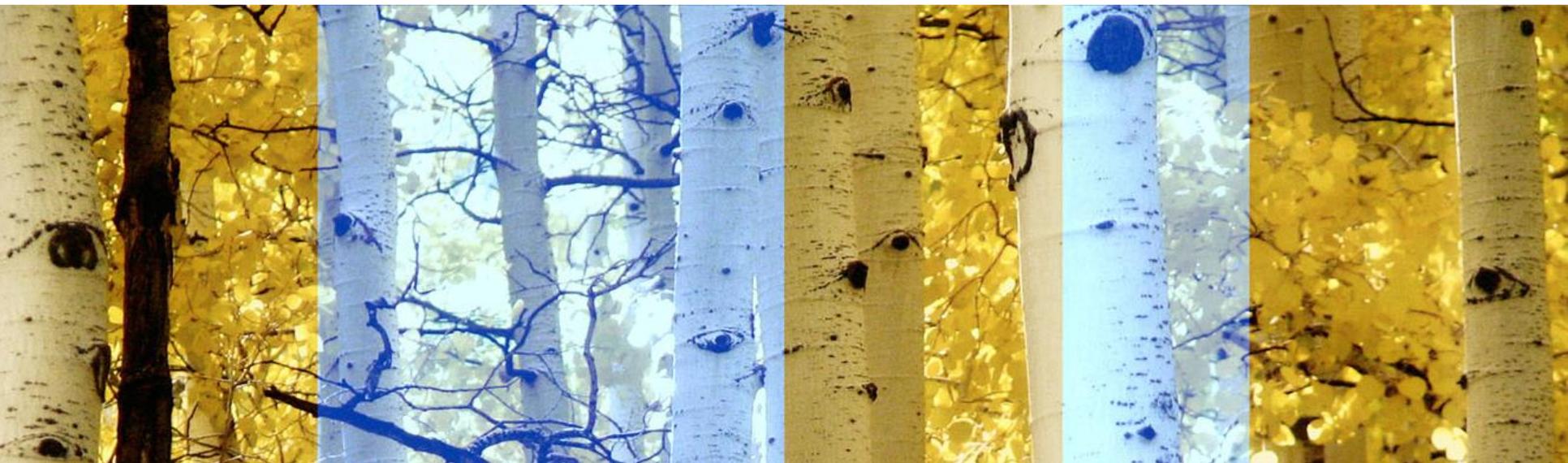


Conceptual Feasibility Study of Sawn Softwood Production

European Bank for Reconstruction and Development – EBRD

6872



October 15, 2013



Indufor ...forest intelligence

Executive Summary (1/2)

Russian Far East is an attractive place to develop sawn softwood production. High quality forest resources, location close to growing Asian markets and the opportunity to design and build a green field mill are comparative advantages of the region. Many places in Khabarovsk and Primorsky Krai as well as in the Sakhalin Oblast would be suitable for building a new mid-sized sawmill with 300 000 m³/a output capacity. This study describes the opportunity on general, conceptual level.

Locating the sawmill to a deep sea port enables chip exports to Japanese and Chinese pulp mills that are seeking for increased volumes of wood chips. Exporting pulpwood as chips is a possibility that has not been widely explored until now. The sawmill could be located on a new industrial site with no existing facilities and hence will not have synergies with other industrial facilities. Later developing the sawmill to an integrated wood and bio products manufacturing complex should be explored.

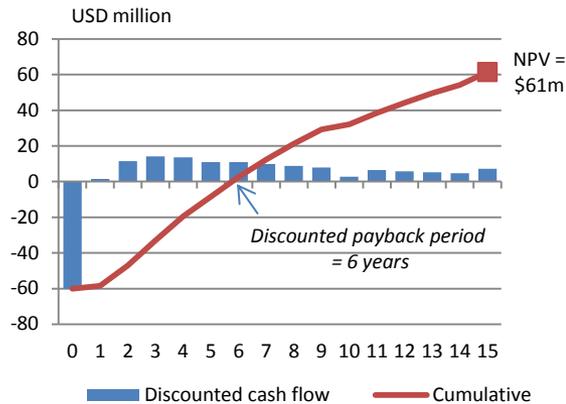
Log exports to China continue on high level, additionally there are very large areas where the current forest utilization is on very low level. Harvesting can be expanded without risking the sustainability. Significant investments to road and infrastructure network will be required to enable stable and continuous wood supply to the mill. Mill gate wood cost is calculated at USD 55 / m³ which is very competitive. 40% of the supply is larch logs and 60% will be high quality spruce logs.

