**Market Environment**

The installed capacity of Ammonium Nitrate in India was 1,098 thousand metric tons in FY2015 which increased to 1,100 thousand metric tons in FY2021. The installed capacity of Ammonium Nitrate is further expected to increase to 1,587 thousand metric tons by FY2025.

The production of Ammonium Nitrate in India stood at 575 thousand metric tons in FY2015, further increasing to 744 thousand metric tons in FY2021. The production of Ammonium Nitrate in India is anticipated to reach to 1,217 thousand metric tons by FY2030.

In India, ammonium nitrate domestic consumption stood at 933 thousand metric tons in FY2021, it is expected that domestic consumption of ammonium nitrate will increase at a CAGR of 7.8% by FY2030F and reach up to 1,814 thousand metric tons.

**Demand-Supply Gap**

TechSci has followed three approaches which are realistic approach (forecast CAGR of 7.8%), optimistic approach (forecast CAGR of 10.8%), and pessimistic approach (forecast CAGR of 6.4%). The pessimistic approach is based on the historic CAGR considering business as usual.

**Realistic Approach @CAGR 7.8% (Historical CAGR has been @6.6%)**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | FY15 | FY16 | FY17 | FY18 | FY19 | FY20 | FY21 | FY22 |
| Capacity | 1,098 | 1,098 | 1,098 | 1,098 | 1,098 | 1,098 | 1,100 | 1,211 |
| Production | 575 | 616 | 637 | 719 | 837 | 700 | 744 | 888 |
| Operating rate (%) | 52% | 56% | 58% | 65% | 76% | 64% | 68% | 73% |
| Import | 90 | 190 | 326 | 220 | 273 | 268 | 218 | - |
| Export | 12 | 22 | 22 | 26 | 31 | 21 | 14 | - |
| Inventory | 11 | 12 | 13 | 14 | 17 | 14 | 15 | - |
| Domestic Consumption | 641 | 771 | 928 | 898 | 1,062 | 933 | 933 | 993 |
| Demand Supply Gap | - | - | - | - | - | - | - | -105 |
|  | **FY23** | **FY24** | **FY25** | **FY26** | **FY27** | **FY28** | **FY29** | **FY30** |
| Capacity | 1,211 | 1,587 | 1,587 | 1,587 | 1,587 | 1,587 | 1,587 | 1,587 |
| Production | 888 | 1,056 | 1,088 | 1,107 | 1,127 | 1,168 | 1,198 | 1,217 |
| Operating rate (%) | 73% | 67% | 69% | 70% | 71% | 74% | 75% | 77% |
| Import | - | - | - | - | - | - | - | - |
| Export | - | - | - | - | - | - | - | - |
| Inventory | - | - | - | - | - | - | - | - |
| Domestic Consumption | 1,059 | 1,134 | 1,217 | 1,310 | 1,415 | 1,533 | 1,665 | 1,814 |
| Demand Supply Gap | -172 | -78 | -129 | -204 | -288 | -365 | -467 | -597 |

*References: TechSci Analysis, Secondary Sources, Primary Interviews*

**Optimistic Approach @CAGR 10.8% (Historical CAGR has been @6.6%)**

**India Ammonium Nitrate Market, Demand-Supply Gap, By Volume (Thousand MT)**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | FY15 | FY16 | FY17 | FY18 | FY19 | FY20 | FY21 | FY22 |
| Capacity | 1,098 | 1,098 | 1,098 | 1,098 | 1,098 | 1,098 | 1,100 | 1,211 |
| Production | 575 | 616 | 637 | 719 | 837 | 700 | 744 | 888 |
| Operating rate (%) | 52% | 56% | 58% | 65% | 76% | 64% | 68% | 73% |
| Import | 90 | 190 | 326 | 220 | 273 | 268 | 218 | - |
| Export | 12 | 22 | 22 | 26 | 31 | 21 | 14 | - |
| Inventory | 11 | 12 | 13 | 14 | 17 | 14 | 15 | - |
| Domestic Consumption | 641 | 771 | 928 | 898 | 1,062 | 933 | 933 | 999 |
| Demand Supply Gap | - | - | - | - | - | - | - | -112 |
|  | **FY23** | **FY24** | **FY25** | **FY26** | **FY27** | **FY28** | **FY29** | **FY30** |
| Capacity | 1,211 | 1,587 | 1,587 | 1,587 | 1,587 | 1,587 | 1,587 | 1,587 |
| Production | 888 | 1,056 | 1,088 | 1,107 | 1,127 | 1,168 | 1,198 | 1,217 |
| Operating rate (%) | 73% | 67% | 69% | 70% | 71% | 74% | 75% | 77% |
| Import | - | - | - | - | - | - | - | - |
| Export | - | - | - | - | - | - | - | - |
| Inventory | - | - | - | - | - | - | - | - |
| Domestic Consumption | 1,079 | 1,318 | 1,455 | 1,582 | 1,725 | 1,886 | 2,068 | 2,275 |
| Demand Supply Gap | -192 | -262 | -367 | -475 | -597 | -718 | -871 | -1,059 |

