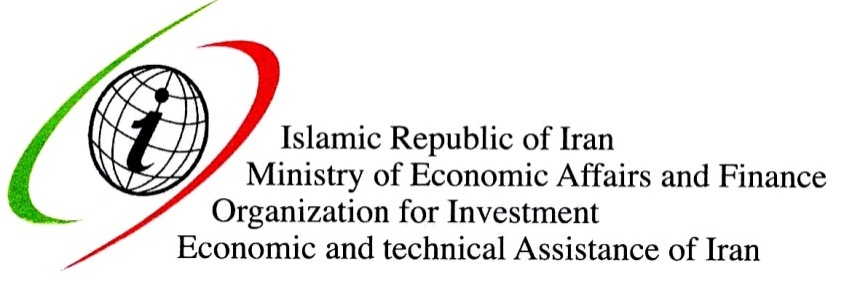
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**Pre-Feasibility Study for Producing Paper from calcium carbonate**



**Executive**

Industry, Mine and Trade organization of South Khorasan

**Consultant for Plan Preparation**

Behbood Sanat Moshaver Parsian Co.

**Investment Services Center of South Khorasan**

**Abstract:**

The stone paper is a novel kind of paper which has been developed recently by practitioners. 80 percent of this kind of paper material is calcium carbonate, which can be considered as an alternate for trees’ wood in paper production. 15% of the constituents of this paper is propylene and ethylene. This paper has some properties, including waterproofness, it resistance against tearing, the magic presentation of its colors, and finally its reversibility to the soil in a short period.

The required land area is 25,000 square meters. The required electricity power is 2520000 kWh annually, the water required is 105000 cubic meters annually and the fuel required is 535000 cubic meters of gas annually. The project is expected to employ 32 people.

**Product Introduction**

Stone paper (also known as rock paper, limestone paper or mineral paper) is a novel generation of paper that has been invented by researchers in recent years. The raw material of this paper is calcium carbonate powder, which replaces the use of tree wood for paper production. Its properties include being waterproof, tear resistance, the magical effect of the colors on it and ultimately its biodegradability during the short recovery period.

Many people consider the “stone paper” as a marvelous phenomenon in the printing and production industry, and assume its production is also the beginning of a new era in the production of environmentally friendly papers, since its raw material only consists of stone, so it seems that we should no longer be concerned about cutting down trees and their detrimental effects on the environment.

Also, in the process of "paper rock" production, not only the use of water is eliminated, but also there is no need to use bleaches in the production because of the whiteness of the raw materials, which result in no more contaminants being added to our environment. Paper production from carbonate is not a recent development and it is being used in the production of many other materials, such as pens and even tissue papers, but the production of a paper consisting of 85% carbonate and offset printable is an innovation.

**Unique Features of the Stone Paper**

This paper has other unique features in addition to its environmental benefits. Stone paper is completely waterproof, and water does not affect even the printed material when being adjacent or immersed in the water.

Also, this paper is tear-resistant, but not completely resistant as it was originally produced with the aim of biodegradability and returning to the recycling cycle.

However, the paper is very resistant to rupture and therefore it may seem aa a substitute to plastic papers in some applications.

Stone paper is also anti-chewable by rodents. Full compatibility with all offset printing machines, compatibility with all types of inks and solvents used in offset printing machines, fast drying of inks on paper immediately after leaving the printing machine and without the need for additional facilities, insensitive to ambient temperature which is one of the main issues in producing high quality printing material, and fire resistance, is another feature of paper rock.

**Stone Paper Ingredients**

About 80% of the Stone Paper consists of calcium carbonate. The most abundant rock on earth is limestone, from which calcium carbonate is extracted. Iran is replete with calcareous rocks which is why our country has many cement factories. The production of the stone paper may not be profitable for other countries, including European countries, because their stone industries are not as rich as Iran, but it is very advantageous for our country.

The constituents of this paper are 15% polypropylene and polyethylene materials. to connect calcium carbonate and resin materials which are polypropylene and polyethylene, some kind of materials named coupling agents are used.

**Product name and code (ISIC[[1]](#footnote-1) 3):**

The ID code of this product (ISIC 3 code) named as a variety of papers and paperboards made from Carbonate Calcium, is 21091118, and its evaluation unit is ton.

