tbody>
</table>

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Example of a Mass Balance Report
Example of a tailor-made process flow diagram