

NX STAMI™ AMMONIA MP SYNLOOP FOR WORLD-SCALE GREEN AND BLUE AMMONIA PLANTS



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AGENDA

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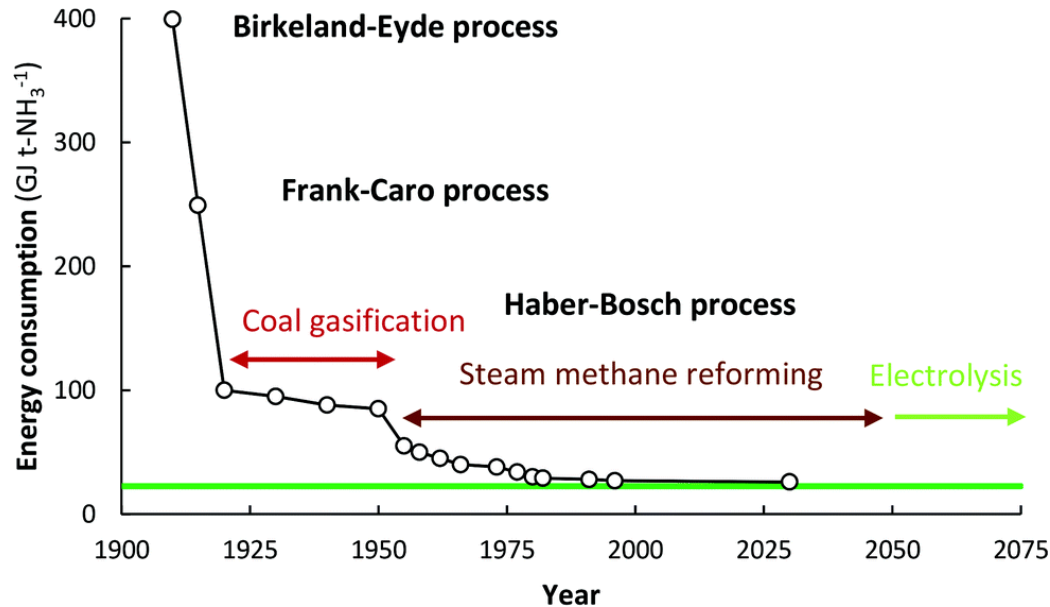
INTRODUCTION

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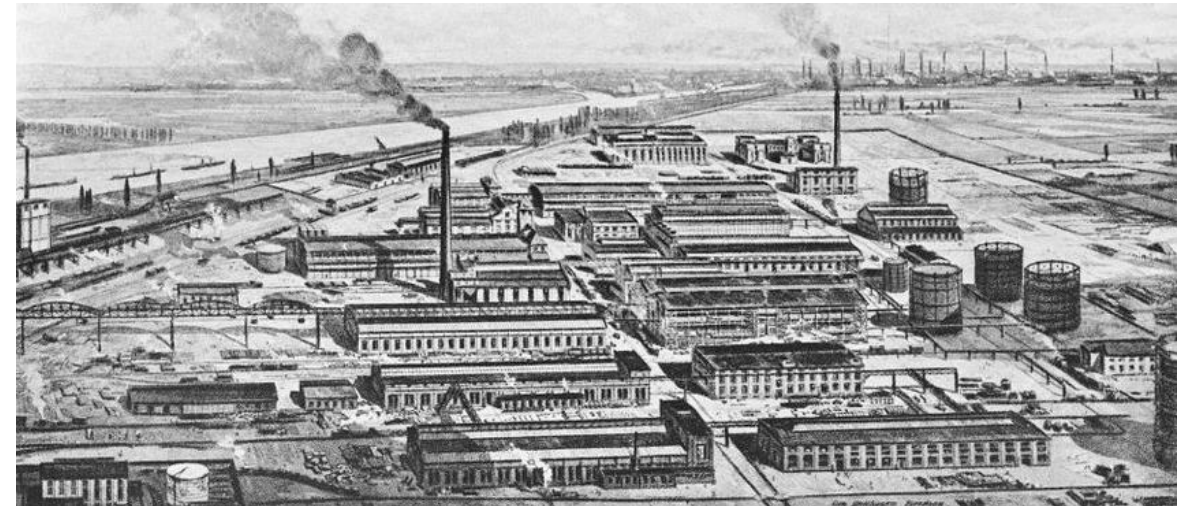


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- Industrial synthetic ammonia synthesis **+110 yrs**
 - Haber Bosch process
- Significant advances in process, catalyst, feedstock, efficiency etc.



