Climate Change

Stark Realities - Real Opportunities

For Probus, April 3, 2019

By Gordon Kubanek, P.Eng.

David Pollock, President CDN Assoc. for the Club of Rome
Our Crime Investigation Plan

Bad Cop Gordon
Explains the Crime

Good Cop David
Solves the Crime
Today we Ask:

Who set the House on Fire?

Why is the Man acting as if nothing strange is happening?

How do we put out the fire?
When Your Car Breaks Down
Who do you Ask about it?
When your Climate Breaks Down, Who do you Ask about it?

For me and many Climate Scientists learning the ‘bad news’ is empowering as it moves us into action.
If you feel so Over-Whelmed by Climate Change that You Cannot Act.... It’s understandable

I started learning and then acting upon what I learned when I got very sick 15 years ago when I asked myself: What can I do to help my kids have a life filled with joy?
You should think of this as a mental health presentation.

Mental health is an ongoing process of dedication to reality at all costs.

-M. Scott Peck

Thus, what follows is not apocalyptic - it is reality.
Silence in the face of evil is itself evil.
Not to speak is to speak.
Not to act is to act.
Punchline: We must avoid Hot House Earth
Whatever it costs
Who set the House on Fire?
GHGs are Causing the Rise in Temperature

Orbital changes
Solar
Ozone
Greenhouse Gases
All major extinctions occurred when CO₂ levels exceeded 1000 ppm.

The asteroid that ended the reign of the dinosaurs around 66 million years ago slammed into rocks rich in carbonates, releasing immense quantities of carbon dioxide into the atmosphere. It also triggered vast wildfires, releasing even more CO₂. Temp. rose 5°C.
The Sun 30% is warmer today
To compensate CO₂ levels are decreasing
Temperature past half Billion years

High RATE of temperature change kills
Feedback Loops

• Even if the world ceased all carbon emissions by 2050, that’s still not enough to stop the feedback loops from cascading into the nightmare scenario Hot House Earth if the 2°C threshold is crossed.

Positive Feedback Loop Example:

- Oceans warm up
- Less snow and ice
- Less heat reflected into space
- Warmer Temperatures
- +
- +
Some large +ve amplifying feedbacks

**Vanishing Arctic Ice**
- Temperature rise
- Arctic sea ice melts.
- As reflective ice disappears, darker ocean waters absorb more heat.

**Warming Wetland Peat**
- Temperature increase
- Warming wetland peat
- Bogs release methane, a greenhouse gas

**Melting Permafrost**
- Temperature rise
- Bogs release methane, a greenhouse gas 25 times more powerful than CO₂.

**Amazon Rainforest Die-Off**
- Temperature rise
- Rainfall decreases.
- Fewer rainforest trees mean less water is pumped into the atmosphere.
- More trees die and decompose, or burn, releasing CO₂.

**Clogging the Ocean Sink**
- Temperature rise
- Warming waters shut down exchange of CO₂ from the surface to the deep ocean.
- Ocean waters dissolve less CO₂ (and may even release some).

**Subsea Floor Methane Hydrate**
- Temperature rise
- Sea floor sediment methane hydrate melts.
- Ocean warming
- Sea floor sediments warm.
Ice Age Positive Feedback Loop

- changes in temperature during this period are explained by changes in the Earth’s orbit around the sun which affects the amount of seasonal sunlight reaching the Earth’s surface [Milankovitch Cycles] every 100,000 years.
Ice Age Feedback Loop

- more sunlight
- warmer oceans
- warmer atmosphere

release more CO2 into atmosphere
Getting colder is slower than warming so life has time to adapt.

Today 411 ppm
The Feedback Loop we are Copying

Permian Mass Extinction 252 Million years ago

96% of marine species & 70% of life on land extinct

1. CO₂ spiked to 3000 ppm triggered by massive volcanic eruptions from the Siberian Traps which then ignited large coal seams

2. Warmer oceans & acidification CO₂ killed ocean life: together this reduced O₂ in the oceans

3. CH₄ created by anaerobic Archaea bacteria thriving in low oxygen oceans accelerated warming & extra nickel from volcanoes
The rate of ejection of CO$_2$ then is similar to the anthropogenic rate of injection now.
TODAY: Human CO$_2$ Emissions

2019
411 ppm
Acceleration of CO₂ emissions rate + 4.75 ppm CO₂ Increase in 2018

Even the increases are increasing.

