Potential markets for collapsible fuel bladders

Final Report

Fortinbras Results Pty Ltd

28 February 2022

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About NineSquared

NineSquared is a specialist economic consulting and commercial advisory firm focused on helping governments and companies make great decisions and achieve your goals and objectives.

Our principals and staff are experienced, senior level practitioners who have worked in and advised government and private sector clients about a range of commercial and economic issues, primarily relating to transportation. Broadly, our expertise lies in the fields of transport and regulatory economics, policy development and analysis and advising on commercial arrangements between government and the private sector as well as arrangements between companies operating within regulated environments.

Our combined public and private sector experience mean that we are well placed to provide our clients with deep understanding of both the public and private sectors and the interface between them.

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1 Introduction

NineSquared was commissioned to undertake an assessment of the potential benefits of the collapsible fuel bladder system that has been developed by Fortinbras Results Pty Ltd. NineSquared has also considered other possible uses for this unique liquid commodity transportation concept.

1.1 Approach

A three-phase approach to the analysis was undertaken of the potential markets for collapsible fuel bladders for bulk commodity producers that currently have empty rail wagons and trucks travelling from ports to mines. The main focus of the analysis was on bulk commodity producers that transport their output directly to port in dedicated wagons or trucks.

In stage 1 we developed a high level costing model to estimate the current cost of transporting diesel fuel using dedicated road tankers to provide an estimate of the potential financial saving from the technology.

In stage 2 we estimated the demand for diesel fuel at various types of mine operations to determine

- how much diesel fuel would be demanded by an illustrative mine
- how many trucks movements are currently required to provide diesel fuel to that mine
- how many empty wagons / trucks would be available to carry the collapsible fuel bladders
- the proportion of wagons / trucks which would be required to carry the collapsible fuel bladders if the system replaced the current fuel transport option
- how many collapsible fuel bladders would be required

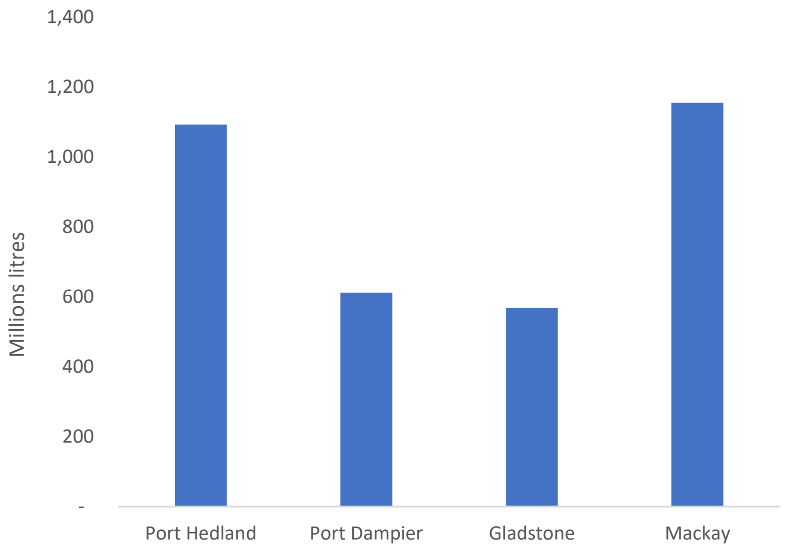
In stage 3 we looked at the wider benefits of the collapsible fuel bladders including the social and environmental benefits of reducing the number of fuel truck movements.

2 Bulk Commodities Hauled in Relevant Markets and Wagon Requirements

The collapsible fuel bladder technology was initially designed with the bulk commodity mining industry in mind to make use of the empty wagons and trucks that travel from bulk export terminals by returning to their mine sites with full diesel fuel loads. These mine sites are typically supplied with diesel fuel using trucks that also return empty to their fuel terminals. If the collapsible fuel bladders are transported using the empty bulk commodity wagons or trucks these diesel fuel trucks can be removed from the road completely, reducing costs for miners and transport operators. There are also other non-financial benefits, as well as the potential for use in industries other than mining.