*References: TechSci Analysis, Secondary Sources, Primary Interviews*

**Pessimistic Approach @CAGR 6.4% (Historical CAGR has been @6.4%)**

**India Ammonium Nitrate Market, Demand-Supply Gap, By Volume (Thousand MT)**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | FY15 | FY16 | FY17 | FY18 | FY19 | FY20 | FY21 | FY22 |
| Capacity | 1,098 | 1,098 | 1,098 | 1,098 | 1,098 | 1,098 | 1,100 | 1,211 |
| Production | 575 | 616 | 637 | 719 | 837 | 700 | 744 | 888 |
| Operating rate (%) | 52% | 56% | 58% | 65% | 76% | 64% | 68% | 73% |
| Import | 90 | 190 | 326 | 220 | 273 | 268 | 218 | - |
| Export | 12 | 22 | 22 | 26 | 31 | 21 | 14 | - |
| Inventory | 11 | 12 | 13 | 14 | 17 | 14 | 15 | - |
| Domestic Consumption | 641 | 771 | 928 | 898 | 1062 | 933 | 933 | 980 |
| Demand Supply Gap | - | - | - | - | - | - | - | -92 |
|  | **FY23** | **FY24** | **FY25** | **FY26** | **FY27** | **FY28** | **FY29** | **FY30** |
| Capacity | 1,211 | 1,587 | 1,587 | 1,587 | 1,587 | 1,587 | 1,587 | 1,587 |
| Production | 888 | 1,056 | 1,088 | 1,107 | 1,127 | 1,168 | 1,198 | 1,217 |
| Operating rate (%) | 73% | 67% | 69% | 70% | 71% | 74% | 75% | 77% |
| Import | - | - | - | - | - | - | - | - |
| Export | - | - | - | - | - | - | - | - |
| Inventory | - | - | - | - | - | - | - | - |
| Domestic Consumption | 1,032 | 1,090 | 1,155 | 1,228 | 1,309 | 1,399 | 1,501 | 1,614 |
| Demand Supply Gap | -144 | -34 | -67 | -121 | -181 | -232 | -303 | -397 |

*References: TechSci Analysis, Secondary Sources, Primary Interviews*

**Even while considering the pessimistic approach, taking the forecast CAGR of 6.4% there is still a significant demand supply gap of 397 thousand metric tons by FY2030 and so a scope for KRIBHCO to operate in the market.**

In India, weak nitric acid domestic consumption stood at 1,456 thousand metric tons in FY2021 growing from 1,275 thousand metric tons with a CAGR of 2.2%. The major demand for WNA comes from the ammonium nitrate industry which constitute approximately 39% of overall domestic consumption followed by fertilizers manufacturing with 26% market share. Other consumption sectors are concentrated nitric acid manufacturing, dyes & paints, explosives, nitroaromatics, etc. manufacturing. Owing to the increasing demand for weak nitric acid from end use segments, it is expected that domestic consumption will increase at a CAGR of 4.8% by FY2030F reaching up to 2,414 thousand metric tons.

