Evoking clean energy solutions

Dr. Mike Biddle

Fueling the energy transition
The Evōk story

Evok Innovations is a unique partnership between the BC Cleantech CEO Alliance, Cenovus Energy and Suncor Energy.

Founded in 2015 with a $100M commitment.

Led by experienced entrepreneurs, CleanTech investors, and O&G executives.

We protect the environment and strengthen the economy by investing in the commercialization of clean technology.
My personal pathway to Evok
Navigation

Why are We Here? *purpose*

Where are We? *situational assessment*

Where Do We Want to Go? *vision*

How Do We Get There? *strategy*
For me, it starts with meaningful shapes

\[ x(t) = x_0 \cdot e^{kt} = \]

\[ x_0 \cdot e^{t/\tau} = \]

\[ x_0 \cdot 2^{t/T} = \]

\[ x_0 \cdot \left(1 + \frac{r}{100}\right)^{t/p} \]
Why are we here?

Investors want to see exponential growth

Venture-backed companies with quick $1 Billion+ valuations


https://ichef.bbci.co.uk/news/1024/cpsprodpb/16A94/production/_87602829_unicornphoto.jpg
The reality?
is more often like …..

Why are we here?
Exponential trends that we believe are both more real and more impactful.

World Population Explosion

http://mcdowellastronomy.weebly.com/unique-earth.html
Why are we here?

Exponential LOSS vs Growth

We lose 150 – 200 species every day!

Source: http://www.geoengineeringwatch.org/mass-extinction-article-underreports-die-off-rate-by-1000/
Humans and The Extinction Crisis

Related?

A nearly “invisible” exponential growth

CO$_2$ levels over the last 10,000 years

Source: [https://skepticalscience.com/is-CO2-a-pollutant.html](https://skepticalscience.com/is-CO2-a-pollutant.html)
Might CO$_2$ and global temperature be related?

Source: https://roadsofstone.com/2007/03/06/140-the-great-global-warming-swindle/
Global Mean Surface Temperature (January-June)

Zoom in on last 125 years

Source: http://www.growingproduce.com/vegetables/nasa-first-6-months-of-year-warmest-to-date/
Oceans have been both a CO$_2$ and heat sink up to now

Source: Nuccitelli et al. (2012)

Heat Content, $10^{22}$ Joules

Oceans are the primary lungs of the planet

"No water, no life. No blue, no green."
— Sylvia Earle, Oceanographer

It is estimated that 60% of the World’s Coral Reefs will be lost by 2030

Warmer Air and Water = Increased Storm Intensity

Natural Disasters Reported

OFDA/CRED
International Disaster Database

http://resilience.earth.lsa.umich.edu/Inquiries/Inquiries_by_Unit/Unit_2a.htm
More Heat = Less Ice = Sea Level Rise, SLR

https://outofthedepths.blogspot.com/2014/08/antarctic-and-greenland-ice-mass-change.html
SLR + Climate Stress = large scale displacement

Climate change could displace up to 200 million people by 2050


[http://www.globalresearch.ca/what-is-it-really-like-to-be-a-syrian-refugee/5553492](http://www.globalresearch.ca/what-is-it-really-like-to-be-a-syrian-refugee/5553492)

Why? In Summary

I believe that we can mitigate these impacts to a large extent by more INTELLIGENT and more EFFICIENT production and consumption of resources and delivery of services.

We can do better.

This is NOT the future I want to leave to my 2 children – or any other future generations.
Where are we?  Climate  

January 2018:  408

Unchartered Territory – except for million years ago

The last time CO$_2$ was nearly 400 ppm:

• Global average surface temperature was up to 6°C warmer
• Very little ice present anywhere on the planet
• Sea level was around 30 meters higher than today

Source:  http://www.climatecentral.org/news/the-last-time-co2-was-this-high-humans-didnt-exist-15938
Where are we?  Resources

Increasing risk of resource scarcity

3 BILLION more middle-class consumers by 2030

Economic growth in emerging markets is fueling dramatic increases in demand for resources...

Projected growth, 2010–30

- **Energy**: +33%
  - 2010: 492 QBTUs
  - 2030: 654 QBTUs

- **Water**: +41%
  - 2010: 4.5 thousand cubic kilometers
  - 2030: 6.4 thousand cubic kilometers

- **Steel**: +80%
  - 2010: 1.3 billion metric tons
  - 2030: 2.3 billion metric tons
The Growing Number of Affluent Consumers will Demand More Energy

Where are we? Energy

Non-OECD nations drive the increase in energy demand

Source: EIA, International Energy Outlook 2013
Where are we?

Governance

Dissonance

DEEP cuts: nearly 90% reduction in emissions per GDP in less than 35 years!
Where do we want to go?