Energy consumption of synthetic nitrogen fixation
K. Rouwenhorst et.al. 2020

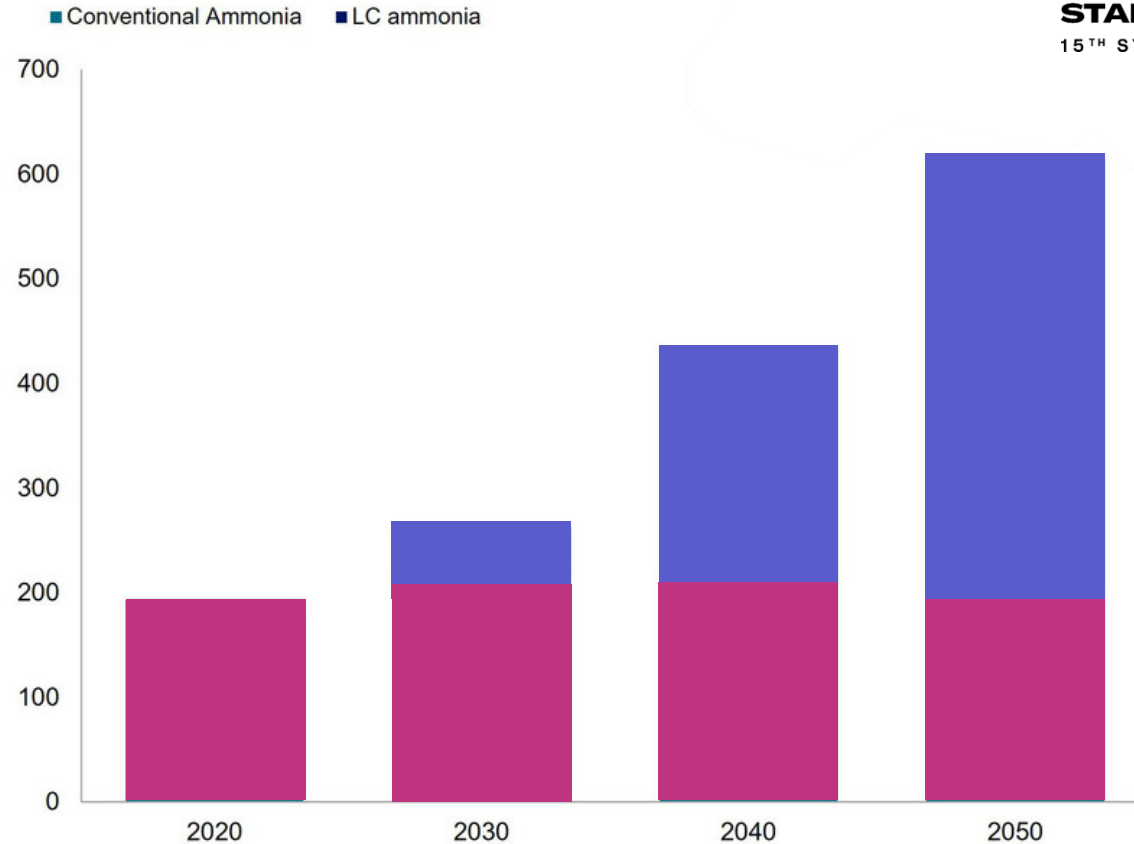


BASF ammonia plant at Oppau, Germany

INTRODUCTION

- Global ammonia demand:
 - **double or triple by 2050**
- New use cases:
 - Shipping fuel
 - Hydrogen/energy carrier
 - Cracking/co-firing
- New drive:
 - Paris climate agreement
 - Reduce carbon intensity
 - Green ammonia (carbon free)
 - Blue ammonia (using CCSU)
- More greenfield stand-alone NH₃ plants
 - Integration become imperative
- NEXTCHEM: One stop-shop fully integrated ammonia and fertilizer plants

Global ammonia demand (excluding urea)
MMt



As of June 2023.
Source: S&P Global Commodity Insights

CCSU: Carbon capture, storage & utilisation



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02



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NX STAMI™ AMMONIA MP SYNLOOP

NX STAMI™ AMMONIA MP SYNTHESIS LOOP

- Suitable for medium to large capacity ammonia plants, up to 3500 MTPD
- Strong technology reference (> 45^{15TH} operational plants, fossil based)
- Operates at medium pressure ≤160 bar, with high plant flexibility between 30-110%
- Proprietary converter design (Radial Flow) to allow high single pass conversion and minimal pressure drop
- Opex and Capex optimised and highly internally integrated, very attractive for higher capacity plants
- HP steam generation for running internal compressor duties or electricity generation



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NX STAMI™ AMMONIA MP KEY BENEFITS

- High feedstock utilisation efficiency
- Intrinsically safe catalyst operation: longer catalyst lifetime
- Low cooling water circulation rate
- High per-pass hydrogen conversion
- Full flexibility between efficient warm and cold ammonia production
- Proprietary equipment is limited to converter



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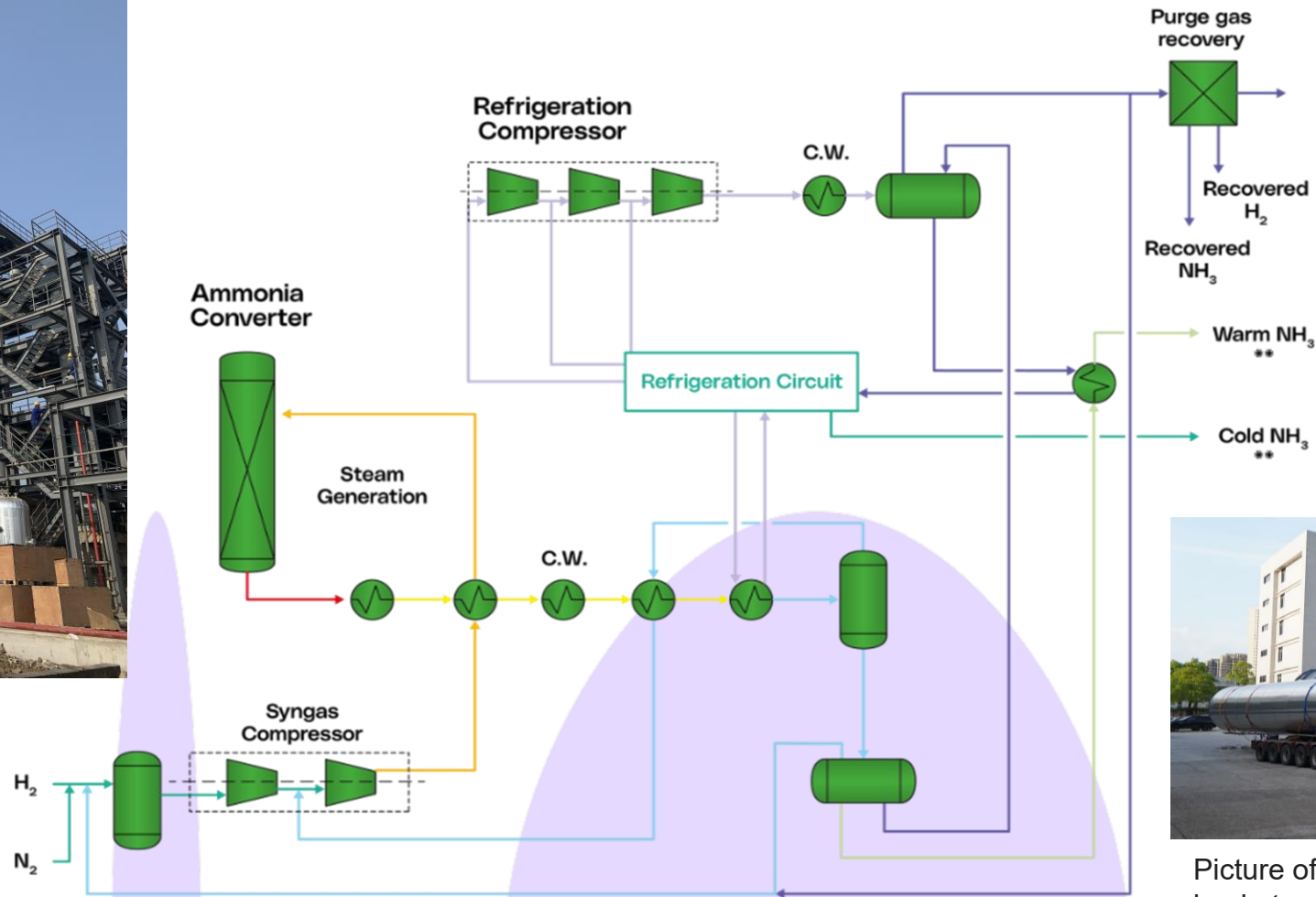
NX STAMI™ AMMONIA MP SYNTHESIS LOOP