**India Weak Nitric Acid Market, Demand-Supply Gap, By Volume (Thousand MT)**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | FY15 | FY16 | FY17 | FY18 | FY19 | FY20 | FY21 | FY22 |
| Capacity | 1,628 | 1,628 | 1,628 | 1,628 | 1,810 | 1,810 | 1,814 | 1,814 |
| Production | 1,319 | 1,399 | 1,421 | 1,546 | 1,596 | 1,553 | 1,471 | 1,565 |
| Operating rate (%) | 81% | 86% | 87% | 95% | 88% | 86% | 81% | 86% |
| Import | 0 | 0 | 4 | 27 | 36 | 30 | 26 | - |
| Export | 17 | 14 | 11 | 16 | 11 | 13 | 12 | - |
| Inventory | 26 | 28 | 28 | 31 | 32 | 31 | 29 | - |
| Domestic Consumption | 1,275 | 1,357 | 1,385 | 1,527 | 1,589 | 1,539 | 1,456 | 1,660 |
| Demand Supply Gap | - | - | - | - | - | - | - | -95 |
|  | **FY23** | **FY24** | **FY25** | **FY26** | **FY27** | **FY28** | **FY29** | **FY30** |
| Capacity | 1,814 | 2,111 | 2,177 | 2,177 | 2,177 | 2,177 | 2,177 | 2,177 |
| Production | 1,565 | 1,704 | 1,782 | 1,852 | 1,904 | 1,904 | 1,931 | 1,931 |
| Operating rate (%) | 86% | 81% | 82% | 85% | 87% | 87% | 89% | 89% |
| Import | - | - | - | - | - | - | - | - |
| Export | - | - | - | - | - | - | - | - |
| Inventory | - | - | - | - | - | - | - | - |
| Domestic Consumption | 1,797 | 1,950 | 2,250 | 2,268 | 2,293 | 2,325 | 2,365 | 2,414 |
| Demand Supply Gap | -232 | -246 | -468 | -416 | -389 | -421 | -433 | -483 |

*References: TechSci Analysis, Secondary Sources, Primary Interviews*

As of FY2022 there is demand-supply gap in weak nitric acid; there is a shortage of supply by 95 thousand metric tons. However, the gap is expected to increase in the forecast period owing to the increasing demand from ammonia nitrate and fertilizers applications sectors. The market is estimated to observe a demand-supply gap of 483 thousand metric by FY2030.

A high demand-supply gap exists starting from 95KMT in 2022 and reaching 483KMT in 2030

**Strategic Relevance of Proposed Locations Shahjahanpur Vs Hazira**

**Shahjahanpur: Ammonium Nitrate and Weak Nitric Acid Market Coverage Based on Distance**

**Ammonium Nitrate**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Ammonium Nitrate: Demand Coverage With Respect to Distance( KM) At Proposed Facility : Shahjahanpur(Volume MT)** | | | | | | | | | | |
| **End-Use** | **%** | **MT** | **0-300** | **301-500** | **501-800** | **801-1000** | **1001-1400** | **1401-1700** | **1701-2000** | **> 2000** |
| Explosive | 8,18,399 | 88% | - | - | 2,72,799 | 2,29,152 | 2,61,887 | 54,559 | - | - |
| Mining | 42,947 | 5% | - | - | 3,767 | 21,044 | 14,473 | 2,920 | 743 | - |
| Commercial & infrastructure | 25,197 | 3% | - | - | 9,070 | 2,268 | 3,275 | 2,016 | 5291 | 3275 |
| Pharmaceuticals | 21,156 | 2% | - | 1,269 | 1,904 | 2,538 | 7,405 | 4,019 | 4019 | - |
| Others | 25,495 | 3% | - | 765 | 1,275 | 3,825 | 5,608 | 6,374 | 7649 | - |
| Domestic Demand MT | 9,33,194 | 100% | - | 2,039 | 2,88,908 | 2,58,842 | 2,92,680 | 69,759 | 17607 | 3359 |
| Domestic Demand Coverage % | | | **0%** | **0.22%** | **31%** | **28%** | 31% | 7% | 2% | 0.4% |

