

## EDEN ENERGY LTD

<b>Company</b>	Eden Energy Ltd
<b>Business</b>	Alternative Fuels
<b>Code</b>	ASX : EDE
<b>Market Cap (o/s)</b>	A\$62.96 mln (£29.72 mln)
<b>Share Price</b>	A\$ 0.40
<b>52wk H / L</b>	A\$ 0.80 / 0.28
<b>No. of Shares</b>	166.9 mln
<b>No. of Options</b>	87.4 mln
<b>Fully Diluted</b>	253.8 mln
<b>Cash (Dec-07)</b>	A\$6.0 mln

### Management

**Gregory Solomon**, Chairman  
**Gregory Egan**, Executive Director  
**Douglas Solomon**, NED  
**Guy Le Page**, NED  
**Andrew Leibovitch**, NED  
**Richard Beresford**, NED

### Top Five Shareholders:

Noble Energy Ltd	20.80%
Ganesh Nominees	13.50%
Mr Gregory Egan	6.2%
Macquarie Bank	5.4%
Goldman Sachs	5.4%

[www.edenenergy.com.au](http://www.edenenergy.com.au)

### Share Price Graph (6 mos.)



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VP - Corporate Finance  
 (Energy and Alternative Fuels)

## CORPORATE FINANCE: RENEWABLE ENERGY AND ALTERNATIVE FUELS



**Eden Energy**

### Background / Summary

Eden Energy Ltd. (ASX: EDE) is an alternative fuel and renewable energy company with operations in Australia, India, the U.K. and the U.S. Though headquartered in Perth, AUS, the Company's major assets are in the state of South Australia, several U.S. cities, South Wales (U.K.) and India. Eden has varied interests in the sectors of hydrogen production, storage & transport, fuel systems, coal seam methane, conventional gas, geothermal power, and research and development into low temperature pyrolysis of methane to produce hydrogen from Natural Gas without producing carbon dioxide. Sewn together as part of an integrated strategy, Eden aims to blaze the trail to a hydrogen-fuel economy through its convenient, economic, and trademarked intermediary fuel, Hythane®.

The Company currently has a market capitalisation of A\$62.96 mln (£29.72 mln; s.p. A\$0.40) and is looking to support its operations through until 4Q09 at which time it should have received a cash injection through the exercising of A\$18mln in outstanding options. Further value is expected to be derived from the realisation of its assets in natural gas and geothermal.

Gas assets in Wales and South Australia will be inserted into a new SPV of which we expect Eden to own between 40 - 50%; the balance will be owned by a key UK traditional fuel investor who is inserting substantial realised and prospected natural gas plays. Negotiations are underway for a strategic industry partner to farm-in anywhere from 25 - 50% of the SPV. The geothermal assets in Australia, a market known for robust geothermal valuations, are set to float on the ASX in early 2Q08 under the name *Terratherma*. Eden will float 50% of that company for an anticipated A\$15 mln, retaining the balance. The Company's motivations for putting these assets into self-funding positions is to free resources to focus on its primary offerings as an integrated hydrogen company.