Most attractive market for sawnwood is Japan, where high quality wood products have a good demand with a strong price level. China is a growing consumer and a significant share of the sawnwood is destined to Chinese markets as well to diversify the market risk. Average sales price is USD 221 / m³.

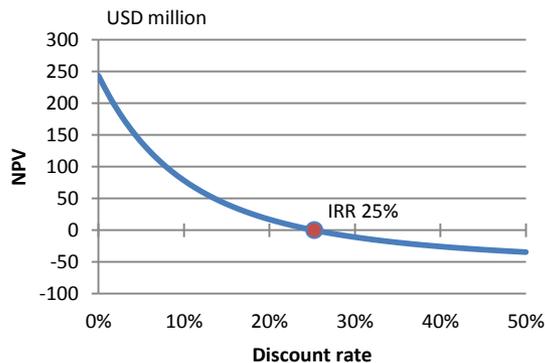


Executive Summary (2/2)

Discounted cash flow



NPV at various discount rates



Estimated investment to a new sawmill would amount to USD 60 million, including equipment, site and buildings.

The planned sawnwood production has a calculated 25% internal rate of return. The net present value of the investment would be USD 61 million, or RUB 1.8 billion, at a 12% discount rate. This demonstrates that sawnwood production can be profitable in the Russian Far East. This requires that there is a market for the sawmilling by-products (chips); without the by-product sales the NPV is only USD 4 million. Therefore it is critical to consider the location well to enable sales of by-products (chips).

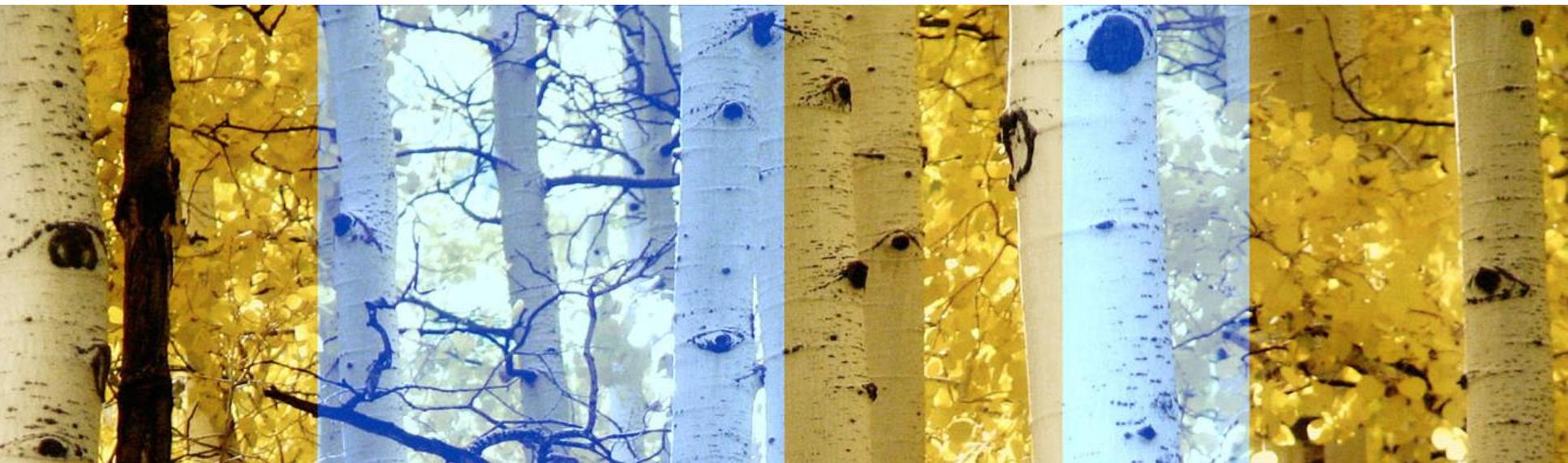
The markets in Japan have been volatile and project includes a market risk in form of volumes and prices. However, target markets include also China, Russia and Europe to diversify the market risks between the regions. Profitability is sensitive to end product prices.



