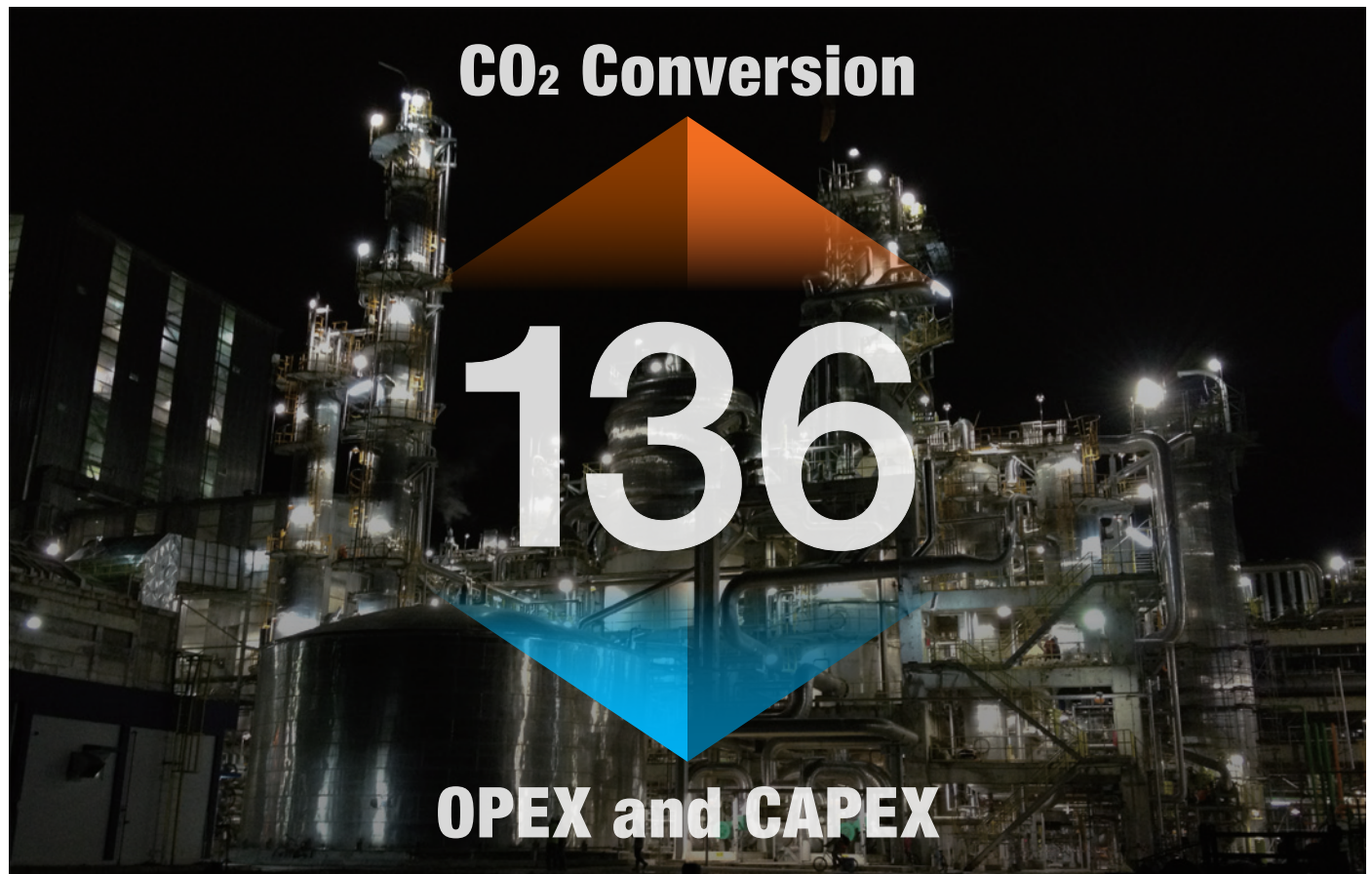


# ACES21-LP<sup>®</sup>

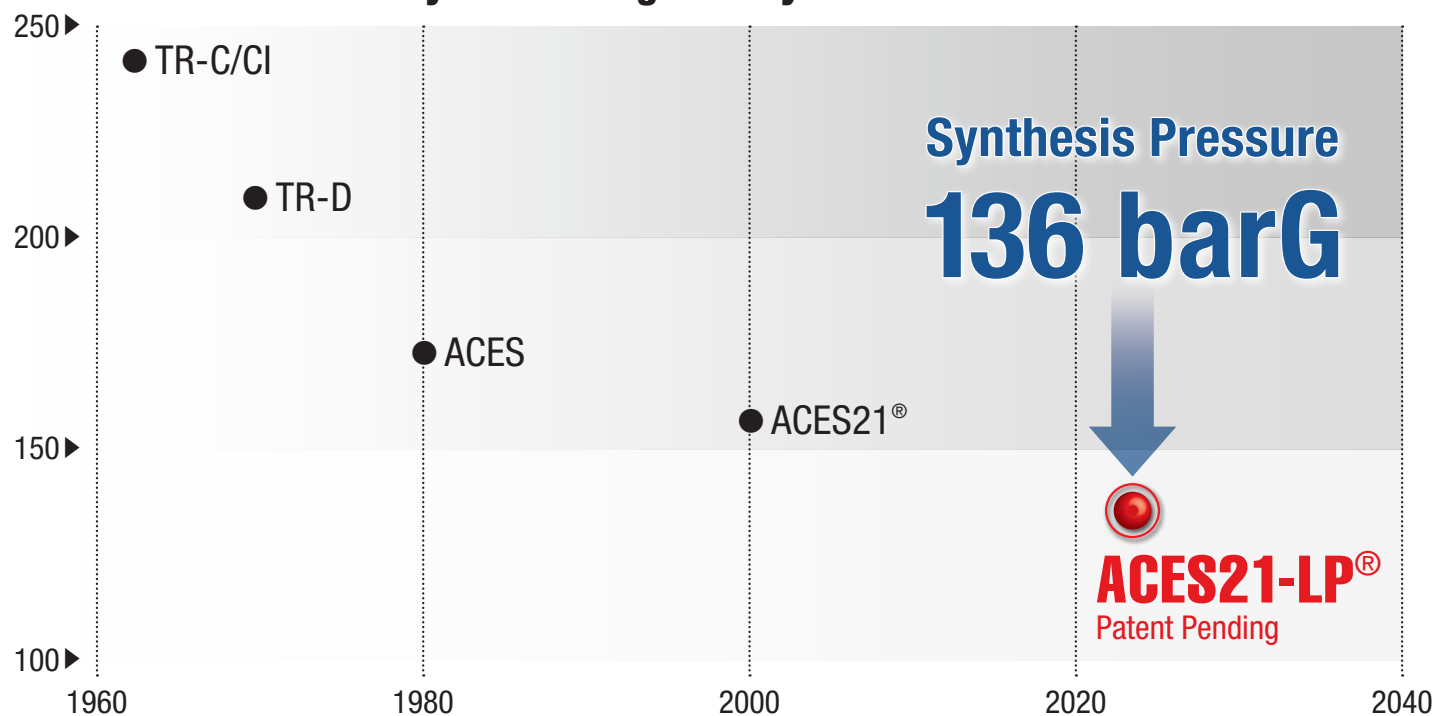
UREA PROCESS by TOYO



## Lowest Synthesis Pressure in Urea History



### History in Lowering Urea Synthesis Pressure



## ACES21-LP<sup>®</sup> Lowers Synthesis Pressure to 136 barG\*

- Urea synthesis at the lowest pressure maintaining all salient features of current ACES21<sup>®</sup>
- Highest CO<sub>2</sub> Conversion
- Less OPEX
- Less CAPEX
- 5-10% reduction of weight of synthesis equipment

## ACES21-LP<sup>®</sup> drastically reduces passivation air\*

Sophisticated application of DP28W™, duplex SS and 316L SS to synthesis section further enhances corrosion resistance even with significantly reduced passivation air

