

RESEARCH REPORT

CONFIDENTIAL

Leaf Resources (LER)

Malaysia to be front runner for first commercial plant

BUY

12 Month Target	\$0.35
Price	\$0.10
Implied Return	250%

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Board of Directors

Jay Hetzel	Chairman
Ken Richards	Managing Director
Matthew Morgan	Non-executive director
Doug Rathbone	Non-executive director
Bill Baum	Non-executive director

Company Data

ASX code	LER
ASX price	\$0.10
Shares on issue	184.35 m
Options on issue	22.55 m
Market capitalisation	\$23.96m
12 month price range	\$0.09-\$0.19
ASX turnover (shares May 2017)	7.09 m

Malaysian opportunity Summary Valuation

LER net interest	50%
Unrisked value US\$ million	216
Unrisked value A\$ million (US\$/A\$=0.75)	288
Unrisked value \$/share (@250m shares)	1.15
Risked value A\$ million	86
Risked value \$/share (@250m shares)	0.35

Risked value \$/share Sensitivities

Glycerol sales tpa	Sugar price US\$/t		
	\$550	\$660	\$770
60,000	0.29	0.35	0.42
90,000	0.34	0.40	0.46
120,000	0.39	0.45	0.51

Leaf Resources makes renewable and sustainable 'cellulosic sugars'. Cellulosic sugars are a major feedstock for renewable chemicals that can replace virtually all petroleum derived chemicals with significant carbon and energy savings. Furthermore, they can compete on price and performance.

Leaf's Glycell process (Patent lodged July 2014), is based on crude Glycerol, and is a game changer for the renewable chemical markets.

The world wants renewable chemicals, evidenced by major chemical companies moving toward a sustainable green economy.

Leaf has coalitions, agreements and/or commercial arrangements from world class companies and governments:

- Novozymes, the largest enzyme company in the world
- Andritz, a leading supplier of plant, equipment and services for pulp industries
- Amalgamated Research Inc., a chromatography expert with 30 years of experience separating sugars
- Claeris, a Dallas based a world class renewable project developer
- Malaysian Government - recently signed MOU with government departments

Validation of the Glycell process has been made by Andritz, Novozymes, and engineering firms Leidos, and AMEC Foster Wheeler.

Since engaging with Malaysian authorities last October Leaf has signed a MOU with Agensi Inovasi Malaysia (AIM), a statutory body under the Prime Minister's department and a Letter of facilitation and collaboration with Malaysian Bioeconomy Development Corporation. These agreements envisage the construction of an initial 100,000 bone dry tonnes (100kdbt) facility, with an early 300kdbt expansion.

We anticipate progress over the next twelve months to include:

- Development of a financial package and incentives from Malaysian Government for the building of the facility.
- Heads of Agreement followed by Production/Sales Contracts.
- Final engineering for specific site – FEL3 which includes integrated demonstration and production of samples.
- Clear pathway to construction.

We estimate a project annual operating cash flow (100%, pre financing and tax) of US\$48 million (US\$24 million net to Leaf at 50% interest) for the initial 100kdbt plant, from the sale of C6 & C5 sugars, and 60,000 tpa of refined glycerol. This is half Leaf's expected level of refined glycerol sales.

We value the combined 100kdbt and 300kdbt opportunity at US\$221 million net to Leaf Resources assuming Leaf retains a 50% share of the project (presently 70%). This equates to A\$295m (at US\$/A\$ of 0.75) or \$1.18 per Leaf share on a fully diluted and expanded capital base of 250 million shares. We discount this value to 35 cps (a 70% discount), but expect share price appreciation as the above milestones are achieved and de-risking occurs.

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Background

Leaf Resource's proprietary Glycell process breaks down waste plant biomass, utilizing waste glycerol from biodiesel production and produces C5 and C6 cellulosic sugars, with lignin and refined glycerol as by-products.

Dilute acid and steam explosion, the two main current processes to produce cellulosic sugars, can't deliver sugars as economically or cleanly for the economic production of renewable chemicals.

