NEXTCHEM

UNFOLD
STAMICARBON
15TH SYMPOSIUM 2026

ULTRA LOW ENERGY – THE ROAD TO THE NEW INDUSTRY STANDARD

Chuanbo Gao
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AGENDA

01 INTRODUCTION ULE

02 PROCESS DESCRIPTION

03 OPERATIONAL EXPERIENCES

04 PERFORMANCE FIGURES

05 CONCLUSIONS

01

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INTRODUCTION

INTRODUCTION

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BACKGROUND

- NX STAMI™ Urea Ultra-Low-Energy (ULE) concept launched in 2012
- OPEX: Drastic reduction in steam consumption from 870 kg/ton in traditional NX STAMI™ Urea Pool Condenser process to 567 kg/ton (23 bara, 330°C) for ULE with an equivalent CAPEX
- Main elements of the ULE Design:
  - CO_2 stripping process
  - Pool condensation
  - Limited high-pressure equipment (without HP scrubber)
  - E-type stainless steels (formerly known as Safurex®)
  - Process-to-process heat exchange between “synthesis and medium-pressure section”

INTRODUCTION

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FIRST APPLICATION

- First ULE plant in operation since February 2021
- Client: XLX (XinLianXin), China
- Design capacity: 2334 MTPD
- Supported remotely during pandemic

INTRODUCTION

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REFERENCE LIST

Plant	Location	Capacity, MTD	Year in operation
XLX-1 (XinLianXin-1)	China	2334	February 2021
Sanning, Hubei	China	2334	March 2021
XLX-2 (XinLianXin-2)	China	2334	September 2023
Runyin, Shandong	China	2×2334	August 2024
XLX-3 (XinLianXin-3)	China	3850	September 2025
Gemlik	Turkey	1640	January 2026
Lianmeng-1, Shandong	China	2334	Construction
Huachang, Jiangsu	China	1860	Construction
Mota-Engil	Mexico	2125	Engineering
Lianmeng-2, Shandong	China	2700	Engineering

- In total, 10 ULE plants are licensed.
- Six ULE plants are in operation.
- Plant capacity varies from 1640 MTPD up to 3850 MTPD.