Conceptual Feasibility Study of Glulam Production

European Bank for Reconstruction and Development – EBRD

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October 15, 2013



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Executive Summary (1/2)

Sawnwood production in the Russian Far East is increasing but the exports concentrate on green and kiln dried sawnwood without any further processing. As the consumer markets mature, there is increasing demand for value added forest products also. Glulam has been identified as one of the products that has potential to grow in the Russian Far East and several places in Khabarovsk Krai and Primorsky Krai would be suitable for building a new glulam production facility with 50 000 m³ output capacity.

Japan is the largest glulam consumer market in the area with an attractive price level. Demand in China, both in standard and custom-made glulam, is increasing although the product is not yet widely known. In Russia, glulam demand has expanded from the original use in log house manufacturing into other applications in non-residential construction.

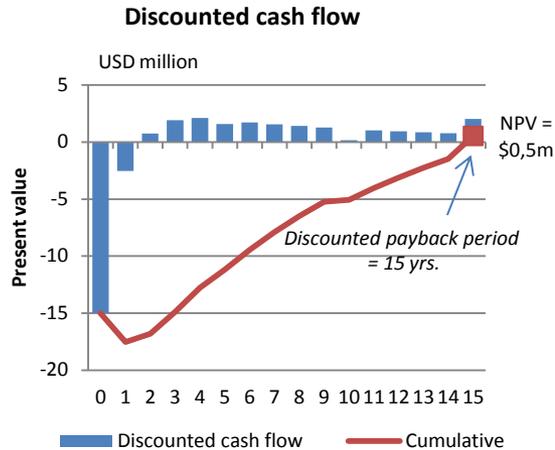
The new glulam production facility should be located adjacent to an existing sawmill, or alternatively close to consuming centers or export ports. Transporting sawnwood, the raw material for glulam, is rather uncomplicated. Supply of other production inputs, mainly glue, can be secured with rail or road connection and does not set any strict criteria for the location.

Calculated raw material cost for the raw material (spruce sawnwood) is USD 245 / m³ which can be sourced from the local markets, or alternatively be provided by an affiliated sawmill. Other raw materials, mainly glue, can be reliably supplied to the site.

Average sales price for the glulam products is USD 582 per m³ at the mill. Market risk is diversified for 3 different markets, Japan and China having an equal share. There is no competition on local RFE markets.



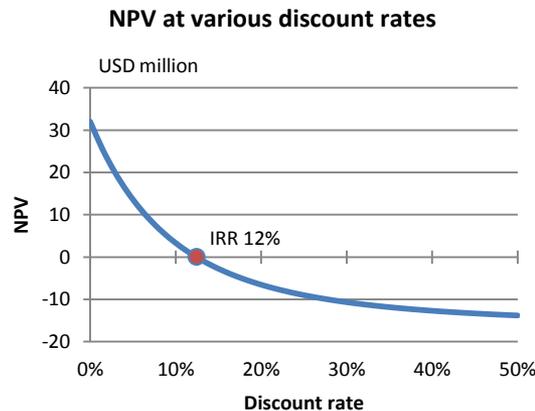
Executive Summary (2/2)



Estimated investment amounts to USD 15 million.

The glulam production has a calculated 12% internal rate of return in the conceptual study. Net present value of the investment would be USD 0.5 million, or RUB 16 million, with a 12% discount rate. This demonstrates that glulam production can be attractive in the Russian Far East when added to an existing sawmill.