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Picture of plant Xuzhou
Longxintai plant licensed by
Anchun

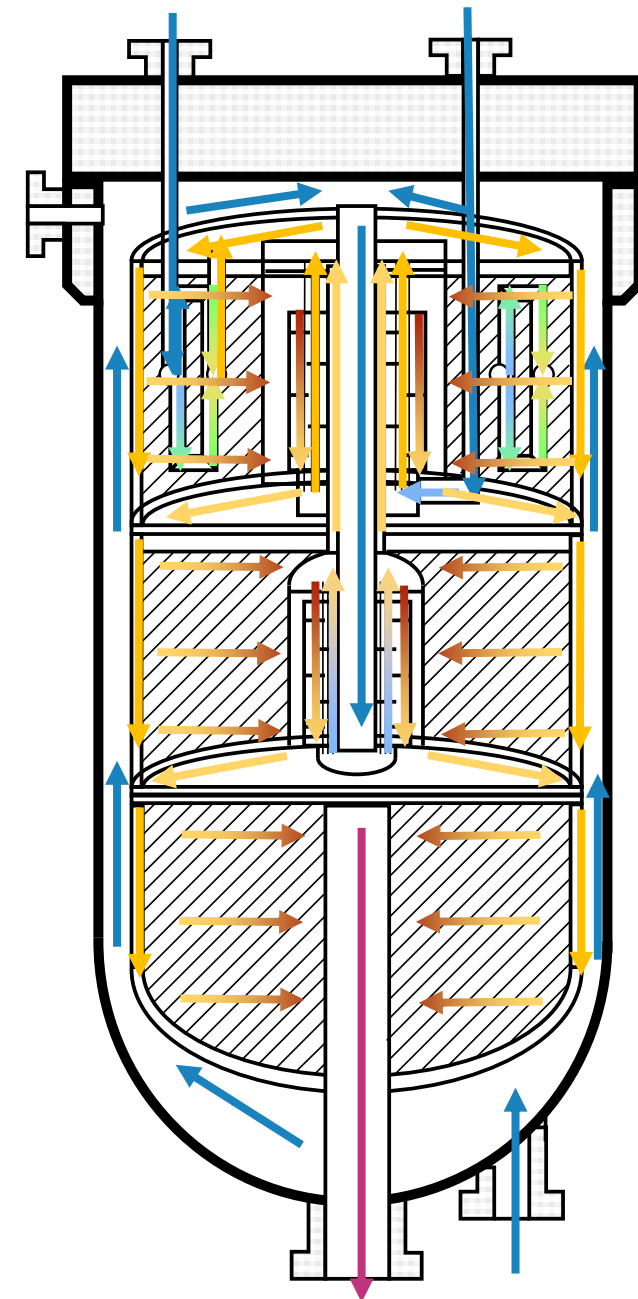
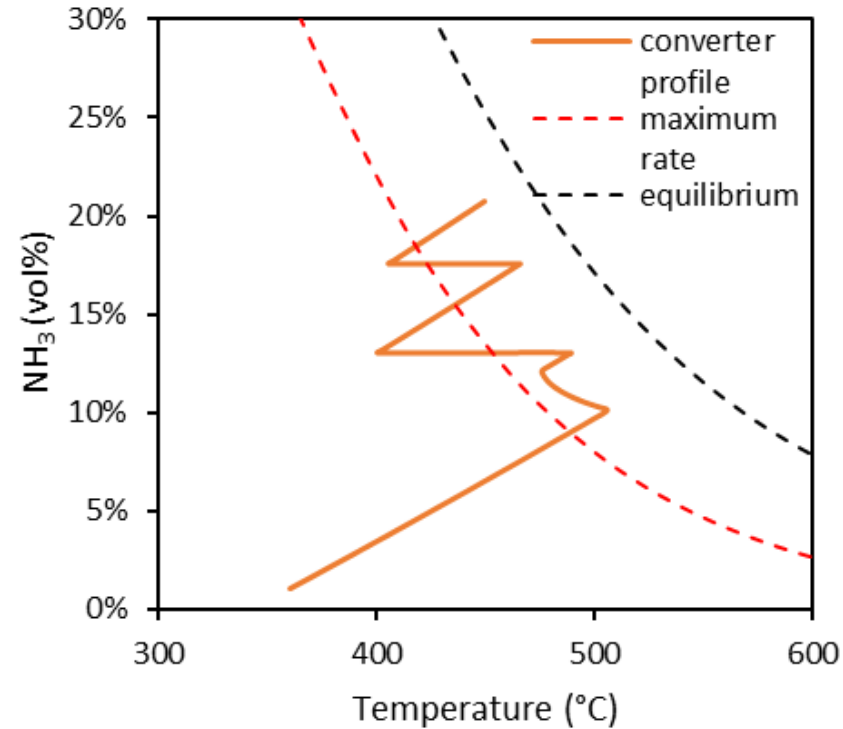