INTRODUCTION

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PROCESS DESCRIPTION

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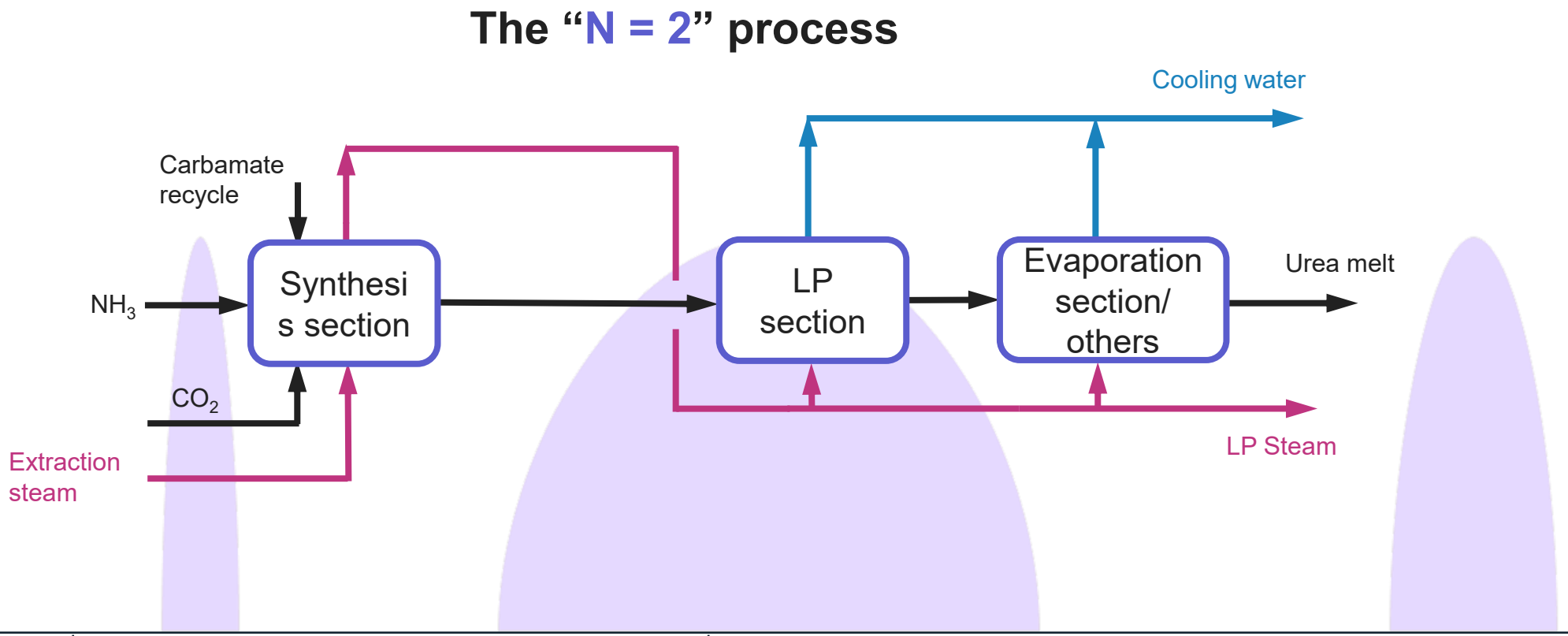
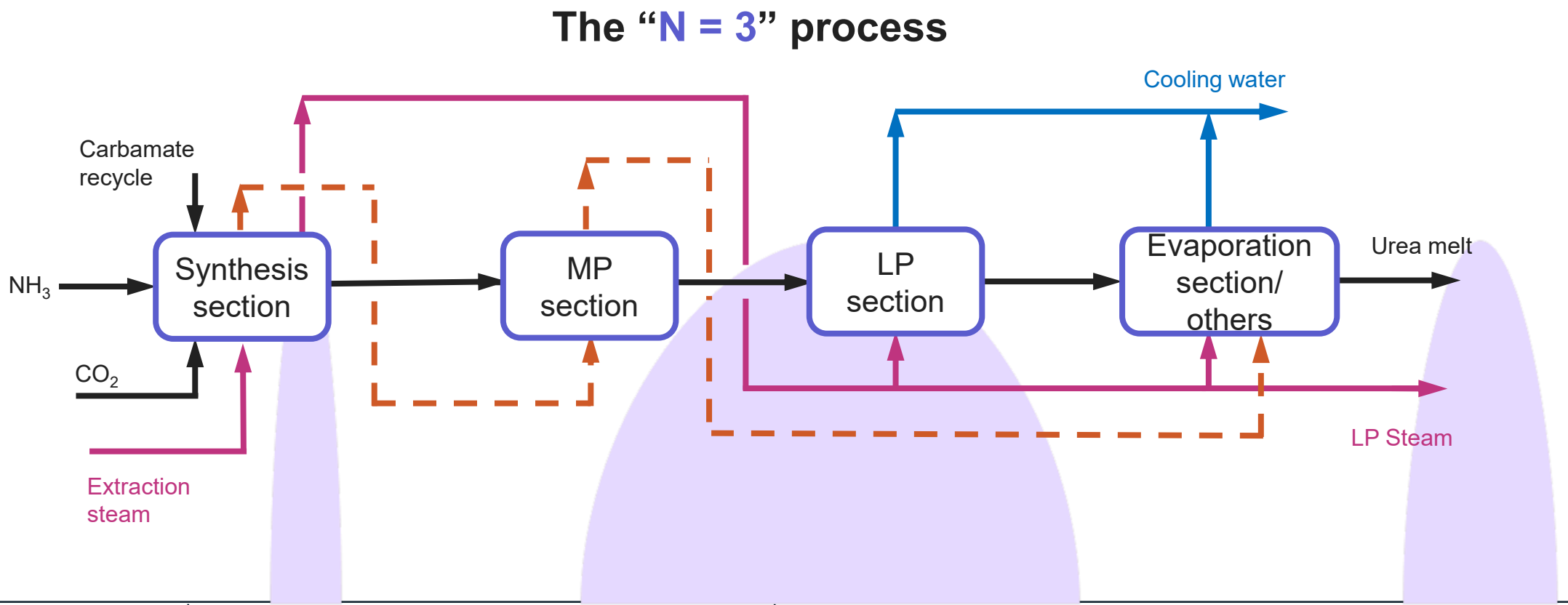
Energy flow diagram of the traditional CO_2 stripping design



