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**Pre-Feasibility Study for Producing Industrial lime**



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**Abstract:**

Hydrated lime is produced as a result of combining water with Cao. It will be converted to limestone after it absorbs the air CO2. The hydrated lime has diverse industrial properties and has a high added value, that is more than 10 times its primary price. No other natural material may have so diverse applications as carbonated rocks, especially in such a big volume.

Burnt and hydrated lime applications: Iron and steel industries (41%), building industries (32%), environmental applications (3%), chemical industries (6%), and paper, ceramics, producing colors, sugar refinery, leather, agricultural and oil industries (8%).

The required land area is 3550 square meters. The required electricity power is 360 kW annually, the water required is 84000 cubic meters annually and the fuel required is 210000 Liters of gas oil annually. The project is expected to employ 40 people.

**Product Introduction:**

**Limestone**

Limestone or Calcium carbonate is rarely found in the form of pure lime in nature. This stone, is mostly found as clay lime, sandy lime and dolomite.

Some of the important limestone impurities include: Magnesium, silica, aluminum and manganese. Limestone is cooked in the furnace at a proper temperature relative to its chemical composition. Pure limestone is calcined at a temperature of about 1000 ° C and clay or Dolomitic limestone is calcined at about 1300 ° C.

**1.3 Different types of lime**

**1.3.1 Fat lime**

This type of lime contains about 4% of impurities and its most important characteristics is that it becomes extremely slaked in contact with water its volume increases by about 2.5 times its initial size. Its mixture with sand grows in contact with carbonaceous gas becomes hard quickly (For 15 days exposed to the air). Therefore, fat lime is also called air lime.

**1.3.2 Weak lime**

This type of lime is produced from limestone containing 5 to 6% lime, and its major impurities are iron oxide (II) (ocher), silicon oxide (silica) and aluminum oxide (aluminum). One of the features of this lime is that it gets slacked slowly, and the resulting mixture obtained from combining this lime with sand becomes hard slowly when exposed to air.

**1.3.3 Hydraulic lime**

This type of lime is usually made of limestone containing about 6 to 22% of clay. An important feature of this type of lime is that it hardens slowly far from air or even under water. It becomes very slaked in contact with water and produces a slightly sticky dough. In general, this type of lime can be considered something between Hydraulic lime and cement.

**The product description and its application in the domestic and foreign markets:**

**Application of quicklime and hydrated lime:**

41% in the iron and steel industry, 32% in the construction industry, 3% in the environment, 6% in the chemical industry, and 8% in industries of paper, ceramics, dyes, sugar refining, leather making, agriculture and the petroleum industry.

**Application of lime in steel industry:**

In addition to reducing the melting temperature, lime has an important role in separating and collecting waste elements including sulfur, phosphorus, aluminum and silica by in increasing it into slag.

**Metallurgy Consumption of Lime:**

lime is used to melt the ore of some metals, such as copper. In addition to reducing the melting temperature, lime absorbs SO2 gas. Lime is used as a soluble pH controller in mineral flotation.

**Hygienic applications of lime:**

improving the quality of drinking water, wastewater pH control, disposal of wastes, neutralizing acidic effluents of factories, controlling the air pollution.

Papermaking: Lime is used in the papermaking industry for the preparation of pulp sulfate, re-use of sodium carbonate and preparation of calcium hypochlorite, which has a bleaching effect.

**Chemical Uses of Lime:**

in the preparation of carbonate and sodium bicarbonate, preparation of calcium carbide, organic chemicals, preparation of magnesium from seawater, preparation of salt, insecticides, dyes and etc.

Construction materials and ceramic: lime is used in glass manufacture to help in melting. Lime is also used in dolomitic refractories. Lime is the main essential material in the preparation of cement.

**Sugar factories:**

lime is used to purify and separate phosphate compounds and organic acids in the preparation of sugar cubes and sugar.

**Petroleum industry:**

Lime is used in order to neutralize organic compounds of sulfur, deactivate SO2 gas and provide special greases.

**Paint industry:**

Lime is used as filler material.

**Leather manufacturing:**

lime is used to remove hair or wool from the skin of the animals (tanning industry).

**Agriculture:** Lime is used to control the pH of water.

**Review of alternative goods, competitors and analysis and its effects on product consumption:**

Due to the fact that lime is known as an old and well-known product in the civil industry, no specific alternative has been defined for it so far, and only methods to increase its quality have been improved.

**Strategic importance of goods in Iran and foreign markets**

Due to the many and vital applications of lime as an intermediate product in these industries, especially strategic products such as steel, the lack of lime in domestic and foreign markets is not allowed.