Not only does the glycerol mix deliver a better physical result – 25% more sugars faster and cleaner – the recovered glycerol is potentially a profit centre. The process inputs cheap waste glycerol from biodiesel manufacturing and recovers it in a purified form at a higher market value.

Delivering cheap clean sugars, Leaf's Glycell process can turn waste plant material into an economical feedstock for the production of renewable chemicals, which are in increasing demand around the world. Companies are moving away from the fossil based black economy to a more sustainable green economy. Over 80 large consumer good companies have signed an accord to replace petroleum sourced goods from their supply chain. Major chemical companies have objectives of 25% of their sales being renewable by 2025.

Validation of the Glycell process includes testing at 10 tonnes per day (5 bone dry tonnes) at an Andritz test facility; a validation that has been independently reproduced by Novozymes.

Leidos Engineering have independently reviewed the process and concluded that Leaf has successfully demonstrated the feasibility of producing glucose syrups, and recovering glycerol for sale or for recycling within the process.

AMEC Foster Wheeler, as part of their FEL2 engineering work have confirmed Leaf's cost assessment for a greenfield plant.

The Malaysian opportunity

Through Leaf Development LLC (LDL), the joint venture company between Leaf and Claeris LLC, Leaf has signed a MOU with Agensi Inovasi Malaysia (AIM), a statutory body under the Prime Minister's department and a Letter of facilitation and collaboration with Malaysian Bioeconomy Development Corporation.

The Malaysian federal and state governments, represented by AIM and Sarawak State Planning Unit, have identified a selection of viable locations for a bio-hub development in the state of Sarawak.

The development of the Sarawak bio-hub is a key part of Malaysia's National Biomass Strategy, which aims to increase Gross National Income by RM\$30 billion, reduce carbon emissions by 12% and create an additional 66,000 new high-value jobs. Leaf's process is the vital link that converts abundant biomass to industrial sugars to facilitate the renewable chemical bio-hub. We believe the Malaysian Government will support the proposed Leaf facility by providing incentives, and an attractive financial package.

We anticipate Malaysian government support for an initial 100 thousand bone dry tonne per annum (100 ktpa) plant to include funding, site allocation and utilities. Early addition of a 300 ktpa facility will utilise the abundant biomass supply being negotiated with AIM.

Progress to date

- The Malaysian federal and state governments have identified two viable locations for a bio-hub development in the state of Sarawak – in the new Samalaju Port Industrial Park, or 60 kilometres to the south in the port of Bintulu.
- Leaf has commenced the application process for a site development.
- AIM will assist in securing the supply of no less than 300,000 bone dry metric tonnes (bdmt) of preferred biomass feedstock, a large volume resource in local plantations.
- The government will assist in securing the biomass at US\$60/bdmt or under.
- We see the potential for future capacity expansion that can take advantage of the potential 1,000,000 tpa availability of biomass in Sarawak.
- We anticipate that Leaf will retain at least a 50% interest in the project, shared with Claeris and another equity partner that could include an operating engineering company.
- Leaf's leading global partners have been critical to the acceptance by the Malaysian government of the Leaf Resources technology, and provide powerful allies to manage financial, technology and process risk.

The new Malaysian bio-economy

Malaysia provides a unique combination of all the attributes necessary to be a successful location for a 'platform' Glycell production facility. These attributes include its abundant biomass resources, its advantageous location within the ASEAN region,

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and the active commitment of both the Federal and State Governments. Malaysia has a forward thinking bio-technology philosophy supported at the highest government levels.

Bioeconomy Corporation is the lead development agency for bio-based industry in Malaysia, it is owned by the Ministry of Finance, and run under the purview of the Ministry of Science, Technology, and Innovation. It is advised by the Bioeconomy International Advisory Panel, chaired by the Prime Minister.

