NEXTCHEM

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STAMICARBON
15TH SYMPOSIUM 2026

AN INNOVATIVE REVAMP CONCEPT FOR UNLOCKING ENERGY EFFICIENCY AND BOOSTING CAPACITY

Ahmed Shams
Robert Rozek

AGENDA

01

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INTRODUCTION

INTRODUCTION

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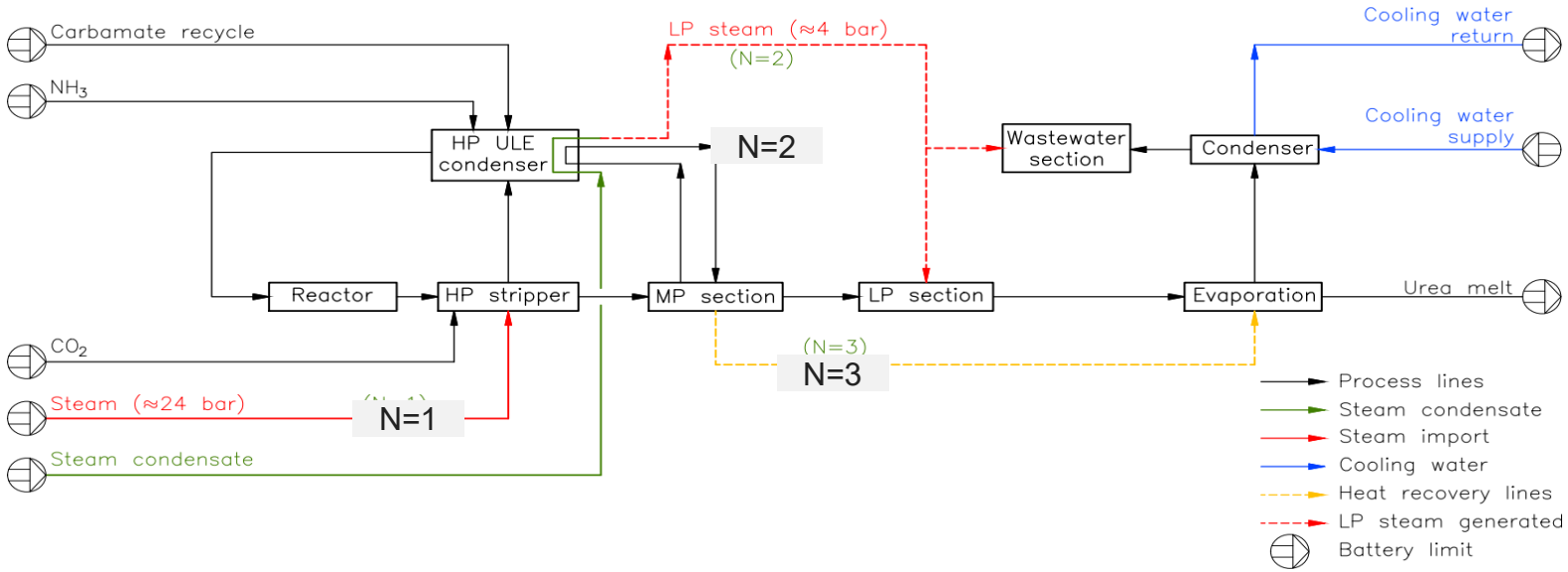
- Global trend to lower carbon footprint within competitive CAPEX and OPEX constraints.
- New innovative energy-saving technologies By Stamicarbon for energy efficient operation, within emission standards.
- Successful implementation of low-energy concepts for grassroots plants such as: MP Adiabatic Flash concept and Ultra-low energy (ULE) concept.
- ULE is based on 3 times usage of heat in the urea plant (N=3)