The Latest Mauna Loa Observatory, Hawaii, Daily Atmospheric Reading on March 19, 2019 was 412.97 ppm CO₂.

Comparable figure at March 19, 2018 was 409.22 ppm CO₂, Highest Atmospheric CO₂ Level in 800,000 Years.
Our Methane Emissions are Accelerating
Why Climate Change Matters
More Than Anything Else

Foreign Affairs, 2018

Global Risks Report 2017
Figure 1.2: Billion-Dollar Disasters
Number of US weather-related disasters
Global Insurance Data: there are 6x more hydrological events now than in 1980

A rising tide
Natural disasters by cause

- **Meteorological**: Storms
- **Hydrological**: Floods, landslides and avalanches
- Extreme temperatures, droughts, forest fires

Source: Munich Re
Climate Change = More Energy =

- more atmospheric water vapour
- more intense floods
- larger hurricanes
- hotter Oceans
- longer droughts
- hotter and longer heat waves
- more severe weather extremes: Nebraska bomb cyclone
- fires so hot the organic soil burns away
- wavy & slower Jet Stream: Polar Vortex
- expansion of deserts
- greatest temperature rise in the Arctic
- Storms, floods, & fires caused by human-generated global warming correlate with elevated rates of anxiety, suicide

Human Suffering Is the Result
Polar Vortex: How the Jet Stream and Climate Change Bring on Cold Snaps

**Polar Vortex Explained**

The polar vortex is a large area of low pressure and cold air over Earth's North and South Poles. When the jet stream weakens, it becomes wavier, allowing that cold air to dip southward in places while warmer air pushes northward elsewhere.

- **Stable polar vortex**
- **Wavy polar vortex**

- A large pressure difference helps keep a strong jet stream on a straighter path, which keeps the cold air over the Arctic.
- When the jet stream weakens, it becomes wobblier, allowing cold Arctic air to move southward.
- Warm air moves north.
How is the jet stream changing?

- Research shows that over the past several decades, the jet stream has weakened. There's also evidence that as it wobbles, it can get stuck out of kilter, which can lead to more persistent weather extremes, including heat waves, cold snaps, droughts and flooding.

- Scientists say there is strong evidence that human-caused global warming has altered the strength and path of the powerful winds.

- More extreme and persistent swings in the jet stream may also be shaping a North American winter weather pattern that's been common the past few years—a warm and dry West, especially California, and cold waves in the Eastern U.S.
This is the result: January 2019
Warm Arctic = Cold Ottawa

• Although it may seem counter-intuitive, this winter’s extremes are exactly the pattern we should expect with climate change, said Jennifer Francis, a research professor at Rutgers University.

• “Rapid Arctic warming is affecting weather patterns farther south,” she said. Winter outbreaks of cold Arctic air are driven by a warming Arctic that is in turn weakening the jet stream.
For first time since records began, NWT hits 20C in March 2019

Daytime temperatures are running some 20-25C above normal, which is extraordinary.
Why have our Springs been so Cold?  
...but it’s so Warm Everywhere Else?

- 2018: cold temperatures the result of a stubborn, stationary mass of warm air over North Atlantic that has blocked the normal flow of air from west to east and south to north.
- 2019: past 2 winters a highly anomalous polar vortex disruptions and a stratospheric polar vortex split.

The start of this 2019 has also seen warm record daily winter temperatures in Europe, unusual cold in North America and searing heatwaves in Australia. Arctic and Antarctic ice extent is yet again well below average.
It’s Personal
It’s Happening in Canada

- Canada is warming up twice as fast as the rest of the world and it's "effectively irreversible," a new scientific report from Environment and Climate Change Canada says [April 2019]
- the average temperature in Canada is 1.7 C higher today than it was 70 years ago, while the average global temperature is up 0.8 C.
Meanwhile, in the Gulf of St. Lawrence

- Rapid loss of oxygen, declining by as much as 55% in some spots since the 1930s — compared to a 2 percent drop globally.
- The dramatic oxygen decline is due to shifts in the major ocean currents that feed the gulf
Lyme Disease in Canada

- **Lyme disease** reported to the Public Health Agency:
- 130 in 2009, 2025 cases in 2017
No seedlings are growing back at all at a third of sites that burned since 2000 [USA]
1/3 of heat entering the oceans is going into the deep ocean below 700m, temporarily slowing warming.
Nebraska March 2019 Bomb cyclone
TORNADOES