**Review of product import trends over the past five years**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Import of lime in recent years (tons)** | | | | |
| **Tariff** | **25221000** | **25222000** | **25223000** | **Summation** |
| **2015** | 10 | 72 | 0 | **81** |
| **2016** | 0 | 4 | 0 | **4** |
| **2017** | 8 | 0 | 0 | **8** |
| **2018** | 0 | 182 | 0 | **182** |
| **2019** | 230 | 112 | 0 | **342** |

**Review of product export trends over the past five years**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Export of lime in recent years (tons)** | | | | |
| **Tariff** | **25221000** | **2522000** | **25223000** | **Summation** |
| 2015 | 36249 | 3372 | 4030 | 43651 |
| 2016 | 59228 | 16339 | 853 | 76420 |
| 2017 | 56851 | 5617 | 1457 | 63925 |
| 2018 | 167416 | 2394 | 20 | 169830 |
| 2019 | 66937 | 3641 | 22 | 70600 |

**Review of consumption trends over the past five years**

According to the information obtained, the demand in previous years has been as follows:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Year** | **Domestic production** | **Import** | **Export** | **Demand** |
| 2015 | 1422690 | 81 | 43651 | 1379120 |
| 2016 | 1555990 | 4 | 76420 | 1479573 |
| 2017 | 1801007 | 8 | 63925 | 1737090 |
| 2018 | 1949357 | 182 | 169830 | 1779709 |
| 2019 | 2105357 | 342 | 70600 | 2035099 |

**Domestic production of lime forecasting in the next five years (tons)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Description** | **2020** | **2021** | **2022** | **2023** | **2024** |
| Capacity of active units | 2105357 | 2105357 | 2105357 | 2105357 | 2105357 |
| Capacity of  75%-90% progress units | 352500 | 423000 | 493500 | 564000 | 634500 |
| Capacity of  50% to74% progress units | 0 | 272175 | 326610 | 381045 | 435480 |
| Capacity of  25% to 49% progress units | 0 | 0 | 211550 | 253860 | 296170 |
| Capacity of  1% to 24% progress units | 0 | 0 | 0 | 235884 | 314512 |
| Total practical domestic supply | 2457857 | 2800532 | 3137017 | 3540146 | 3786019 |

**Product demand forecasting in the next five years**

In order to forecast the total demand in the coming years, according to the consumption trends in the last five years, the domestic demand has been estimated. Likewise, due to sufficient domestic production, Import of products has been estimated as zero and export of products are expected to increase by 10% annually.

Product demand = (Domestic Demand + Export) – (Domestic Supply + Import)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Product demand forecasting** | | | | | |
| Description | Year | | | | |
| 2020 | 2021 | 2022 | 2023 | 2024 |
| Domestic Supply | 2457857 | 2800532 | 3137017 | 3540146 | 3786019 |
| Import | 0 | 0 | 0 | 0 | 0 |
| Domestic Demands | 3083543 | 3315101 | 3546658 | 3778216 | 4009773 |
| Exports | 77660 | 85426 | 93969 | 103366 | 113702 |
| Product Demand | 703347 | 599995 | 503610 | 341436 | 337457 |

**Analysis and determination of the minimum economic capacity**

## **1- project's fixed costs**

|  |  |  |
| --- | --- | --- |
| # | Description | Amount in Million Rials |
| 1 | Land | 2450 |
| 2 | Landscaping and Buildings | 59706 |
| 3 | Facilities | 6252 |
| 4 | Vehicles | 400 |
| 5 | Equipment and machinery | 83360 |
| 6 | Office and workshop equipment | 970 |
| 7 | Pre-operation costs | 3062 |
| 8 | Miscellaneous costs | 1618 |
|  | Total | 157818 |