N=1 : HP steam from BL

N=2: Double bundle In ULE

N=3 Use heat from MP section in concentrating solution in evaporation section

INTRODUCTION

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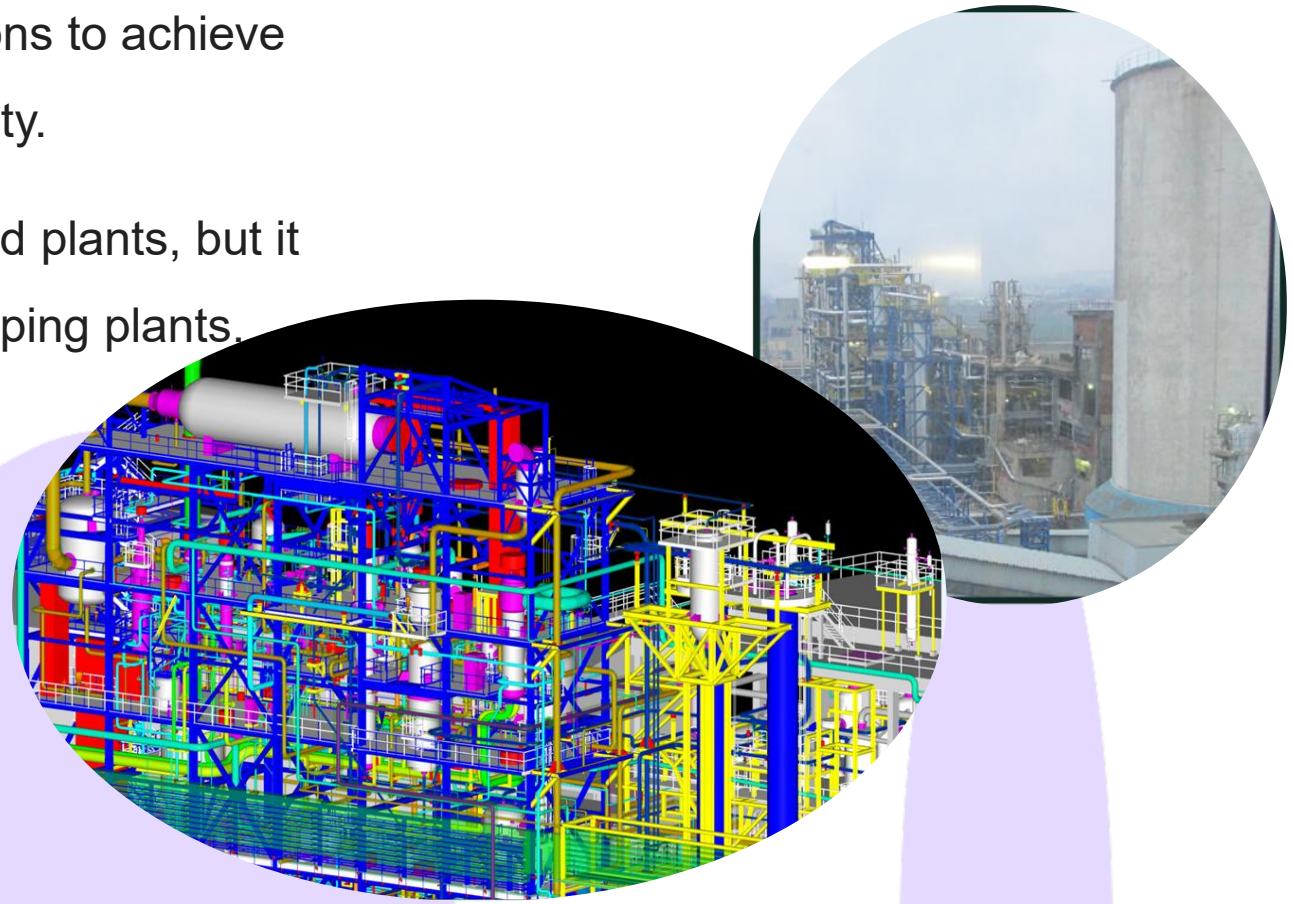
- Stamicarbon has successfully completed over 110 revamp projects (different concepts).
- Now ULE concept developed for revamp applications to achieve clients' goals for higher sustainability and profitability.
- ULE concept is not limited to Stamicarbon-designed plants, but it can be effectively applied to non-Stamicarbon stripping plants.



02

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DRIVERS & CHALLENGES

DRIVERS OF REVAMPING UREA PLANTS

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Capacity expansion (enabled by feedstock and utility availability

Product diversification (e.g. DEF, UAN, TGU, etc.)