**Consumption cases and application of the product in domestic and foreign markets:**

Stone paper is produced in different grammages ranged from 50 microns to 400 microns in order for different applications, and it is used for providing the adhesive labels with different grammages, high value of coefficient of adhesion, and water resistance feature. Applications of stone paper are not restricted to industries of publishing, packaging and advertisements, and it is similar to coated papers in terms of facing with publishing and bookbinding machines, and does not require any distinct ink.

Thin grammages of this type of paper are appropriate for applications such as food packaging. Its moderate grammages are appropriate for publish tasks such as valuable books, maps with different applications, hand bags, magazines, brochures, and pockets, and its thick grammages are appropriate for cases in which paperboards are used for providing them, such as credit cards.

In general, the product has a wide application in the area of publishing and advertisements. One of the important applications of making papers from stones is regarding cement packaging. In order to produce cement packages, 5 papers covered by a polyethylene layer is used. A polyethylene layer is applied to prevent cement from infiltrating into outside, but because polyethylene is used to make stone papers, it requires no covering.

Investigations represent that currently, the annual consumption level of writing paper in our country is 400k tons which will face a significant raise according to the post-sanctions economic development. On one hand, based on the statistics of Ministry of Industry, Mine and Trade as well as Iranian chamber of commerce and association of Iran wood industry in year 2017, more than one million tons of paper, paste and offal have entered the country. This is while the production of paper in the country (Chooka and Pars companies) provides less than 10 percent of the domestic demands.

**Examining the replaced goods, competitors, and analysis and its effects on product consumption:**

The main goods replacing this product are the conventional papers which their source is wood. Hence, according to the point that preserving the trees is critical and vital, this technology would surely be an appropriate replacement for the conventional papers, and it would play a significant role in preserving the environment. The next replaced products are recycled papers which may not be recognized easily as appropriate replacements due to the limitations of technology in the country and low quality of its recycling.

The difference between typical papers and stony ones is that typical papers cause suction in the ink due to existence of short and long fibers, so that there is no favorable quality in multicolor printing. In order to have a print with a higher quality, coated papers are used and stony papers deliver us a lower-priced coated paper. The printability of a stony paper is much better than a traditional paper, and it consumes ink about 20 percent of a traditional paper.

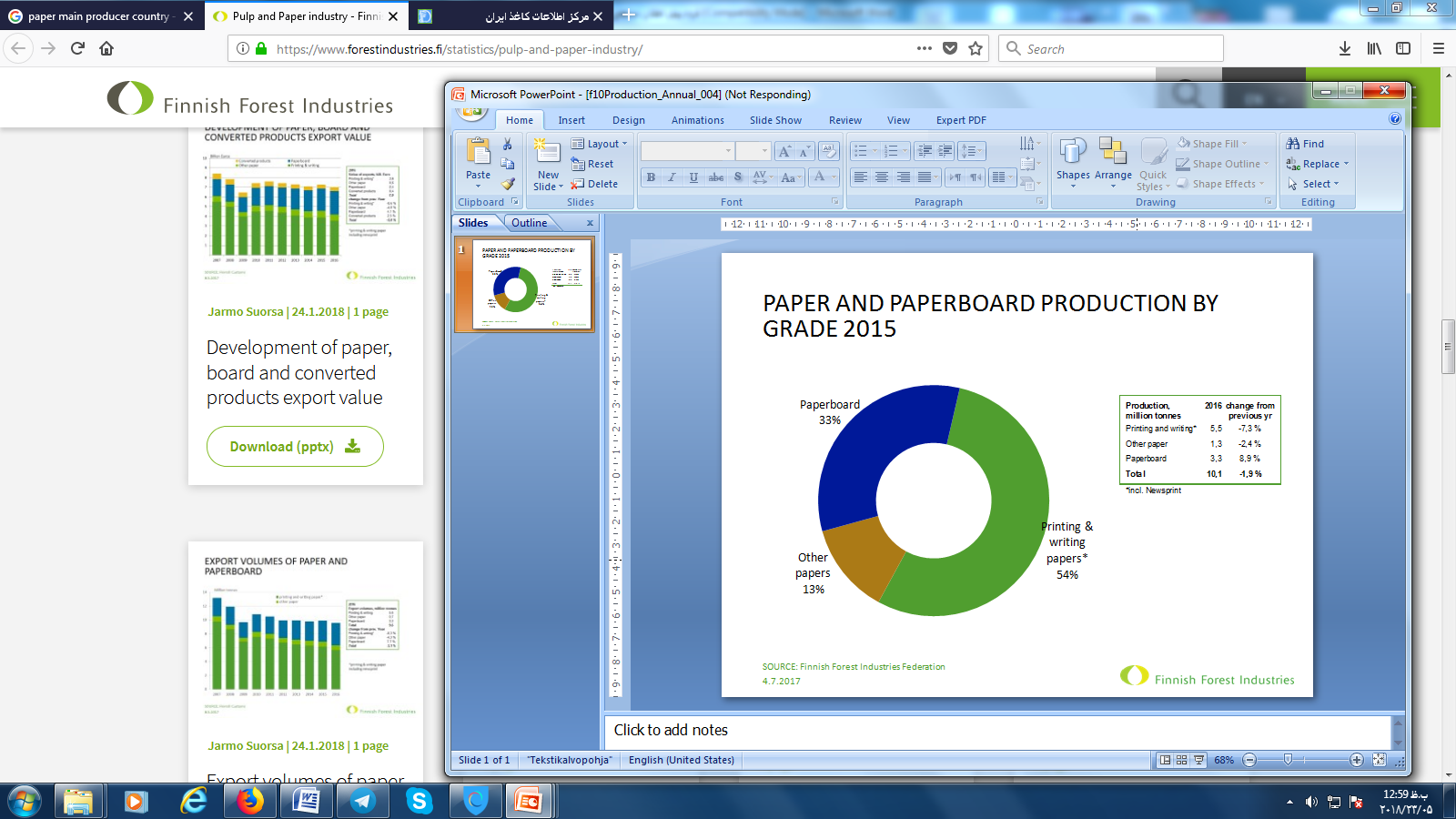
Based on the estimations, we require 2 million tons of cellulose substances annually for consumption in Iran. These products also include grayish back paperboards and paper tissues. Of this level, almost a capacity for one million tons has been created, but in practice, the operable level in country is not more than 700 thousand tons and the remainder should be supplied through imports. In other words, we require supplication of 1 million and 300 thousand tons of papers.