PROCESS DESCRIPTION

UNFOLD STAMICARBON 15TH SYMPOSIUM 2026

Energy flow diagram of the ULE Design



PROCESS DESCRIPTION ULE

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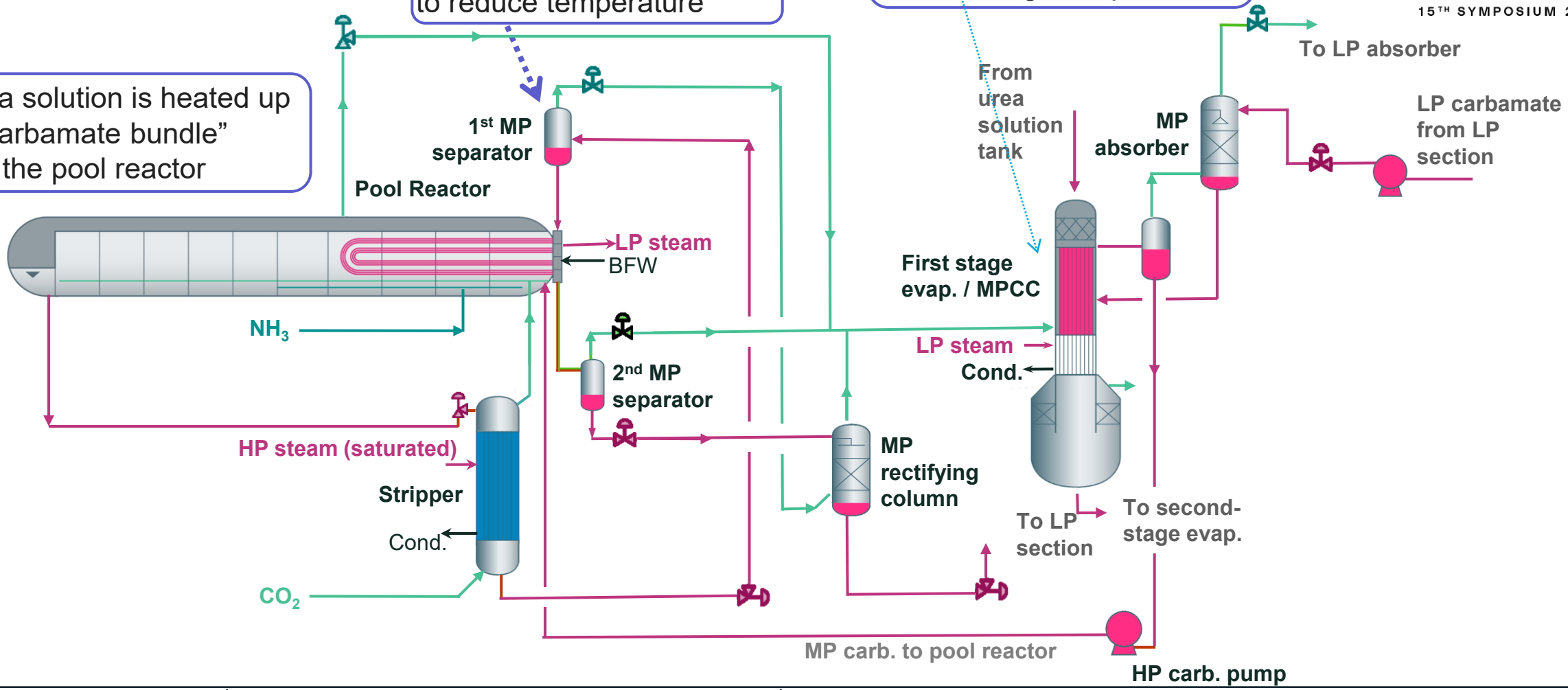
1. Urea solution is flashed to reduce temperature

2. Urea solution is heated up in a “carbamate bundle” inside the pool reactor

3. The MP pressure vapor condensation heat is used for “first-stage evaporation”



ULE DESIGN HIGHLIGHTS (≤ 3000 MTPD)