**Total % Demand Coverage Up to 1000 KM: 59%**

**Weak Nitric Acid**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **End-Use** | **%** | **MT** | **0-300** | **301-500** | **501-800** | **801-1000** | **1001-1400** | **1401-1700** | **1701-2000** | **> 2000** |
| **Fertilizers** | 60% | 1,38,585 | 12,472 | 15,244 | 23,559 | 18,016 | 30,489 | 13,858 | 9,702 | 15,244 |
| **CNA** | 10% | 23,098 | 692 | 5,082 | 6,006 | 1,848 | 3,233 | 2,541 | 2,309 | 1,385 |
| **Others** | 30% | 69,293 | - | 4,157 | 6,237 | 9,700 | 22,868 | 13,165 | 13,165 | - |
| **Domestic Demand** | | 2,30,975 | 13,182 | 24,486 | 35,808 | 29,566 | 56,576 | 29,552 | 25,157 | 16,648 |
| **Domestic Demand Coverage %** | | | **6%** | **11%** | **16%** | **13%** | 24% | 13% | 11% | 7% |

**Total % Demand Coverage Up to 1000 KM: 46%**

**Hazira: Ammonium Nitrate and Weak Nitric Acid Market Coverage Based on Distance**

**Ammonium Nitrate**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Ammonium Nitrate: Demand Coverage With Respect to Distance( KM) At Proposed Facility: Hazira (Volume MT)** | | | | | | | | | | | |
| **End-Use** | | **%** | **MT** | **0-300** | **301-500** | **501-800** | **801-1000** | **1001-1400** | **1401-1700** | **1701-2000** | **> 2000** |
| Explosive | 88% | | 8,18,399 | - | 136,400 | - | 253,703 | 18,823 | 81,840 | - | 327,360 |
| Mining | 5% | | 42,947 | - | 1,657 | - | 6,228 | 8,160 | 9,835 | 16,320 | 742 |
| Commercial & infrastructure | 3% | | 25,197 | 2,016 | 1,008 | 2,520 | 9,323 | 6,048 | 1,008 | - | 3,275 |
| Pharmaceuticals | 2% | | 21,156 | 4,231 | 3,597 | 1,693 | 3,597 | 6,769 | 635 | 423 | 212 |
| Others | 3% | | 25,495 | 4,589 | 3,825 | 1,785 | 4,844 | 7,904 | 1,020 | 510 | 1,020 |
| Domestic Demand MT | | | 9,33,194 | 10,805 | 146,373 | 6,030 | 277,713 | 47,769 | 94,379 | 17,404 | 332,444 |
| Domestic Demand Coverage % | | | | **1%** | **16%** | **1%** | **30%** | 5% | 10% | 2% | 36% |

**Total % Demand Coverage Up to 1000 KM: 48%**

**Weak Nitric Acid**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Demand Coverage with Respect to Distance (KM) At Proposed Facility: Hazira (Volume MT)** | | | | | | | | | | |
| End-Use | % | Volume | 0-300 | 301-500 | 501-800 | 801-1000 | 1001-1400 | 1401-1700 | 1701-2000 | > 2000 |
| Fertilizers | 60% | 1,38,585 | 29,103 | 13,858 | 18,016 | 20,788 | 18,016 | 9,702 | 5,543 | 23,559 |
| CAN | 10% | 23,098 | 1,848 | 2,541 | 2,309 | 5,774 | 4,850 | 924 | 462 | 4,389 |
| Others | 30% | 69,293 | 22,173 | 11,088 | 5,542 | 6,237 | 13,165 | 4,158 | 1,385 | 5,542 |
| Domestic Demand MT | | 2,30,975 | 53,114 | 27,476 | 25,879 | 32,803 | 36,019 | 14,786 | 7,395 | 33,503 |
| Domestic Demand Coverage % | | | **23%** | **12%** | **11%** | **14%** | 16% | 6% | 3% | 15% |

**Total % Demand Coverage Up to 1000 KM: 60%**

Key demand of Ammonium Nitrate is utilised for the demand for explosives, with Coal India Limited being the largest customer in the country capturing over 64% of the demand generated.

Majority demand for explosives comes from states such as Jharkhand, Odisha, Chhattisgarh, West Bengal, Madhya Pradesh, Telangana, Maharashtra etc.

Jharkhand holds dominating share of 26.06% in demand for explosives, followed by 24.86% of Odisha, 17.93% of Chhattisgarh, 9.93% of West Bengal etc.