Energy consumption reduction

Market competition

Compliance with environmental regulations

Safety enhancement

Replacement of aging or obsolete equipment

CHALLENGES OF REVAMPING UREA PLANTS

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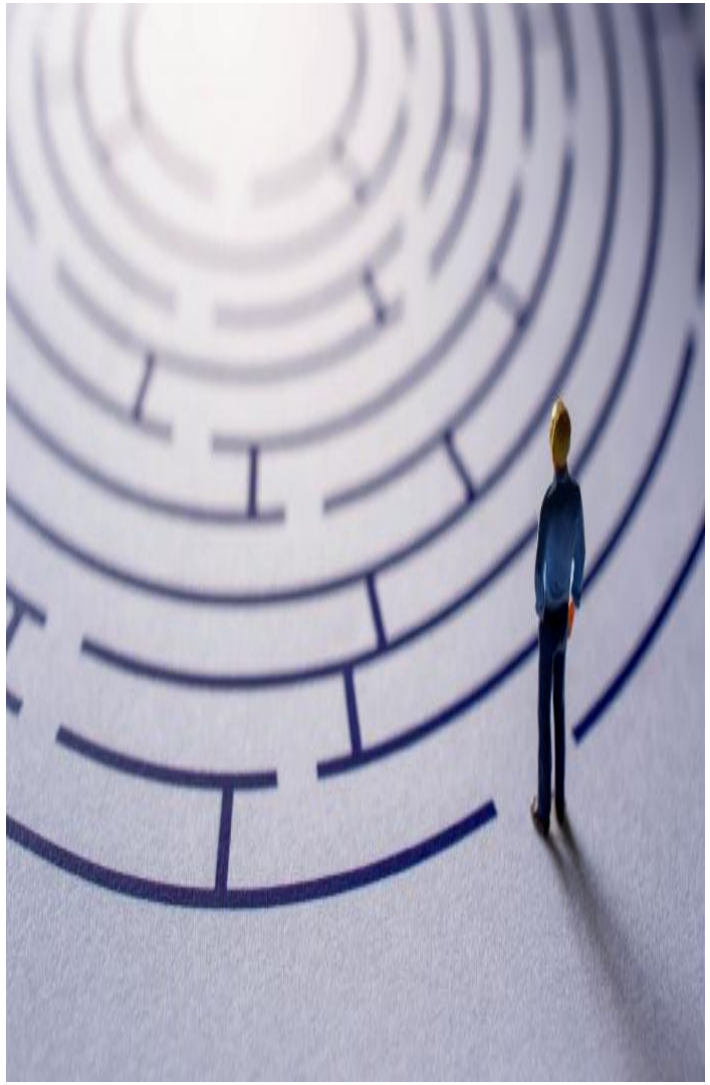

- Increased energy consumption in case of capacity increase
- Higher synthesis load
- Size limitations and lifetime of HP equipment
- Higher load on LP recirculation, evaporation and wastewater sections after increasing the plant capacity
- Higher cooling water demand after revamp
- Layout and footprint constraints
- Extended downtime during revamp execution