According to the existing records, the first active factory in the country has been operated by Pishgaman company with a nominal capacity of 5000 tons in the special economic zone of Yazd province in year 2016.

120 establishment permits have been issued until April 2017 which the total number of their nominal production capacity equals to 163000 tons.

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

Limitation of the area of global jungles and their severe destruction on one hand, and increasingly raise of consumption of paper and paper products along with raise in population and progression in technology on other hand, have made the establishment of paper-making industries important and essential. The existing demand status in the area of paper types in the world are also as the below chart:

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Global Forest, Paper & Packaging Industry Survey: 2016 edition – survey of 2015 results

**Examining the product import and export trend**

According to the information obtained from customs of Islamic republic of Iran, the rates of import and export of all types of papers in previous years are as below table:

|  |  |  |
| --- | --- | --- |
| **Year** | **Paper imports (Ton)** | **Paper exports (Ton)** |
| 2013 | 306407 | 14 |
| 2014 | 238,151 | 429 |
| 2015 | 318,947 | 221 |
| 2016 | 323,504 | 1,006 |
| 2017 | 336,207 | 1,359 |

**Prediction of the product sale market in the next 5 years**

According to the available information, the paper consumption per capita in Iran is 22 Kgs annually which of course, this rate is very low in comparison to the advanced countries. Now, according to the rate of population growth in the country, the paper consumption in the country may be examined in the next 5 years. Also, if only 1 percent of the paper required for the country is supplied through the paper produced from stone, the level of product demand in the next years is estimated.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Prediction of the level of contribution obtained from calcium carbonate (tons) | | | | | |
| Description | Year | | | | |
| 1399 | 1400 | 1401 | 1402 | 1403 |
| Paper consumption per capita in country (Kgs) | 22 | 22 | 22 | 22 | 22 |
| Population of country | 80,992,000 | 81,996,301 | 83,013,055 | 84,042,417 | 85,084,543 |
| Paper consumption in country | 1,781,824 | 1,803,919 | 1,826,287 | 1,848,933 | 1,871,860 |
| The contribution obtainable from paper market for the studied product | 17,818 | 18,039 | 18,263 | 18,489 | 18,719 |
| Internal offer of papers made from stone | 3,000 | 3,000 | 3,000 | 6,570 | 7,080 |

According to the point that the internal offer of paper made from calcium carbonate is estimated as very low in the next years, establishment of this unit would be economical.