**Competitive Business Environment: AN Market**

* DFPCL has maximum installed capacity (44%) and will have a share of 61% by 2030 of India’s total capacity in absence of new plant
* Except for NFL, each manufacturer operates at minimum 70% (two-third operating efficiency and will reach high operating efficiency at a level of 85% (GNFC), 90% (DFPCL), 95% (RCF) by 2030. Capacity Utilization is linked with the proximity of market (Primarily Up to 1000 KM) and market penetration
* DFPCL is only manufacturer of ammonium nitrate in prill/ granule/solid form giving it an advantage of PAN India market coverage as AN Melt has limitation of transportation beyond 1,000 KM
* DFPCL has higher market penetration primarily because of its offerings of ammonium nitrate in prill/ granule/solid form
* DFPL is the only manufacturer of Pharma-grade AN, offering it an added advantage
* Perceived quality of DFPL is high over to other manufactures
* All manufactures have disadvantages to the proximity of eastern region market. New plant DFPCL in Gopalpur, Odisha (East Coast) will offer an advantage
* GNFC, RCF, and NFL produce AN melt as an intermediatory product in the production line of calcium ammonium nitrate as fertilizer industry is their key focus although Deepak Fertilizer has their key focus on AN market
* All manufactures will get benefited as there would always be Demand Supply Gap (Optimistic, Realistic and Pessimistic)
* Export market potential is an added opportunity for all manufacturers
* Increasing Tariff on Imports will always be beneficials for all manufacturers

**Concluding Remarks**

* Overall, the AN market is expected to be approximately double from 933KMT in 2021 to 1814KMT in 2030— growing demand and advantages of ANFO over other Blasting Agents, making it a lucrative market to operate and generate revenues.
* Deepak Fertilizer is a significant competitor as it has dedicated plants to manufacture AN in both forms ( Melt and Granular) for higher market reach.
* A high demand-supply gap exists starting from 105KMT in 2022 and reaching at the level of 597KMT in 2030,considering the new plant of Deepak Fertilizer in east India by 2025.
* Even considering the unlikely scenario, such as an approved plant of Chambal Fertilizer and initiative towards higher capacity utilization of NCF, there is still a significant demand-supply gap to be capitalized by a new player with a planned capacity of 100KMT to operate at least at 50% operating efficiency. However, 2025 is expected to be a challenging year as most of the capacities will get introduced this year.
* All manufactures will be profitable as there would always be a Demand Supply Gap in all scenarios (Optimistic, Pessimistic and Realistic Scenarios, excluding the 2025 (Realistic) and 2025 and 2026( Pessimistic).
* Export market potential is an added opportunity for all manufactures.
* Increasing Tariff on Imports will always be beneficials for all manufactures.

A substantial business opportunity exists, but there would always be a threat of new players entering the market, specifically those companies with the advantage of in-house Ammonia. The early entrant will influence the entry plans of possible another entrant.

Key demand of Ammonium Nitrate is utilized for the demand for explosives—In India overall explosives market, Coal India Limited is the largest customer: over 64% of the demand. In AN based explosives market, Coal India Limited has a share of approximately 80%. Out of the total East India region demand (40%), the primary demand is from states— Jharkhand (26.06%), Odisha (24.86%), Chhattisgarh (17.93%), West Bengal (9.93%)

East India is a strategic location to be tapped. Deepak fertilizer’s new plant will have an early mover advantage.

* Overall, the WNA market is expected to be approximately 66% more, from 1,456 KMT in 2021 to 2,415 KMT in 2030
* Gujarat is the largest manufacturer of fertilizers in India accounting to more than 25% of the total production of nitrogenous as well as phosphatic fertilizers in the country. The state has more than 14% of the India's total installed capacity of fertilizers.
* Most of the WNA is used by its producers in the vertically integrated production of a wide range of chemical products such as fertilizers, ammonium nitrate, concentrated nitric acid, nitro aromatic compounds, etc.
* A high demand-supply gap exists starting from 95KMT in 2022 and reaching at the level of 483KMT in 2030,considering the new plant of Deepak Fertilizer in east India
  + Even considering the unlikely scenario, such as an approved plant of Chambal Fertilizer and GNFC, including the initiative towards higher capacity utilization of NCF, there is still a significant demand-supply gap to be capitalized by a new player with a planned capacity of 200 KMT to operate at least at 50% operating efficiency.
* Export market potential is an added opportunity for all manufactures

A substantial business opportunity exists, but there would always be a threat of new players entering the market, specifically those interested in manufacturing AN and Fertilizers. The early entrant will influence the entry plans of possible another entrant.