• The ‘Dry Line’ is Moving East as Moisture in the Great Plains Dries Up

• These areas tend to be more densely populated than tornado alley

• There is also a higher concentration of residents living in mobile homes — structures more vulnerable to damage

• March 5, 2019: Alabama tornado stretched for nearly a mile – four times wider than your average twister – kills 23
Tornado Alley has shifted East
due to the shift in the ‘Dry Line’
Iditarod sled dog race across Alaska Is Melting Away

- One feature of this year’s race is a nearly ice-free section of the Bering Sea. Dramatic winter melt has removed sea ice that the mushers would normally cross on their approach to Nome.
Black Land First [BLF] in Mozambique

• BLF blames tropic cyclone Idai on whites and want the African Union to demand reparations and relief from the West for the disaster.

• The BLF president charged that this was “not a natural disaster but a direct consequence of the white, Western system of ecological assault on the environment by a “profit no matter what the side effects value system.”
Those who contribute the least greenhouse gases will be most impacted by climate change.
Yesterday the independent Environmental Commissioner of Ontario, was eliminated

- This means that the government will take charge of investigating itself.
- The legislation transfers the commissioner's position into the office of the provincial auditor general. {$}
- The commissioner, Miller said, speaks for the trees, "for the trees have no tongues."
Does Canada Matter?

- We are now one of the world's largest extractors of fossil fuels per capita

- We're planning increases through to 2030

- Which makes reaching our Paris Accord commitments impossible to meet
Increasing extraction threatens both climate promises & our future economic stability.
So, Who set the House of Fire?

We all did
Why is the Man acting as if nothing strange is happening?

- It’s not my fault
- It’s all about me & my stuff
- Whatever I do won’t make a difference
- Misinformation by Vested Interests
- Anti-Science opinion based thinking
- Denial
- Being Over-whelmed
- Feeling Helpless
- Not Wanting to Know
- Short Term Thinking
- Ideology
Impact of Ideology in the USA

There is “solid evidence” of recent global warming due “mostly” to “human activity such as burning fossil fuels.” [agree, disagree]

![Graph showing the impact of ideology on ordinary science intelligence.](Image)
We value ‘**My Stuff**’ instead of ‘**Our Shared Enriching Experiences**’

*Me! Me! Me!*
The Fairy Tale Story of Roseto
before they became wealthy: no crime, nobody on welfare, no suicide/drug addiction/alcoholism

'The Power of the Clan' by S. Wolf & J. Bruhn
We are SOCIAL beings

• In Roseto, PA. virtually no one under 55 died of a heart attack or showed any signs of heart disease. For men over 65, the death rate from heart disease in Roseto was roughly half that of the rest of the U.S.A.

• Even though people smoked, drank, cooked with lard and were over-weight!
How can We all become this Healthy?
Live like Everybody around you matters

• They went to Mass at Our Lady of Mt. Carmel Church - a unifying and calming effect
• There were 22 separate civic organizations in a town of just under 2,000 people
• There was a particular *egalitarian ethos* of the town that discouraged the wealthy from flaunting their success and helped the unsuccessful obscure their failures
• *Therefore Our best medicine is other people* - that we trust and can count on unconditionally so that we do not live in a chronic state of stress
The Hidden Mental Health Impacts Of Climate Change

- Laurie lost her Long Beach, New York home in 2012 during the violent onslaught of Superstorm Sandy.
- ‘In recent months I have had several flashback dreams in which I am standing in my old house as the water breaks in through the floors and the walls,’ she said.
- I wake up screaming or crying.
- We expect that over 200 million Americans will have some mental health problem because of climate change.”
Peak Indifference

• At some point, a crisis gets so bad that it becomes unignorable. Our indifference reaches a peak, begins to decline—and panic emerges. This could describe what we’re now seeing in the climate polling. Media coverage and real-life events have finally broken through to folks: “Increasingly they’re saying, ‘Wait a minute, this is happening right here, right now,’” Leiserowitz says.

• This is great for anyone who wants to fix the problem, yes? Society is finally ready!

• But Doctorow’s theory also predicts another psychological hazard: When we ignore trouble for so long, we can slip quickly into nihilism. It’s too late. We missed our chance to take action.
Ecological Grief

• “the grief felt in relation to experienced or anticipated ecological losses, including the loss of species, ecosystems and meaningful landscapes due to acute or chronic environmental change.”

• It is a form of disenfranchised grief i.e., grief that is not openly acknowledged by society

The Inuit’s entire way of life is melting away
Melting sea ice prevented travel to significant cultural sites and engagement in traditional cultural activities, such as hunting and fishing.