NOT:

http://www.momscleanairforce.org/climate-change/
“F**k Earth! Who cares about Earth?” Musk said. “If we can establish a Mars colony, we can almost certainly colonize the whole solar system” Elon Musk

http://www.recode.net/2014/10/1/11631474/codered-the-best-elon-musk-quote-ever
Shelter in Place?

Luxury Survival Condo
PEACE OF MIND COMES WITH BEING PREPARED FOR ANYTHING

When anything is possible, preparation is peace of mind.

Fortified Homes
Fortified "Hardened" Homes with Bunkers
"Genesis" Underground Shelter Systems
2012 Structures
Shelter in Place?

$12,000

2 views/hr!
Five kilometers of continuous tunnels form individual chambers, which Vivos packages as separate living quarters.
Where do we want to go?

WHEN LIFE GIVES YOU LEMONS MAKE LEMONADE
Where do we want to go with Resources?

Are You Ready for the Resource Revolution?

At least $1 trillion more investment in the resource system needed each year to meet future resource demands.
MINING THE SCARCITY BOOM

Investors are clamoring for natural resource plays. Here's how to get in without getting burned.
“THE GARBAGE MAN”

Junk Dealer

Michael Biddle’s $3,000-square-foot recycling plant in Redmond, Calif. Virtually all of its machines, telephones, keyboards and cell phones are fed into giant hoppers atop 20-foot-tall bins. Pop- and concrete bottles run everywhere. Amid the whirring fans and churning grinders, you can pick out the source of metalinking as itゲー, sucked out by vacuum, plastic piping in it, is pulled away from the bag and popped at the machine’s mouth in two separate light blue plastic bins. Out the end come gray pellets, several tons six or more grades of reusable plastic.

To Biddle it’s a symphony, the result of nearly two decades of hard work. He claims to be the first to figure out how to take basically any kind of plastic trash, which is usually a mangled blend of up to 20 different plastics, and separate it by chemical type. Biddle’s factories make the floor important plastics used to durable goods and electronics—polypropylene, polyethylene, polyvinylchloride, styrene, acetate, and polyvinylit.

“Some people think it’s a day job, but I’m not sure. Every day, making a plastic table, chair, or sofa, and so on, is different,” he says. “And I’ve been doing this for 15 years.”

Biddle’s company, Polymers, is the first in the world to separate plastic waste into its component parts, and then recycle those parts into new products. The company’s “MBA” process makes it possible to take used plastic products and turn them into new ones. The result is a more sustainable, environmentally friendly process that reduces waste and conserves resources.

Forbes

Junk Into Money

Here’s one fellow who has no objection to $65 c:\ a plastics recycler | By Kerry A. Dolan
A Miner

BARCLAYS SMART INVESTOR

Resource Depletion

“YOU SEE GARBAGE...

WE SEE ABOVE-GROUND MINES”

Why Mike Biddle, founder of MBA Polymers, sees resource depletion as a major investment opportunity, and why you should too.

WORDS: ORI HEATON, PAUL TYRELL
PHOTOGRAPHY: NADIR BURDA
Where do we want to go? Depends on your Mindset

Is this the CRISIS of our time?

Or the OPPORTUNITY of our Time?

The Planet-Saving, Capitalism-Subverting, Surprisingly Lucrative Investment Secrets of Al Gore

According to Mercer, the average return for Generation’s global-equity fund, in which nearly all its assets are invested, was 12.1 percent a year, or more than 500 basis points above the MSCI index’s growth rate. Of the more than 200 global-equity managers in the survey, Generation’s 10-year average ranked as No. 2. In addition to being nearly the highest-returning fund, Generation’s global-equity fund was among the least volatile.
Where do we want to go?

Climate Leadership comes from efficient companies
Where do we want to go?
CARBON FOOTPRINT (2017)
Total Greenhouse Gas Emissions Per Index Using Scopes 1, 2, 3

Etho Capital

Greenhouse Gas Emissions (measured in millions of metric tons)

<table>
<thead>
<tr>
<th>Stock Index</th>
<th>Etho Climate Leadership Index - US</th>
<th>S&amp;P 500 Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Emissions</td>
<td>565</td>
<td>3688</td>
</tr>
<tr>
<td>% Reduction</td>
<td>-85%</td>
<td>—</td>
</tr>
</tbody>
</table>

Data Source: Etho Capital's Sustainability Database
How Do We Get There?

We have great ideas & technologies that can change the world.

Both new and seasoned entrepreneurs are ready to turn them into great business.

We need **Faster and Better** delivery of solutions - out of the labs and garages more quickly and further developed.
So What’s in Our Way?