Picture of Guanxi Henyi ammonia converter
basket manufactured by Anchun

NX STAMI™ AMMONIA MP CONVERTER

HIGHLIGHTS

- Three bed radial flow design
- 2 interbed heat-exchangers
- 1 submerged intrabed heat-exchanger
- Preheat feed and cool converter bed effluent to increase conversion
- Protect catalyst from overheating / sintering



NX STAMI™ AMMONIA MP REFERENCES



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no.	Company Name	Reactor size	Start-up date	Production MTPD
1	Hebei Chengxin	DN1800	nov-23	480
2	Hebei Chengxin	DN1600	nov-23	300
3	Hebei Zhongkefufeng	DN1200	okt-23	150
4	Guizhou Qixin	DN2200	apr-23	780
5	Pingdingshan Dongxin	DN1600	mrt-23	270
6	Shangxi Yaxin	DN1600	feb-23	300
7	Ningxia Yongli	DN2000	jan-23	600
8	Shanxi Mingguang	DN1600	dec-22	300
9	Neimenggu Qinghua Wusitai	DN1800	sep-22	540
10	Shanxi Shengxin	DN2000	aug-22	600
11	Guangxi Hengyi	DN2300	mei-22	900
12	Hebei Dingzhou Tianlu	DN1600	mrt-22	300
13	Jiangsu Yizhou	DN1600	jan-22	300
14	Fushan Yuechenxintai	DN1600	dec-21	300
15	Shanxi Gengyang	DN1600	nov-21	330
16	Etuokeqi Xinhang	DN1200	okt-21	150
17	Neimenggu Guangju	DN2000	aug-21	600
18	Xuzhou Longxingtai	DN1600	jul-21	333
19	Alashanmeng Donghai	DN1600	jun-21	333
20	Neimanggu Dongri	DN1600	mei-21	300
21	Jintaoyuan	DN1800	apr-21	666
22	Shandong Zhangqiu Riyue	DN2200	jun-24	720
23	Hejing Yumenkou	DN1600	mrt-21	333
24	Shanxi Junjie	DN1400	jan-21	266
25	Neimenggu Heimao	DN1600	dec-20	333

no.	Company Name	Reactor size	Start-up date	Production MTPD
26	Shanxi Tongzhou	DN1600	dec-20	333
27	Chifeng Zhongji	DN2300	nov-20	866
28	Baogang Qinghua	DN1600	nov-20	333
29	Xinjiang Wangjing	DN1600	okt-20	433
30	Xiaoyi Jinyan	DN2000	okt-20	666
31	Hejin Huayuan	DN1600	jun-20	333
32	Shanxi Yaxin	DN1400	mrt-20	266
33	Hebei Fengmei	DN1400	sep-19	266
34	Datang Dingwang	DN1800	jul-19	1000
35	Henan XLX	DN2200	jun-19	1000
36	Shandong Jining	DN1200	mei-19	166
37	Jiangsu Huachang	DN2000	jan-19	600
38	Sichuan Guagyu C	DN1600	dec-18	400
39	Hebei Lingang	DN2000	jun-18	500
40	Yingcheng Xindu	DN2200	feb-18	1000
41	Jiangsu Huachang	DN1800	nov-17	500
42	Zhisheng	DN2200	okt-17	600
43	Zhejiang Petroleum	DN2300	jun-17	1000
44	SD Steel Rizhao	DN2000	jun-17	500
45	Yangmei Pingyuan	DN1800	apr-17	500
46	Jiangsu Haili	DN2500	jan-17	1400
47	Inner Mongolia E	DN1600	jan-17	333
48	Shanxi Tianze	DN3000	okt-16	1500
49	Shangxi Longmen	DN2800	sep-16	1000
50	Haohua Junma	DN2800	feb-16	1000

CAPACITIES

- More than 7 plants above 1000 mtpd Capacity
- **15 plants** between **500 and 1000 mtpd**
- Around **17 plants** between **300 and 500 mtpd**
- **11 plants** between **150 and 300 mtpd.**
- All plants built in the last **10-15 years**

NX STAMI™ AMMONIA MP CAPACITY



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- up to **3500 MTPD** ammonia
- Largest converter in operation:
 - Shanxi Tianze Coal Corporation
 - ID: 3000 mm
 - TL-TL: 30 m
- Operating capacity: 1650 MTPD with 16% inert gases
- Under low-inert operation maximum capacity of the basket: **2950 MTPD**