- These disruptions to an Inuit sense of place was accompanied by strong emotional reactions, including grief, anger, sadness, frustration and despair.

- One male who grew up hunting and trapping on the land in the community of Rigolet, said:

  “People are not who they are. They’re not comfortable and can’t do the same things. If something is taken away from you, you don’t have it. If a way of life is taken away because of circumstances you have no control over, you lose control over your life.”

Watch this CDN movie about loss of the land
Children are particularly at risk for heightened anxiety and depression from a natural disaster.

- Climate change can instigate feelings of vulnerability and powerlessness that take the shape of anxiety.
- **Surveys** indicate that not only is global warming on our children’s minds, it is scaring them. One report found that approximately half of the children surveyed, ages 7 to 11, were anxious about climate change and often lost sleep over it. Another study showed that children ages 11 to 14 were more concerned about climate change than they were about their homework.
Solastalgia: the distress caused by environmental change

- It is a sense of loss for what the future is bringing, knowing that the world you knew is gone forever.
- People exposed to environmental change experienced negative affect that is exacerbated by a sense of powerlessness or lack of control over the unfolding change process.

Australia, The Big Dry, 2002-2012
Boiled Frog Syndrome: people just adapt and think this is now “normal”

When we ignore trouble for so long, we can slip quickly into nihilism. It’s too late. We missed our chance to act...
DENIAL IS OUR BIGGEST THREAT

- March 31, 2019 - Trump’s proposed budget will fire hundreds of meteorologists and slash tornado research: Ignorance is good?
- In 2016 all but 1 of 23 references to “climate change” contained in a Department of Defence report draft were deleted or changed to “extreme weather” by the Trump administration
- In 2012, North Carolina legislators passed a bill that barred policymakers and developers from using up-to-date climate science to plan for rising sea levels on the state’s coast
- In 2015 Florida, officials ban term 'climate change'
- The growth of right-wing nationalism in Europe has contributed to an increase in climate change denial
- Joe Oliver, former Harper cabinet minister, one of Canada’s most notorious climate deniers, was appointed by Premier Ford to the board that oversees Ontario’s electricity system
- Doug Ford cancelled all electricity conservation measures beyond 2020
Slave Lake 2011

A report was written... And ignored

then Good Bye
Fort Mac 2016
We can either choose to change or Nature will, painfully, force us to

- This is NOT the apocalypse, as we are doing this to ourselves
- We have to un-bind ourselves from thinking humans are the centre of everything.
- Paradoxically: If humans are responsible for the problem, we must be capable of undoing it
So, Why is the Man acting as if nothing strange is happening?

IT'S NOT DENIAL
I'M JUST VERY SELECTIVE ABOUT THE REALITY I ACCEPT
Onto David who will now answer:

How do we put out the fire?
Good Cop

Good News
There **ARE** Pathways to achieve the urgent and massive global transformation required.
Reduce Energy Use: Residential, Transportation, Industrial & Agriculture

Reduce Combustion Based Ghgs  72%

Reduce Non-combustion Based Ghgs  28%

Produce Technologies That Are Net Negative

MANY Pathways different combinations in different geographies and jurisdictions; sharing solutions among jurisdictions.
As a society & as Individuals we must choose between denial, paralysis, or engaged hope.
These are ultimately *deeply spiritual decisions* about whether we will use some of our own life energy to nudge history in a more hopeful direction.

- The evidence shows that engagement on the side of positive social change is a wonderful helpmate in increasing our sense of joy and purpose and

- Opens up otherwise undreamed of possibilities for community, knowledge and satisfaction along the way.
Committed
Strong
Committed
Sustained
Unwavering
Leadership
Reduce Energy Use

Reduce Combustion-based GHGs 72%
Reduce Non-Combustion GHGs 28%
Produce Technologies that are Net Negative
A gigaton is equal to a billion metric tons. A metric ton is 1,000 kilograms, or about 2,200 pounds.