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GOALS

GOALS OF ULE AS A REVAMPING TOOL

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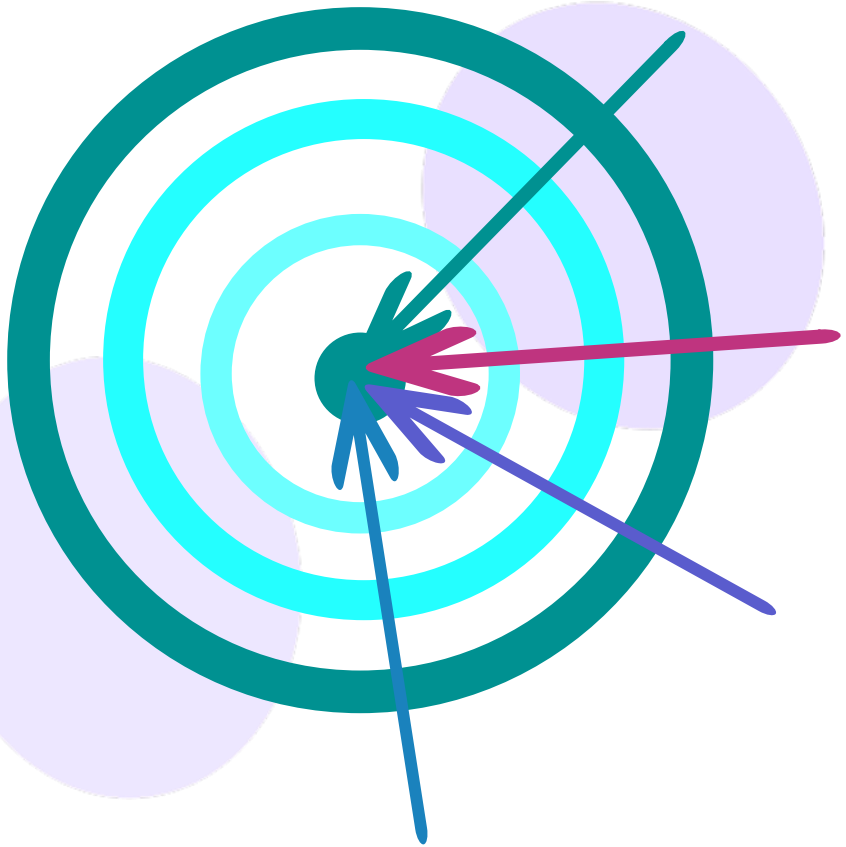
Steam Savings
up to **30% reduction** in consumption

Capacity increase:
10% - 45% compared to the pre-revamp baseline

Cooling Water Optimization:
minimize specific cooling water usage through smart heat integration techniques

CAPEX and OPEX Efficiency:
optimized via improved energy integration and system performance



HOW TO ACHIEVE THESE GOALS?

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Short downtime — Smart and adaptive design, with simplified implementation via an add-on construction concept (stepwise approach)

Equipment footprint — Compact design ensures smooth integration within existing plant layouts.

Low cooling water — Process-to-process heat integration and steam savings -> Lower specific cooling water consumption

MP section — New MP section acts as a buffer, stabilizing the LP section.

Heat integration — Efficient process to process heat exchange, for energy saving (steam reduction)

Reaction volume — Additional reaction volume for capacity increase

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THE FEATURES

FEATURES OF ULE CONDENSER

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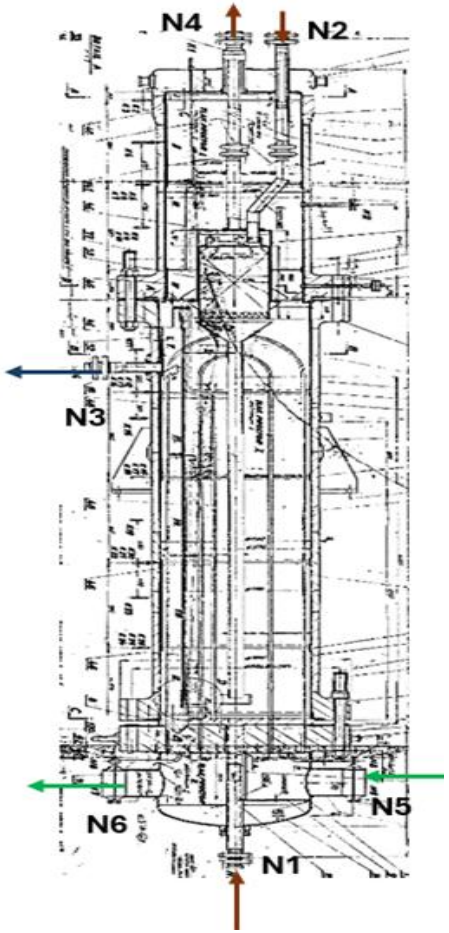

*HP scrubber submerged vertical design applied in the **1970-1980** in Stamicarbon plants*

Condenser type

- Special engineered shell-and-tube design featuring U-tubes.
- Submerged type, with incorporated a U-tube bundle an additional volume
- Process to Process (N=3) or process to steam (N=2)
- ULE carbamate condenser is designed for plug flow behavior via special trays in the vertical orientation, or process baffles in horizontal orientation

