

# MANTRA VENTURE GROUP LTD

## Diverse, Innovative Energy Player Offers Greatest Upside in the Space

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September 22, 2014

### MANTRA VENTURE GROUP LTD. (OTC:QB – MVTG - \$0.53)

Price Target: \$3.00

Rating: Speculative Buy

#### COMPANY SNAPSHOT

Mantra Venture Group Ltd. is a clean technology developer that takes innovative emerging technologies and moves them towards commercialization. The Company, through its subsidiary Mantra Energy Alternatives, is currently developing two groundbreaking, patented electrochemical technologies. ERC (Electro-Reduction of Carbon Dioxide) is designed to make reducing greenhouse gas emissions profitable, and MRFC (Mixed-Reactant Fuel Cell) promises to simplify and reduce the costs of fuel cell systems.

#### KEY STATISTICS

Price as of 9/19/14	\$0.53
52 Week High – Low	\$0.75 – 0.05
Est. Shares Outstanding	70.7M
Market Capitalization	\$37.47M
3 Mo Avg Vol	44,000
Exchange	OTC:QB

#### COMPANY INFORMATION

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#### INVESTMENT HIGHLIGHTS

**Mantra Venture Group Ltd.'s MEA subsidiary is set to introduce what may be the most disruptive technology in the chemical and energy industries in years, with target markets representing tens of billions of dollars.**

**Mantra's patented electro-chemical process (ERC) converts the problem greenhouse gas CO2 taken from industrial emissions into useful feedstock materials.** MVTG's first product/application is formic acid, although other chemicals such as synthetic gas can also be produced using this process. With 31 billion metric tons of CO2 emitted annually, the number of applications is huge.

**Mantra's strategic relationships with some of the world's leading firms provide huge validation of MVTG's approach and market opportunities.** Mantra is set to begin production of its system for a field test with Lafarge, the largest provider of building materials in North America, and Alstom, the leading power generation company in Europe.

**Not only is the Mantra technology disruptive but it has evolved a second offering; its own fuel cell.** We believe that the MRFC could emerge as an alternative to the fuel cells produced by Ballard Power (NASDAQ – BLPD) and Fuel Cell (NASDAQ – FCEL) which use hydrogen, a dangerous explosive gas. When the two MVTG technologies are combined, Mantra will be able to offer the holy grail of a scalable energy storage system. As renewable energy usage grows, so too does the market for energy storage.

**With key milestones ahead, deep IP, joint ventures with Fortune 100 firms, and innovative offerings, we believe MVTG's stock could reach the \$3 level next year.** Even at \$3, MVTG would trade at a 50%+discount to the market cap afforded BLPD and FCEL. We rate these shares Speculative Buy.

## THE VIEW FROM 10,000 FEET

Even naysayers and outliers in the scientific community can agree that the concentration of carbon dioxide in the earth's atmosphere is increasing to unacceptably high levels. The combustion of fossil fuels, the world's primary source of energy releases the greenhouse gas, which absorbs energy re-radiated from the earth and contributes to global warming. Although the consequences are highly uncertain, it is presumed that this effect serves as a primary contributor to future, irreversible climate change, threatening the balance of the earth's ecosystems and life on earth.

What is certain is that in 2011, global carbon emissions from fuel combustion totaled 31.6 billion tons. The International Energy Agency's *450 Scenario*, which sets out a path by which global temperature rise could possibly be limited to 2 °C, requires an emissions cap of 32.6 billion tons before 2017. In the absence of the rapid implementation of technologies to reduce these emissions, it is likely that this limit will be far surpassed.

The primary process option to combat these emissions referred to as Carbon Capture and Storage (CCS) is in broad use today but is irreparably flawed and requires a more effective technological and financial solution. According the Carbon Capture and Storage Association, CCS, is a technology that can capture up to 90% of the carbon dioxide (CO<sub>2</sub>) emissions produced from the use of fossil fuels in electricity generation and industrial processes, preventing the CO<sub>2</sub> from entering the atmosphere.

The CCS chain consists of three parts: CO<sub>2</sub> capture, CO<sub>2</sub> transport and CO<sub>2</sub> storage underground in depleted oil and gas fields or deep saline aquifer formations. Capture technologies enable the separation of carbon dioxide from gases produced in electricity generation and industrial processes via pre-combustion capture, post-combustion capture, and oxyfuel combustion. The carbon dioxide is then transported by pipeline or ship for "safe storage." Millions of tons of carbon dioxide are transported each year for commercial purposes by road, tanker, ship, and pipeline. The CO<sub>2</sub> is then injected under pressure into a carefully selected geological rock formation that is typically located several miles below the earth's surface.