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

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

|  |  |  |
| --- | --- | --- |
| # | Description | Amount in Million Rials |
| 1 | Land | 13,750 |
| 2 | Landscaping and Buildings | 39,137 |
| 3 | Facilities | 7,917 |
| 4 | Vehicles | 6,980 |
| 5 | Equipment and machinery | 404350 |
| 6 | Office and workshop equipment | 755 |
| 7 | Pre-operation costs | 3,051 |
| 8 | Miscellaneous costs ( 1% of fixed investment ) | 4759 |
|  | **Total** | **480698** |

## 1-1- Equipment and Machinery

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| # | Machinery | Quantity | Unit | Unit cost in Euro | Total Costs (Million Rials) |
| 1 | Full set of limestone paper production line including:  Extrusion + Casting(Calander) + Simultaneous MD/TD+ Winding  Made by Marchante French company | 1 | Series | 2900000 | 348000 |
| 2 | China Paper Cutting Line | 1 | Series | 70000 | 8400 |
| 3 | China-made printing and laminating line | 1 | Series | 150000 | 18000 |
| Machinery transportation, customs and installation costs (equivalent to 8%) | | | | | 29950 |
| **Total** | | | | | **404350** |

|  |  |  |
| --- | --- | --- |
| # | Description | Costs in Million Rial |
| 1 | Raw materials | 206,577 |
| 2 | Salary | 9,476 |
| 3 | Fuel and energy | 4,355 |
| 4 | Repair and maintenance | 7,260 |
| 5 | Wear and tear | 16,915 |
| 6 | Advertising Cost (1% of Sales) | 5,184 |
| 7 | Unexpected expenses (2% of the sum of rows 1 to 4) | 4,553 |
|  | **Total** | **254,320** |

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

## 1-2- Raw materials

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| # | Main Raw Materials | Place of Supply | Annual Consumption | Unit | Unit Cost  (Rials) | Total Costs in Million Rials |
| 1 | Limestone | Internal | 16,200,000 | kg | 450 | 7,290 |
| 2 | Polypropylene | Internal | 1,330,000 | kg | 63,500 | 84,455 |
| 3 | PE | Internal | 1,330,000 | kg | 60,400 | 80,332 |
| 4 | Chemical additives | Foreign | 150,000 | kg | 230,000 | 34,500 |
|  | **Total** | | | | | **206577** |

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 | Managing Director | 1 | 30,000,000 | 360 |
| 2 | Administrative and financial employee | 3 | 14,000,000 | 504 |
| 3 | Warehouse keeper | 2 | 12,500,000 | 300 |
| 4 | Driver | 5 | 11,500,000 | 690 |
| 5 | Janitor | 1 | 11,500,000 | 138 |
| 6 | Guard | 2 | 11,500,000 | 276 |
| 7 | Total | 14 |  | 2,268 |
|  | Benefits, bonuses and premiums | | | 1588 |
|  | **Total** | | | **3856** |

## Production personnel

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| # | Description | Quantity | Monthly Salary (Rial) | Annual Salary (Million Rial) |
| 1 | Production Manager | 1 | 16,000,000 | 192 |
| 2 | Site worker | 15 | 13,500,000 | 2,430 |
| 3 | Technical and repairs technician | 2 | 14,000,000 | 336 |
|  | Total | 18 |  | 2,958 |
|  | Benefits, bonuses and premiums | | | 2662 |
|  | **Total** | | | **5620** |

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 | Natural gas | Cubic meter | 535,000 | 3,800 | 2,033 |
| 2 | Gasoline | Liter | 4,500 | 10,000 | 45 |
| 3 | Electricity | KWh | 2,520,000 | 700 | 1,764 |
| 4 | Water | Cubic meter | 105,000 | 2,500 | 263 |
| 5 | Viscosine and oil | Liter | 2,000 | 50,000 | 100 |
| 6 | Communications | --- | --- | --- | 150 |
|  | **Total** | | |  | **4355** |

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

|  |  |  |  |
| --- | --- | --- | --- |
| # | Description | Time (days) | Total Costs (Million Rials) |
| 1 | Raw material storing costs | 60 | 41,315 |
| 2 | Petty cash | 30 | 4,774 |
| **Total** | | | **46090** |

**4- Investment Table**

|  |  |  |
| --- | --- | --- |
| # | Description | Total Costs (Million Rial) |
| 1 | Fixed investment | 480698 |
| 2 | Circulating capital | 46090 |
| **Total** | | **526788** |