ORIENTATION OF ULE CONDENSER

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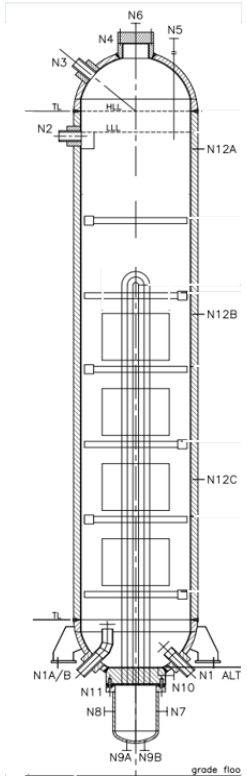
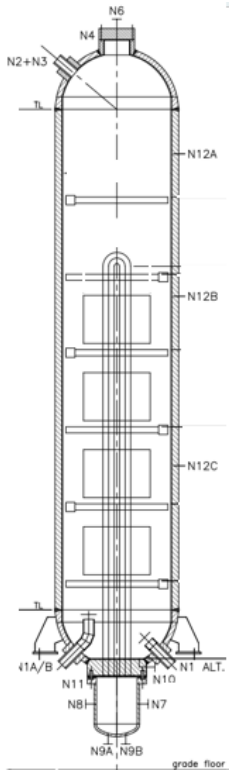
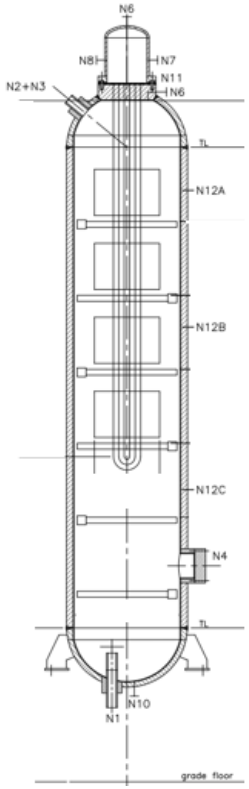


Concept A:
Bottom tube sheet, level measurement at the top.



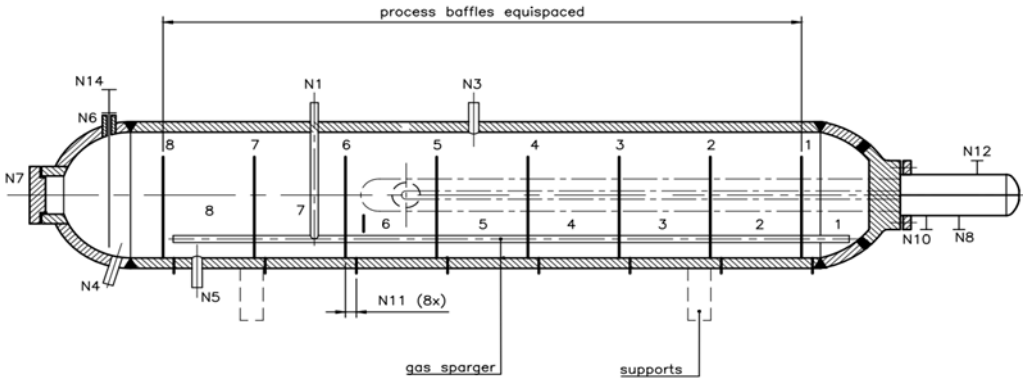
Concept B:
Bottom tube sheet, fully submerged (no level control)



Concept C:
Top tube sheet at the top, fully submerged (no level control)

Mechanical considerations:

- Leak Detection System
- Accessibility for maintenance and inspection
- Removability of the trays via manways



Concept D:
Horizontal layout perfect fit for revamping concepts as applied in the grassroots