The potential size of this market in the bulk commodity mining sector can be gauged by examining the size of the fuel imports at the major bulk export hubs and estimating the proportion that is transported to mine sites. Figure 1 provides an indicative estimate of the amount of diesel fuel that is currently being transported to mines associated with a number of the major bulk commodity export ports in Australia. In the case of Gladstone and Mackay all this fuel is transported to the mine sites using dedicated fuel transport road services.

Figure 1 Estimated annual diesel transported to mine sites from major bulk commodity export ports



Source: Port statistics

2.1 Potential impact on bulk commodity mine operations

The impact of the bladder system on a mine's fuel supply chain will depend upon how fuel and outputs are currently transported to / from the mine. Three alternative scenarios have been evaluated

- Bulk commodity mines with rail links that currently use road to transport diesel fuel
- Bulk commodity mines with rail links that currently use rail to transport diesel fuel
- Bulk commodity mines without rail links.

2.1.1 Bulk commodity mines with rail links, currently supplied with diesel fuel by road

Mines with rail links use rail wagons to transport their outputs to the export terminals and use road freight (either road trains or B-doubles) to transport all their inputs, including diesel fuel, to the mine. Diesel fuel is transported using dedicated fuel trucks which arrive full at the mine site and leave empty. At the same time the bulk output rail wagons arrive empty at the mine site and leave full of mine output. There is an opportunity to use the empty rail wagons to transport the full fuel bladders to the mine and return the empty collapsed fuel bladders on the rail wagons full of bulk mine output being transported to the export terminal thereby potentially eliminating the need for diesel fuel trucks.

For example, an open cut coal mine that produces 3mtpa would be expected to consume around 30 million litres of diesel fuel per year (based on 10 litres per tonne of output). This would require around 550 return fuel truck movements a year (based on fuel being transported by B-Double) which could be removed if each 120 rail wagon train consist used to transport coal to the export terminal carried only 10 bladders. Under this scenario around 30 – 40 bladders (15,000 litres each) would be required.

2.1.2 Bulk commodity mines with rail links, currently supplied with diesel fuel by rail

Mines with rail links that use rail to transport both their output and fuel utilise dedicated fuel wagons to transport the diesel fuel. These wagons are typically transported on dedicated fuel train consists and therefore take up a potentially valuable train path on the rail network. If the full fuel bladders were carried to the mine in the empty mine output rail wagons and the empty collapsed fuel bladders returned on the rail wagons full of mine output being transported to the export terminal, this would free up paths on the rail network and remove the requirement to have a dedicated fuel train consist.

A mine operation which had a dedicated fuel train consist would be a relatively large operation since even a relatively short 40 wagon consist could carry around 3.2m litres of fuel on each trip. Assuming one trip per week that would imply an annual consumption of 166.4m litres, and based on a fuel consumption of 2 litre per tonne of output (consistent with iron ore mining), that implies 83 mtpa of output. Under this scenario around 90 – 110 bladders would be required (15,000 litres each) and less and 1 in 60 of the iron ore wagons would need to carry fuel bladders i.e around 3 per consist.

One of the key advantages of the use of the collapsible fuel bladder technology would be the removal of the requirement to dedicate rail paths to fuel trains. Iron ore trains in Western Australia carry over 20,000 tonnes per train consist, which at current prices is worth over $2m. If only 5 of the above example 52 fuel train paths (one train per week) were utilised for revenue trains (i.e. a train transporting mine output) the mining company could generate an additional $10m worth of output per year and if all of the 52 fuel train paths were able to be utilised, then this could generate an additional $104m worth of output per year.

It is understood in some cases miners in the Pilbara use a hub and spoke type approach to transport fuel to multiple mine sites given the vast distances involved, i.e. rail transport fuel to a single central mine site location and then road transport fuel to satellite mine sites. The collapsible fuel bladder technology would negate the need for such an approach as fuel could be rail transported direct to each mine site with the mine output train involved. Also, if the miners are currently required to maintain or contribute to maintenance of roads used in fuel transport by truck, then it could be argued that such contributions may no longer be necessary if the collapsible fuel bladder technology was adopted.