Bioeconomy Corporation is responsible for the National Biotechnology Policy, and acts to identify value propositions in both R&D and commerce and to support these ventures via financial assistance and developmental services. Two of its key mandates are to nurture and accelerate growth of Malaysian bio-based companies, and to actively promote foreign direct investments in bio-based industry.

It spearheads a number of programmes and initiatives that include the:

- Bioeconomy Transformation programme (BTP),
- BioNexus Status Programme, and
- Bioeconomy Community Development Programme (BCDP).

At the end of 2016 there were 61 Trigger Projects under BTP, 28 BCDP projects, and 278 BioNexus Status companies in Malaysia.¹

If LDL emulates the path of another biotechnology company (Verdezyne) in the Malaysian bioeconomy, we would expect LDL being awarded BioNexus Status in the near future that would deliver considerable tax advantages. Verdezyne reached a collaboration agreement with Bioeconomy Corporation in June 2013 (as LDL has recently done), and in September 2013 were awarded BioNexus Status. Ten months later, in April 2014 Verdezyne announced an agreement with Bio-XCell (a Bioeconomy Corporation/hub development joint venture) to finance and build Verdezyne's commercial diacid plant, which included US\$75 million funding, a 20,000 square foot facility, and all major utilities. We anticipate a similar commercial and funding model will be achieved by LDL at the Samalaju or Bintulu sites currently under application.

Such an arrangement would streamline commercial development for LDL and remove the need of project equity funding by Leaf.

In 2010 the government also set up Agensi Inovasi Malaysia (AIM) as the nation's innovation agency. It published a National Biomass Strategy in 2010 with the aim to assess new industries and high-value opportunities by utilising agricultural biomass for high value products, initially with oil palm biomass. An updated strategy was published in 2013 led by Bas Melssen², then Biomass Strategy team leader and VP Strategic Innovation for AIM. The updated strategy also explored the opportunity for Malaysia to capitalise on other types of biomass, such as forestry residues. The report³ identified Bintulu as a logical site for biomass processing and estimated the potential availability of 1 million bdtpa from existing Acacia mangium plantations.

Biodiesel manufacture – locally available crude glycerol

The Glycell process uses crude glycerol as an essential solvent. The crude glycerol emerges in a more refined state, and can either be recycled as the solvent, or incrementally refined to a commercial product. Hence a ready source of crude glycerol and a market for refined glycerol can benefit the process economics. Crude glycerol is a by-product (~10% by weight) of biodiesel production.

The first commercial palm biodiesel plant was built in Malaysia in 2002, with biodiesel exports commencing in 2006. A mandatory palm biodiesel blending programme in the transport sector commenced in 2011 with 5% blended with conventional diesel (B5). This was increased to 7% in 2014 (B7), and a B10 government policy is in place to further increase biodiesel use.

Malaysia is expected to produce 900,000 tonnes of biodiesel in 2017, up about 80% from half a million tonnes last year, while Indonesia's production is projected to rise to 3.5 million tonnes this year from three million tonnes in 2016⁴.

¹ see: <http://www.bioeconomycorporation.my/bioeconomy-to-significantly-impact-people-economy-and-capital-economy/>

² Bas Melssen is currently the Director of BioRefining Asia Pacific for Novozymes, the world's largest producer of industrial enzymes, and a collaboration partner of Leaf Resources in a joint programme to increase yields and efficiency of the Glycell process.

³ AIM, 2013 - National Biomass Strategy 2020: New Wealth creation for Malaysia's biomass industry, Version 2.0.

⁴ U. R. Unnithan, President Malaysian Biodiesel Association – www.mybiodiesel.org.my

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A 100 ktpa processing plant that is using 100% recycled glycerol requires only about 18,500 tonnes of glycerol per annum. In the situation where refined glycerol is sent forward to sale, this would increase to approximately 132,000 tonnes of crude glycerol for refined glycerol sales of 100,000 tpa. It is likely that crude glycerol purchases would be made from both Malaysia and Indonesia.