While this method may appear reasonable, it is actually fraught with some potentially serious issues. Ironically, the two primary factors that are actually driving this train are also the greatest problems; environmental concerns and economics.

Storage site leakage is a major risk to the environment which could result in major health problems, legal and regulatory issues. Plus, the cost of transportation and even the ability to scale this method is not cheap and has its limitations. In fact, over time, it is likely that our electricity costs could rise due to the continued broad use of this method. As a result, the industry is screaming for an alternative that is truly carbon negative, has good economics, and does not potentially pass on one environmental problem for another.

Enter Mantra, which has developed an approach to solve the carbon dioxide emissions reduction problem by converting these excess emissions into viable products, along with its own fuel cell for multiple markets and the option to combine the two technologies into a ground-breaking energy storage system.

**MANTRA VENTURE GROUP LTD (OTCQB – MVTG)****COMPANY OVERVIEW**

Tracing its roots to 2007, Mantra Venture Group Ltd. is a clean technology developer that takes innovative emerging technologies and moves them towards commercialization. The Company, through its subsidiary Mantra Energy Alternatives (MEA), is currently developing two groundbreaking electrochemical technologies designed to make reducing greenhouse gas emissions profitable, ERC (Electro-Reduction of Carbon Dioxide) and MRFC (Mixed-Reactant Fuel Cell). The Company has made tremendous strides on the development front, and offers new approaches to solve problems affecting several industries representing billions of dollars in revenue annually. Moreover, the Company is partnered with some of the largest energy and infrastructure companies in the world, including Alstom (Switzerland) Ltd. (OTC – ALSMY), Lafarge (OTC – LFRGY), Kemira, and Powertech (a subsidiary of BC Hydro). Plus, the Company owns key patents related to its key technologies and is well-positioned to begin the early stages of commercialization via pilot projects in early 2015. The combination of its intellectual property portfolio, successful early stage testing, broad adoption markets, and the unusual strength and breadth of its Fortune 100 partners, indicate that Mantra could emerge as the next big player in the chemical and energy markets through its innovative capture, storage, and renewable energy/product conversion offerings. Importantly, the Company is emerging from the pure development stage into the revenue generation phase, following its nearly \$300,000 in R&D revenue recorded from the Alstom relationship. Therefore, we expect MVTG to begin recording meaningful revenue in 2015/2016.

**THE MANTRA ADVANTAGE: ERC**

Like the widely used CCS (carbon, capture and storage), the Company's carbon capture and utilization (CCU) approach reduces carbon dioxide released to the environment. However, CCU benefits from all the advantages offered by CCS while avoiding the major pitfalls of the storage issue and the enormous process costs. By treating carbon dioxide as a resource rather than a "throw-away", CCU strategies seek to produce useful products that can be sold to recover the costs of capture and conversion. A dirty secret regarding CCS is that it typically requires a level of subsidization in order to be uniformly and broadly economically viable. Conversely, CCU offers the potential of being financially self-sufficient and even profitable. Mantra Energy Alternatives owns one of the very few CCU technologies and seeks to become a global leader in the production of green chemicals using widely abundant waste carbon dioxide as a feedstock.

Mantra Energy Alternatives Ltd. is the proprietor of one of the few viable CCU technologies. The "electro-reduction of carbon dioxide", or ERC, uses electrochemistry to convert carbon dioxide into high-value products, of which Mantra is currently focusing on formic acid and formate salts. Mantra also exclusive license rights to an innovative "mixed-reactant fuel cell", or MRFC, technology. This fuel cell offers several benefits over conventional cells, and, when used in tandem with ERC, can utilize the chemicals produced from carbon dioxide as an energy storage medium.

Mantra Energy obtained the original intellectual property rights for the ERC technology from its inventor, Professor Emeritus Colin Oloman, in 2008. Ongoing research by Mantra Energy and its partners continues to

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reduce the energy consumption of the process, improve its overall efficiency, increase catalyst activity and selectivity, and improve the process concept towards a complete turnkey system.