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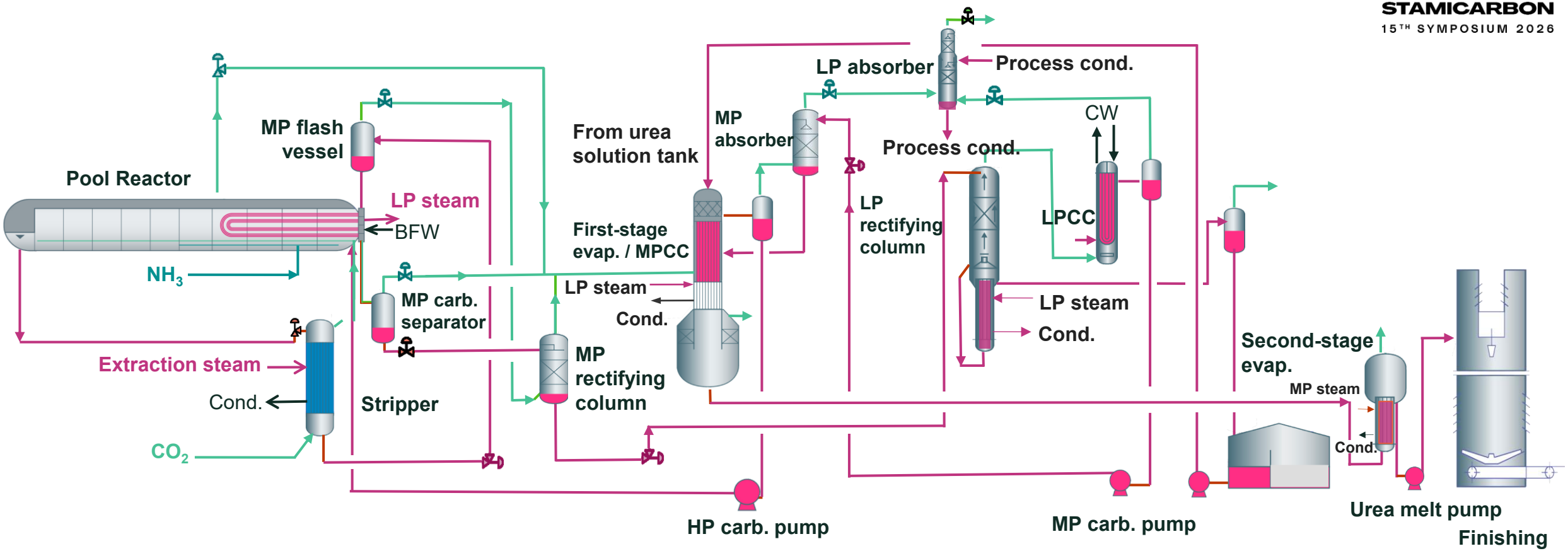
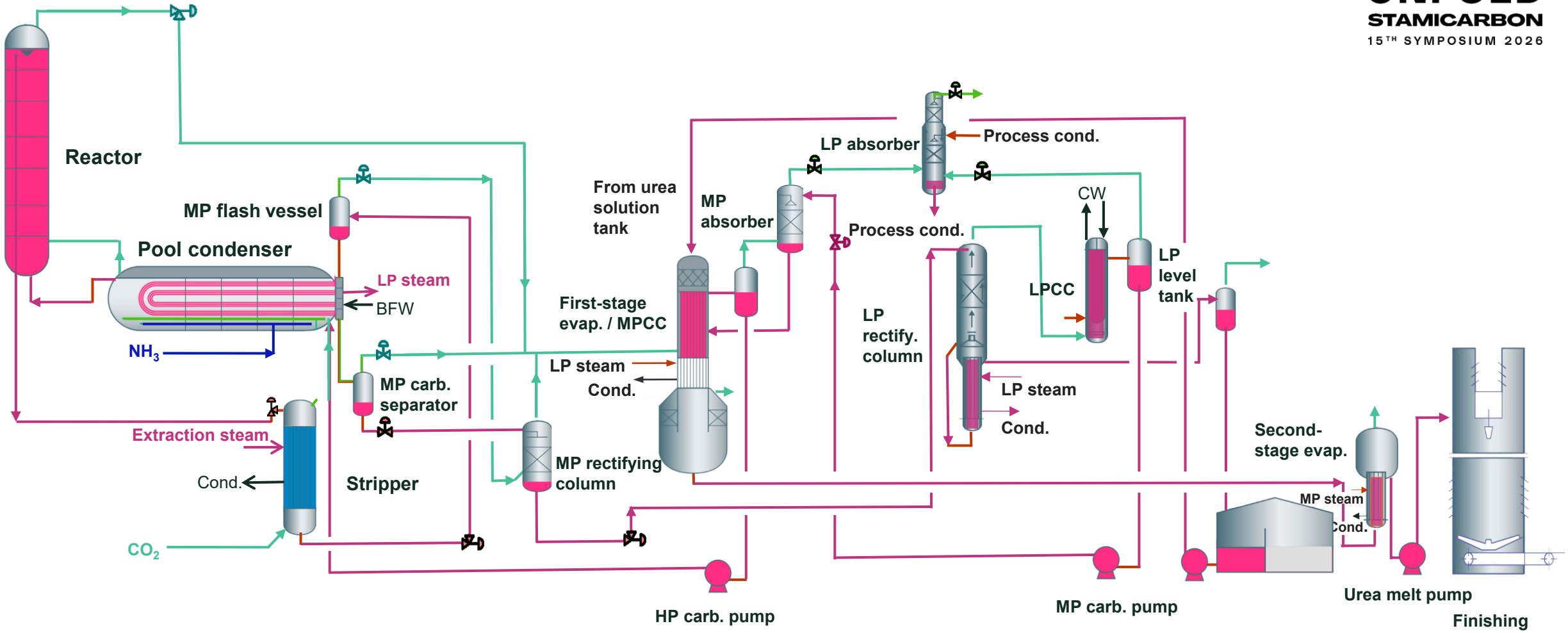


ULE DESIGN HIGHLIGHTS (> 3000 MTPD)