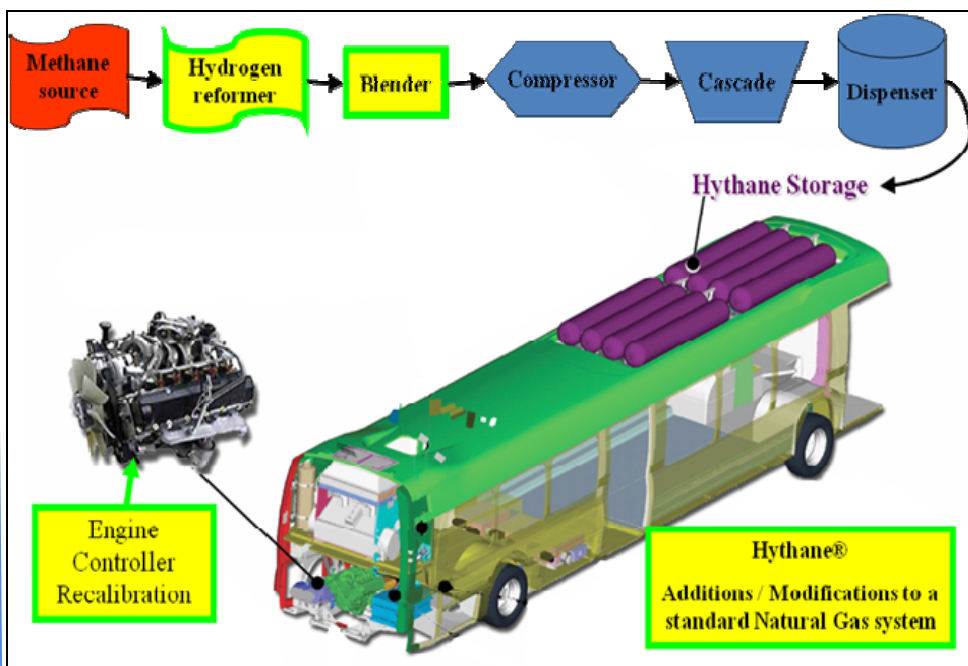
### Hythane and Hythane®

Eden aims to be the world leader in the production, storage, transportation and use of hydrogen, subdividing these specialties under: Hythane® Company LLC ("Hythane-Co"), HyRadix Inc ("HyRadix") and Eden Cryogenics LLC ("Cryogenics").

### Hythane® Company LLC

Hythane-Co has a pure focus on the production and use of its patented blend of 20% hydrogen and 80% natural gas by volume, 7% and 93% respectively by energy. This achieves several advantages over regular compressed natural gas (CNG) and other fuels:

- 50% NOx reduction over CNG; when blended with CNG in Hythane® the hydrogen produces leveraged benefits that also reduce NOx 7x more effectively than pure hydrogen;
- 3 - 10% efficiency gains are achievable, depending on the engine (stoichiometric vs. lean burn);
- Hythane® has 15 years of proven use and is fully compatible with existing natural gas infrastructure and is also suitable for liquefied natural gas / dual-fuel;
- Represents one of the cheapest way to meet new emission standards; and,
- Hythane® only requires relatively low purity gas (>90% H2) versus fuels cells - Hythane® thus justifies early investment in hydrogen infrastructure.



**Hythane® Bus Fleet Model**

### Market Dynamics

Eden's approach to the market in India for Hythane® is two-pronged: bus fleets and stationary generator sets (gen-sets). Bus fleets have been legislatively forced to convert to natural gas due to photochemical pollution across India's major cities. The addition of the Hythane® kit enables a further 50% reduction in pollutants, especially in carcinogenic particulates and oxides of nitrogen. The only major alteration to a CNG vehicle is a reprogramming of the engine's control tables in the micro. The economic benefit to the operator is the >3% (up to 8 - 10% in lean burn engines) increase in efficiency for only a <10% increase in operating costs. While the Company has not released any projections related to either its bus fleet Hythane® or its generator set markets, it has provided the following: i) average of 50 buses per refuelling unit with an average daily output of 12,000 Nm<sup>3</sup> Hythane®, ii) the Company will enter into cost-plus arrangements with the fleet's natural gas supplier (typically state-owned), and iii) the Company targets the following typical proportions of the markets:

	Targeted Market Penetration	
	Buses (Stn.)	Gen-sets
2008	100 (2)	2
2009	1,000 (20)	100
2010	5,000 (100)	500
2011	10,000 (200)	1,000

Based on these, the use of Hythane in one fuelling stations represents an attractive opportunity for Eden under its cost-plus business model. Eden's natural gas partners believe the market can sustain approximately a 10% margin available through the use of Hythane® as a clean premium blend of natural gas. In addition to such returns and the cost coverage models provided by its partners, Eden carries minimal direct responsibility

for maintaining the project except for triennial replacement of the catalysts and a few hours regular monthly maintenance. Assuming a base selling price of approximately Rs17.6/Nm<sup>3</sup> for Hythane®, which is a premium margin of 10% of 16 Rs/ Nm<sup>3</sup> CNG, and Eden receiving a margin of 10% of that (1.76 RS/Nm<sup>3</sup>), Eden's nominal Gross Margin per refuelling station equates to approximately US\$193k (A\$209k). With warranty coverage, 10yr straight-line depreciation, and a capex of about US\$900k, we project each such station would yield an unleveraged cashflow IRR in excess of 12.5%, with asset financing increasing this figure 1.5 – 2.5x. This proposition is strongly reinforced by the legislated market pull, and is reasonably expected to extend to other vehicles including auto-rickshaws, taxis, motorcycles and mopeds, with potential for the entire burgeoning car and truck industry in India.