The Valley of Death
https://www.greentechmedia.com/articles/read/into-the-valley-of-death
The CleanTech Gold Rush

Source: Dow Jones VentureSource, Lux Research, personal communications.
The Pipeline Of U.S. Cleantech Startups Dries Up As VCs Withhold Dollars

VC Funding Into U.S. Cleantech Startups

By Funding Type

- Series Unknown
- Series E+
- Series D
- Series C
- Series B
- Series A
- Angel/Seed

Total Capital Raised (in Millions USD)

2005: $0
2007: $1,000
2009: $2,000
2011: $3,000
2013: $2,000
2015: $1,000
2017: $0

Bridging the Gap with Money, Network & Battle Scars
Investing in the future

Carbon capture/gas separations

Carbon to value

Intersection of Industrial IoT, Machine Learning and Artificial Intelligence
Step-Change CO₂ Adsorbents

- Very large CO₂ adsorption capacities under nearly all T,P conditions
- Mild regeneration conditions for TSA, PSA, or VSA
Potential for Lower Cost CO2 Adsorption

- Coal flue gas: 0.15 bar
- Natural gas flue gas: 0.05 bar
- Natural gas production: >1 bar
- Cryogenic air distillation: 400 ppm
- Enhanced Oil Recovery
- Hydrogen Production: 2-10 bar
- Biogas upgrading: 0.5 bar
- Air recycling: 1-3 bar
REVERSE COMBUSTION

A platform technology that recycles CO₂ back into chemicals and fuels

1. INPUTS: CO₂, WATER, ELECTRICITY

2. ELECTROCHEMICAL REDUCTION OF CO₂

3. OUTPUTS: PRODUCTS THAT DROP INTO EXISTING SUPPLY CHAINS

- CHEMICALS & FUELS
- PURE O₂

75% ENERGY EFFICIENCY
37,000 trees

...in a suitcase
How will We Work in the Future?

*Informed by the past*

- **Hunter Gatherer**
  - MILLIONS OF YEARS
- **Early Tools: Agriculture**
  - THOUSANDS OF YEARS
- **Industrial Revolution**
  - A FEW CENTURIES
- **Information Revolution**
  - DECADES
- **Human Augmentation**

Sources
- [https://www.psychologytoday.com/blog/the-tao-innovation/201204/the-evolution-innovation](https://www.psychologytoday.com/blog/the-tao-innovation/201204/the-evolution-innovation)
Digital Innovation is Creating New Reality for Many Industries

Gartner 25bn enterprise-owned connected things across globe by 2020 will generate a $2 TRILLION economic benefit

McKinsey & Company The Internet of Things has a total potential economic impact of $3.9 trillion to $11.1 trillion per year in 2025

GE estimates that the industrial internet will bring productivity gains of $8.6 trillion for industrial companies in next 10 years

evōk INNOVATIONS CISCO Digital disruption will displace 40% of incumbent companies in the next 5 years
Control as a Service
We fit at a unique intersection of capabilities
Autonomous production

Improving production operations performance through sensor fusion, analytics & new control models.

Kelvin never stops listening, so your business continuously improves.
Kelvin’s Multi-level Impact on Pad Performance

Every red dot is a human intervention

Production

Deferment

Kelvin Pad Model takes control

Production Up

Safety Up

Costs Down

Deferment Down

Vents on Pad
(45 Days Pre & Post Kelvin)

Before Kelvin

After Kelvin
Value from modernisation and transformation

**Reliability monitoring**
- **40 million** calculations per day on 400 pieces of Atlantis equipment using Plant Operations Advisor

**Acoustic sensing**
- **30** wells in Azerbaijan with fibre optic sensing capability to detect sand

**Finding a field in a field** in the Gulf of Mexico
- **200mmboe** new barrels identified in Atlantis using BP proprietary imaging algorithms

**Applying big data analytics** in Lower 48
- **74%** reduction in venting
- **20%** increase in production
- **22%** reduced costs

**Optimising production**
- **30mboed** from APEX production system digital twin
- **Rapid field development** in Oman
- **12x** productivity gains using Siraj optimisation tool

**Machine intelligence** informing business decisions
- **40 years** of data helping predict corrosion to drive more effective inspection programmes

**Global operations continuous improvement**
- **2,700** individual projects
- **$330m** value created
- **55mboed** production
Multi-Level Improvements

Applying big data analytics in Lower 48

74% reduction in venting
20% increase in production
22% reduced costs

What’s Next? Blockchain

Q4'17 caps biggest year for blockchain equity rounds
Quartely blockchain equity financing (excluding ICOs). Q3'16 - Q4'17

Investors are Flocking to the Space
As are buyers of tokens and coins.
What’s Holding You Back?