UNFOLD STAMICARBON 15TH SYMPOSIUM 2026



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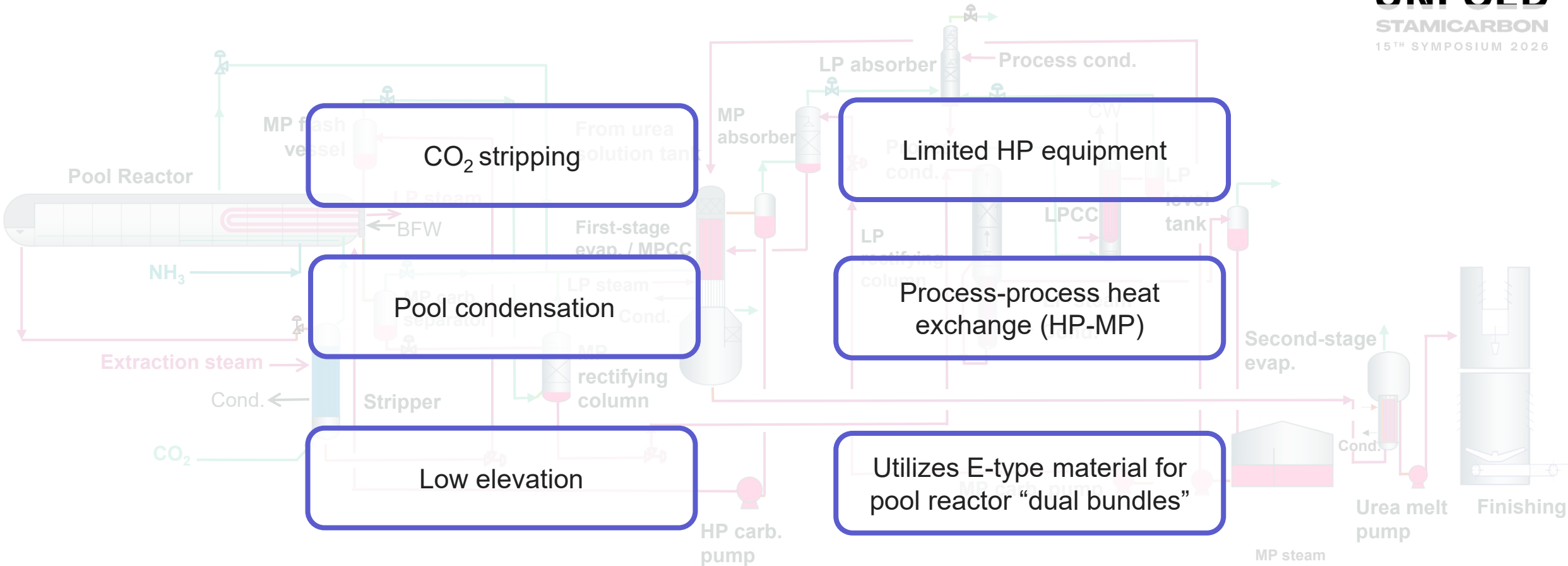

TYPICAL LAYOUT OF SYNTHESIS AND MP SECTION

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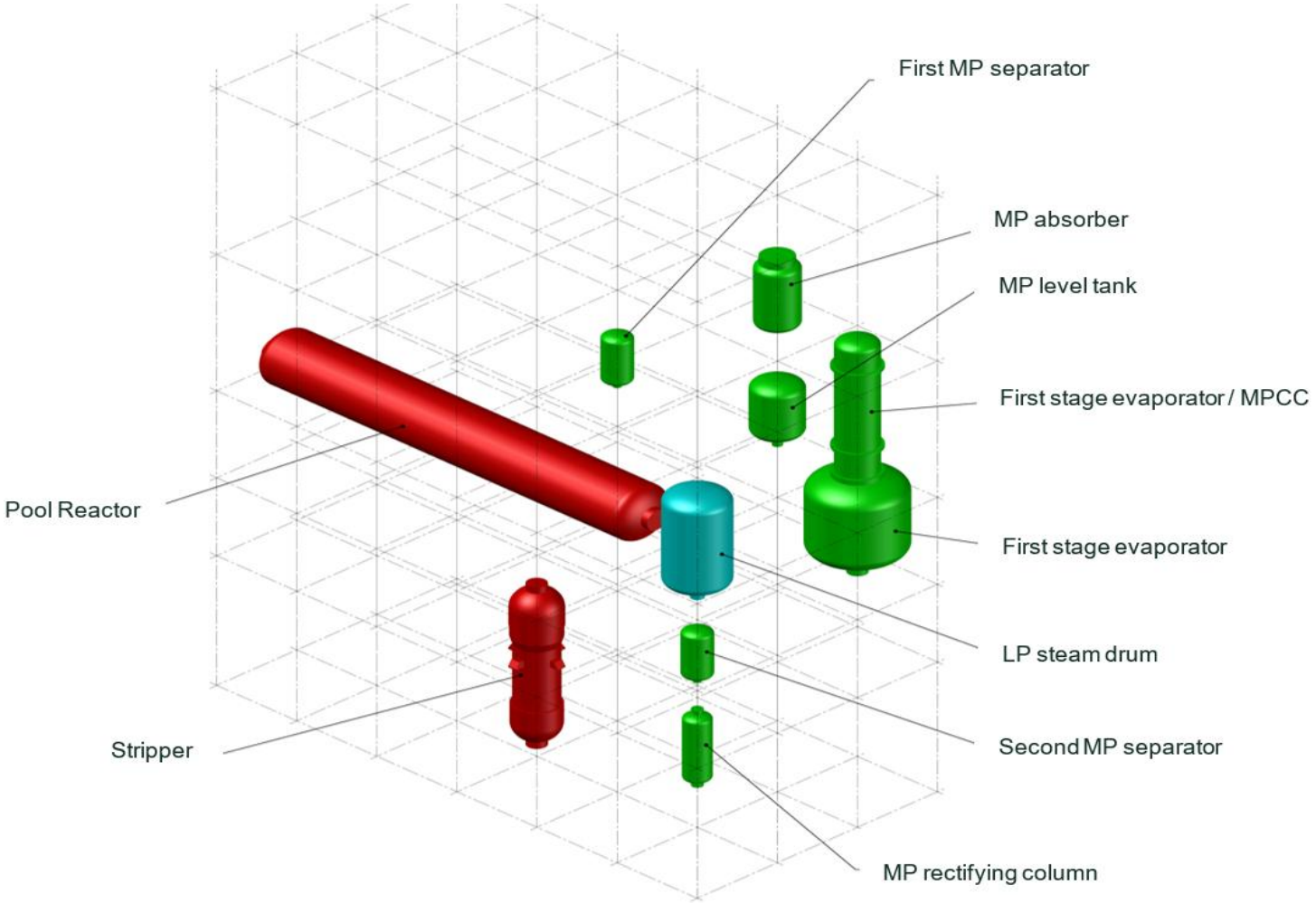