Price data from Oleoline.com, a subsidiary of the global oleochemical broker and agent HBI, indicates a strengthening price for recent crude glycerol in both SE Asia and the USA. While this represents an increased input cost for Leaf, the crude price increases are matched by increased refined prices which would offset higher costs if refined glycerol were sold. We provide more detailed price data in the Valuation section below.

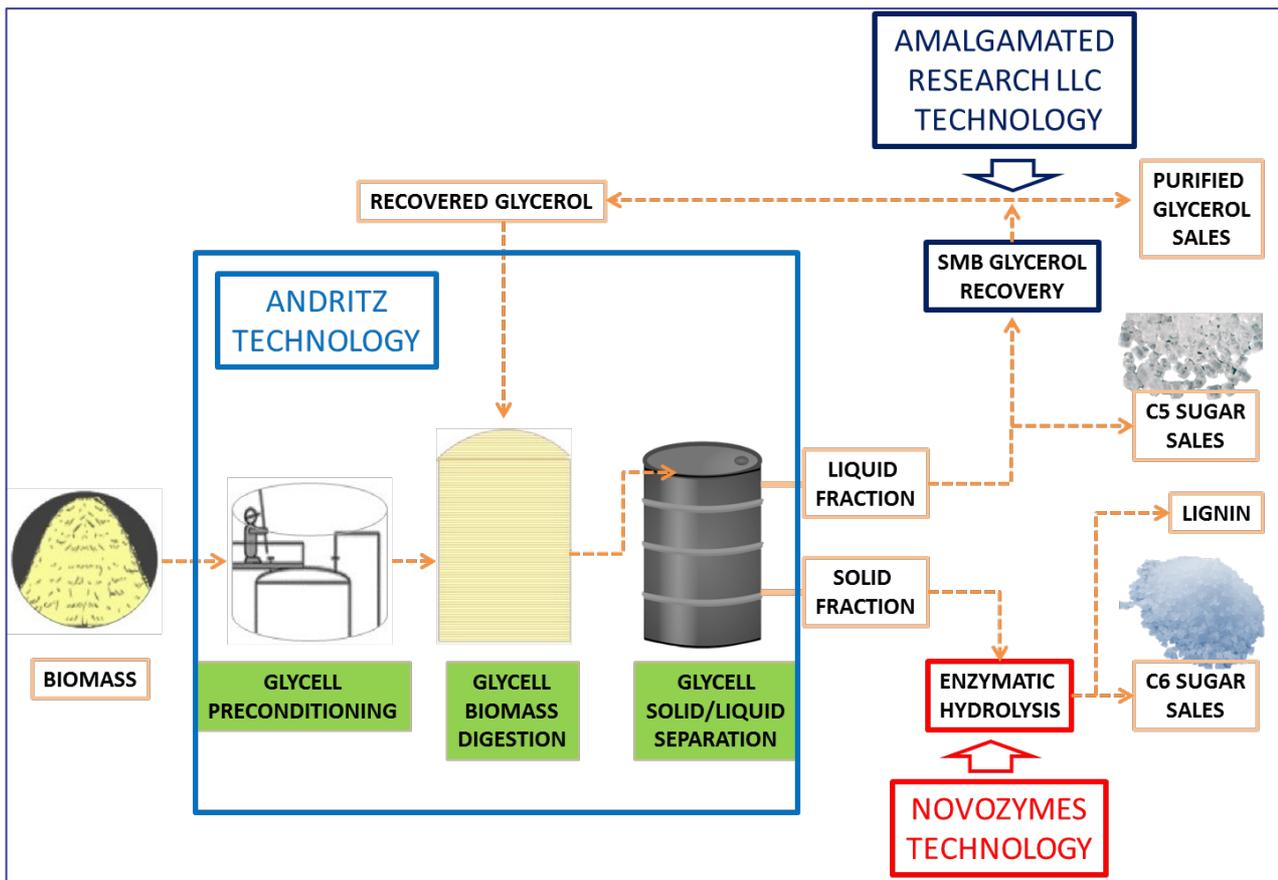
Leaf Resources - advances with powerful partners

In July 2016 Leaf announced a joint venture entity – Leaf Development LLC – with Claeris LLC, a well-connected and credentialed project developer in the bio chemical industry. Claeris has been instrumental in bringing the current Malaysian opportunity from the conceptual stage to the point of high-level government negotiation and agreement. Claeris will continue to guide this project through the current FEL3 execution development stage.