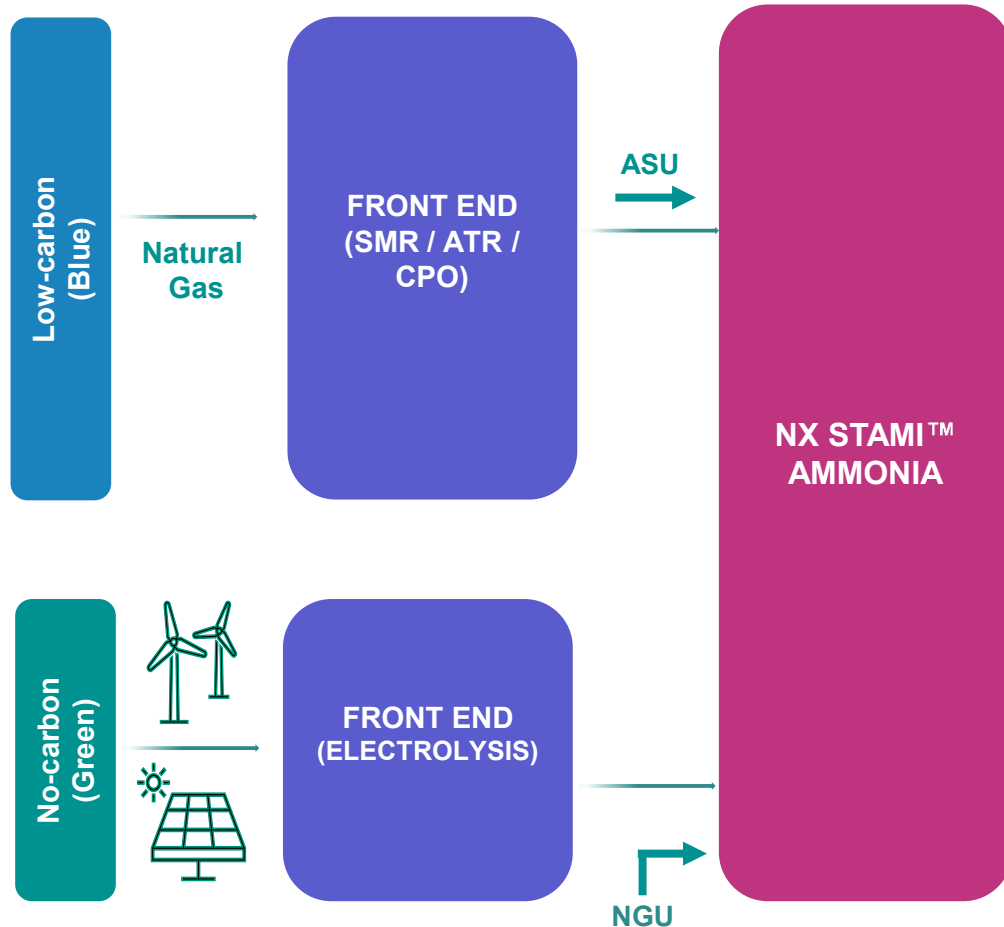


FRONT-END INTEGRATION

NX STAMI™ AMMONIA



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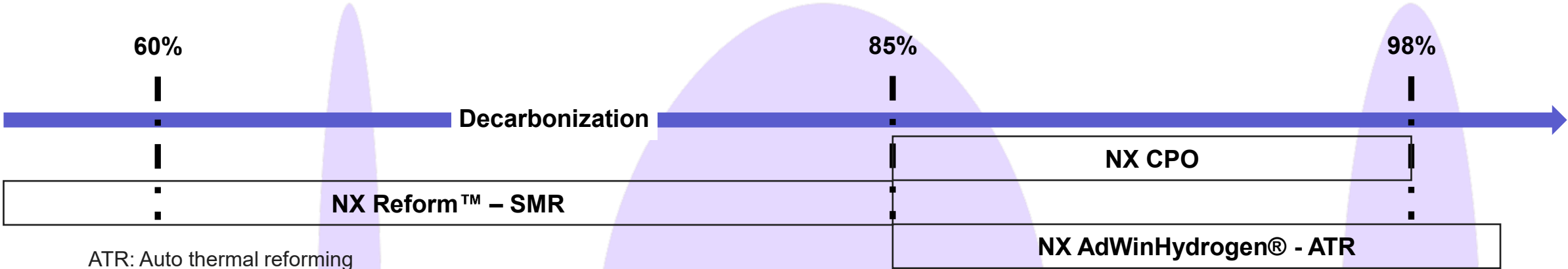
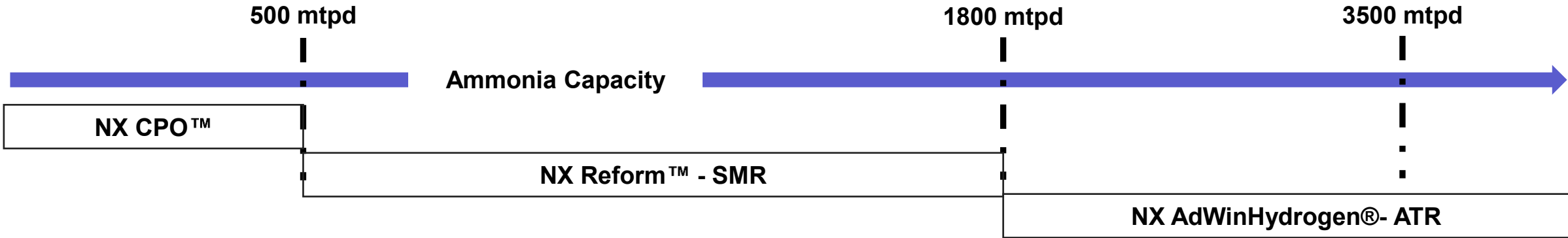
- Front end by NEXTCHEM sister company
 - NX AdWinHydrogen® ATR for blue and high capacity
 - **NX Reform™** for mid-range capacity
 - **NX CPO™** for low capacities
 - **HyDep** electrolysis for green
- NEXTCHEM offers efficient solutions for blue and low carbon ammonia synthesis plants based on natural gas feedstock
- NX STAMI™ Ammonia MP is also suitable downstream of coal gasification

ATR: Auto thermal reforming
CPO: Catalytic partial oxidation
MP: Medium pressure (~150 bar)