- Pool reactor: horizontal design with highest weight and dimension
- Stripper located at ground floor
- No HP scrubber needed which results in lower elevation of the structure

Lower plant elevation →
Lower CAPEX and simpler construction

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OPERATIONAL EXPERIENCES

OPERATIONAL EXPERIENCES

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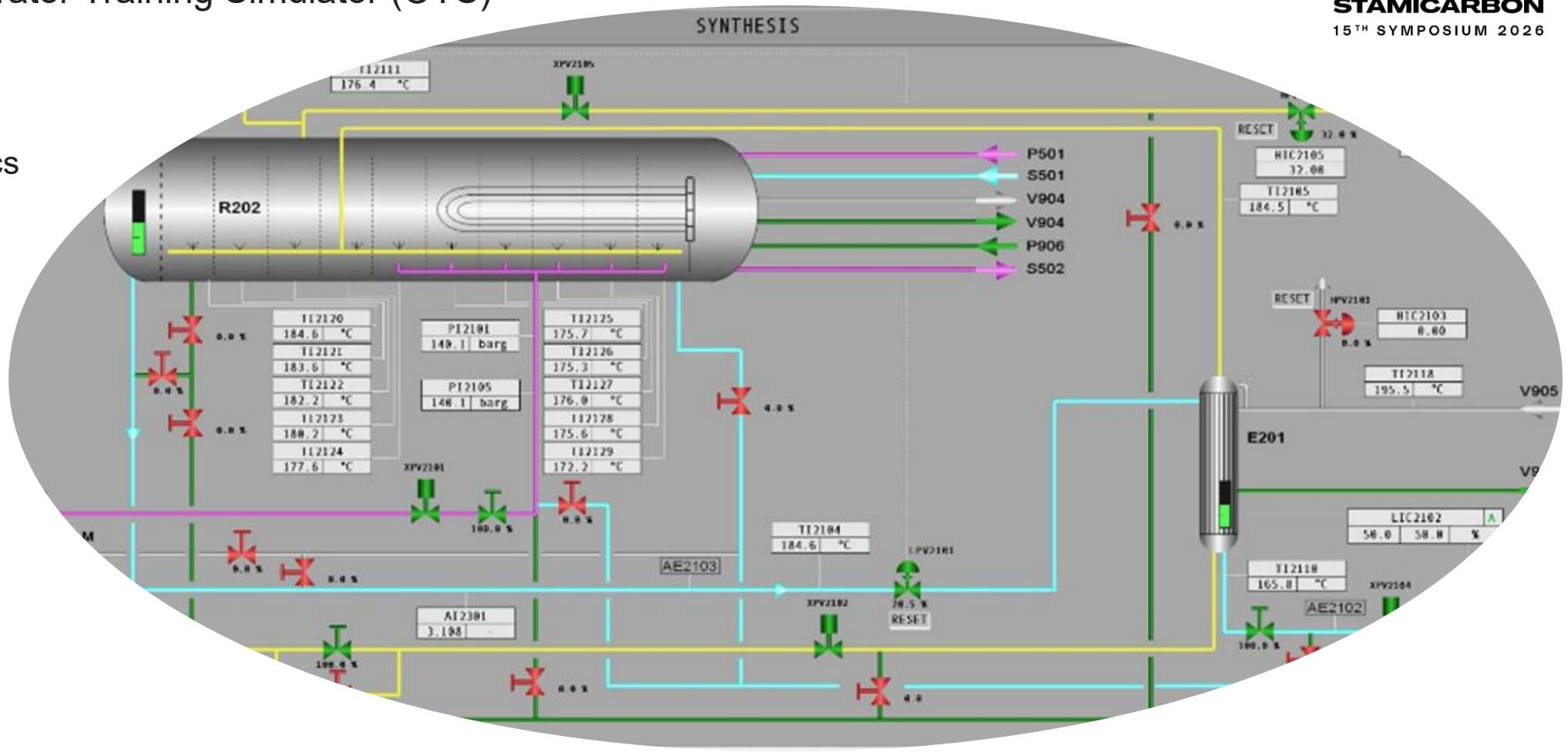
NX STAMI™ Operator Training Simulator (OTS)