Hi, I'm Anthony and welcome to my Messy Miner Man Cave

https://daodaily.news/9956-2/

https://steemit.com/introduceyourself/@anthonyc/hi-i-m-anthony-and-welcome-to-my-messy-miner-man-cave
DIY Mining

http://www.buttcoinfoundation.org/
DIY Mining 2.0


DIY Mining 3.0

[Links]
What’s Holding You Back?

Serious Computing = Serious CapEx Investment

……greater than the current energy consumption of 159 individual countries, including Ireland, Nigeria and Uruguay. The Bitcoin Energy Consumption Index by cryptocurrency platform Digiconomist puts the usage on a par with Denmark, consuming 33 terawatts of electricity annually. http://www.newsweek.com/bitcoin-mining-track-consume-worlds-energy-2020-744036

![Diagram showing energy consumption of Bitcoin, Ethereum, and Fiat](https://blog.cofound.it/blockchain-the-bane-and-blessing-of-energy-consumption-b449d69cd282)
A Few Numbers for Perspective

> $7 Bln
Annualized Global Mining Revenues

4,470,000
Number of US Households that could be powered by Bitcoin

23,699
kilotons of CO$_2$ emitted per year by Bitcoin activities
How to mitigate High CapEx & Energy Costs?

More than half a billion people may be inadvertently mining cryptocurrencies from their computers, smartphones and other devices, according to research conducted earlier this year by ad blocking firm AdGuard.

Hidden software was found embedded within 220 popular websites, which have an aggregated audience of over 500 million people. The mining tool hijacks a computer’s central processing unit (CPU) and uses it to run mining software in the background.
Canada’s surplus isn’t enough

Ironically, Hydro Quebec may have to renege on its commercial power strategy - as forecasts show that they would not be able to meet the booming demand of industries looking to take advantage of the energy surplus in the province. The company is reviewing its plans after 70 cryptocurrency mining operators applied to set up shop in the province in the space of the week.  

The Energy Industry is Exploring Opportunities

Blockchain in Energy & Industry: A Growing Intersection

Investments
- 2015: $5m seed, $7.6m FILAMENT, $500k
- 2016: €3m seed, $7.6m Gem, $5m Skuchain, $3m
- 2017: $2.5m private coin offering, $3m, $3m

Partnerships
- 2016: Siemens, 3LO Energy, Consensys, L3 Energy
- 2017: Siemens, 3LO Energy, Consensys, L3 Energy
Business and Technology Evolves

A long term vision for Ethereum is to transition away from “proof of work” to a mining model called **proof-of-stake (PoS)**. This way Ethereum’s energy requirements would collapse by more than 90%.

**Swirlds** has developed a new consensus algorithm called **Hashgraph** based on a) Gossip about Gossip and b) Virtual Voting.

- Much less computation required
- More Efficient
- MUCH Faster – 1000’s to 100,000’s transactions/sec vs 7/sec for Bitcoin
- More Fair
- More Secure
The challenges and opportunities we face are enormous

Who can we trust to make the Lemonade?
The Usual Suspects

Government?

Industry, Large Companies?

SMEs (Small to Medium Enterprises)?

Individuals?
Big companies?

CEO Polman: 'Unilever Sustainable Living Plan', a blueprint that will lead to company doubling in size while halving its carbon footprint.

Reduction of $\text{CO}_2\text{e}$

- 1,000,000 MT from 2008-2014
- 167,000 MT per year on average
- 1 MT/yr per Unilever employee
Big companies?

Reduction of $\text{CO}_2\text{e}$

- 182,000 MT from 2007-2013
- 26,000 MT per year on average
- 2 MT/yr per CCE employee
Individuals?

“Everyone thinks of changing the world, but no one thinks of changing himself.”

-Léo Tolstoy
Some Individuals I Know

Only 4 lifestyle changes

~ 10 going solar
~ 4 using bikes & trains more than cars
~ 3 air-drying clothes
~ 4 going mostly vegan

~ 21 MT/yr for 1 family
> 5 MT/yr per person

~ (0.4) RT flight SFO - IAH
“Never doubt that a small group of thoughtful, committed citizens can change the world. Indeed, it is the only thing that ever has.”

-Margaret Mead
Over 90,000
Approx. 900
Approx. MT/yr CO2 savings
MT CO2 savings/employee!

The 2017 Young Global Leaders Award for Circular Economy SME

The Audience voted MBA the overall winner from the 7 other category winners including Patagonia Clothing, Nike and the Scottish Government.
The ones who are crazy enough to think they can change the world, are the ones who do.

*Steve Jobs*
Thank you!

Q&A