We see this opportunity as the first commercial development of up to five projects globally.

We expect that Leaf will have a final interest in Leaf Development LLC of 70%. Our modelling assumes that Leaf’s net revenue interest in an operating processing plant is reduced to 50%.

Figure 1. Process schematic showing technology partner contribution.



Other technology partners

Leaf has assembled collaborative ventures with major global technology and process engineering companies that provide confidence for achieving financial, engineering and process success. Figure 1 shows a schematic of:

1. the Glycell pre-treatment process,
2. enzymatic hydrolysis producing C6 sugars and lignin, and

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3. simulated moving bed chromatography (SMB) recovering purified glycerol and C5 sugars.

The figure also shows where Leaf's technology partners will interact and support each of these three process areas.

The significance of these partners is highlighted below.

Andritz.

Andritz is a leading supplier of plant, equipment, and services to the pulp and paper, hydro power, metal and steel industries and solid/liquid separation. The Austrian based company employs over 25,000 people and operates over 250 sites worldwide. Andritz supplies off-the-shelf hardware for the processing of biomass and chemical recovery in the pulp and paper industry. It has designed and costed off-the-shelf components for the Glycell pre-treatment process. Leaf Resources and Andritz have undertaken evaluation of the Glycell pretreatment technology on a number of specific biomass products including Eucalyptus Globulus, empty fruit bunch (EFB), sugar cane bagasse, wheat straw and various other hardwoods. Andritz has identified the Glycell process as a preferred pre-treatment of EFB and other biomass.

Novozymes

Novozymes is the world leader in bioinnovation and biological solutions, in the business of industrial enzymes and microorganisms. Novozymes is headquartered in Denmark, with affiliates and sales offices in over 30 countries. The Asia Pacific region represents 20% of its sales and 28% of its workforce. In December 2016 Leaf announced a collaboration with Novozymes to use its expertise to customise its broad portfolio of robust, high yielding enzymes to further enhance the performance of the Glycell process. Novozymes has independently validated the Glycell process results that were evaluated by Andritz.

Amalgamated Research LLC (ARi)

ARi develops and installs industrial separation and purification systems including simulated moving bed chromatography (SMB), ion exchange and membrane systems. Examples include recovery of sucrose from beet and cane sources, recovery of betaine and production of fructose from starch. ARi also provides efficient and cost effective biomass separation equipment for production of fuels and chemicals.

ARi has been designing and installing industrial SMB chromatography systems for more than 30 years. It installed its first industrial scale simulated moving bed chromatography system in 1981 for High Fructose Corn Syrup (HFCS) production and since that time, has installed numerous SMB systems world-wide.

ARi has tested filtrate from the Glycell process and confirmed that greater than 95% of the glycerol in the filtrate is recoverable by SMB chromatography at 95% purity.⁵

The sugar market – “sugars ain't sugars!”

Chemically, “sugar” is a naturally occurring organic crystalline substance called sucrose. Sucrose, a disaccharide, is a combination of two simple (monosaccharide) sugars – fructose and glucose. Internationally, when the term “sugar” is used, it is understood to mean sucrose that is produced from either sugar cane or sugar beet. Raw sugar is sugar normally produced from sugarcane and requires further refining to remove impurities. Refined sugar is widely used for industrial purposes.

Fructose, galactose, and glucose are all monosaccharides, with the formula $C_6H_{12}O_6$. Dextrose is an isomeric form of glucose. Glucose, dextrose or grape sugar, occurs naturally in fruits and plant juices and is the primary product of photosynthesis. It can be manufactured from starch by the addition of enzymes or in the presence of acids.