* Approximately 13% (231KMT) market belongs to the merchant market.
* Out of 13% merchant market, 35%(81KMT) and 27% (62KMT) is consumed in West and South region respectively. East (22%) and North India (16%) jointly contribute 38% (88KMT)

Although the cumulative merchant market of WNA in the South and East regions stands at 68%, the competitive intensity is very high because all current manufacturers are in the west region. Deepak fertilizer’s new plant will have an early mover advantage, but still, there is no player present in North India.

* In Domestic market, from the coverage point of view, (up to 1,000 KM)
  + Ammonium Nitrate: Shahjahanpur and Hazira cover 59% and 47% demand respectively
  + Weak Nitric Acid: Shahjahanpur and Hazira cover 45% and 60% respectively
* In Exports markets, Hazira has advantage because of the proximity of JNPT port.
* In the case of WNA, Kribhco will always have an advantage in Shahjahanpur because of the absence of WNA manufacturers in North India with competition from only Deepak fertilizer’s new plant in East India.
  + To operate in West and South Regions will become more complicated if the proposed plans of existing players (GNFC, RCF) see the light of implementation. In addition, the situation will become more competitive if Chambal Fertilizer’s plant becomes operational.

**TechSci recommended that Kribhco should set up AN and WNA plants at Shahjahanpur location to have more comprehensive market coverage, get competitive location advantage with an aim to generate additional revenue sources.**

**Financial Environment**

**Fixation of plant capacity & Project configuration**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Product** | **Capacity (MTPA)** | **Raw Materials** | **Per MT consumption** | **Unit** | **Annual Quantity Required** | **Unit** |
| **Weak Nitric Acid** | 82500 | Anhydrous Ammonia (Liquid) | 0.2875 | MT | 23719 | MT |
| Platinum (94%)/Rhodium (6%) Gauze (Catalyst)\* | 0.00028 | Kg | 23 | Kg |
| **Ammonium Nitrate** | 100000 | Weak Nitric Acid (WNA) | 0.747 | MT | 74700 | MT |
| Anhydrous Ammonia (Liquid) | 0.213 | MT | 21300 | MT |

**Product Specifications**

When the plant is operated the following product specifications shall be met:

|  |  |
| --- | --- |
| Nitric Acid | |
| Concentration | Not less than 60 wt.% Nitric Acid |
| Dissolved oxides of nitrogen | Not more than 0.01 wt.% expressed as HNO2 |
| Chlorides | Not more than 20 ppm w |
| Sulphates as H2SO4 | Not more than 20 ppm w |
| Residue on ignition | Not more than 250 ppm w |
| AN Solution | |
| Concentration | Not less than 88 wt.% Nitric Acid |

Manufacturing Process & Available Process Technology of WNA & AN

To manufacture weak nitric acid and ammonium nitrate, many technology providers are in the race to weak nitric acid and ammonium nitrate plants. Thyssenkrupp is the primary technology provider to the Indian WAN and AN manufacturing company. Casale SA and Stamicarbon are the other providers of technology of ammonium nitrate to Indian manufactures. However, Kribhco has signed an agreement with KBR as the technology licensee for weak nitric acid and ammonium nitrate plant.

KBR offers two process to manufacture weak nitric acid:

**Dual pressure:** The Weatherly Dual-Pressure Nitric Acid plants from KBR provide more effective heat recovery, which results in lower running costs. The technology reduces the overall plant plot plan using its tried-and-true vertical reactor and heat recovery design, which lowers capital costs for pipes and structural steel.

**Mono pressure:** KBR Weatherly's high mono-pressure design uses less energy. The technology uses a single, high-pressure level. Smaller, less expensive plant equipment is possible with this high-pressure strategy, which greatly lowers capital costs.