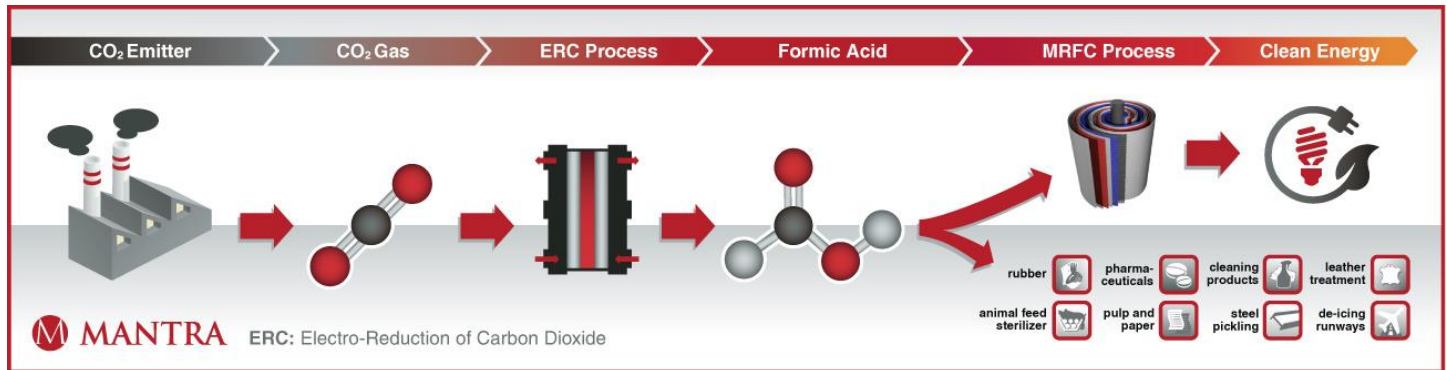


Image I. Mantra CCU Process

Source: [www.MantraEnergy.com](http://www.MantraEnergy.com)

The cornerstone of the technology, of which Mantra holds four issued worldwide patents (several more in application phase), is the ERC reactor. The reactor at the core of the chemical process, referred to as the electrochemical reduction of carbon dioxide (CO<sub>2</sub>), or ERC, has already been proven functional through small scale prototype trials and limited scale-up trials. ERC seeks to reduce the impact of CO<sub>2</sub> on Earth's environment by converting CO<sub>2</sub> into chemicals with a broad range of commercial applications, including a fuel for a next generation of fuel cells. Powered by renewable electricity, the ERC process combines captured carbon dioxide with water to produce materials, such as formic acid, formate salts, oxalic acid and methanol, that are conventionally obtained from the thermo-chemical processing of fossil fuels. However, while thermo-chemical reactions must be driven at relatively high temperatures that are normally obtained by burning fossil fuels, ERC operates at near ambient conditions and is driven by electric energy that can be taken from an electric power grid supplied by hydro, wind, solar or nuclear energy.

In a fuel cell, a fuel is oxidized and an oxidant reduced, resulting in the production of an electric current to drive an external load. Production of chemical fuels generated from the ERC such as formic acid can be used in the MRFC to produce electricity. This is an example a CO<sub>2</sub> neutral energy cycle.

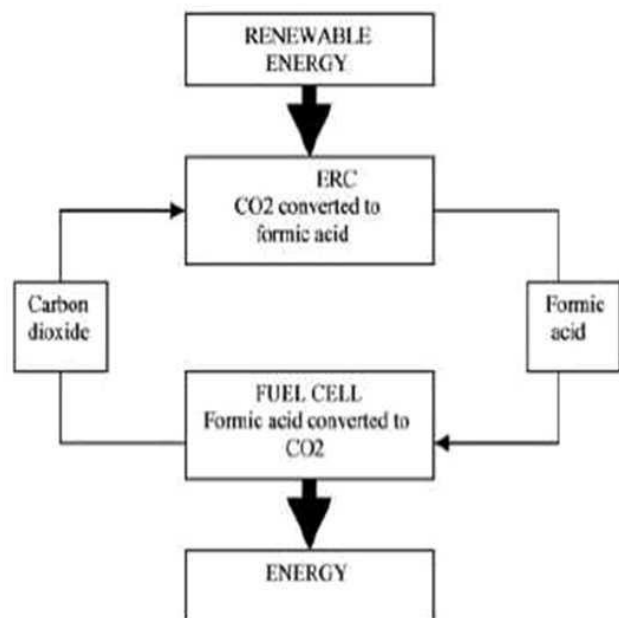


Image II. The ERC Process

Source: Mantra Energy



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As shown in the figure above, this concept can be used to provide energy storage, whereby clean electricity produced by intermittent renewable resources can be stored and its supply correlated with demand.

Mantra commenced its first prototype reactor testing in 2008 and the reactor successfully processed 1 kilogram of carbon dioxide per day. Mantra Energy is currently designing a pilot plant that will be the first of its kind operating in an industrial setting. Lafarge Canada has agreed to host this unit at its cement plant in Richmond, British Columbia (Canada). Designed for a capacity of converting 100 kg per day of carbon dioxide to formate salts, the pilot plant will serve several purposes: a demonstration of the capabilities of the technology; a first foray into continuously processing industrial emissions; and a “living laboratory” by which the ERC technology can be further developed. Moreover, its success will pave the way for the first commercial installations.