- Operator training
- Process dynamics
- Process insights



OPERATIONAL EXPERIENCES

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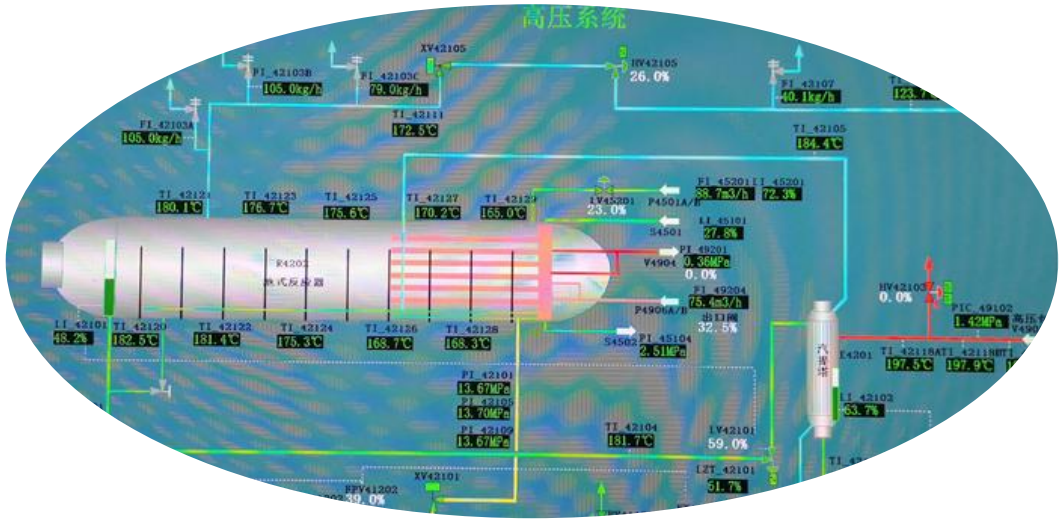
XLX-1, FIRST APPLICATION IN CHINA

First ULE plant started up in February 2021

- The startup of the plant went very smooth without any issues.
- Initially operated at turndown capacity, the capacity increased to about 100% within a week.

Main observations from operations:

- Relatively simpler and stable operation of the plant.
- Expected energy consumption achieved.
- Milder stripper conditions due to lower steam side pressures.



OPERATIONAL EXPERIENCES
(STRIPPER OPERATION)