CAPACITY RANGES AND DECARBONISATION



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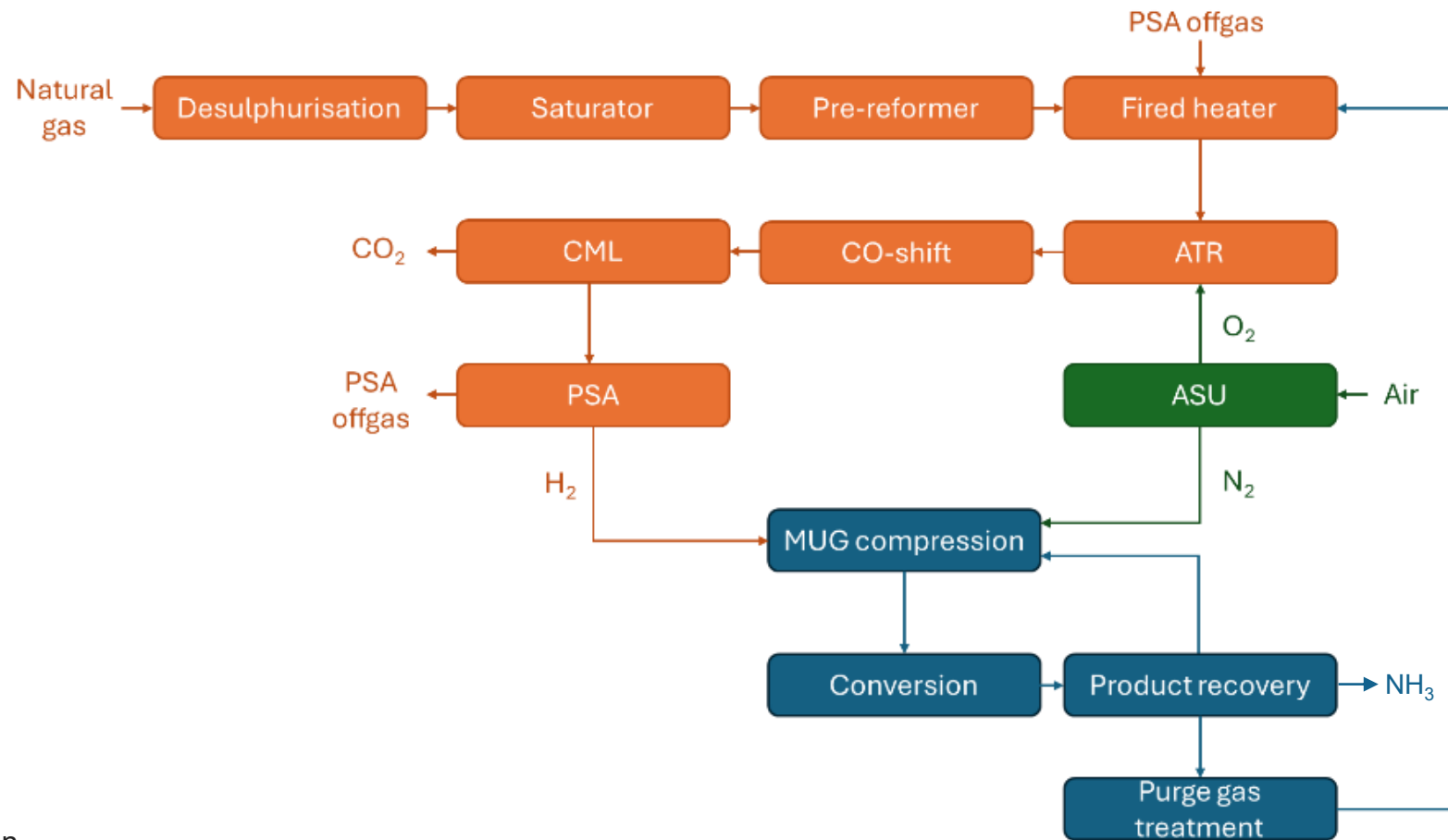


ATR: Auto thermal reforming
SMR: Steam methane reforming
CPO: Catalytic partial oxidation

NEXTCHEM LARGE-SCALE BLUE AMMONIA



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PSA: Pressure swing adsorption
CML: Cold methanol loop
ASU: Air separation unit
MUG: Make-up gas