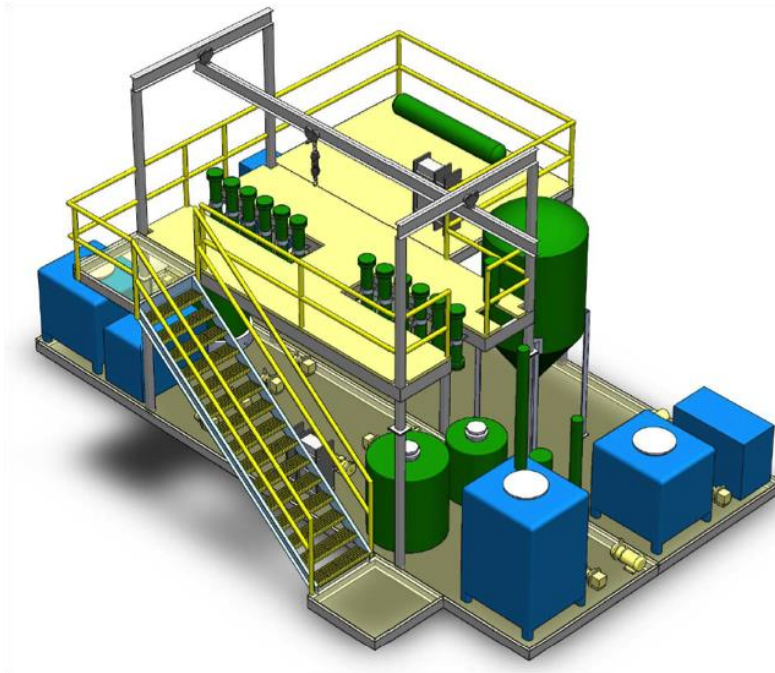


Image IV. ERC Pilot Plant  
Source: [www.MantraEnergy.com](http://www.MantraEnergy.com)

### Mantra's Powerhouse Partners

As noted above, Mantra is partnered with some of the world's leading companies in energy and infrastructure that generate tens of billions in annual revenue. We infer from these joint ventures with Mantra that these partners believe in the efficacy and broad use of the technology which could serve to aid in propagating the process in key markets in Europe, Asia, and North America.

The following are excerpts from the Company's filings regarding Alstom and Lafarge:

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*On June 24, 2013, through its majority owned subsidiary, MEA, Mantra entered into an agreement with Alstom (Switzerland) Ltd. concerning the joint research and development projects relating to (1) a pilot plant for the conversion of carbon dioxide to formate at a Lafarge cement plant (the “Lafarge pilot project”); and (2) the development of processes for the conversion of carbon dioxide to other valuable chemicals.*

*Pursuant to the agreement with Alstom, MEA and Alstom will co-operate in one or more research and development projects related to MEA’s ERC technology. Prospective projects will be associated with the development of technologies and processes for the conversion of CO<sub>2</sub> to chemical products and the investigation of the feasibility of scale-up and commercialization of these processes. Prior to undertaking any research and development project under the agreement, MEA and Alstom will mutually agree to special terms and conditions governing the purpose, aims and objectives of any such project, including technical descriptions, the designation of work phases and project managers, and the allocation of responsibilities and costs between the parties.*

*The agreement with Alstom will remain valid for 5 years or the completion of the last active project, whichever last occurs, and may be extended at any time by the written agreement of both parties. The first joint research and development project under the agreement is the Lafarge pilot project, which plans for the design, construction, and installation of a pilot plant for the conversion of 100 kg/day carbon dioxide to formate, followed by a commercialization scale-up study. Alstom’s contribution to the Lafarge pilot plant project will be approximately CDN\$250,000 for in-kind services. A second integrated research and development project will study carbon dioxide conversion to alternative chemical products by electrochemical reduction, with a focus on catalyst materials and lifetime. Alstom’s contribution to the alternative products project will be approximately CDN\$190,375 for Phase 1. For Phases 2 through 4 Alstom’s planed, but not committed, contribution is estimated at CDN\$456.125 and the final amount of Phase 5 will be determined. Mantra and Alstom are actively seeking external funding to support the execution of the projects.*

**MRFC TECHNOLOGY**

In addition to its ERC ownership, Mantra Energy also holds an exclusive license on an innovative fuel cell technology from Professor Oloman. This “mixed-reactant fuel cell”, or MRFC, has the potential to be cheaper, smaller, lighter, and have a higher volumetric power density than conventional fuel cells, which have struggled to be adopted due to their high costs.