Mono-pressure technology is recommended by KBR for this size plant. This technology is most relevant for Kribhco as per the planned capacity.

**Unit Consumption of Raw Materials and Utilities**

**Amount Per Metric Ton Acid (100% Basis)- 250 MTPD: Nitric Acid**

|  |  |
| --- | --- |
| Ammonia (100% basis) (m. ton) | 0.2875 |
| Gross Platinum Catalyst g (Note 1) | 0.280 |
| 1900 kPag Steam Export (superheated to 360 °C) (m. ton) | <0.645> |
| Low Pressure Steam Import (m. ton) | 0.0475 |
| Boiler Feedwater (m. ton) (Note 2) | 1.07 |
| Steam Condensate Export (m. ton) | <0.0475> |
| Cooling Water Cubic meters (Note 3) | 132.7 |
| Turbine Condensate Export (m. ton) | <0.0278> |
| Electric Power 400 v KWh (Note 4) | 8.34 |

*Notes:*

*1. Based on using platinum recovery gauze and a platinum filter net burn off is 0.085 gm/mt.*

*2. Makeup feedwater to be of suitable quality to permit 1% blowdown while generating 4100 kPag steam.*

*3. Based on a cooling water temperature rise of 9.2 °C.*

*4. Includes pumps, lighting, and instrumentation.*

**Amount Per Metric Ton AN- 300 MTPD: Ammonium Nitrate**

|  |  |
| --- | --- |
| Ammonia (100% basis) (m. ton) | 0.213 |
| Nitric Acid (100% basis) (m. ton) | 0.747 |
| Electricity kWh (1) | 6.0 |
| Cooling Water Cubic meters (2) | 15.0 |
| 345 kPag Steam Import (m. ton) | 0.02 |
| Steam Condensate Export (m. ton) | <0.02> |
| Process Condensate Export (m. ton) | 0.284 |

***Notes:***

*1. Includes pumps, lighting, and instrumentation.*

*2. Based on a cooling water temperature rise of 10 °C.*

**Process Chemistry- Nitric Acid Plant– Mono Pressure Technology**

**Nitric Acid**

**Reaction No. 1**

4NH3 + 5O2  4NO + 6H2O

Ammonia Oxygen Nitric Water

Oxide

**Reaction No. 2**

2NO + O2  2NO2

Nitric Oxygen Nitrogen

Oxide Dioxide

**Reaction No. 3**

3NO2 + H2O  2HNO3 + NO

|  |  |  |  |
| --- | --- | --- | --- |
| Nitrogen | Water | Nitric | Nitric |
| Dioxide |  | Acid | Oxide |

The overall reaction of Reaction Nos. 1 through 3 is shown by the following:

NH3 + 2O2  HNO3 + H2O

Ammonia Oxygen Nitric Acid Water

**Ammonium Nitrate**

NH3 + HNO3  NH4NO3

**List of Hazardous Waste:**

|  |  |  |  |
| --- | --- | --- | --- |
| **Sr. No.** | **Name of waste** | **Source of generation** | **Disposal Method** |
| 1 | Discarded containers, drums | Receipt, storage, and handling of raw/packing materials | Collection in drums, storage and transportation to authorized recyclers /authorized TSDF |
| 2 | Used/Spent Oil | Process / rotary machines / transformers | Collection in drums, storage, transportation, and sales to authorized recyclers. |
| 3 | Spent Catalyst | Process | Regeneration / Recycle through catalyst supplier |
| 4 | NOx abatement Spent Catalyst | Nitric Acid Plant | Collection in drums, storage, and transportation to authorized recyclers /authorized TSDF. |
| 5 | Chemical sludge from wastewater treatment | Wastewater treatment schemes | Chemical Sludge from wastewater treatment scheme is being disposed to cement plants for co-processing / TSDF, Udaipur |
| 6 | Contaminated cotton waste or other cleaning materials | Maintenance and cleaning activities | Collection, storage and transportation to Common incinerator |