The gen-set market in India is already widespread; its growth continues due to national productivity outpacing the construction of a reliable electrical grid. As such, factories and building managers maintain on-site generators with outputs from 500kW - 1MW, all running almost exclusively on diesel. By way of explaining the scope of such gen-sets, a 500kva (400KW) dual-fuel engine requires 100L of diesel per hour. Eden has collaborated with Cummins to modify a diesel/Natural gas dual fuel kit for Hythane® operations. Hythane® allows a dual-fuel generator to shift its gas:diesel ratio from 60:40 to least 80:20 which leads to major cost savings due to the higher cost of diesel. We examine the economics of **one** such generator over its depreciable life (10yrs) as:

Exchange Rate: Rs1 = \$0.025, Rs40 = \$1.00		INR	USD
Cost of Diesel / L		Rs45.0	\$1.13
	1 L diesel (MJ)	38.68	
	1 MJ Natural Gas (mcf or MMBtu)	0.00095	
Natural Gas Prices per MMBtu (USD)		Rs340.0	\$8.50
Cost of Natural Gas / L-equiv		Rs12.5	\$0.31
<b>Typical 500kW Dual-Fuel Engine (per hour)</b>			
Hourly Cost (100 L Diesel + 150 L-equiv NG)		Rs6,374.0	\$159.35
<b>500kW Dual-Fuel Engine using Hythane® (per hour)</b>			
Increased cost of Hythane® (H <sub>2</sub> -CNG) over NG	3%		
Hourly Cost (25 L Diesel + 225 L-equiv H <sub>2</sub> -CNG)		Rs4,020.4	\$100.51
<b>Saving using Hythane (per hour)</b>		<b>Rs2,354</b>	<b>\$58.84</b>
Baseload minimum generation (hrs/yr)	6000		
Minimum Cost Savings (total/yr)		Rs14,121,870	\$353,047
Capital Cost for Hythane® Add-On Kit		Rs5,400,000	\$135,000
<b>Capital Cost to Customer, Yr.1</b>		<b>-Rs1,869,533</b>	<b>-\$46,738</b>
Gensets depreciable life	10 years		
Discount rate	10%	12%	15%
<b>NPV (in total in-/outlays), 10yrs</b>		<b>\$861,478</b>	<b>\$723,885</b>
			<b>\$551,196</b>

While the above reflects total benefits to all parties presumably Eden, due to the important role Hythane® plays in the gen-sets, will be able to capture a significant amount of the value illustrated above. The impact on the economy of diesel displacement in these engines leads to impressive savings for operators for whom cost-cutting is of primary importance. For Eden, collaborating with a gas supplier or gen-set manufacturer as a backer suggests a clear applicability and available market for Hythane®'s advantages – Cummins' Indian division (BSE:KCC) grew its share price 77% YOY until Aug-07 and is considered the leading industrial gen-set manufacturer. Moreover, it is notable that Cummins is the largest foreign investor in the Chinese diesel engine industry.

#### HyRadix Inc.

In Apr-07, Eden purchased HyRadix Inc., a Chicago-based company that specialises in the on-site production of hydrogen from natural gas reformation. HyRadix has for years been producing on-site hydrogen in the U.S., Malaysia and China, for all of: hydrogen fuel cell buses (California), palm oil processing (Malaysia) and the heat treatment of steel (China). The company differentiates as the lowest-cost hydrogen producer. The use of natural gas as opposed to electrolysing water with grid electricity underpins this strategy.

Furthermore, mobile on-site hydrogen applications are also in higher demand, eliminating complex and expensive transportation.