The advantage of MRFCs lies in that their operation does not demand the separation of fuel and oxidant. In conventional fuel cells it is imperative to prevent the fuel and oxidant from mixing, a requirement that necessitates the use of expensive membranes (15 – 68% of the total capital cost), thick, heavy flow plates (10 – 25% of the total capital cost), and a variety of other gaskets and seals.<sup>1</sup> By contrast, MRFCs have no membranes and reduced seal requirements, allowing them to benefit from significant cost, volume, and weight reductions. Volume reductions may be so significant that, although MRFCs necessarily have a lower efficiency than conventional cells, they exhibit higher volumetric power densities.

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Professor Oloman's MRFC is a superb complement to ERC as it can utilize a variety of fuels, including formic acid and formate salts. Taken together, the two technologies represent a form of energy storage and offer the potential to use carbon dioxide as an energy storage medium.

The necessity of a membrane and the separation of fuel and oxidant in the conventional fuel cell results in a larger, more complex, and more expensive unit.

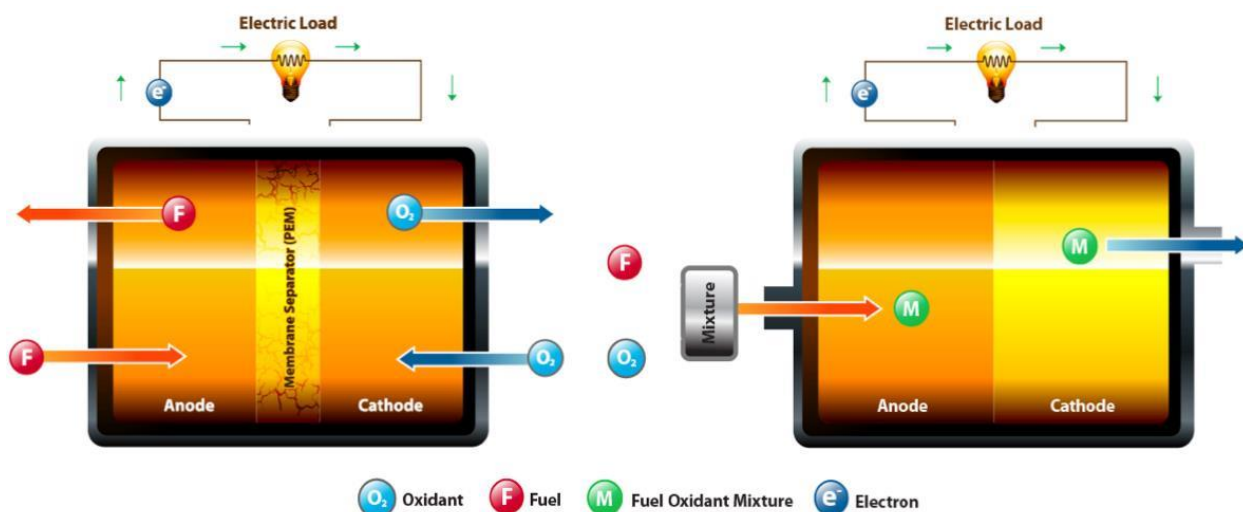


Image V. Conventional Fuel Cell vs. MRFC

Source: [www.MantraEnergy.com](http://www.MantraEnergy.com)

## MANTRA'S MARKETS & MILESTONES

The list of potential ERC adopters is virtually limitless. Any emitter of large amounts of carbon dioxide, either from fuel combustion or other processes, could benefit from the implementation of ERC. Electric utilities, for example, that generate electricity from coal, natural gas, or oil (which account for about two thirds of electricity production globally) emit enormous amounts of the greenhouse gas through the combustion of these fuels. Cement producers also generate a great deal of carbon dioxide, about 830 kg per ton of cement, during the production of clinker. The production of crude steel can result in the release of anywhere between 500 and 2,500 kilograms of the gas per ton of product. These plants represent "point sources" where large volumes are emitted from a single location. Chemical production facilities, including petrochemicals and pharmaceuticals, pulp and paper plants, aluminum factories, and many others are also point sources.

Global emissions from just a few of potential ERC adopters represent the release of billions of tons of each year. On a plant or localized level, a typical 500 MW coal-burning power plant, operating at a capacity factor of 70%, will generate about 3.07 million megawatt-hours (MWh) per year. With an emission intensity of 971 kg

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CO<sub>2</sub> per MWh, such a plant will release about three million tons of carbon dioxide each year. Thus, even a single plant represents an enormous resource for the ERC process.

As noted above, the Company's first product to market from the ERC will be formic acid. Currently, the primary producers of formic acid are Kemira and BASF. While they produce formic acid by using natural gas as a feedstock, Mantra will use CO<sub>2</sub> and renewable energy. The current global formic acid consumption is estimated to be about 600,000 tons per year, and is growing annually. Assuming a value of \$1,500 per ton, this represents a market of approximately \$1 billion.