## Equipment and Machinery

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| # | Machinery | Quantity | Unit Cost (Rials) | Total Costs (Million Rials) |
| 1 | Jaw mill | 1 | 4800.000.000 | 4800 |
| 2 | Conveyor | 1 | 960000000 | 960 |
| 3 | Funnel | 1 | 800000000 | 800 |
| 4 | Crusher | 1 | 5600000000 | 5600 |
| 5 | Crusher output elevator | 1 | 1280000000 | 1280 |
| 6 | Primary silo | 1 | 2400000000 | 2400 |
| 7 | Silo Output Elevator | 1 | 960000000 | 960 |
| 8 | Moisturizer | 1 | 20800000000 | 20800 |
| 9 | Separator input elevator | 1 | 960000000 | 960 |
| 10 | Early Sepator | 1 | 5600000000 | 5600 |
| 11 | Secondary separator | 1 | 5600000000 | 5600 |
| 12 | The spiral of the product | 1 | 1600000000 | 1600 |
| 13 | Save silos | 1 | 3200000000 | 3200 |
| 14 | Reservoir Output Elevator | 1 | 640000000 | 640 |
| 15 | Silo | 1 | 2400000000 | 2400 |
| 16 | Spiral | 1 | 800000000 | 800 |
| 17 | Output Elevator | 1 | 640000000 | 640 |
| 18 | Hopper | 1 | 1600000000 | 1600 |
| 19 | Filling bag | 1 | 4000000000 | 4000 |
| 20 | Dust catcher | 1 | 5600000000 | 5600 |
| 21 | Spray tower | 1 | 3520000000 | 3520 |
| 22 | Electrical panel | 1 | 5600000000 | 5600 |
| 23 | Compressor | 1 | 1600000000 | 1600 |
| 24 | Required Cables | 1 | 2400000000 | 2400 |
|  | Total | | | 83360 |

## **2- Estimation of project's working expenses**

|  |  |  |
| --- | --- | --- |
| # | Description | Costs in Million Rial |
| 1 | Raw materials | 21,772 |
| 2 | Salary | 27,780 |
| 3 | Fuel and energy | 4,948 |
| 4 | Repair and maintenance | 3,922 |
| 5 | depreciation | 5,732 |
| 6 | Unforeseen (2% of rows 1 to 4) | 1,168 |
|  | Total | 56,322 |

## 1-2- Raw materials

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| # | Main Raw Materials | Annual Consumption | Unit | Unit Cost  (Rials) | Total Costs in Million Rials |
| 1 | Limestone | 24192 | ton | 900.000 | 21,772 |
|  | Total | | | | 21,772 |

2-2- Salary Estimate

Salaries are estimated for two categories; production and non-production personnel. Benefits, bonuses and employer premiums for non-production and production personnel are 70% and 90% of the annual salary, respectively. The following tables depict the estimated salaries.

## Non-production personnel

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| # | Description | Quantity | Monthly Salary (Rial) | Annual Salary (Million Rial) |
| 1 | Project Manager | 1 | 70,000,000 | 840 |
| 2 | Administrative and financial employee | 4 | 230,000,000 | 1440 |
| 3 | Guardian and attendan | 2 | 24,000,000 | 576 |
| 4 | Driver | 1 | 24,000,000 | 288 |
|  | Total | 8 |  | 3,144 |
|  | Benefits, bonuses and premiums | | | 2,200 |
|  | Total | | | 5,344 |

## Production personnel

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| # | Description | Quantity | Monthly Salary (Rial) | Annual Salary (Million Rial) |
| 1 | Technical Assistant | 4 | 46,000,000 | 1,104 |
| 2 | Skilled worker | 8 | 40,000,000 | 1,920 |
| 3 | Simple worker | 20 | 24,000,000 | 2,880 |
|  | Total | 32 |  | 5,904 |
|  | Benefits, bonuses and premiums | | | 5314 |
|  | Total | | | 11218 |

2-3- Estimating the amount of required energy and water

In a production unit, in addition to the raw materials needed to produce a product, facilities are needed to operate the equipment and machinery. These requirements, also known as utilities, include: electricity, process water, cooling water, and diesel. In this section, the amount of consumption of each of these components is determined in two categories; the process components (required for manufacturing equipment) and the non-process components (utility and general use).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| # | Description | Unit | Annual Consumption | Unit Cost (Rial) | Total cost (Million Rials) |
| 1 | Gasoline | Liter | 210,000 | 7,000 | 1,470 |
| 2 | Gasoline | Liter | 4,500 | 20,000 | 90 |
| 3 | Electricity | KWh | 1,800,000 | 1,500 | 2,700 |
| 4 | Water | Cubic meter | 84,000 | 7,000 | 588 |
| 5 | Viscosine oil | Liter | 3,000 | 20,000 | 60 |
| 6 | Communications | --- | --- | --- | 40 |
|  | Total | | |  | 2474 |

**3- Estimating project's circulating capital**

|  |  |  |  |
| --- | --- | --- | --- |
| # | Description | Time (days) | Total Costs (Million Rials) |
| 1 | Raw material storing costs | 30 | 1,814 |
| 2 | Petty cash | 30 | 3,630 |
| Total | | | 5,444 |

**4- Investment Table**

|  |  |  |
| --- | --- | --- |
| # | Description | Total Costs (Million Rial) |
| 1 | Fixed investment | 156,200 |
| 2 | Pre-operation costs | 1,618 |
| 3 | Circulating capital | 5,444 |
| Total | | 163,262 |