Xylose, commonly called wood sugar, is a natural 5-carbon sugar (C5, pentose) obtained from the xylan rich portion of hemicellulose. Xylose is also a monosaccharide with the formula $C_5H_{10}O_5$.

The Glycell process produces pure C6 sugars and C5 sugars. The C6 sugar specification anticipated is DE-95 (DE refers to a Dextrose Equivalent), which implies 95% glucose. Sucrose, being the combination of glucose and fructose, could be described as DE-50 (although both sugars are fermentable).

Sugar is traded extensively on world futures exchanges. The Sugar No. 11 contract is the world benchmark contract, which prices the physical delivery of raw cane sugar (DE-50).

⁵Edye, Baker & Sabourin, 37th Symposium on Biotechnology for Fuels and Chemicals, April 2015.

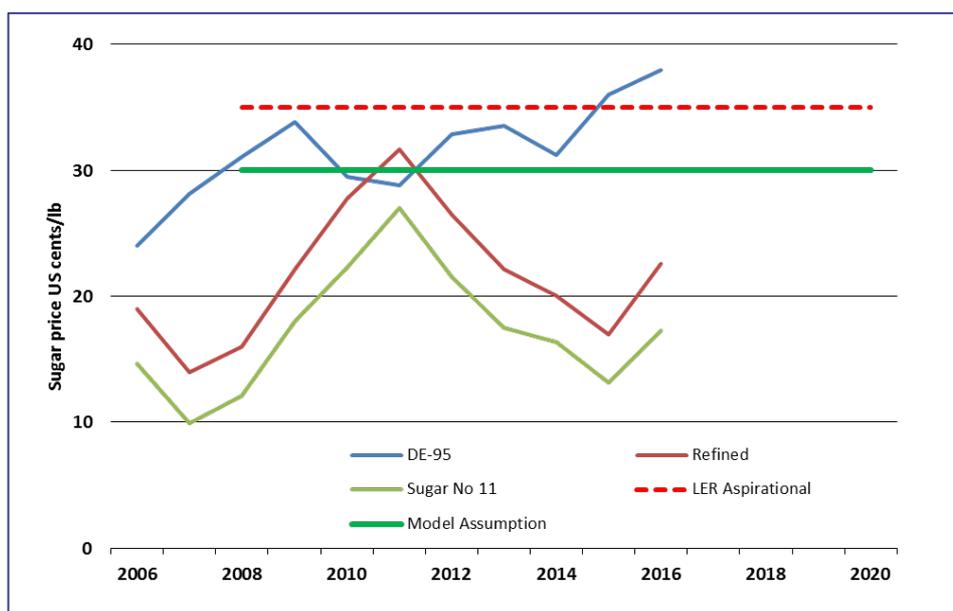
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C6 Sugar

Cellulosic C6 sugar production (also referred to as second generation sugar production or 2G sugars) will be the primary output of the Malaysian facility, and will supply local bio-refineries under the National Biomass Strategy. Figure 2 shows a ten year history of Raw, refined and DE-95 sugar prices. Also shown is the C6 sugar price assumed in our base case modelling (US\$0.30/lb or US\$660/tonne), and the long term Leaf aspirational price (US\$0.35 or US\$770/tonne). In our modelling we have run sensitivities at +/-US\$0.05/lb.

Figure 2. Historical sugar prices.



(Source: Milling & Baking News; LIFFE).

C5 Sugar

Leaf believes that its clean C5 sugars can be the ideal input for the natural sweetener, xylitol, and bio-glycol production. Several companies provide catalytic process technologies to achieve these products.

Increasing health awareness among consumers for low calorie based sweeteners in product formulation should drive global xylitol market size. Xylitol is a natural sweetener, with a low Glycaemic Index, 40% less calories and 75% less carbohydrate than sugar. It is claimed that xylitol doesn't promote tooth decay; it doesn't raise blood sugar levels, and is safe for diabetics. The market for xylitol is expected to reach US\$1.12 billion by 2023⁶.

