

How to Start Manufacturing Industries

UREA

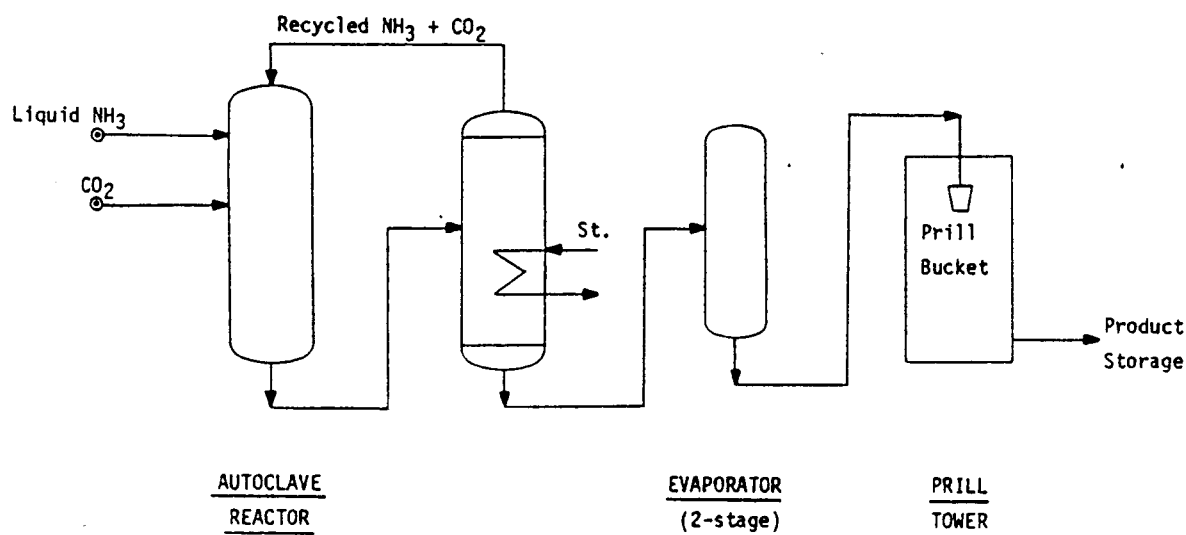
Process Description

Ammonia and carbon dioxide are compressed to a pressure in the range of 150-220 bar and a temperature of 180-220°C, an exothermic reaction occurs to form carbonate which is then dehydrated to urea.

The unconverted carbonate and excess reactants are removed in the solution purification stages and returned to the reaction system. The urea solution is evaporated to achieve required concentration for fertiliser or technical grade urea. If a low biuret content is required, the product is concentrated by crystallisation. The final shaping of the product is almost always done by prilling.

Uses

Urea is used mainly as a fertiliser. In recent years, the demand for urea as a supplement in cattle feed has been steadily growing. Another important use is in formaldehyde resins.



Land area for 500 000 tonnes per year of urea would be approximately 8 000 square metres. Capacities as low as 7 000 tonnes per year are technically feasible.

This information has been prepared for UNIDO by Chem Systems International Ltd., United Kingdom.

Any inquiry about the information contained should be sent to: IO/COOP, Registry file No. ID/562/12, UNIDO, P.O. Box 300, A-1400, Vienna, Austria.

COST OF PRODUCTION ESTIMATE FOR UREA
(EXPRESSED IN CONSTANT 1980 US DOLLARS)

PROCESS - STRIPPING PROCESS

BASIS	CAPITAL COST	\$ MILL
LOCATION- BENELUX	BATTERY LIMITS	41.37
CAPACITY- 500 000 TONNES PER YEAR	OFFSITES	28.83
PRODUCTN- 500 000 TONNES PER YEAR		
YEAR - 1980	TOTAL FIXED INV.	70.20
STR.TIME- 8000 HOURS PER YEAR	WORKING	54.97

RAW MATERIALS	QUANTITY/TONNE	PRICE*	ANNUAL COST	UNIT* COST
AMMONIA	.6000 TONNE	195.000	58 500 000	
CARBON DIOXIDE	.7600 TONNE	205.000	77 900 000	
CATALYST+CHEMS	.1254 DOLLARS	1.000	62 700	