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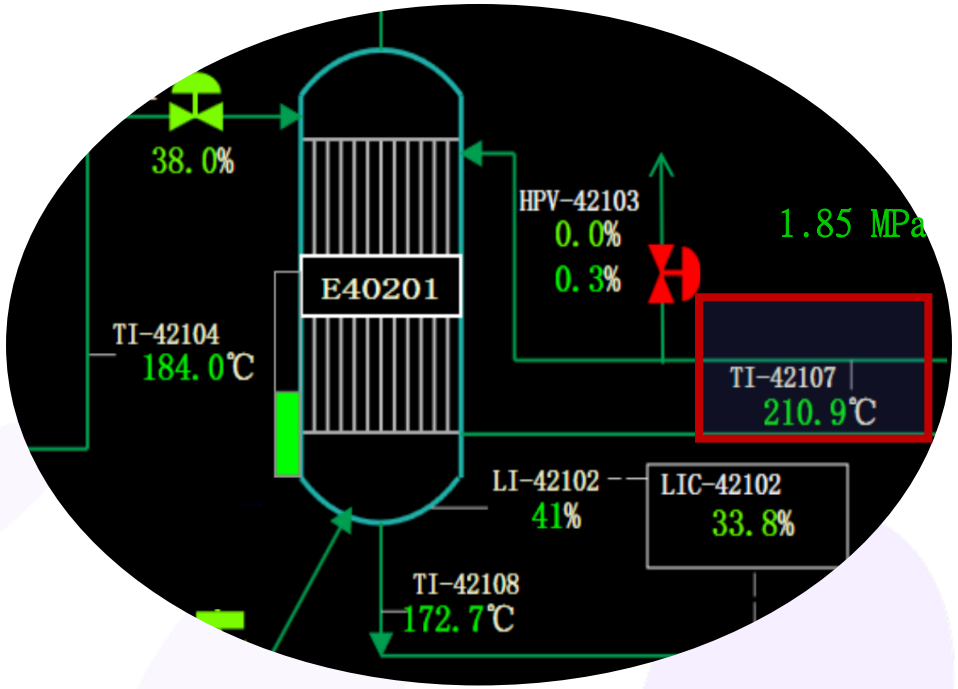
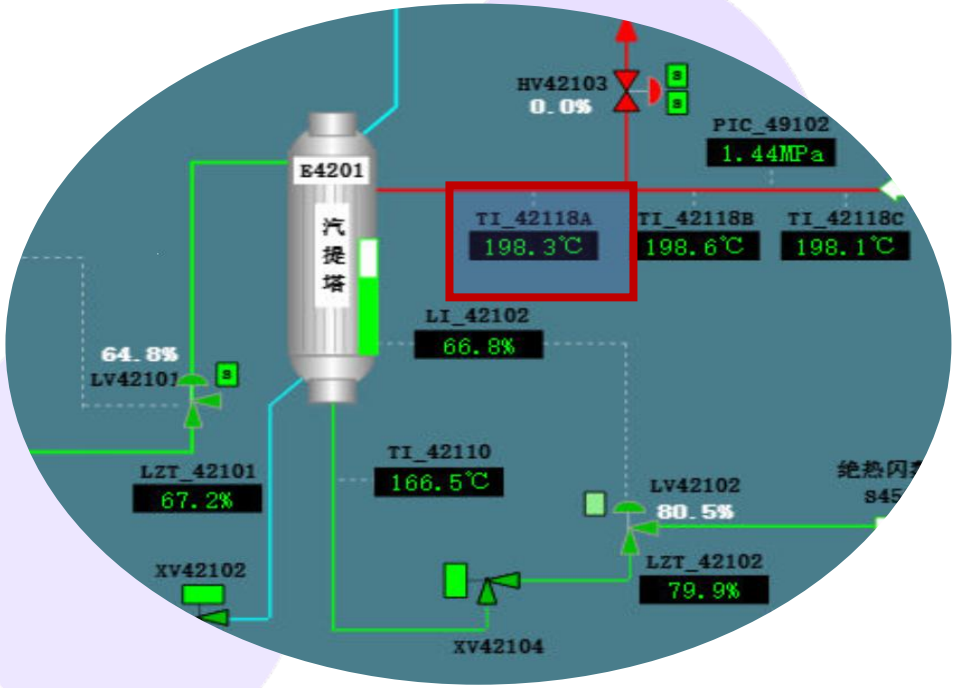
With the use of ULE synthesis HP stripper shell temperature reduction > **10 ˚C**

- Provides a longer lifetime of the HP Stripper
- Lower biuret formation at stripper



CO_2 stripper in traditional synthesis (107% cap.)

HP steam shell side: **211 ˚C**



CO_2 Stripper in ULE synthesis (110% cap.)

HP steam shell side: **198 ˚C**

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PERFORMANCE FIGURES

KEY PERFORMANCE PARAMETERS

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XLX-1, first application in China

Key performance parameters (based on XLX-1)		Units	Expected values during design phase	Actual plant performance during the performance test
Production capacity		tons/day	2334	2387
Cooling water		$tons/ton_{urea}$	61 (ΔT = 10 °C)	61 (ΔT = < 10 °C)
High-pressure steam	Extraction steam 23 bara, 330 °C	kg/ton_{urea}	577	567
Product quality	Total nitrogen	wt.%	46.5	46.6
	Biuret	wt.%	0.85	< 0.80

Note: Steam figures are based on prilled product. 25 kg/ton lower value is expected in case of granulated product.

KEY PERFORMANCE PARAMETERS

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XLX-1, first application in China

Process concept	Steam consumption (23 bara, 330 °C)	Cooling water consumption (ΔT_{cw} as 10 °C)	Expected biuret in final product
NX STAMI™ Urea Pool Reactor Design (formerly Urea 2000plus®)	870 kg_{steam} / ton_{urea}	73 ton_{CW} / ton_{urea}	0.85 wt%
NX STAMI™ Urea Ultra-Low Energy plant in operation	567 kg_{steam} / ton_{urea}	61 ton_{CW} / ton_{urea}	< 0.8 wt%
Improvement/reduction	-35%	-16%	-0.05 wt%

KEY PERFORMANCE PARAMETERS

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Summary of steam figures for ULE plants

Plant/client	HP steam consumption kg/ton, sat. at 26 bara	HP steam consumption kg/ton, at 23 bara, 330 °C	Current plant load, %	Years in operation
XLX-1	638	567	110%	5
Sanning	595	532	113%	5
XLX-2	605	539	109%	3
Runyin (two lines)	590	527	111%	2

- Low steam figures achieved for all listed plants
- Plant load of about 110%
- Stable plant operation

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CONCLUSIONS

CONCLUSIONS

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- Stamicarbon has licensed 10 ULE plants, from which six are in operation.
- Real steam consumption achieved is in the range of 527-567 kg/ton (23 bara, 330°C) in the first four plants, which is much less than the previous urea processes.
- All operational features with pool condensation are also observed with ULE process, such as easy startup, stable plant operation.
- Extra benefits are achieved on the biuret content in the final product and longer lifetime of the stripper.

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THANK YOU