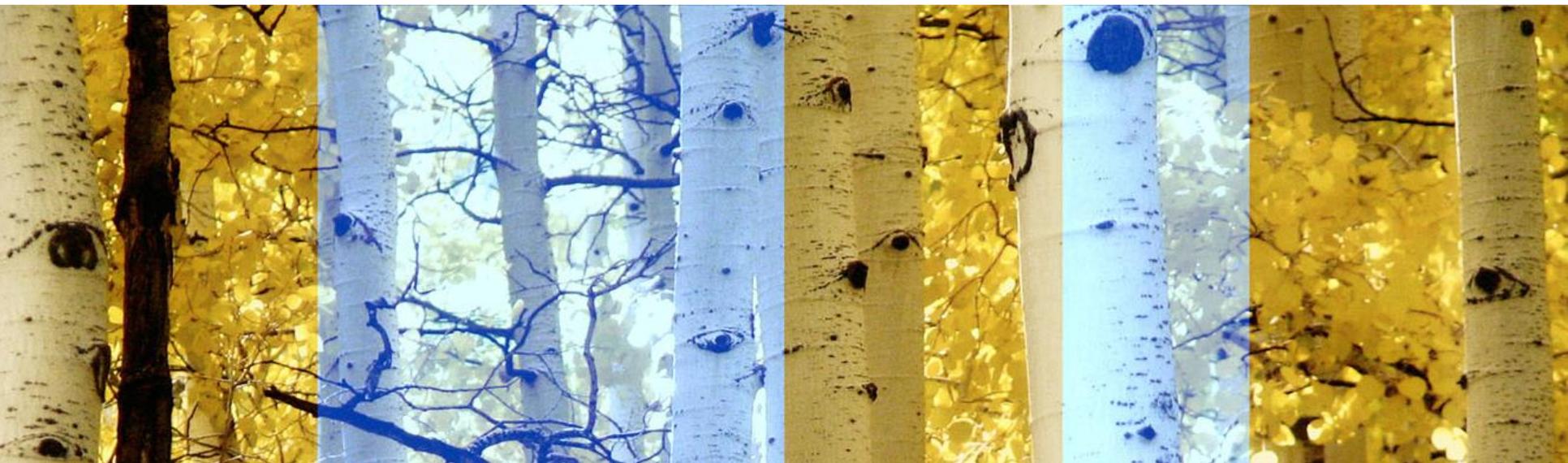
Successful implementation is a pre-condition for a successful investment and great focus should be paid to achieving a high quality production facility. Previous experience of both glulam production and glulam sales will be necessary and they should be brought into to the project by a foreign investor. Local partner will be required to secure the raw material (sawnwood) availability.



Conceptual Feasibility Study of Particleboard Production

European Bank for Reconstruction and Development – EBRD

6872



October 15, 2013



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Executive Summary (1/2)

Good supply of wood raw material (sawdust and wood chips), location close to growing Asian markets and the opportunity to further develop a wood product industry complex can make the Russian Far East an attractive place for a new particleboard investment. Locating the particleboard mill next to an existing sawmill enables creating a forest industry complex with significant synergies. A few places in Khabarovsk and Primorsky Krai would be suitable for building a new mid-sized particleboard mill with 300 000 m³ output capacity.

Russian Far East is a net importer of particleboard due to low quality and poor cost competitiveness of the existing production units. Competitive situation in the wood based panels markets in Asia is tight as the production in China has grown rapidly. However, high wood raw material costs in China may enable constructing more mills to the Russian Far East as the raw material supply is more economic and forecasted to grow when the sawmilling sector grows in the Russian Far East.

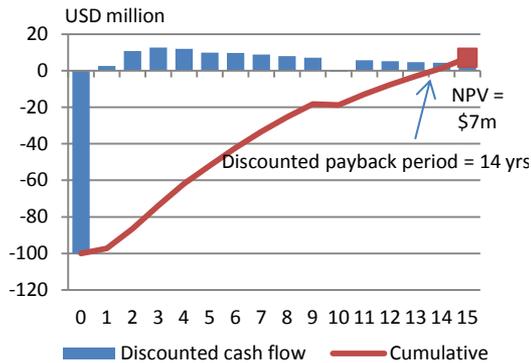
The particleboard mill would be located on an existing industrial site with existing sawmilling activities. There will be significant synergies with in raw material supply and logistics. Particleboard mill can utilize all by-products left over from a sawmill and additionally can utilize small diameter roundwood that is not consumed by the sawmill. Average cost for wood raw material is calculated at USD 32.50 / m³, including both side products from sawmills and harvested pulpwood.