NEXTCHEM INTEGRATED UREA PRODUCTION



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 **NEXTCHEM**



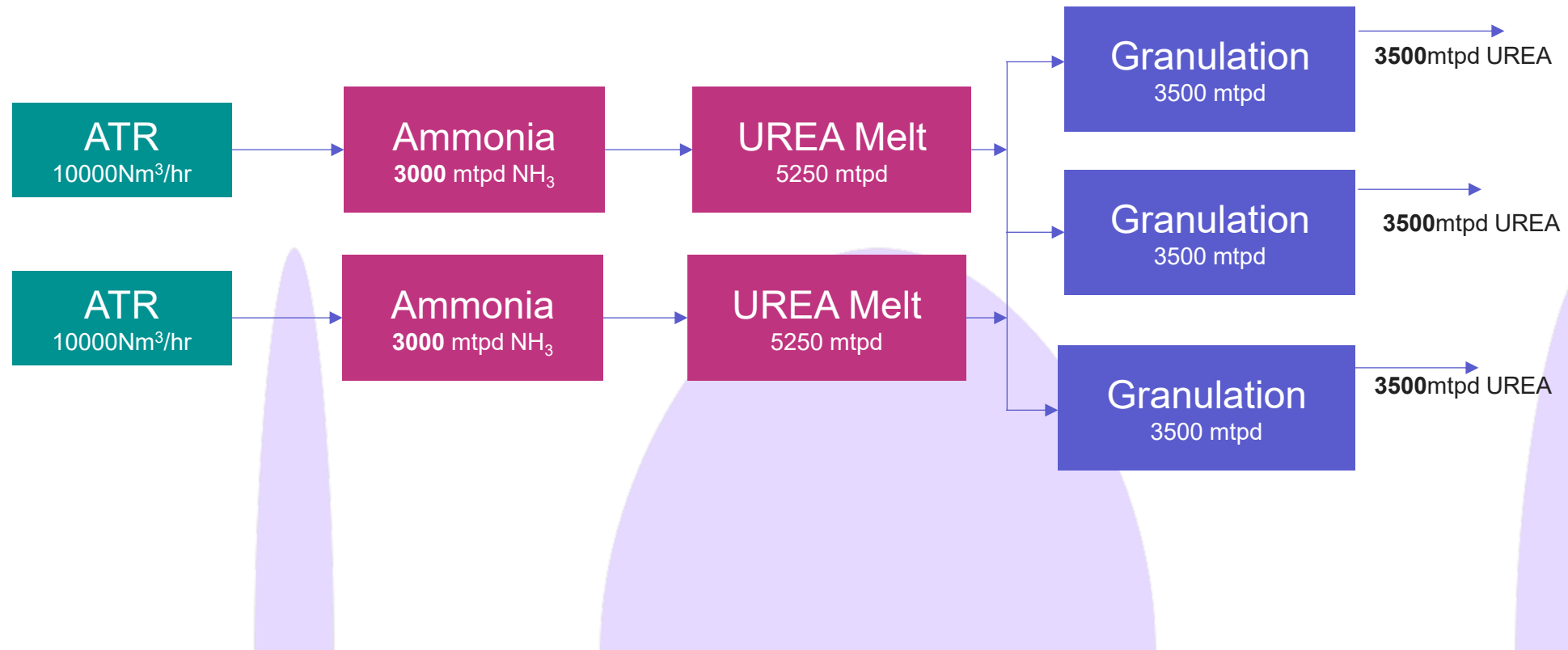
PRESS RELEASE

NEXTCHEM awarded €485 million contract for licensing, PDP and critical proprietary equipment based on its proprietary hydrogen, ammonia, urea, and methanol technologies for three world-scale complexes in West Africa

NEXTCHEM INTEGRATED UREA PRODUCTION



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NEXTCHEM INTEGRATED UREA PRODUCTION



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Grey Ammonia Cost of Production

NX STAMI™ AMMONIA as Lowest Cost of Production!!

Blue Ammonia Cost of Production

Figure 8 Grey Ammonia Cost of Production, USGC
(dollars per ton)

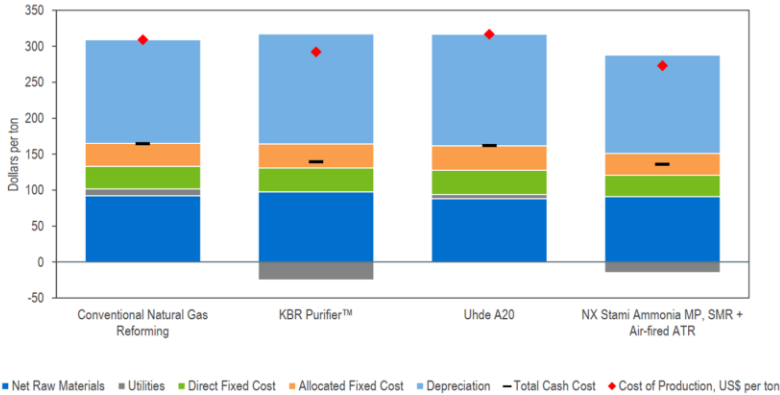
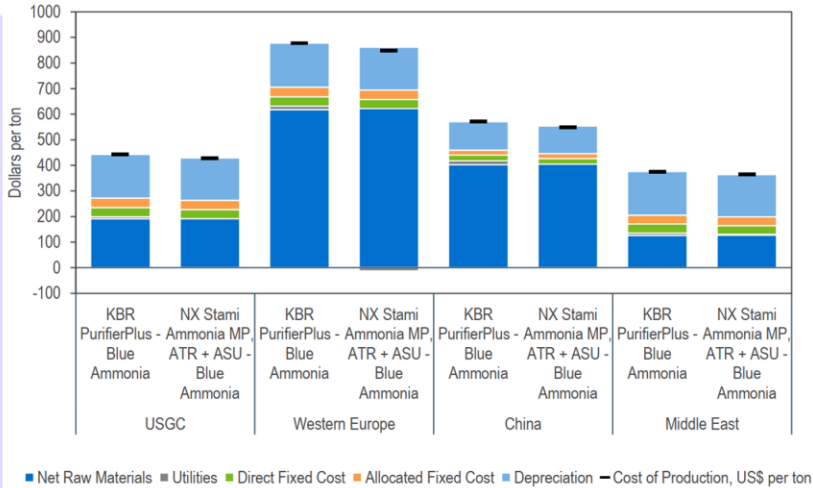


Figure 97 Blue Ammonia Cost of Production, All Regions
(dollars per ton)