BLOCK SCHEME (N=2), BASE CASE

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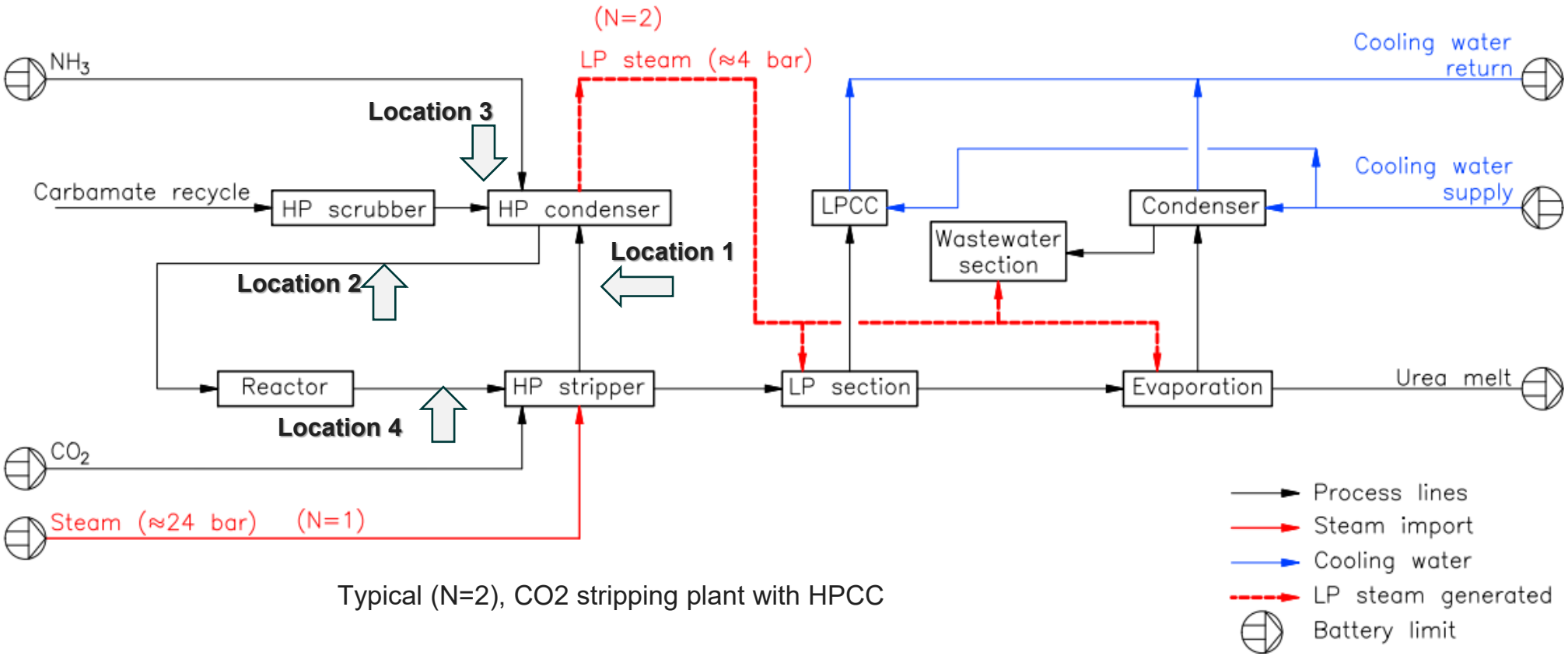
Where can the ULE carbamate condenser be located?



Typical (N=2), CO2 stripping plant with HPCC

The location is determined by project specifics such as layout and foot-print, licensor, hydraulics, etc.

Each option, regardless its location receives gas either from HP stripper or HP reactor

ULE BLOCK SCHEME (N=3)