This segment of Eden's operations possesses a very strong technological base and is core to the Hythane® projects and industrial gas sector. Marketing in India of HyRadix hydrogen reformers for the industrial gas market has already led to **Praxair's approval of Eden as its supplier of hydrogen in India**; Praxair is one of the four largest industrial gas companies in the world. HyRadix has also agreed to **supply a reforming unit to Pilkington**, the international glass company. Lastly, Eden's commercial operations with its U.S. client the SunLine Transit Agency (Palm Springs, CA) have yielded financial and operational benefits including a 50% cost savings in hydrogen. This unit has more than 10,000 hours operation, 50% NO<sub>x</sub> reduction, 50% H<sub>2</sub> cost reduction, and has fuelled more than 120,000 bus-driven miles.

#### *Eden Cryogenics and Cryogenic Technical Services*

In Aug -07, Eden bought US-based Cryogenic Technical Services. Cryogenic storage capability of hydrogen completes Eden's technology package related to the production, application and storage of hydrogen. The technology is also used in the liquefaction and storage of LNG and liquid H<sub>2</sub>. Eden Cryogenics makes and markets a range of cryogenic valves, vacuum insulated piping, cryogenic connectors (bayonets), cryogenic filters, vacuum evacuation valves, hinge and gimble joints, and other associated equipment. Currently, Cryogenic Technical Services is fabricating a storage container for cryogenic Hythane® which has significant market potential for the large truck and locomotive markets which utilise LNG as a fuel. At present, however, **Eden Cryogenics' largest client is NASA**, who contracts Eden's cryogenics divisions for various cryogenic hydrogen parts and is ramping up its lunar and Martian programmes. This is perhaps the strongest endorsement of both divisions' continuing leadership.

Key recent developments in Hydrogen and Hythane® include:

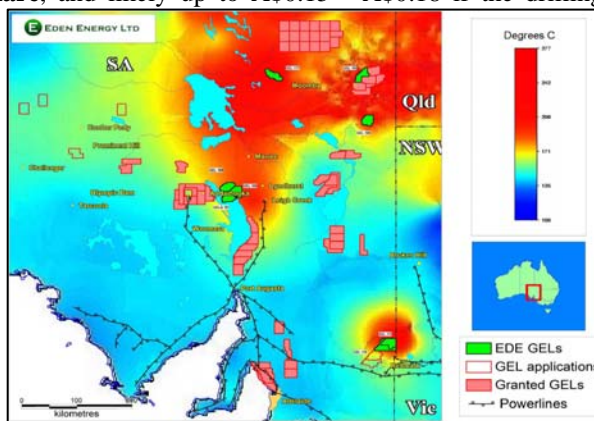
- Start of manufacturing of H<sub>2</sub> production units for the Indian Hythane® bus demonstration projects and industrial gas applications;
- Indian Government announced a target of having all NG powered vehicles (about 1 million) or 20% of the national vehicle market running on a H<sub>2</sub>-CNG (Hythane®) blend by 2020;
- Agreements in marketing and corporate structuring concluded with **Ashok Leyland** (10yr manufacturing contract), **Gujarat State Petroleum**, **Cummins Power** and **Larsen & Toubro**. The last will ultimately result in a joint venture covering the manufacturing of Eden's range of hydrogen and Hythane® equipment;
- The Indian government plans to extend the gas pipeline network to cover more than 50% of the population (of 1.1 billion) and more than 60% of its entire vehicle market;
- Negotiations are underway for conversion of a second Indian Natural Gas bus engine (first is completed) and a mini-bus engine to Hythane® operation;
- Eden Energy won an international competitive tender over US and European competitors for the construction of a H<sub>2</sub>-CNG refuelling station on New Delhi's major thoroughfare, Lodhi Road, opening Aug-08;
- Praxair, after a lengthy vendor review, adopts Eden's hydrogen reforming for all H<sub>2</sub> generation in its on site hydrogen production in India; and,
- San Francisco Airport confirms its decision to trial Hythane®, and Syracuse (NY) and Hempstead (NY) announce progressed Hythane® demonstrations; the Company has entered into discussions with other ports and municipalities such Barstow (CA) and the Port of Los Angeles.