Since they are easily biodegradable and environmentally benign, formic acid and formate salts are continually finding new applications in industry (especially as environmental regulations increase). Formic acid finds use as a preservative in animal feed, as a chemical intermediate in the production of various chemicals and pharmaceuticals, in the dyeing of natural fibers and the dyeing and pickling of leather, as a de-scaling agent and disinfectant in a variety of industries, and traditionally in the coagulation of rubber. Formate salts, such as potassium formate and sodium formate, are most often used in oil drilling, as heat transfer fluids, and as environmentally friendly de-icing agents for airports and roads.

Formic acid and its salts have also been recognized as excellent energy carriers. They have high volumetric and gravimetric energy densities compared to conventional storage technologies such as batteries, and as liquids are much easier to store and distribute than gaseous hydrogen. By liberating energy from them using direct fuel cells, these chemicals can be used to produce electricity on demand, and as such can be used for energy storage.

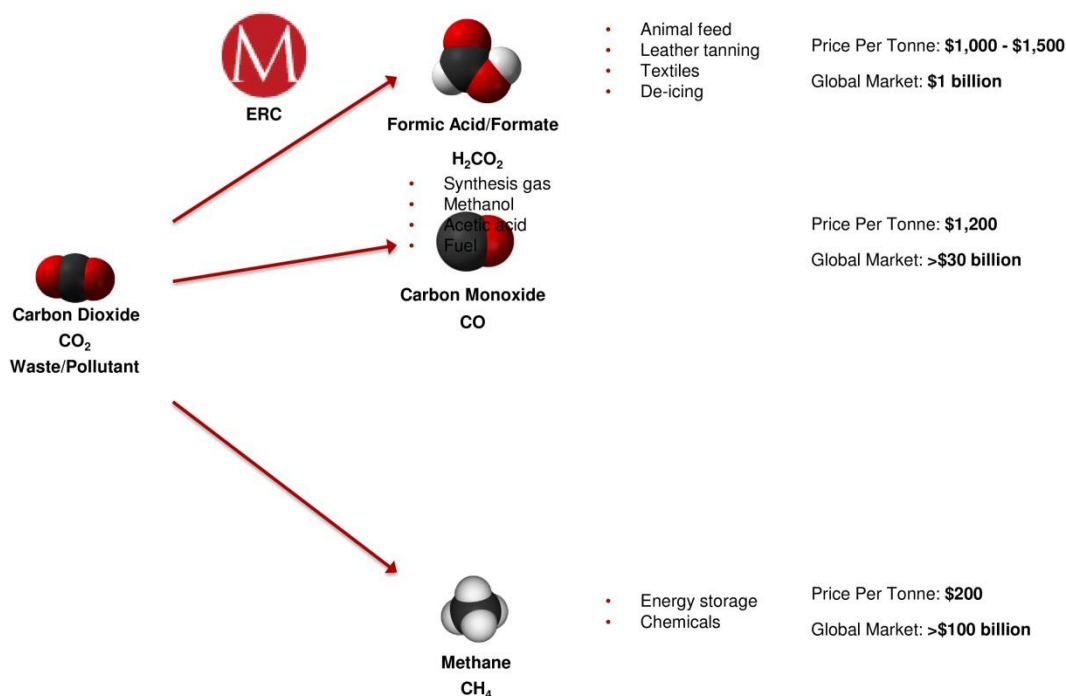


Chart I. ERC Target Markets

Source: Mantra Energy



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Their use in energy storage applications would vastly increase the market for formic acid and its salts, as the value of energy storage market is expected to surpass \$20 billion in the coming years, potentially reaching \$100 billion.

The MFRC revenue opportunities are also very strong, as evidenced below. Interestingly, it is difficult to find true, direct competitors for the Mantra fuel cell, which could become an ace-in-the-hole given the huge valuations afforded publicly traded comparables such as Ballard Power (NASDAQ – BLPD) and Fuel Cell Energy (NASDAQ – FCEL) who make hydrogen fuel cells. An argument can be made that the Mantra fuel cell is better because it uses a liquid such as formates produced by the ERC (can be powered by other energy storage chemicals as well), and does not use an explosive gas like hydrogen. Therefore, it could potentially be used as an alternative to these producers.