Local markets and export markets seem both feasible, local market paying currently higher prices due to shortage of quality particleboard. Volumes are small and a large share of production will have to be exported also. Average sales price is USD 225 / m³.



Executive Summary (2/2)

Discounted cash flow

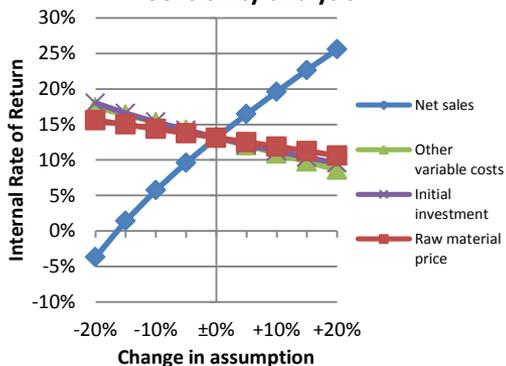


New particleboard production line would require an investment of USD 100 million and a precondition is to be located in the vicinity of an existing sawmill that can provide inexpensive wood raw material to the mill on a stable basis.

The planned particleboard production has a calculated 13% internal rate of return. The net present value of the investment would be USD 7.2 million, or RUB 216 million, at a 12% discount rate. This demonstrates that particleboard production can be profitable in the Russian Far East.

Profitability is the most sensitive to end product prices.

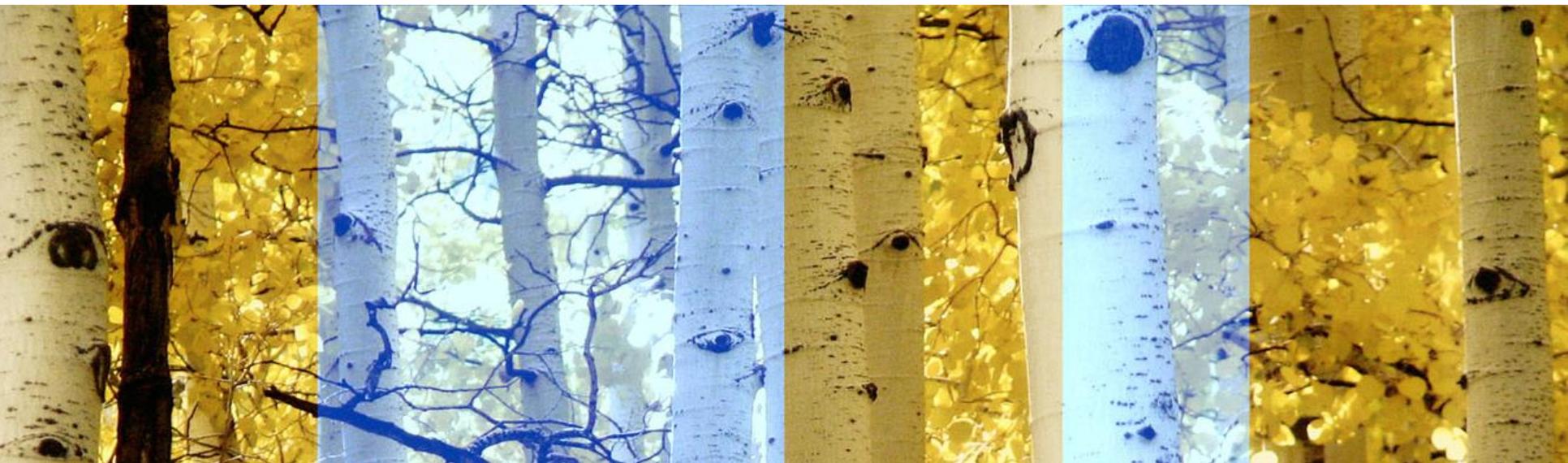
Sensitivity analysis



Conceptual Feasibility Study of Small Timber Production

European Bank for Reconstruction and Development – EBRD

6872



October 15, 2013



Indufor ...forest intelligence

Executive Summary (1/2)

Russian Far East is an attractive place to develop small timber production for infrastructure, (temporary) construction and mining applications. Under utilization of forest resources, location close to significant industrial operations utilizing large amounts of construction materials (mining, oil, etc.) and the opportunity to design and build a green field mill are comparative advantages of the region. Existing sawmills in Khabarovsk Krai and Primorsky Krai would be suitable places for building a new small diameter log sawmill with 100 000m³/a output capacity. This study describes the opportunity on general, conceptual level.