**Geothermal: Terratherma**

Eden has assembled a portfolio of tenements in South Australia comprising 10 granted geothermal exploration licenses and 12 applications for geothermal exploration licenses and one further application in New South Wales. In total, these tenements cover an area of 11,859km<sup>2</sup>. These licenses and applications have been selected due to their geothermal prospectivity and potential to develop geothermal power generation projects. In the Cooper Basin, one of these GELs abuts those held by Australian company, Geodynamics (ASX:GDY). Geodynamics is the largest Australian geothermal company with a present market capitalisation of A\$275 mln. To give an idea of values for Australian geothermal assets, in 4Q07, Geodynamics granted a strategic partner to farm-in A\$105 mln for 30% of its tenements. Other pure-play geothermal comparators in Australia are:

Company (ASX Code)	Market Cap
Geodynamics (GDY)	A\$275.0 mln
Petratherm (PTR)	A\$48.0 mln
Geothermal Res. (GHT)	A\$23.1 mln
Green Rock (GRK)	A\$16.0 mln

Eden’s geothermal tenements are not contiguous, but nonetheless are generally in either very hot beds or adjacent to accessible transmission lines, or ideally both. An opening valuation of A\$30 mln is reasonable for its location and proximity to the Geodynamics licenses which are undergoing promising drilling. With outlays under A\$1 mln spent on drilling and exploration of the licenses, Eden Energy should see an indicated increase in its share price. A review of Eden’s historical price impact resulting from positive geothermal news-flow suggests the market is affording little value to these assets. Thus, any upside should either be reflected in an appropriate price uplift or be considered a latent, uncollateralised asset accruing to the longer-term shareholders’ equity. Based on a current capitalisation of 253.4 mln shares f.d., we would reasonably expect an **immediate increase of at least +A\$0.06/share**, and likely up to A\$0.15 - A\$0.18 if the drilling programme proves successful and preliminary operational arrangements are made. Furthermore, given the industry’s expectation for successful flow through GDY’s boreholes, and assuming Eden is capable of reproducing such drilling (under similar conditions), that per share impact could easily double over the successive twelve months, particularly with the Company’s close proximity to substations, transmission and consumers.



**South Australian Geothermal Exploration License (GEL) area, by thermal gradient**

Terratherma completed the drilling of its first geothermal exploration hole on the Renmark project in South Australia in February 2008 (Chowilla 1), with key results expected to be known by April 2008.

**Natural Gas: Conventional and Unconventional**

Eden Energy is negotiating to enter into an agreement with a private energy investor, Welshman Gerwyn Williams, to inject its natural gas assets in South Australia and in south Wales into a new special purpose vehicle. In return, Eden is likely to own approximately 45% of the SPV, the balance to be owned by Mr Williams in return for his gas assets in the U.K. and South Wales, and his drilling rig. The assets include coal bed methane (CBM), coal seam methane (CSM), conventional hydrocarbon targets, conventional drilling and abandoned coal mine methane. These assets are:

<b>Gerwyn Williams</b>	<i>North Wales</i>	CBM in Chester, already drilled and capped
	<i>South Wales</i>	CSM 50% carried ownership interest, potential very significant quantities of gas in place
	<i>Drilling Rig</i>	Used for perforations and drilling abandoned mine methane
<b>Eden Energy</b>	<i>South Wales</i>	CSM 50% contributing ownership interest plus \$1m working capital.
	<i>South Australia</i>	Untested potentially large (100kmX10km) gas field

The key asset in the natural gas portfolio is the South Wales programme. Preliminary testing has already revealed high porosity and gas density, both of which are requisite in economic natural gas extraction proving out sufficient offgassing. Moreover, the geologic surveys and first drilling has shown that the original seams have split with one side subsiding the other at such an angle that the seams repeat vertically. While one portion is thus at a more difficult depth to drill, it also means that the most costly aspect of recovery, the drilling itself, can yield near double the resource seams.