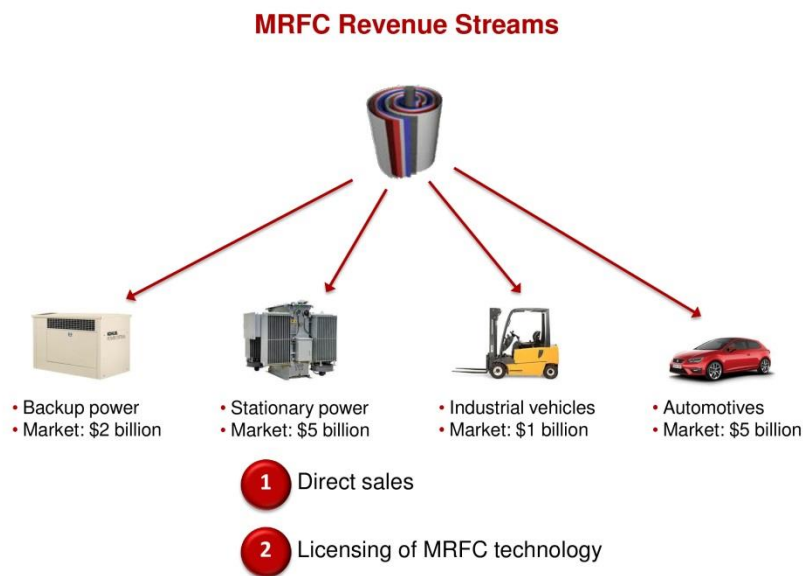


Chart II. MFRC Revenue Opportunities  
Source Mantra Energy

Finally, a pure energy storage application is possible by combining ERC and MRFC. There are a number of options for limited large scale energy storage but these options are not able to be used in most locations. The drive by all countries into the renewable energy market is in turn highlighting and driving the need for energy storage. Some market watchers estimate that the market value for energy storage is expected to be \$25 billion by 2021.

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There are a series of milestone events in the coming quarters which should serve as major catalysts for Mantra and its stock. These include:

- Q1 2015 pilot and demonstration for ERC
- End of 2014 for small vehicle demonstration MRFC.
- Q3 2015 combination of ERC and MRFC demonstration for energy storage.
- 2016 first commercial projects for ERC and MRFC

**THE MANTRA TEAM****Larry Kristof**

Founder, Chief Executive Officer  
Chairman of the Board of Directors

Larry Kristof has over 15 years of experience in business development and corporate leadership. In 2003 Larry co-founded Lexington Energy, a company engaged in manufacturing and leasing oil field service equipment to oil and gas, and other oil field service, companies. Under Larry's stewardship, Lexington introduced the first nitrogen-on-demand system to Alberta oil markets. The technology represented a significant advancement in the application of nitrogen technology, with purification capabilities of 98-99.5%. Lexington went on to become the first manufacturer of drilling systems specifically designed for oil sands exploration coring. As a result of Larry's business acumen and vision, Lexington was able to successfully shepherd these innovative technologies from concept to reality and ultimately generate assets of over \$7 million. After ensuring the financial sustainability of the company by recording corporate revenues of \$2 million in the first two quarters of 2007, Larry resigned from Lexington Energy to focus full-time on the "green-tech" sector by founding Mantra Venture Group Ltd.

**Patrick Dodd**

VP Corporate Development, Director

With a Bachelor's degree in Chemical Engineering from McGill University in Montreal, Quebec (Canada) and a Master's degree in Clean Energy Engineering from the University of British Columbia in Vancouver, British Columbia (Canada), Patrick is continually pushing the boundaries of carbon capture and utilization technology research. This passion and commitment began as an intern at Carbon Recycling International in Iceland and continues today with Mantra.

**Jonathan Michael Boughen**

Director

Jonathan Boughen has a great deal of experience in the technology sector. From 2000 to 2006, Jonathan was a sales manager at Ropak Corporation, a company that specializes in plastic packaging, container and film technologies worldwide. Responsible for managing the sales team and key distributors, he shared the profit

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and loss accountability with the Regional Plant Manager. In 2006 Jonathan joined Scientek Technology Corporation as a general manager. The company is a recognized provider of specialized hospital and laboratory products such as washers and dryers for the processing of delicate surgical instruments and fragile laboratory glassware. He is directly responsible for ensuring sales and growth by adopting sophisticated technology while continuing to be accountable for profits and loss.

**Randy Gue**

Industry Specialist

Randy Gue worked for Lafarge Canada Inc. in for over 30 years in various roles (including production, maintenance, quality, process, and sales), for the latter half in the field of resource recovery. In this capacity he had a continued focus on reducing the plant's greenhouse gas emissions, and thus naturally has been integral to the development of Mantra's Lafarge-based ERC pilot plant. As Industry Specialist Mr. Gue brings to Mantra an intimate knowledge of the cement industry and cement production processes (among other industrial processes), expertise that is be extremely valuable as Mantra continues to expand its activities and industry partners. An understanding of the myriad possibilities for the integration of Mantra's technologies with existing industrial processes is of great benefit to the company.