2.1.3 Bulk commodity mines without rail links

Mines without rail links rely on trucks (either road trains or B-doubles) to transport all their inputs and outputs. Fuel is a critical input and is typically supplied by dedicated fuel truck services which have the capacity to reduce or increase supply as required. These fuel trucks arrive full at a mine site and leave empty. At the same time the bulk output trucks arrive empty at a mine site and leave full of mine output. The collapsible fuel bladders provide the opportunity to eliminate the requirement for fuel trucks by utilising the empty bulk output trucks to transport the full fuel bladders to the mine and return the empty collapsed fuel bladders on the trucks full of bulk mine output being transported to the export terminals.

For example, an iron ore mine producing 5 mtpa would be expected to consume around 10 million litres of diesel fuel a year based on fuel consumption of 2 litres per tonne of output. This would require around 100 to 200 return fuel truck movements per year (depending on whether fuel is transported by road train or B-double) which could be removed if only 2 in a 100 of the required iron ore road train movements to the port carried a 15,000 litre fuel bladder. Under this scenario only around 10 -20 bladders would be required, however, given the flexibility of the number of truck movements it may be that more smaller bladders prove to be more suitable.

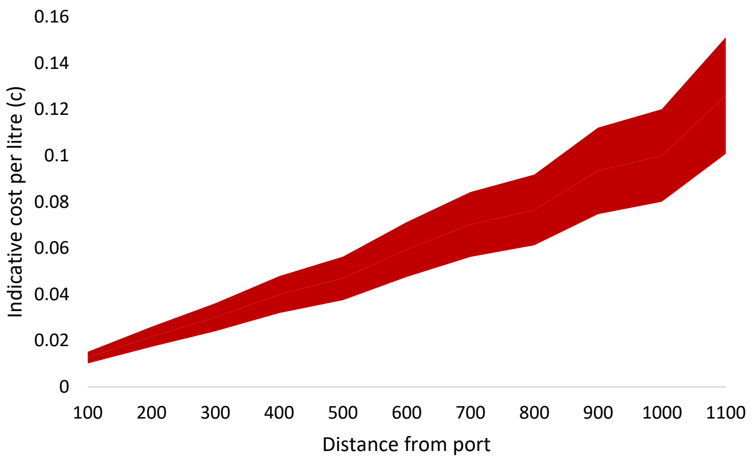
2.2 Financial Savings

The financial savings from these varied mining operations would depend on how far the mines were from the port. The further the mine from the port, the higher the cost of transporting the fuel and the higher the potential saving.

As illustrated in the graph below the potential savings would be greatest for mines which are further from port and / or consume more fuel. The net saving from the operation will depend on how well the collapsible fuel bladder system can be integrated into the current fuel handling operations at the mine and in the case of rail operations on whether the cost of any equipment required (e.g. overhead loading/unloading gantries) can be offset across multiple users. However, as outlined in the previous section, the number of bladders required is relatively modest.

Based on the average characteristics of mines that are serviced by the four major bulk ports of Gladstone, Mackay (Hay Point), Dampier and Headland, the current cost of transporting fuel is estimated to be in the vicinity of $70 - 100m per annum.

Figure 2: Indicative Range of Cost per Litre of Transporting Fuel by Truck



Source: NineSquared cost modelling, range dependent on the vehicle type used etc.

Further, in relation to rail usage of the collapsible fuel bladder concept, the financial benefits could extend beyond operational cost savings, by also increasing fuel supply chain reliability, particularly if seasonal disruptions to road networks through flooding is reduced and, instead, the fuel is delivered to the mine on the same rail network that transports the mine output to the port.