Presently, the Company and Mr Williams are in discussions to invite a strategic partner to farm-in to the south Wales project. It is reasonable to expect that the SPV will not wish to transfer control, though any potential will want a sizable minority stake, thus we estimate a sale of between 25 - 50%. To date, the project has achieved: i) first drilling, ii) strong offgassing assays, and iii) a geologic assessment with potential for very significant quantities of gas. In our valuation, we assume, though without an independent reserve assessment:

- 25% of the gas is economically recoverable (Proven and Probable; *p50*)
- 15 years of economic recovery
- Declining curves (high impact in Yrs 1 – 4, inflection in Yr 7)
- Gas price of 50p/therm (forwards average 55p/therm)
- Higher margin (£1.5/mcf) due to reduced complexity and proximal consumers

Total Resource (bcf)	1,250.0	430km <sup>2</sup> license area
<b>Resource as 2P (bcf)</b>	<b>312.5</b>	25% estimated
Eden's Interest in SPV	45%	
Proportion to E.E. (25% Farm-in)	33.75%	
Proportion to E.E. (50% Farm-in)	22.5%	
<b>EBITDA -15yr PV10 (mlns)</b>	<b>£507.43</b>	
Chance of successful recovery	60%	Drilling successful + Positive offgassing
Chance of execution	75%	Major gas player as w.i. operator
Risk-adjusted PV10	£228.34	
Attributable EBITDA Value to E.E. (25% Farm-in)	£64.73	A\$118.62 mln
Attributable EBITDA Value to E.E. (50% Farm-in)	£46.65	A\$84.77 mln

There are several aspects which make this an achievable target. There are believed to be at least two world class potential farm-in partners seeking a working interest, operating position and marketing capabilities. The results to date of the assays showed significant offgassing. The nearness to the consuming market, especially around Port Talbot, reduces transportation/piping costs.

### *Future Research & Development*

Eden continues to work alongside university departments – particularly in the US and Australia – to devise new methods and processes related to its hydrogen business model. One such development involves a 50:50 joint venture with the University of Queensland to investigate a method of low temperature pyrolysis, or “cracking”, of methane. Using a catalyst, the process would separate hydrogen (H<sub>2</sub>) from the methane (CH<sub>4</sub>) in the absence

of oxygen (O<sub>2</sub>). This equates to hydrogen production without the undesirable carbon dioxide – a revolution on the road to a clean hydrogen economy. Importantly, the carbonaceous by-product is *carbon black*, a reinforcing ingredient in automobile tyres. At a prevailing market price of US\$1,000/tonne, this could have a strong impact on the top-line. Patent coverage for the process is global, and the Company maintains that it is continuously investing in longer-term R&D projects related to the energy value chain.

#### *Corporate*

Eden is currently cleaning house, subdividing its operations under the three primary banners above: Geothermal and other Renewables, Natural Gas, and Hydrogen. Management is confident that each division is self-sustainable. As above, the geothermal division should receive sufficient development capital from the ASX IPO, the natural gas division is in advanced discussions for strategic partner funding, and the hydrogen division inflects into cash-flow positivity around 4Q09 / 1Q10. To achieve the outgrowth in hydrogen and Hythane®, Eden is seeking to raise sufficient funding to finance Indian developments and offer near-term working capital coverage in the subdivisions of Cryogenics and HyRadix.

At the beginning of 4Q09, Eden expects the exercising of A\$18 mln in options. Meanwhile, the in principle decision has been made to pursue a fast-tracked listing onto the LSE AIM, motivated by a drive to generate liquidity and a global trading platform for a global operating company. The focus will continue to be on the compelling economics of the Indian Hythane® expansion and related hydrogen infrastructure. Even if the Company were to achieve a low-side market penetration, the returns of Hythane®'s fuelling business model – without any of the E&P, major maintenance, or pipelining of conventional energy majors – suggest a convincing market position should be reached in the medium-term. With the increased liquidity of the AIM IPO, the immediate price benefits from the geothermal spin-out, the likely agreement with a major strategic entity for gas development, the sewing up of the highest level Indian contracts around the lowest-risk/highest-return model – already demonstrating Eden Energy as the supplier-of-choice to the world's industrial gas majors – all combine to indicate that the shares are highly undervalued. Especially noticeable is that the conventional geothermal and gas assets of the subsidiaries, in a most-likely scenario, should increase the current market capitalisation substantially. Noting the break-up value of the company's natural resource play with evident synergies across its hydrogen offerings, we believe there is sufficient latent value in excess of current trading.

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