Locating small diameter log processing unit next to an existing sawmill or plywood/veneer mill enables the use of small diameter logs (pulpwood) also. Currently small diameter logs (pulpwood) are not harvested at all in many Russian Far Eastern forestry operations as there is not much demand for this wood assortment. Combining pulpwood and log utilization is a possibility that has not been widely explored. The small log sawmill could be located on an existing industrial site with existing facilities and hence have synergies with other industrial facilities.

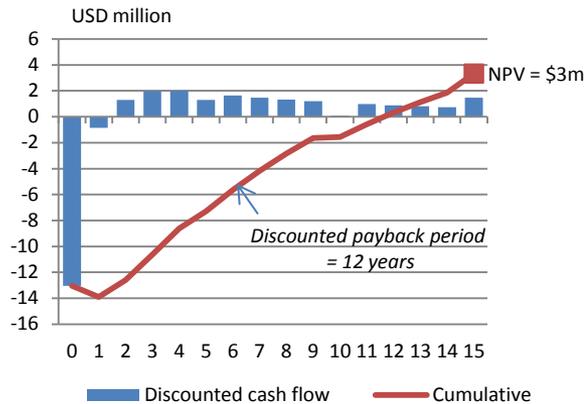
Harvesting can be expanded without risking the sustainability. Significant investments to road and infrastructure network will be required to enable stable and continuous wood supply to the mills but collecting and transporting pulpwood will not at additional cost when logs are harvested.

Mill gate wood cost is estimated at USD 30 per m³ which is very competitive (estimated cost for pulpwood). Average sales price for the small timber products is calculated at USD 150 per m³.



Executive Summary (2/2)

Discounted cash flow



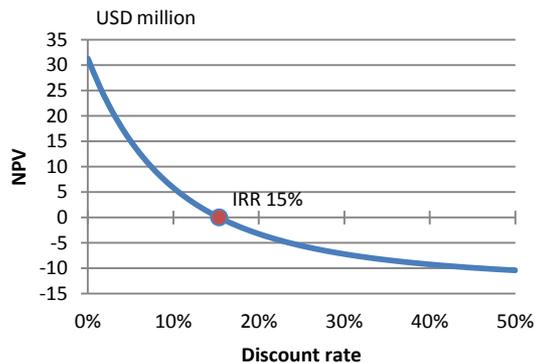
Required investment amounts to USD 13 million.

The planned sawnwood production has a calculated 15% internal rate of return. The net present value of the investment would be USD 3.3 million, or RUB 100 million, at a 12% discount rate. This demonstrates that small timber production can be profitable in the Russian Far East.

This requires there is a market for the sawmilling by products; without the by-product sales the NPV is USD 5 million negative. Therefore it is critical to consider the location well to enable sales of by-products. By products are assumed to be sold to local particleboard production with lower quality requirements that international wood chip (pulp chip) markets have.

Profitability is most sensitive to end product prices.