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2.3 Broader benefits

In addition to financial savings from reducing the number of fuel truck movements there are significant environmental savings generated by taking such trucks off the road. These include reduced

- air pollution
- noise
- congestion
- traffic accidents
- greenhouse gas emissions

2.3.1 Air pollution, noise, congestion and traffic accidents

Air pollution, noise, congestion and traffic accidents are factors which are included in an economic analysis of a mine operation and are particularly important where the port access roads travel through congested urban areas. In some situations governments could look to incentivise the use of the collapsible fuel bladders because it would reduce the negative impact of the port and mine operations on local communities.

2.3.2 Greenhouse gas emissions

Reducing greenhouse gas emissions is becoming increasingly important to companies as some key customers now take into account the overall environmental footprint of a company when choosing which producer to purchase from. It is estimated that for each 1m litres of fuel transported by road 300km to a mine 18 tonnes of Co2 is emitted, approximately the same amount that is absorbed by a hectare of mangroves[1]. For example, in this instance a 3mtpa open cut coal mine would use about 30 million litres of diesel fuel per year (based on 10 litres per tonne of output) meaning around 540 tonnes of Co2 would be saved by not using road transport for the fuel. The collapsible fuel bladders offer mines a relatively straightforward means of reducing their emissions without having to make major changes at the mine or export port sites.

[1] https://onetreeplanted.org/blogs/stories/how-much-co2-does-tree-absorb

3 Other Potential Markets

While the collapsible fuel bladder concept was initially designed with the diesel fuel transportation for the bulk commodity mining sector in mind, the ability to have a relatively large, robust, refillable liquid storage container transported as collapsed flat packs is likely to have value to a number of other markets.

3.1 Defence and emergency services

The combination of the size and strength with the ability to be stored flat could make the collapsible bladders useful for defence and emergency service operations which require the rapid and flexible deployment of equipment to areas which may not be well served by storage facilities.

For these markets the key advantage of the collapsible bladder system would be both the ability to store large numbers of the bladders in a relatively small place and the ability to recover the bladders without necessarily having to send numerous heavy vehicles, as would be required if each bladder was a similar size to a container.

3.2 Farm fuel and chemicals

Grain producers are also bulk producers that transport their produce in trucks and rail wagons to export ports that typically arrive full at the export port and leave empty. At the same time, these operations have fuel and chemical needs transported to their farms usually by road.

This could create a potential market for the collapsible bladders, although it is noted that the demand from individual grain producers would be much lower than from individual miners however the number of producers would be significantly larger.

4 Implications

The collapsible bladder technology concept offers the potential for financial, as well as broader social and environmental benefits, through more efficient use of existing transport systems.

The most immediate market for consideration is bulk commodity mining, where fuel needs are mostly transported by fuel trucks, or for some iron ore mines by rail, from port to mine sites. In Queensland, NSW and Western Australia this offers considerable potential for coal and iron ore miners to save on fuel – i.e. diesel – delivery costs.

The extent of the financial benefits will depend on a number of factors unique to each mine, namely fuel usage for the mine, the distance to transport the fuel and the operational configuration of the mine.

It follows that the greater the fuel consumption (related to the mine’s output) and the greater the distance from the port, then the greater the potential financial benefits presuming costs of integration with existing mine and port operations are not excessive.

The analysis suggests that the technology may have greater financial benefits for miners, where some or all of the following circumstances apply:

- the cost savings are material, relative to the overall operating costs of the mine operation;
- the incorporation of the collapsible fuel bladder technology frees up valuable rail network capacity to allow the more efficient movement of bulk commodities from mine to port; and
- where other (environmental and social) benefits are relevant

The analysis also suggests that for fuel transport operators who are contracted – or are seeking to be contracted – to mining companies for this service, the collapsible fuel bladder technology is an innovative and environmentally-favourable option that could assist in the gaining and retaining of contracts with mining companies to deliver diesel fuel to their mines.

In some instances, the decision to move to the collapsible bladder method of fuel transport may not be solely based on financial benefits to miners through cost savings, but environmental benefits (e.g. greenhouse gas emissions) or social benefits (e.g. less heavy vehicles on the roads and reduction in traffic accidents).

Although beyond the scope of this report, the technology has market potential across a range of non-mining sectors. This includes emergency services, defence and agriculture and these may require further investigation.