Bio-glycols is a growing market (4.6% CAGR) and is expected to reach an estimated US\$47.2 billion in value by 2025⁷. This demand is being driven across a range of industries including food and beverage, textiles, medicine and aerospace

These growing markets provide Leaf with offtake opportunities for its C5 sugars from the Malaysian, and future plants. We expect that sales of C5 sugar into this market could achieve a price of US\$0.45/lb (US\$1,000/tonne). Our current price assumption for C5 sugar, however, is equivalent to the more conservative C6 sugar price.

Valuation

We have approached our valuation on the basis of risked, discounted cash flow models over a production period to the end of 2047 (ie a 25 year period from the expanded plant commencement), under the following scenario.

⁶ Global Market Insights, <https://www.gminsights.com/pressrelease/xylitol-market>.

⁷ Grand View Research Inc, <http://www.marketwatch.com/story/glycols-market-size-worth-472-billion-by-2025-growth-rate-60-grand-view-research-inc-2017-03-20-5203313>

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A 100 ktpa plant commences production in 2020 using EFB or Acacia mangium woodchips purchased for US\$60/bdmt (equivalent to \$30/tonne on an 'as-is' basis at a 50% moisture content). Crude glycerol is purchased locally for US\$250/tonne. The plant is funded by a 10 year Malaysian government loan for 100% of the capital (US\$133 million) at an interest rate of 5%. C6 sugars are sold 'over-the-fence' at US\$660/tonne as part of a bio-hub development, and C5 sugars are sold independently at the same price.

This facility uses an off-the-shelf 100 ktpa Andritz horizontal digester that is suitable for either EFB or hardwood.

Plant expansion in 2023 uses an additional off-the-shelf 300 ktpa Andritz vertical digester (or 3 additional 100ktpa digesters) suitable for hardwood. The expanded plant is funded by a combination of debt (60% @ 6%) and equity by LDL.

Our modelling assumes the biomass cost in both plants is US\$60/bone dry tonne plant, although we recognise that if the plants used EFB as a feedstock then this biomass is expected to be available for approximately half the price of Acacia woodchips

We believe the regional market can absorb up to 120,000 tpa of refined glycerol sales⁸ from Leaf production in Malaysia. We assume that refined glycerol sales occur from the initial 100ktpa facility. We run sensitivities on the sale of various volumes up to 120,000 tpa of refined glycerol at a price of US\$700/tonne. Our base case assumes sales of 60,000 tpa.

We assume no lignin sales, but consider lignin output is burnt as fuel, offsetting energy costs.

This project value, with sensitivities for C6 sugar price between US\$550 and US\$770 per tonne, and volume of glycerol sales varying from no sales to 100,000 tonnes per annum, is given in Table 1.

Our base case valuations are at a sugar price of US\$660/tonne, and are highlighted in Table 1 and Table 2.

NPV calculations are made using a discount factor of 10%, with **no** escalation applied to costs or prices.

Table 1. Value and sensitivities (US\$ & A\$million) – Leaf 50%.

Refined Glycerol sales tpa	C6 Sugar Price US\$/t (with C5 price at US\$660/t)					
	\$550	\$660	\$770	\$550	\$660	\$770
	US\$ million			A\$ million (@ US\$/A\$ = 0.75)		
60,000	183	221	260	244	295	346
90,000	212	250	289	282	334	385
120,000	241	279	317	321	372	423

We have calculated A\$ per share value on an expanded capital base of 250 million shares and then applied a 30% risk factor (70% discount) to account for project development risk. These results are shown in Table 2.

Table 2. Value and sensitivities (A\$ per share & risked A\$ per share) - Leaf 50%.