- Since 1751, approximately 356 billion metric tonnes (gigatons) of carbon has been released into the atmosphere from burning fossil fuels (and cement production).
- 2018: 37.1 GIGATONS in just one year.
From Top 15 Solutions Globally to Limit Climate Change

“Drawdown”

Thanks the publication Drawdown from which we drew gigaton data on the savings and rankings of global climate solutions.
NO. #1 Refrigeration and Air Conditioning

Ranking and results by 2050
- 89.74 gigatons reduced CO2
- Data too variable to be determined
- $902.8 billion net savings

You Could
- Research groups dedicated to safe removal of HFC’s.
- Start a citizens fund to help developing countries to remove and transform HFCs safely. Great project for 4 or 5 of you to develop.
- There are NGO’s you can support who work on this.
- Contact embassies for example India and Singapore and inquire about their plans.
- Make sure your MP knows about the financing commitment around the Kigali accord and ask if Canada is on target.

HFCs: Hydrofluorocarbons
1,000 - 9000 times CO2
NO. #2  Wind Turbines

Ranking and results by 2050

- 84.60 gigatons reduced CO2
- $1.23 trillion net cost
- $7.4 trillion net savings

You Could

- Explore and understand the https://canwea.ca site
- Join the Ottawa Renewable Energy Co-operative
- Write to the Ontario Government to ensure Co-op projects for renewables remain feasible
2017 World Leaders on Wind Energy Integration

- CanWEA's *Wind Energy Grid Services Primer* provides insights about advancements in variable generation integration, the key capabilities of wind power generation facilities when it comes to grid services, and market considerations to encourage continued success.

- The *Pan-Canadian Wind Integration Study* demonstrates that Canada can source more than one-third of its electricity from wind energy without compromising grid reliability – while capturing wind
Reduced Food Waste

• Buy Local as much as possible
• Buy Just what you need
• Ask every store manager what their policy is in cutting down on waste, same with restaurants you go to
• Research, Support Join organizations advocating for reduced waste

NO. #3

Ranking and results by 2050

• 70.53 gigatons reduced CO2
• Cost and savings too variable to be determined

You Could
NO. #4 Plant Rich Diet

Ranking and results by 2050

• 66.11 gigatons reduced CO2
• Too variable to be determined cost and savings
2017 Worldwide average CO2 emissions per food type, per person, per year:

- Pork = 3.54 kg
- Poultry = 1.07 kg
- Beef = 30.86 kg
- Lamb & Goat = 35.02 kg
- Fish = 1.60 kg
- Eggs = 0.92 kg
- Milk – including cheese = 1.42 kg
- Wheat & Wheat Products = 0.19 kg
- Rice = 1.28 kg
- Soybeans = 0.45 kg
- Nuts – including Peanut Butter = 1.77 kg

You Could

- Eat less beef and lamb
- Reduce meat by a percentage
- Become Vegetarian
NO. #5  Tropical Forests

Ranking and results by 2050

• 61.23 gigatons reduced CO2
• Cost and savings: too variable to be determined

You Could

• Support organizations trying to protect the rain forests, the Amazon and other tropical forests
• Write relevant embassies to ask about their protection and restoration policies
NO. #6 Educating Girls

You Could

- Support Education of girls organizations worldwide
- Dialogue with relevant embassies
- Join with friends to make it an

Ranking and results by 2050

- 59.6 gigatons reduced CO2
NO. #7 Family Planning

You Could

• Research and support Family Planning Organizations

Ranking and results by 2050

• 59.6 gigatons reduced CO2
• Inappropriate to monetize a human right
Ranking and results by 2050

- 36.9 gigatons reduced CO2
- -$80.6 billion net cost
- $5.02 trillion

You Could

- Discuss with your family which house might be a good one for solar.
- Yours? Your Church? Your children’s?
- Give an early \[\text{(financial)}\] inheritance for
NO. #9 Silvopasture

Ranking and results by 2050

- 31.19 gigatons reduced CO2
- $41.6 billion net cost
- $699.4 billion net savings
NO. #12 Temperate Forests

Ranking and results by 2050

• 22.61 gigatons reduced CO2
• Cost and savings to variable to be determined

You Could
• Get involved with reforestation Projects
• Check out the World Resources Institute’s global restoration project and get involved
  https://www.wri.org/our-work/project/global-restoration-initiative
NO. #13 Peatlands

Ranking and results by 2050

- 21.57 gigatons reduced CO2
- too variable to be determined: global cost and savings

You Could
Canada's boreal wetlands are key to fighting climate change: A new report from the Boreal Songbird Initiative calls for enhanced protection of wetlands within Canada's boreal forest.

You Could

- Research and get involved in the Boreal Songbird Initiative

Preserving wetlands helps keep carbon from being released.
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CANADA'S CHALLENGE & OPPORTUNITY
Transformations for major reductions in GHG emissions

Thanks to the Suzuki Foundation for using this picture
Reduce Energy Demand
• Residences, Transportation Industry, Commercial, Conservation, Efficiency, Lifestyle

This slide is a mess but so are family conversations and they are important.

