

HOTTER THAN HELL !!!

By David Lincoln

1 INTRODUCTION AND RATIONALE

How hot will our climate get? In recent years, many people have been concerned about global warming. Yes, I know it's technically called climate change, but we are going to be focused on maximum temperature changes in the near future. This paper is addressed to those who believe the threat of Global Warming is exaggerated or that the evidence for human causes is weak. Most of those who are in complete denial are unlikely to be swayed by the facts even when confronted with the fires of hell.

In the past 5 years, we have learned a great deal more about the feedback loops and processes responsible for global temperature changes. We have begun to better understand the El Nino cycles, methane emissions, relationships between fires, soot, coal and ice with fossil fuels extraction. These discoveries utilize new technologies and take many forms and have not received the media attention they deserve. We will attempt to update the data and put it into a context where ordinary people can understand the situation on a gut level.

Many people still believe that global warming is a problem only for future generations. That is because future temperature projections have been based on the assumption that people will act rationally in the interests of society and for the preservation of our civilization. They assume there is a limit to how fast and how much we will allow the temperature to rise before we take drastic action to restructure our global economy and modify our behavior. They are dead wrong!

2 WARNING

You've been lied to. You think that all we need to do is turn off the lights and turn up the temperature on your air conditioner and then your kids and grandkids can apply some mysterious future technology to solve the Global Warming problem. However, while you're thinking you might buy an electric car in a decade or two, the energy companies are busily figuring out how they can produce and sell 30% more dirty oil in the next 25 years effectively slamming the door shut on any conceivable solution to Climate Change before they incinerate the planet.

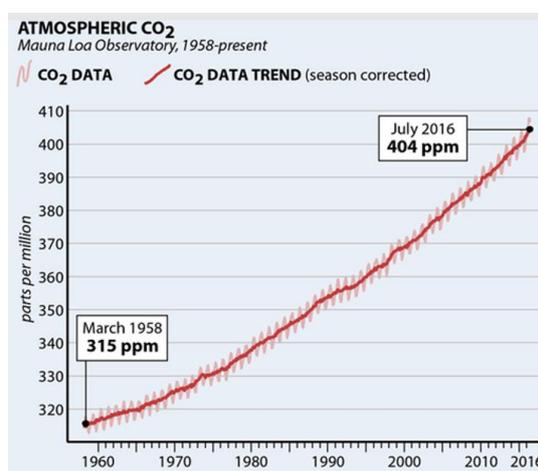
As you will see, not only are oil and gas companies, like EXXON, willing to squander their assets and subsidies to do whatever it takes to sell more oil and amass obscene profits, they are hell bent on producing the dirtiest, highest risk oil and gas with the highest Carbon Dioxide (CO₂) emissions potential on the planet. Simply put, the Energy Companies are leading us over a failed bridge down a dead end road at top speed in a vehicle driven by a madman, drunk with power. We are rewarding them for the chances that they take with our lives and our children's future. This must stop now!

In 2009, at the beginning of the Obama Administration, Dr. James Hansen who, at the time was the leading Climatologist at NASA, wrote to the White House and sounded the alarm:

“There is a profound disconnect between actions that policy circles are considering and what the science demands for preservation of the planet. A stark scientific conclusion, that we must reduce greenhouse gases below present amounts to preserve nature and humanity, has become clear to the relevant experts.”

In January 2010, about the time of President Obama’s first State of the Union Address an alarming report was released by the International Energy Agency (IEA) stating;

"Unprecedented climate change has Earth hurtling down a path of catastrophic proportions," warning of "a continual unfolding of climate disasters" and "giant waves of migration and mass mortality" if drastic actions were not taken **within the next five years.**



Nearly seven years later, the link between Global Warming and increasing CO₂ (and methane) is crystal clear (see chart above). The alarm bell has gone unheeded and many of the people and the Congress are still in denial. The purpose of this paper is to combine the latest science from academia and the energy industry to show you the fires and let you feel the heat as global warming takes its toll on us and our children.

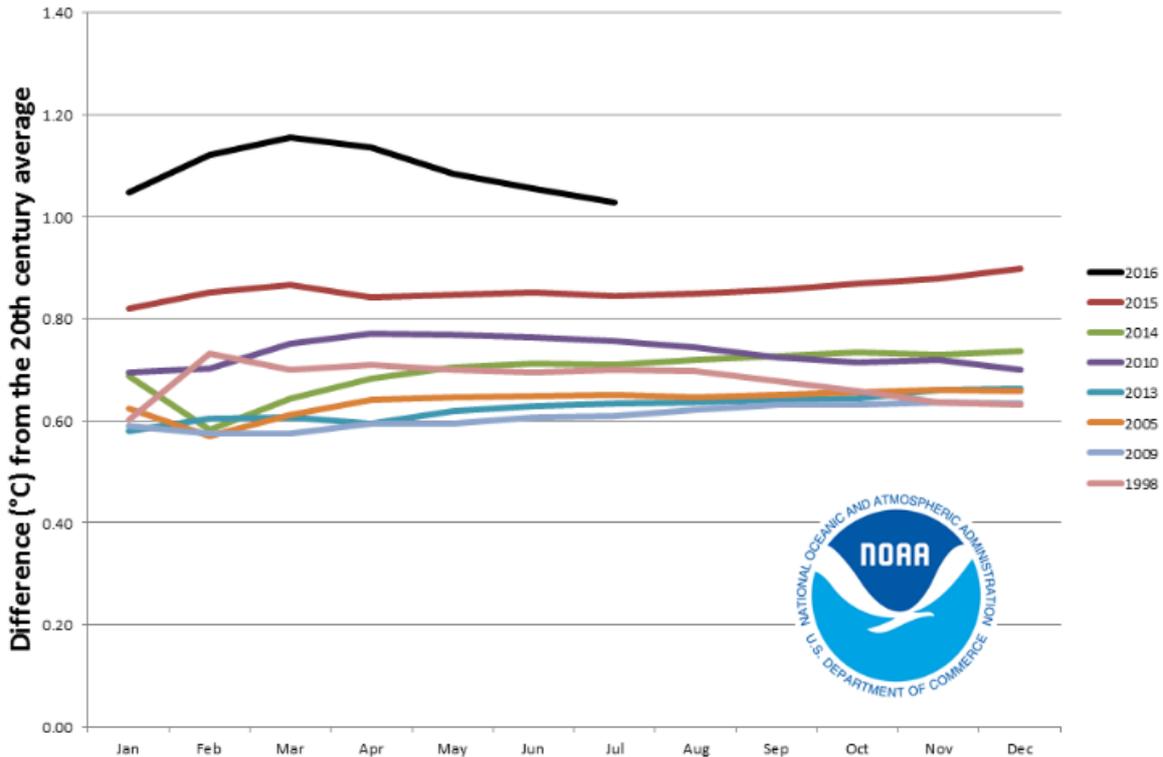
Time has run out for us and the choices we make in the next year could well determine how many people like us will die needlessly in this decade and beyond from Global Warming!