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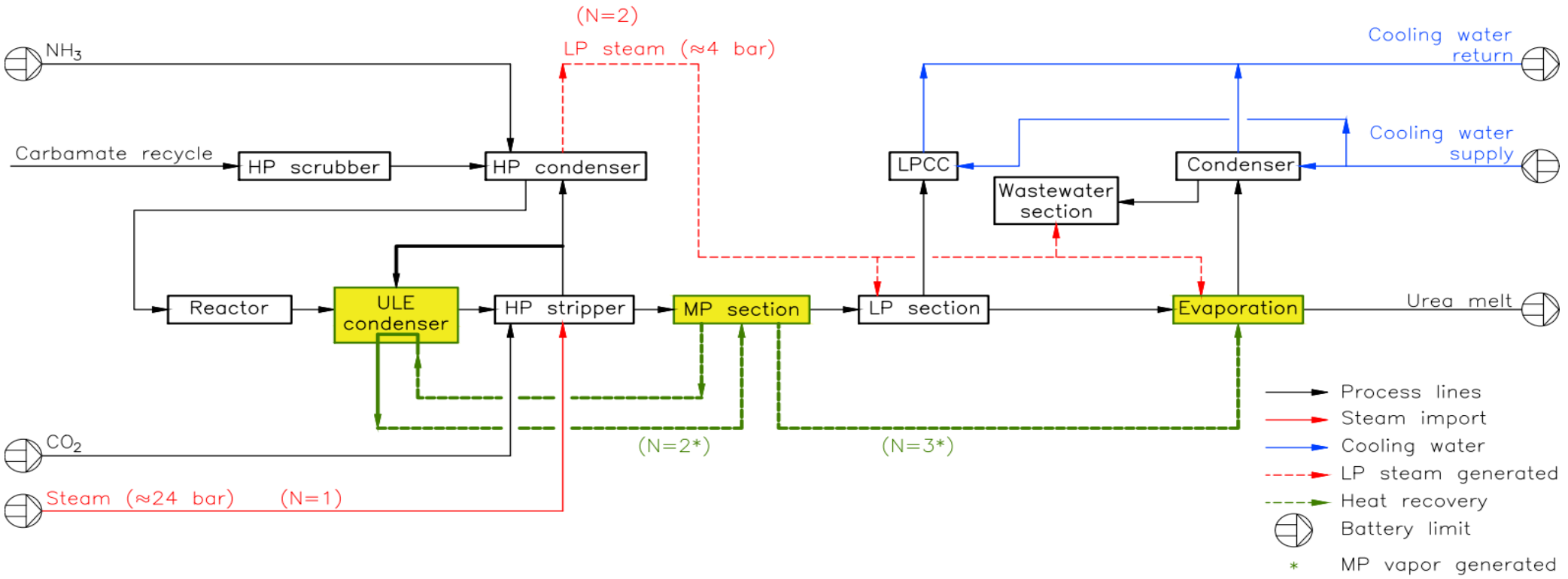
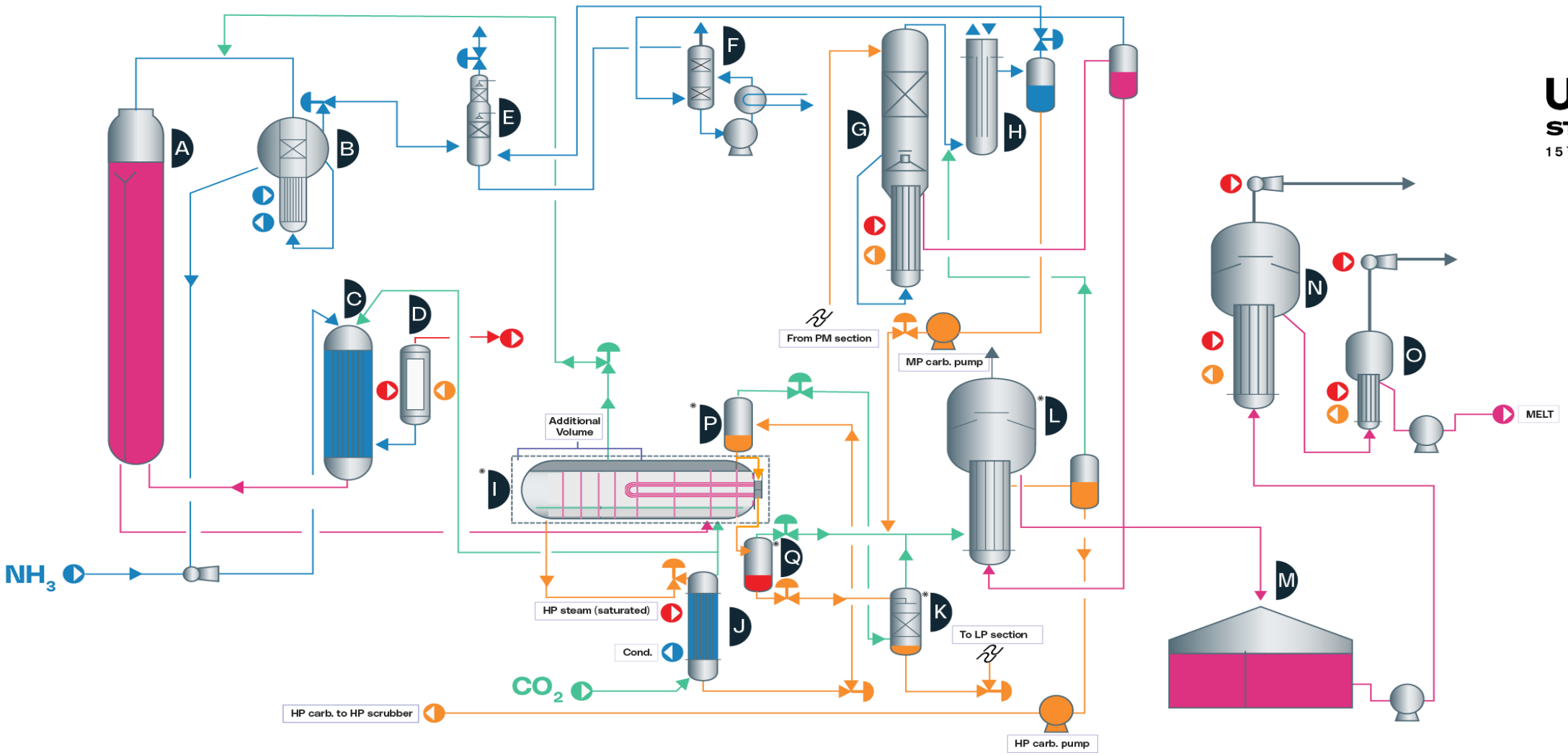