**5- Annual Production Costs**

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

|  |  |
| --- | --- |
| Description | Total cost |
| Raw material | 206,577 |
| Energy and fuel | 4,355 |
| Personnel expenses | 9,476 |
| Annual wear and tear, repair and maintenance costs | 24,175 |
| **Total** | 244,582 |

**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 | Production Amount (Kg) | Unit Value  (Rial) | Total costs (Million Rial) |
| 1 | Packaged paper | 4,114,286 | 126,000 | 518,400 |
| **Total** |  | **4,114,286** |  | **518,400** |

**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 |
| 226,384 | 0.66 | 1.50 | 9,199 | 10,640 |

**8- Profit and Loss Calculation Table**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Profit and Loss Forecast Table | | | | | |
| Description | 1st year | 2nd year | 3rd year | 4th year | 5th year |
| Production Amount | 2,880,000 | 3,291,429 | 3,702,857 | 4,114,286 | 4,114,286 |
| net sales | 362,880 | 414,720 | 466,560 | 518,400 | 518,400 |
| Production Costs | | | | | |
| Raw material | 144,604 | 165,262 | 185,919 | 206,577 | 206,577 |
| Production staff salaries | 3,934 | 4,496 | 5,058 | 5,620 | 5,620 |
| Energy Consumption | 3,048 | 3,484 | 3,919 | 4,355 | 4,355 |
| Maintenance | 5,082 | 5,808 | 6,534 | 7,260 | 7,260 |
| Unexpected | 3,187 | 3,643 | 4,098 | 4,553 | 4,553 |
| Wear and Tear | 11,840 | 13,532 | 15,223 | 16,915 | 16,915 |
| Total production costs | 171,696 | 196,224 | 220,752 | 245,280 | 245,280 |
| The finished price of the sold product | 171,696 | 196,224 | 220,752 | 245,280 | 245,280 |
| Gross profit | 191,184 | 218,496 | 245,808 | 273,120 | 273,120 |
| Operation Costs | | | | | |
| Office staff salaries | 3,856 | 3,856 | 3,856 | 3,856 | 3,856 |
| Administrative and sales costs | 7,258 | 8,294 | 9,331 | 10,368 | 10,368 |
| Total operating costs | 11,113 | 12,150 | 13,187 | 14,224 | 14,224 |
| Operating Profit | 180,071 | 206,346 | 232,621 | 258,896 | 258,896 |
| Non-operation Costs | | | | | |
| Pre-operation depreciation | 610 | 610 | 610 | 610 | 610 |
| Fixed asset insurance | 589 | 589 | 589 | 589 | 589 |
| Total non-operating costs | 32,512 | 32,512 | 32,512 | 32,512 | 32,512 |
| Pre-tax net profit and net loss | 147,559 | 173,834 | 200,109 | 226,384 | 226,384 |
| Net profit | 147,559 | 173,834 | 200,109 | 226,384 | 226,384 |
| Annual profit | 0 | 147,559 | 321,393 | 521,502 | 747,886 |
| Gross profit on sale | 0.37 | 0.53 | 0.53 | 0.53 | 0.53 |
| Net profit on sale | 0.28 | 0.42 | 0.43 | 0.44 | 0.44 |

**Pre-Feasibility Summary**

|  |
| --- |
| **General Specification** |
| Project Name: Paper production from calcium carbonate |
| Project Capacity: 4114 tons |
| Number of Personnel: 32 |
| Working Days: 300 |
| Product Usage: Writing - Printing & Publishing |
| Technical Study |
| Land Area: 25,000 square meters |
| Building Area: 6,650 square meters |
| Main Raw Materials: Calcium carbonate rock |
| Supplying Method of Raw Materials: Internal (home) mines |
| Power Requirement: 2,520,000 kwh annually |
| Water Requirement: 105,000 cubic meters annually |
| Fuel Requirement: 535,000 cubic meters of gas annually |
| Economical & Financial Study |
| Fixed Investment Cost (Rial & other Currencies): 480698 million rials |
| Working Capital: 46,090 million rials |
| Total Investment: 562788 million rials |
| Annual Sale: 518,400 million rials |
| Net Present Value(NPV): 291,383 million rials |
| Break Even Point(BEP): 21% |
| Internal Rate of Return(IRR): 66% |
| Investment Return Period: 1.50 years |

1. International Standard Industrial Classification [↑](#footnote-ref-1)