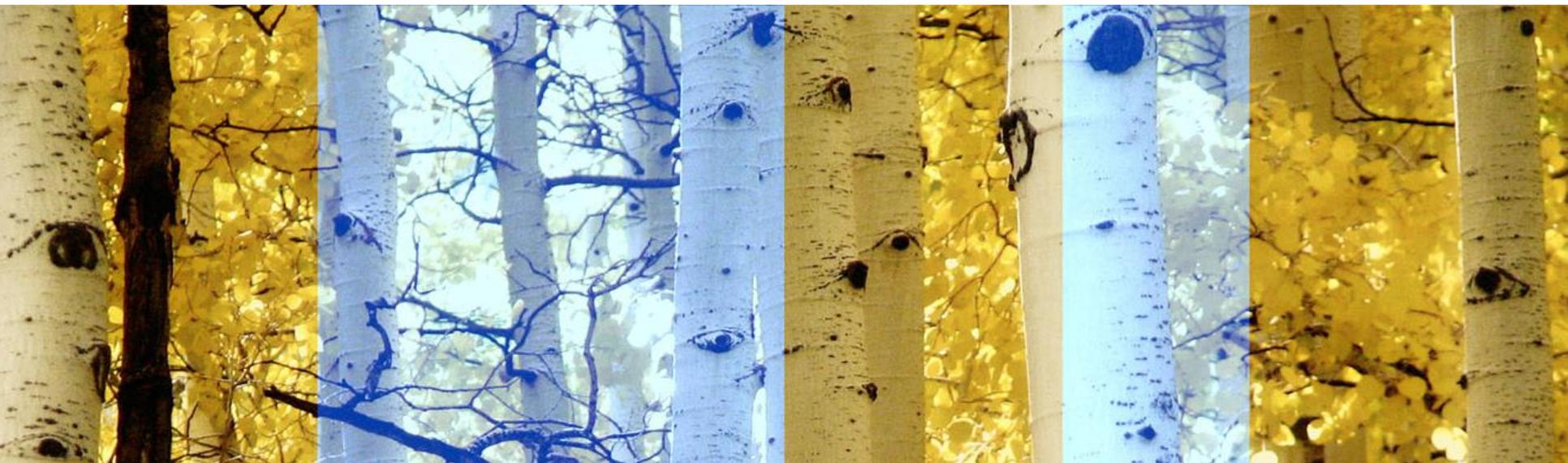
NPV at various discount rates



Conceptual Feasibility Study of Biofuel Production

European Bank for Reconstruction and Development – EBRD

6872



14 October 2013



Indufor ...forest intelligence

Executive Summary (1/2)

Liquid biofuel production techniques are being developed all over the world. The most developed liquid biofuel concepts based on woody (“lignocellulosic”) biomass are pyrolysis of bio-oil and fermentation of bioethanol, both processes of which are in a commercial stage today. One of the options to develop biofuel production is to integrate units with sawmills as they have significant synergies in raw material sourcing and shared infrastructure.

In the Russian Far East a liquid biofuel production facility could be located adjacent to an existing sawmill, or in a new integrated wood processing unit. The preferred location would be a sea port with loading facilities. There are a few sawmills and integrated production facilities that fulfill this criteria today. High quality forest resources (required for sawmill products) allow the development of new facilities in the future.

Currently there is no, or very little, demand for wood chips and sawdust in the whole Russian Far East region. Pulpwood is also available in large quantities as it is generally not collected together with sawlog harvesting operations. Suitable raw material for liquid biofuel production is available at a competitive cost. Average cost for such wood at the mill is USD 17.5 per m³ with a described raw material mix.

The most attractive biofuel markets are Russia itself and China, possibly also Japan. Japan has the most developed fuel standards today in Asia. Europe is not excluded as a market either as the demand is increasing and sea transportation is reasonably priced. Average price for pyrolysis oil at the plant is assumed USD 312 per m³ (based on LSFO price of JPY 70 000 per m³ in Japan, which is used as a reference price in the study). 70% of the bio fuel is targeted for export markets and remaining 30% is planned to be sold to local markets.

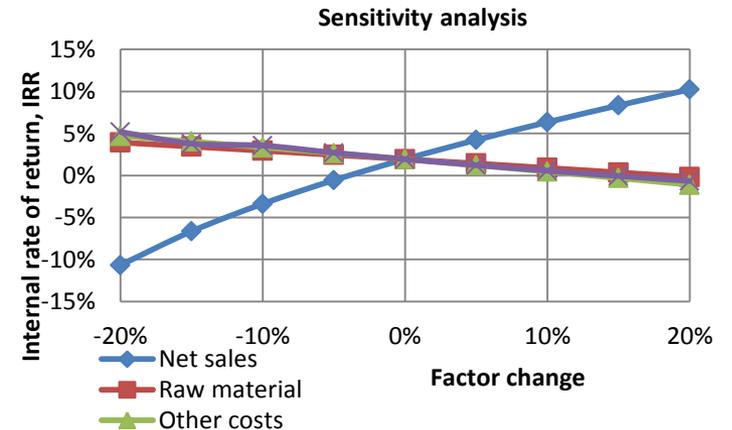
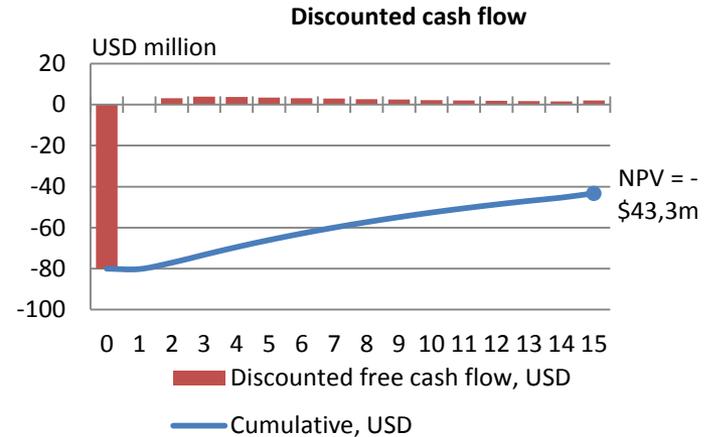