ULE configuration as a revamping tool, based on location 4 in Stac. plants

All options meet the revamp objectives, location 4 is prefer from hydraulics point of view in Stamicarbon plants



- A | HP reactor
- B | HP scrubber
- C | HPCC
- D | LP steam to consumers
- E | LP absorber
- F | Atm. absorber
- G | LP rectifying column
- H | LPCC
- *I | ULE Pool reactor
- J | Stripper
- *K | MP Rectify column
- *L | Pre-evap / MPCC
- M | Urea solution tank
- N | 1st stage evap
- O | 2nd stage evap
- *P | 1st MP Separator
- *Q | 2nd MP Separator

* New equipment after the revamp

05

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SAFETY

SAFETY EVALUATION

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Considerations:
- High level safety evaluation for new safety scenarios leading to CAPEX or safety impact
- Only major scenarios **(risk level* (RL) >= 1)** resulting from ULE revamp are considered

HP section:
NO new HP scenario due to ULE

RL 2 scenario for **LP section**:
High pressure scenario due to connection with new MP section. E.g. tube rupture pre-evaporator
Mitigation actions e.g.: PSV, HP interlocking and manhole with water seals on storage tanks.

MP section:
RL 2 scenario
tube rupture of ULE condenser.
Mitigation actions:
e.g.: PSV, material selection, leak detection of tube sheet

RL 3 scenario
Re-routing outlet valve of HP stripper to MP section (failure open of Level valve of HP stripper).
Mitigation actions e.g.: PSV, HP interlocking and dedicated XPV

*Risk level: a methodology of categorizing the risk based on a risk graph according to their severity and probability for scenarios that lead to LOC (loss of containment). Only major scenarios (>RL=1 needs corrective measures)

06

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CONCLUSION

CONCLUSION AND WRAP UP

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- Exceptional performance gains by ULE revamp concept as successfully achieved in grassroots: up to 30% steam savings, 45% additional capacity, and reduced OPEX, without compromising safety, quality, or reliability.
- The MP section of the ULE revamp concept acts as a buffer between HP and LP sections, helping stabilize plant performance and enhance controllability.
- Versatile and compatible with Stamicarbon and non-Stamicarbon plants.
- ULE carbamate condenser, an advanced shell-and-tube U-tube heat exchanger, combines highly efficient heat recovery with additional reaction volume.
- ULE design allows vertical or horizontal installation at several potential locations within the synthesis loop, with the optimal configuration tailored to each specific project.
- No adverse safety impact on the existing plant or significant CAPEX requirements are anticipated due to the ULE concept.

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THANK YOU

QUESTIONS?

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AND THAT'S A WRAP FOR TODAY!

SEE YOU AT THE NETWORKING DRINKS IN THE EXHIBITION AREA