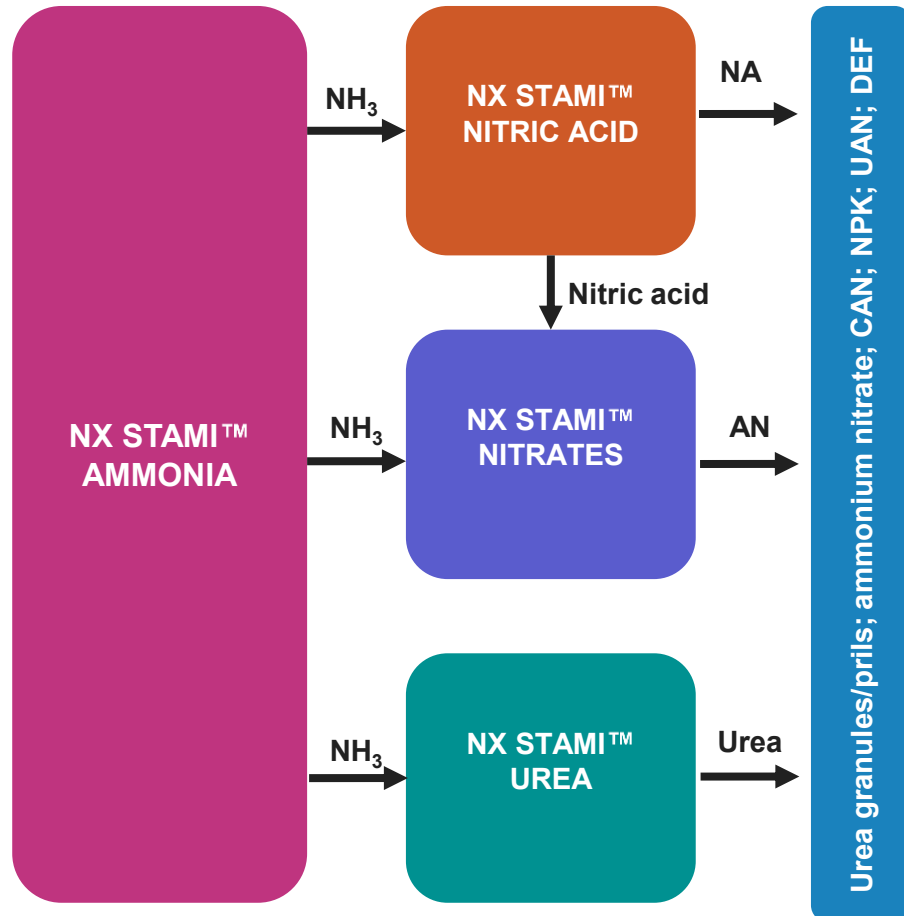


BACK-END INTEGRATION

NX STAMI™ FERTILISER COMPLEX



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- Back end by Stamicarbon and NEXTCHEM
 - **NX STAMI™ UREA**
 - **NX STAMI™ NITRIC ACID**
 - **NX STAMI™ AMMONIUM NITRATE**
- NEXTCHEM offers full downstream conversion into all common fertilizer grades
- Most technologies inhouse in Stamicarbon some collaboration with Balestra

NA: Nitric acid
AN: Ammonium nitrate
CAN: calcium ammonium nitrate
NPK: Nitrogen Phosphorus Potassium
UAN: Urea ammonium nitrate
DEF: Diesel exhaust fluid (AdBlue™)

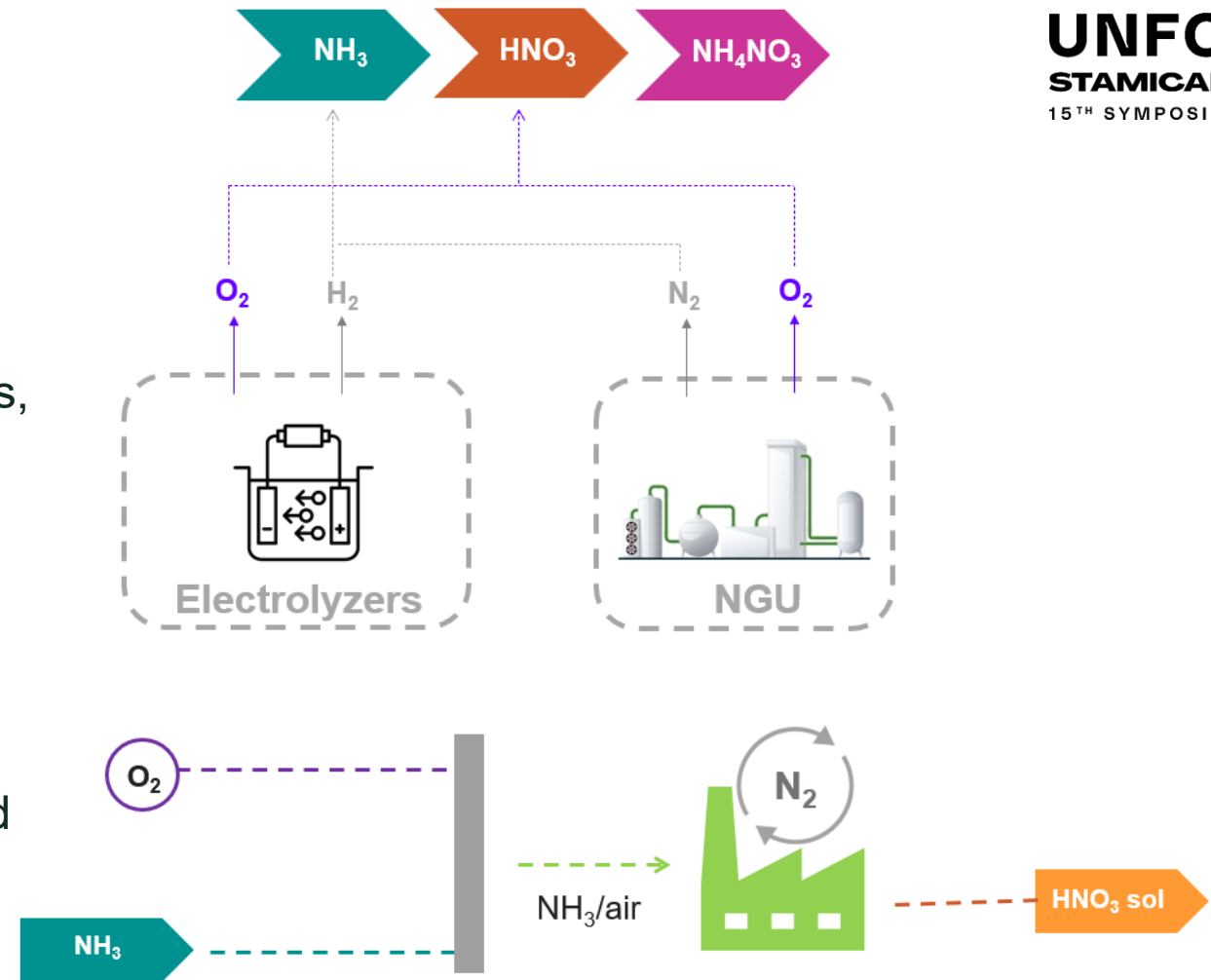
FULLY DECARBONISED FERTILIZERS: AN-BASED



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HIGHLIGHTS

- Ammonium nitrate based fertilizers are inherently carbon-free
- If ammonia is made from renewable sources, the full fertilizer chain can be decarbonized
- This offers perfect integration with the NX STAMI™ Nitrates - Total recycle NA plant concept
- All oxygen for nitric acid synthesis is derived from electrolyzer and ASU
- Nextchem can offer the full value chain



05



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CONCLUSIONS

CONCLUSIONS

- Nextchem offers full technology solutions for:
 - Green and blue (low carbon) ammonia production
 - Fully integrated low carbon fertilizer complexes
 - **Urea**
 - **Ammonium nitrate-based**
 - **UAN**
 - **DEF**

“The whole is greater than the sum of its parts”

– Aristotle, “Metaphysics”

THANK YOU



QUESTIONS?