### Comparison with other processes

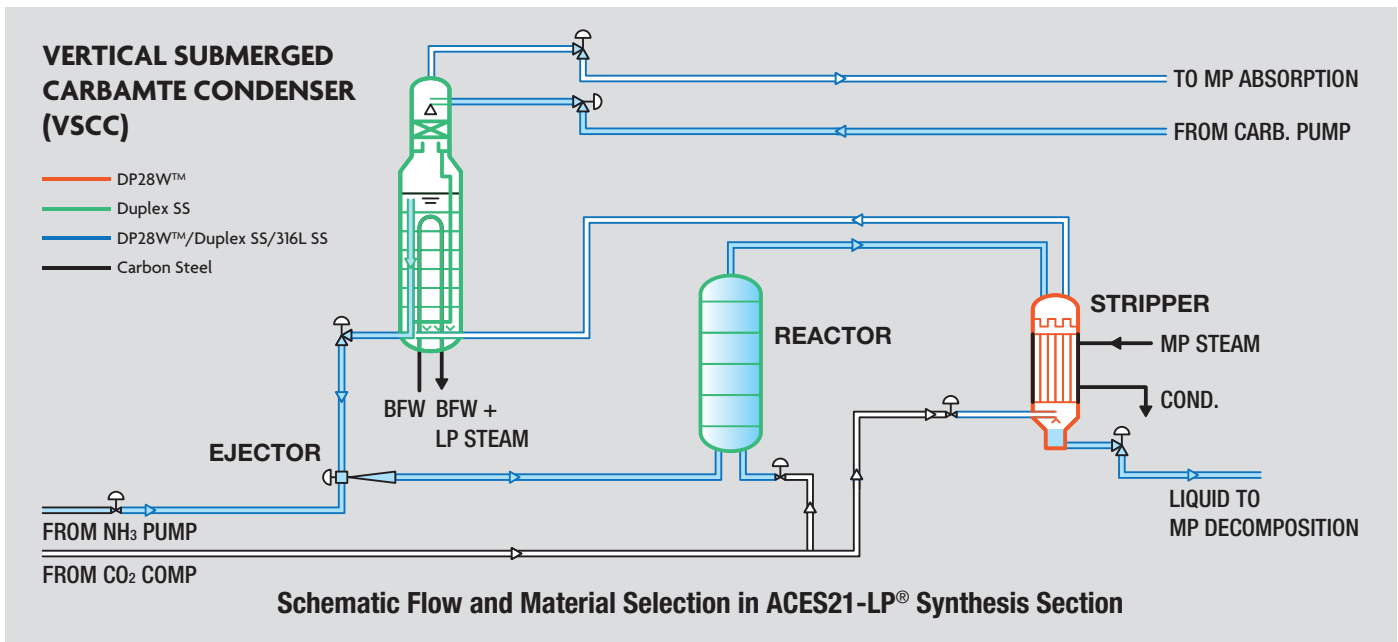
| Process                     | ACES21-LP <sup>®</sup><br>CO <sub>2</sub> Stripping | Process A<br>CO <sub>2</sub> Stripping | Process B<br>NH <sub>3</sub> Stripping |
|-----------------------------|---|--|--|
| Synthesis Pressure [barG]   | <b>136</b>  | 142                                    | 147                                    |
| Reactor N/C Ratio [mol/mol] | <b>3.7</b>  | 3.0                                    | 3.3                                    |

### OPEX Reduction by ACES21-LP<sup>®</sup>

|   | ACES21 <sup>®</sup> | ACES21-LP <sup>®</sup> |
|---|---------------------|------------------------|
| Electricity                               | Base                | <b>5% Reduction</b>    |
| Steam (MT/MT) at compressor turbine inlet | Base                | <b>3% Reduction</b>    |

## Currently operating ACES21<sup>®</sup> plants can be easily upgraded to ACES21-LP<sup>®</sup>\*

- Low-pressure synthesis at 136 barG realizes 3% energy savings or 3% production increase only with minor modifications, maintaining original process scheme and HP equipment in-situ
- Excellent cost-benefit performance; payout within one year



\*Patent pending by Toyo Engineering Corporation



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