**Christina Gyenge, Ph.D.**

VP of Technology, Marketing and Innovation

Since receiving her Ph.D. from UBC in 2000, Dr. Christina Gyenge has worked extensively in chemical and biological engineering. This experience includes postdoctoral fellowships at the University of Bergen and Stanford University and a position as a research associate at Geballe Laboratory for Advanced Materials. In 2009 she returned to UBC as a teaching faculty, in which capacity she developed and delivered numerous courses such as Energy Engineering. Dr. Gyenge combines an interdisciplinary and innovative background with a broad overview and vision related to the practical applications of alternative energy technologies and novel chemical technologies in general.

**RISK FACTORS**

In our view, MVTG's biggest risk is the timing of the start of field trials and the length of the trial, versus the results. A secondary concern would be the typical delays associated with long-term project financing for prospective customers, which could result in commercialization delays, even in a license model. Execution risks could push meaningful revenue generation out to a later date, or in a smaller initial ramp, thus impacting the Company's revenue ramp or time to profitability. Competition from larger firms or even from newer entrants is a typical concern and is also consistent with firms of Mantra's size and standing, although given the Company's partners, we deem it an unlikely event.

**MANTRA VENTURE GROUP LTD (OTCQB – MVTG)****CONCLUSION**

We originally initiated coverage of MVTG at a price of \$0.099 in June of 2012 and the stock recently reached a high of \$0.75 before sliding back into its current tight trading range. As excited as we were about the Company's prospects then, the success and evolution of the model should provide investors with even greater confidence going forward. Importantly, the Company is emerging from the pure development stage into the revenue generation phase, following its nearly \$300,000 in R&D revenue recorded from the Alstom relationship. Therefore, we expect MVTG to begin recording meaningful revenue in 2015/2016.

In our view, Mantra Venture Group Ltd.'s Mantra Energy Alternatives subsidiary is set to introduce what may be the most disruptive technology in the chemical and energy industries in years. While the MVTG's initial target market is \$1 billion, the actual market size is in the tens of billions. Mantra's patented electro-chemical process converts the problem greenhouse gas CO<sub>2</sub> taken from industrial emissions into useful feedstock materials. MVTG's first product/application is formic acid, although other chemicals such as synthetic gas can be produced using this process with minor modifications. With 31 billion metric tons of CO<sub>2</sub> emitted annually, the number of applications is huge.

Mantra's strategic relationships with some of the world's leading firms provide tremendous validation of the Company's approach and market opportunities. Mantra is set to begin production of its system for a field test with Lafarge, the largest provider of building materials in North America, and Alstom, the leading power generation company in Europe. Other major partners include BC Hydro subsidiary Powertech to assist in the test design.

Not only is the Mantra technology disruptive but it has evolved into new offerings, such as its own fuel cell. We believe that the MRFC could emerge as an alternative to the fuel cells produced by competitors Ballard Power (NASDAQ – BLPD) and Fuel Cell (NASDAQ – FCEL) which use hydrogen, a dangerous explosive gas.

It should be noted that when the ERC and MRFC technologies are combined, Mantra will be able to offer the holy grail of a scalable energy storage system. Chemicals created by the ERC from captured CO<sub>2</sub> can be stored and then utilized by Mantra's fuel cell to recapture the stored energy. As the world relies more on renewable energy, the market size for energy storage grows in lock step.

With a series of key milestones ahead, deep intellectual property, joint ventures with Fortune 100 firms, and innovative offerings, we believe that these shares could reach the \$3 level next year. Even at our target price of \$3, the shares would trade at a 50% or more discount to the market cap afforded BLPD and FCEL. We rate these shares Speculative Buy.



**MANTRA VENTURE GROUP LTD (OTCQB – MVTG)**

**RECENT TRADING HISTORY FOR MVTG**

(Source:www.StockTA.com)





## MANTRA VENTURE GROUP LTD (OTCQB – MVTG)

### Senior Analyst: Robert Goldman

Rob Goldman founded Goldman Small Cap Research in 2009 and has over 20 years of investment and company research experience as a senior research analyst and as a portfolio and mutual fund manager. During his tenure as a sell side analyst, Rob was a senior member of Piper Jaffray's Technology and Communications teams. Prior to joining Piper, Rob led Josephthal & Co.'s Washington-based Emerging Growth Research Group. In addition to his sell-side experience Rob served as Chief Investment Officer of a boutique investment management firm and Blue and White Investment Management, where he managed Small Cap Growth portfolios and *The Blue and White Fund*.

### Analyst Certification

I, Robert Goldman, hereby certify that the view expressed in this research report accurately reflect my personal views about the subject securities and issuers. I also certify that no part of my compensation was, is, or will be, directly or indirectly, related to the recommendations or views expressed in this research report.

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