TOTAL RAW MATERIALS	136 462 700	272.93
UTILITIES		

POWER	.1250 MWH	61.500	3 843 750	
COOLING WATER	.0550 KTONNE	17.000	467 500	
MP.STEAM	1.0000 TONNE	19.200	9 600 000	

TOTAL UTILITIES COST	13 911 250	27.82
OPERATING COSTS		

LABOUR	24.00 MEN @ 17 700 \$/YEAR	424 800	
SUPERVISION	1.00 MEN @ 29 200 \$/YEAR	29 200	
MAINTENANCE	@ .04xBLCC	1 654 783	

TOTAL OPERATING COST	2 108 783	4.22
OVERHEAD EXPENSES		

DIRECT OVERHEAD	@ .400x LAB+SUPERVISION	181 600	
GEN PLANT OVERHEAD	@ .650x OPERATING COSTS	1 370 709	
INSURANCE+PTY TAX	@ .015x TOTAL FIXED CAP	1 053 043	
DEPRECIATION	@ .100x BLCC+ .050xOFFS	5 578 623	
INTEREST	@ .100x WORKING CAPITAL	5 497 042	

TOTAL OVERHEAD EXPENSES	13 681 017	27.36
BYPRODUCT CREDIT		

LP.STEAM	.1500 TONNE	16.700	1 252 500	
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TOTAL BYPRODUCT CREDIT	1 252 500	2.50
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NET COST OF PRODUCTION	164 911 250	329.82
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VARIABLE COST OF PRODUCTION	298.24
CASH COST OF PRODUCTION	318.67
TRANSFER PRICE @ 10.0PC RETURN ON FIXED INV	343.86
TRANSFER PRICE @ 15.0PC RETURN ON FIXED INV	350.88
TRANSFER PRICE @ 20.0PC RETURN ON FIXED INV	357.90

* \$/UNIT. TONNE=METRIC TON=2204.6 LB.

LONG FACTOR 0.65

STRIPPING PROCESS

UREA

VARIAION ANALYSIS FOR

CASE NO. 1 2 3 4 5 6 7

TONNES PER ANNUM

PLANT CAPACITY 500000 500000 500000 500000 400000 300000 200000
PLANT OUTPUT 500000 425000 375000 300000 400000 300000 200000

MILLION DOLLARS

CAPITAL COST
B.O.C.C. 41.4 41.4 41.4 41.4 35.8 29.7 22.8
OFFSITES 28.8 28.8 28.8 28.8 24.9 20.7 15.9
TOTAL FIXED 70.2 70.2 70.2 70.2 60.7 50.4 38.7
WORKING 55.0 47.3 42.1 34.4 44.3 33.5 22.7

DOLLARS PER TONNE PRODUCT - (BASED ON AMMONIA AT \$195/TONNE)

RAW MATERIALS 272.9 272.9 272.9 272.9 272.9 272.9 272.9
UTILITIES 27.8 27.8 27.8 27.8 27.8 27.8 27.8
BYPROD. CREDIT -2.5 -2.5 -2.5 -2.5 -2.5 -2.5 -2.5

VARIABLE COST 298.2 298.2 298.2 298.2 298.2 298.2 298.2
OPERATION 4.2 5.0 5.6 7.0 4.7 5.5 6.8
OVERHEAD(EXCL. DEPR) 16.2 17.2 18.2 20.2 16.9 17.8 19.6

CASH COST 318.7 320.5 322.0 325.4 319.8 321.6 324.7
DEPRECIATION 11.2 13.1 14.9 18.6 12.1 13.3 15.4

NET COST OF PRODN 329.8 333.6 336.9 344.0 331.9 334.9 340.0
RETURN ON INVESTMENT 21.1 24.8 28.1 35.1 22.8 25.2 29.0
(AT 15% ON TOTAL FIXED INVESTMENT)

TRANSFER PRICE 350.9 358.4 365.0 379.1 354.6 360.1 369.1

EFFECT OF AMMONIA PRICE VARIATION

PRICE CHANGE +20% -20% +20% -20% +20% -20% +20% -20% +20% -20% +20% -20%
RM PRICE \$/TONNE 234.0 156.0 234.0 156.0 234.0 156.0 234.0 156.0 234.0 156.0 234.0 156.0
NET COST OF PRODN 353.2 306.4 357.0 310.2 360.3 313.5 367.4 320.6 355.3 308.5 358.3 311.5
TRANSFER PRICE 374.3 327.5 381.8 335.0 388.4 341.6 402.5 355.7 378.0 331.2 383.5 336.7