Refined Glycerol sales tpa	C6 Sugar Price US\$/t (with C5 price at US\$660/t)					
	\$550	\$660	\$770	\$550	\$660	\$770
	A\$ per share on 250 million share base			A\$ per share with 30% risk factor		
60,000	0.98	1.18	1.38	0.29	0.35	0.42
90,000	1.13	1.33	1.54	0.34	0.40	0.46
120,000	1.28	1.49	1.69	0.39	0.45	0.51

⁸ We have sighted correspondence between HB International SAS, a global brokerage house specialising in glycerine and other oleochemicals, and Leaf, stating their ability to sell up to 120,000 tonnes per annum of Leaf production at market prices.

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Potential project cash flow

We summarise in Table 1Table 3 the potential cash flows from the 100k bdt and 300 k bdt plants on a pre-tax and pre-financing basis at various levels of refined glycerine sales.

Table 3. Potential annual pre-tax, pre-financing cash flow (US\$million)

Plant	Refined Glycerol sales ktpa	Annual NCF pre-tax pre- financing (100%)	Annual NCF pre-tax pre- financing (50%)
100k bdt	0	26	13
100k bdt	60	48	24
100k bdt	120	70	35
300 k bdt	0	84	42
Base Case			
100 + 300 k bdt	60	132	66

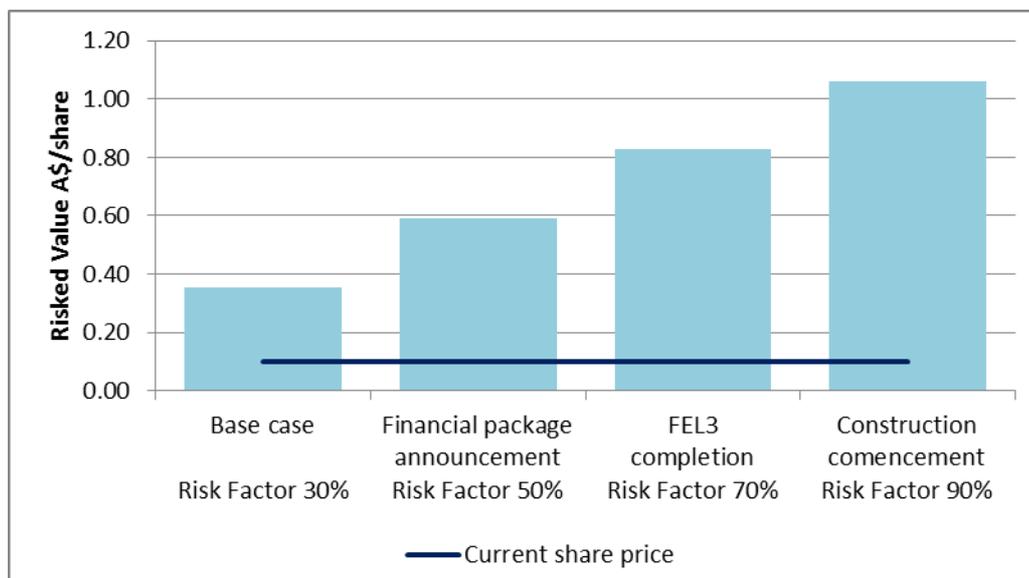
De-risking the valuation

We expect Leaf to progress the Malaysian opportunity over the next twelve to eighteen months, and anticipate announcements that will progressively de-risk our valuation. Three major milestones will be:

- An announcement of a financial package that will provide funding details and include Malaysian government incentives,
- Completion of FEL3, and
- Commencement of facility construction.

Figure 3 presents the impact of this de-risking on our risked share valuation.

Figure 3. Potential risked value and de-risking milestones.



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Expected total Return is measured as (capital gain (or loss) + dividend)/purchase price

We have divided our recommendations into three main categories:

Buy: Expected Total Return in excess of 15% over a 1 year period.

Hold: Expected Total Return between 0% and 15% over a 1 year period.

Sell: Expected Total Return less than 0% over a 1 year period.

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I verify that I, (Peter Cameron), have prepared this research report accurately and that any financial forecasts and recommendations that are expressed are solely my own personal opinions. In addition, I certify that no part of my compensation is or will be directly or indirectly tied to the specific recommendation or financial forecasts expressed in this report.

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