Executive Summary (2/2)

The planned pyrolysis oil production has a calculated 2 % internal rate of return. Net present value of the investment would be negative USD (44.3) million, or RUB (1 299) million, with a 12% discount rate. This clearly shows that biofuel production requires subsidies, such as investment grants or soft loans, to be commercially viable.

Majority of the international reference projects in liquid biofuel production have enjoyed some form of subsidies, in the form of investment grants or alternatively price guarantees for end products. With a 50% investment grant the biofuel production in this study would have an IRR of 12.5% and an NPV of USD 1 million.

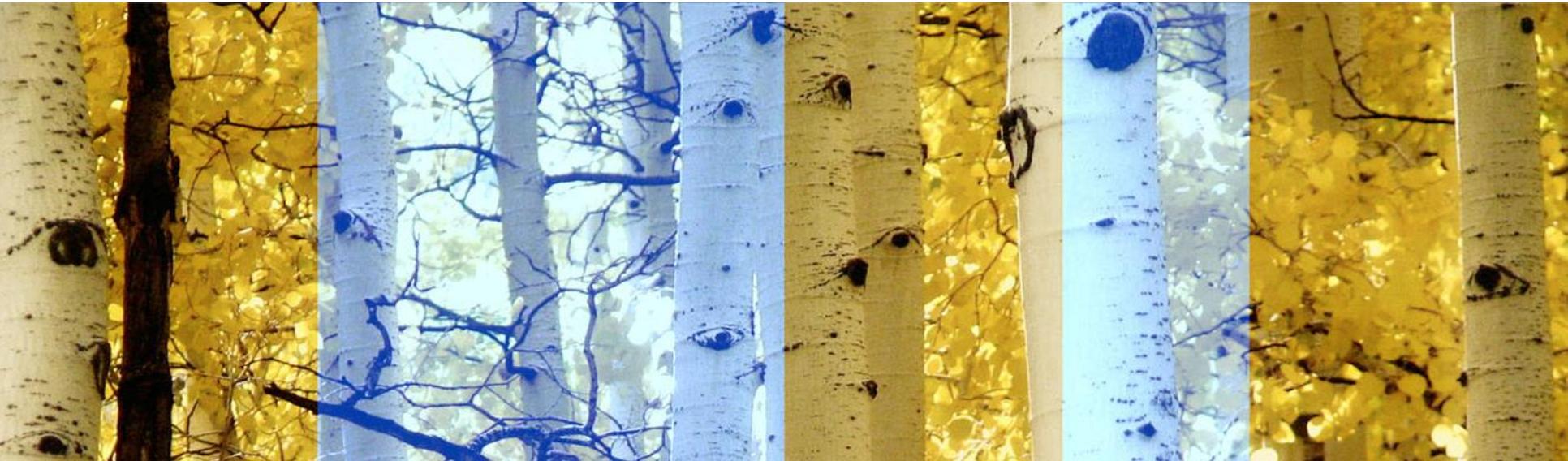
Development of production technologies is expected to increase the yields and lower the investment costs in the future. Markets for the products are now only emerging and price levels may strengthen. Biofuel production may become an attractive alternative in the Russian Far East in the future.



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