**5- Annual Production Costs**

The total annual production costs are estimated from the sum of fixed and variable costs.

|  |  |
| --- | --- |
| Description | Total cost |
| Raw material | 21,772 |
| Energy and fuel | 4,948 |
| Personnel expenses | 27,780 |
| Annual wear and tear, repair and maintenance costs | 9,654 |
| **Total** | 64,154 |

**6- Sales Forecast**

It is calculated based on the finished product price, taking into account the market price and deduction of overhead expenses. So the selling price of the product is estimated as follows:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| # | Description | Amount (ton) | Unit Value  (Rial) | Total costs (Million Rial) |
| 1 | Hydrated Lime | 17,280 | 4,000,000 | 69,120 |
| 2 | Lime Live | 40,320 | 2,800,000 | 112,896 |
|  | Total | 57,600 |  | 91,008 |

**7- Plan’s Financial Indicators**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Special profit and loss | The rate of return on investment | The period of return on investment | Per capita fixed investment | Per capita total investment |
| 72,580 | 0.44 | 2.25 | 3,946 | 4,082 |

**8- Profit and Loss Calculation Table**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Profit and Loss Forecast Table | | | | | |
| Description | 1st year | 2nd year | 3rd year | 4th year | 5th year |
| Production Amount | 80460 | 92160 | 102680 | 115200 | 115200 |
| net sales | 127412 | 145612 | 163814 | 182016 | 182016 |
| Production Costs | | | | | |
| Raw material | 15.240 | 17.418 | 19.596 | 21.772 | 21.772 |
| Production staff salaries | 15,704 | 17,948 | 20,192 | 22,436 | 22,436 |
| Energy Consumption | 3,464 | 3,958 | 4,454 | 4,948 | 4,948 |
| Maintenance | 2,746 | 3,138 | 3,530 | 3,922 | 3,922 |
| Unexpected | 818 | 934 | 1052 | 1,168 | 1,168 |
| Wear and Tear | 4,012 | 4,586 | 5,158 | 5,732 | 5,732 |
| Total production costs | 41,984 | 47,982 | 53,980 | 59,978 | 59,978 |
| The finished price of the sold product | 41,944 | 47,942 | 53,940 | 59,938 | 59,938 |
| Gross profit | 85,466 | 97,670 | 109,874 | 122,078 | 122,078 |
| Operation Costs | | | | | |
| Office staff salaries | 5,344 | 5,344 | 5,344 | 5,344 | 5,344 |
| Administrative and sales costs | 1,274 | 1,456 | 1,638 | 1,820 | 1,820 |
| Total operating costs | 6,618 | 6,800 | 6,982 | 7,164 | 7,164 |
| Operating Profit | 78,848 | 90,870 | 102,892 | 114,912 | 114,912 |
| Non-operation Costs | | | | | |
| Pre-operation depreciation | 324 | 324 | 324 | 324 | 324 |
| Fixed asset insurance | 316 | 316 | 316 | 316 | 316 |
| Total non-operating costs | 18,138 | 18,138 | 18,138 | 18,138 | 18,138 |
| Pre-tax net profit and net loss | 60,710 | 72,730 | 84,752 | 96,774 | 96,774 |
| Net profit | 45,532 | 54,548 | 63,564 | 72,580 | 72,580 |
| Annual profit | 0 | 45,532 | 100,080 | 163,644 | 236,226 |
| Gross profit on sale | 0.94 | 1.34 | 1.34 | 1.34 | 1.34 |
| Net profit on sale | 0.5 | 0.74 | 0.78 | 0.8 | 0.8 |

**Pre-Feasibility Summary**

|  |
| --- |
| **General Specification** |
| Project Name: Industrial lime production |
| Project Capacity: Hydrated lime 17280 tons - Live lime 40320 tons |
| Number of Personnel: 40 |
| Working Days: 300 |
| Product Usage: Hot water and steam boilers - Construction applications |
| Technical Study |
| Land Area: 35,000 square meters |
| Building Area: 3,550 square meters |
| Main Raw Materials: Limestone |
| Supplying Method of Raw Materials: Domestic mines |
| Power Requirement: 1,800,000 kwh annually |
| Water Requirement: 84,000 cubic meters annually |
| Fuel Requirement: 210,000 liters of diesel per year |
| Economical & Financial Study |
| Fixed Investment Cos: 157818 million rials |
| Working Capital: 5444 million rials |
| Total Investment: 163262 million rials |
| Annual Sale: 136512 million rials |
| Net Present Value(NPV): 57792 million rials |
| Break Even Point(BEP): 32% |
| Internal Rate of Return(IRR): 44% |
| Investment Return Period: 2.25 years |