What kind of car??

Vacation near home?

Are we walking enough??

Insulation? Geothermal? Solar?

Sweaters or Gas??
Calculate your Carbon Footprint

- www.carbon.ca
- Sign a Carbon Pledge
Carbon Offsets   goldstandard.org
Established in 2003 by WWF and other international NGOs

Our Impact

1500+ Climate and development projects in 80 countries
98 MILLION Tonnes of CO2 saved (nearly double the annual emissions of Switzerland)
5.2 BILLION Dollars of value created in benefits beyond carbon
Make Your Next Car Electric
Norway hit 55% of plug-in car sales in 2017
The Rise of Electric Cars

By 2022 electric vehicles will cost the same as their internal-combustion counterparts. That’s the point of liftoff for sales.

Electric vehicles would account for 35% of all new vehicle sales.

Sources: Data compiled by Bloomberg New Energy Finance, Marklines
Gordon’s new car for windy days

DELETE TOP SECRET SLIDE
• TESLA SEMIS

• 500-600 Mile range

• $60,000 more BUT 20% cheaper to run

• $250,000 savings over 1 million miles
• Via Rail replacing core fleet with trains capable of using electric and diesel power
• March 19, 2019
Fly in an Electric Plane as In Norway
Power Your Home with Wind or Solar

The average cost of energy in North America

Dollars per megawatt hour

- Solar
- Wind
- Nuclear
- Coal
- Gas

2009: $400
2010: $350
2011: $300
2012: $250
2013: $200
2014: $150
2015: $100
2016: $50
2017: $45

$148
$102
$60
$50

0 100 200 300 400 500 600
Zero Net Energy Homes are here:
Colorado, USA
• Decarbonize the electricity grid
• Wind, solar, interprovincial sharing, geothermal
• And especially…
Canada has about 160,000 megawatts of

- This is more than twice the country’s current capacity

Muskrat Falls, Labrador
Fourth generation Nuclear
Is much cheaper and safer

- Sodium-cooled fission reactors are available
- They can burn spent uranium and plutonium: the unwanted by-products from water-cooled reactors
- A British **MOLTEX** reactor is to be built in New Brunswick
Methane traps 84x as much heat as CO$_2$ in a 20 year period

• Methane is responsible for 25% of man made climate change

• Canada Sets Methane Reduction Targets for Oil and Gas but Alberta Has Its Own Plans and all plans do not include tar sands and Alberta’s is voluntary
British Columbia-based Carbon Engineering has shown that it can extract CO2 in a cost-effective way. It has now been boosted by $68m in new investment from Chevron, Occidental and coal giant BHP.
So, How do we put out the fire?

- Stop Using Fossil Fuels & Use MUCH less energy
- **More importantly, Change Our Life Equation**
- From Happiness = More Stuff
- To Happiness = More Shared Enriching Experiences
Punchline: We **CAN** avoid Hot House Earth
• Have We Solved the Crime?

• Who set the House of Fire?
• All of us

• Why is the Man acting as if nothing strange is happening?
• Denial

• How do we put out the fire?
• Leadership: yours, mine and that elected gal/guy
• Changing our actions, policies, technologies and lifestyle

Together we CAN put the fire out!
The dinosaurs thought they had time too!
If you really enjoyed learning this...

• Why not attend a Canadian Association for the Club of Rome lunch held monthly at the Army Officers Mess on Somerset?
• See http://canadiancor.com/ for details
Our Bios

• David Pollock
  Currently the Chair of the Canadian Association for the Club of Rome (CACOR), environmental novelist and the former Executive Director of the Pembina Institute. With a rich background in non-profit management and serving for 12 years on the Board and Vice Chair of the Sustainable Development Technology Foundation, and he is a graduate of both Queens and Toronto Universities.

• Gordon Kubanek
  Studied Chemical Engineering at Queens before earning a Master’s Degree in Chem. Eng. at McGill. After working in the Pulp & Paper Industry he changed careers and became a High School Physics teacher. He studied an on-line course from MIT on System Dynamics modelling, the methodology used in the ‘Limits to Growth’ and used these skills to become a consultant for DND. He is a writer, beekeeper, a candidate for the Green Party and is also on the board of CACOR. gordonjkubanek@gmail.com