**Government Standards for Ammonium Nitrate and Weak Nitric Acid Effluent:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **S. No.** | **Parameter** | **Standards** | | | |
|  |  | **Inland surface water** | **Public sewers** | **Land of irrigation** | **Marine coastal areas** |
| 1 | Ammonical  Nitrogen (as N), mg/l Max. | 50 | 50 | -- | 50 |
| 2 | Free ammonia (as NH3) mg/l, Max | 5 | -- | -- | 5 |

|  |  |  |  |
| --- | --- | --- | --- |
| **S. No.** | **Industry** | **Parameter** | **Standards** |
| 1 | Nitric Acid | Oxides of Nitrogen | 3 kg/tonne of weak acid (before concentration) produced |

**Project cost estimation**

|  |  |  |
| --- | --- | --- |
| **Particulars (INR Crore)** | **Shahjahanpur** | **Hazira** |
| Total Project cost | 418 | 418 |
| Total Production Cost (Weak Nitric Acid) | 90.17 | 97.13 |
| Total Production Cost (Ammonium Nitrate) | 138.66 | 150.24 |

**Profitability projections**

**Shahjahanpur-**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Particulars | 2025 | 2030 | 2035 | 2039 |
| Operating Revenue | 280 | 379 | 379 | 379 |
| Total Operating Cost | 161 | 234 | 249 | 260 |
| Income bef. Depr., Int.& Taxes | 119 | 146 | 131 | 119 |
| Gross Margin (%) | 43% | 38% | 34% | 31% |
| Profit Before Tax (PBT) | 64 | 106 | 110 | 99 |
| PBT Margin (%) | 23% | 28% | 29% | 26% |
| Profit after Tax (PAT) | 64 | 70 | 68 | 59 |
| PAT Margin (%) | 23% | 18% | 18% | 15% |

**Hazira-**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Particulars | 2025 | 2030 | 2035 | 2039 |
| Operating Revenue | 280 | 379 | 379 | 379 |
| Total Operating Cost | 173 | 252 | 268 | 280 |
| Income bef. Depr., Int.& Taxes | 106 | 127 | 111 | 99 |
| Gross Margin (%) | 38% | 34% | 29% | 26% |
| Profit Before Tax (PBT) | 51 | 88 | 90 | 78 |
| PBT Margin (%) | 18% | 23% | 24% | 21% |
| Profit after Tax (PAT) | 51 | 58 | 55 | 45 |
| PAT Margin (%) | 18% | 15% | 14% | 12% |

**Financial Indicators**

|  |  |  |
| --- | --- | --- |
| **IRR** | **Shahjahanpur** | **Hazira** |
| Project | 7.53% | -0.41% |
| Equity | 1.05% | -20.14% |

**Recommendations Based on Key observations**

**Most Suitable plant Set-up location:**

Shahjahanpur is observed as the most favorable location for the plant set-up of integrated weak nitric acid (WNA) and ammonium nitrate (AN) due to much lower raw material price i.e., ammonia (major raw material).

Overall, the operating cost of production of weak nitric acid and ammonium nitrate in Shahjahanpur has been much lower than the operating cost of production in Hazira.

The overall cost of production per ton of weak nitric acid in Shahjahanpur is INR 10995 per ton, around INR 800 per ton lower than the cost produced in Hazira which impacts the overall cost of production ammonium nitrate solutions in both the locations.

When comparing the production cost of ammonium nitrate in both the locations, Shahjahanpur has a cost advantage of around INR 1158 per ton over Hazira impacting the overall profitability of plant.

The less the ammonium nitrate cost of production in the location, the more feasible and profitable the plant.

The location possesses strategic advantage from both market and financial point of view which offers competitive benefit to Kribhco.

It should be preferred due to low operating cost of production per ton of WNA and AN produced, further supported by attractive IRR and Payback Period.

Moreover, the percentage margin observed in Shahjahanpur has been around 5% higher than that is observed in Hazira. In addition to this, profit before and after-tax percentage margin is also observed to be much higher.

Furthermore, the project and equity IRR in Shahjahanpur location is 7.53% and 1.05%, respectively representing the profitable operations of the plant in the forecast period.

In Conclusion, Shahjahanpur location is the most suitable for the Integrated WNA – AN plant.