We will not be satisfied until we have informed you of the decisions which must be made soon and the consequences if those decisions and actions are delayed by corporate and political maneuvering due to sheer greed.

We will end with a list of specific recommendations which can be enacted resulting in the least pain for the fewest number of people.

3 FIRST HALF OF 2016

Year-to-Date Global Temperatures for 2016 and the other seven warmest years on record



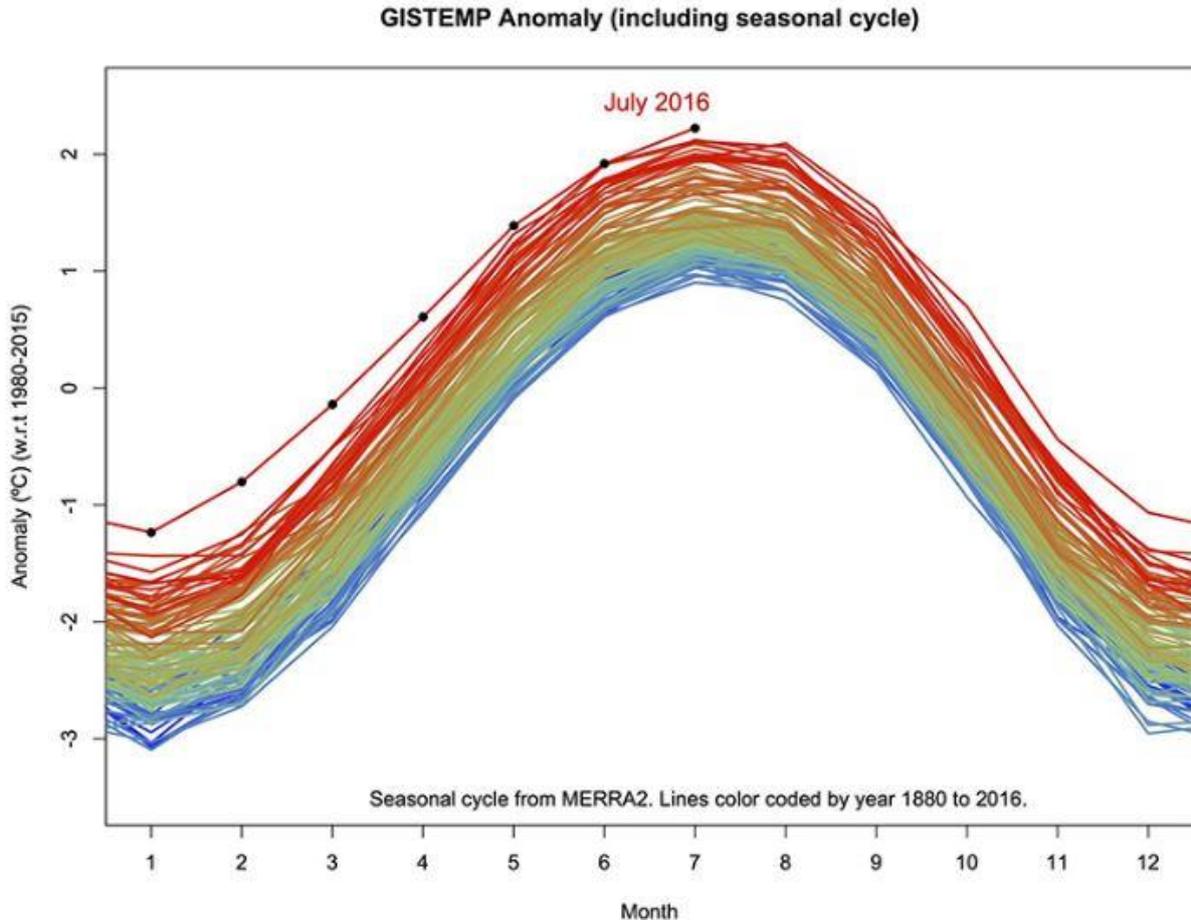
Global Year to Date Temperature Anomalies

Source: NASA

<http://www.ncdc.noaa.gov/sotc/global/2016/7/supplemental/page-2>

NOAA has recently released the chart of Global Year to date Temperature Anomalies (See chart above) which shows that not only was July 2016 the hottest month in recorded history, all of the months in the year so far have been much hotter than the seven hottest years recorded since the late 1800s. Note that seven of the 8 hottest years occurred in the 21st Century and the eighth hottest occurred in 1998.

HOTTEST GLOBAL TEMPERATURE RISE (FROM HISTORIC BASELINE)

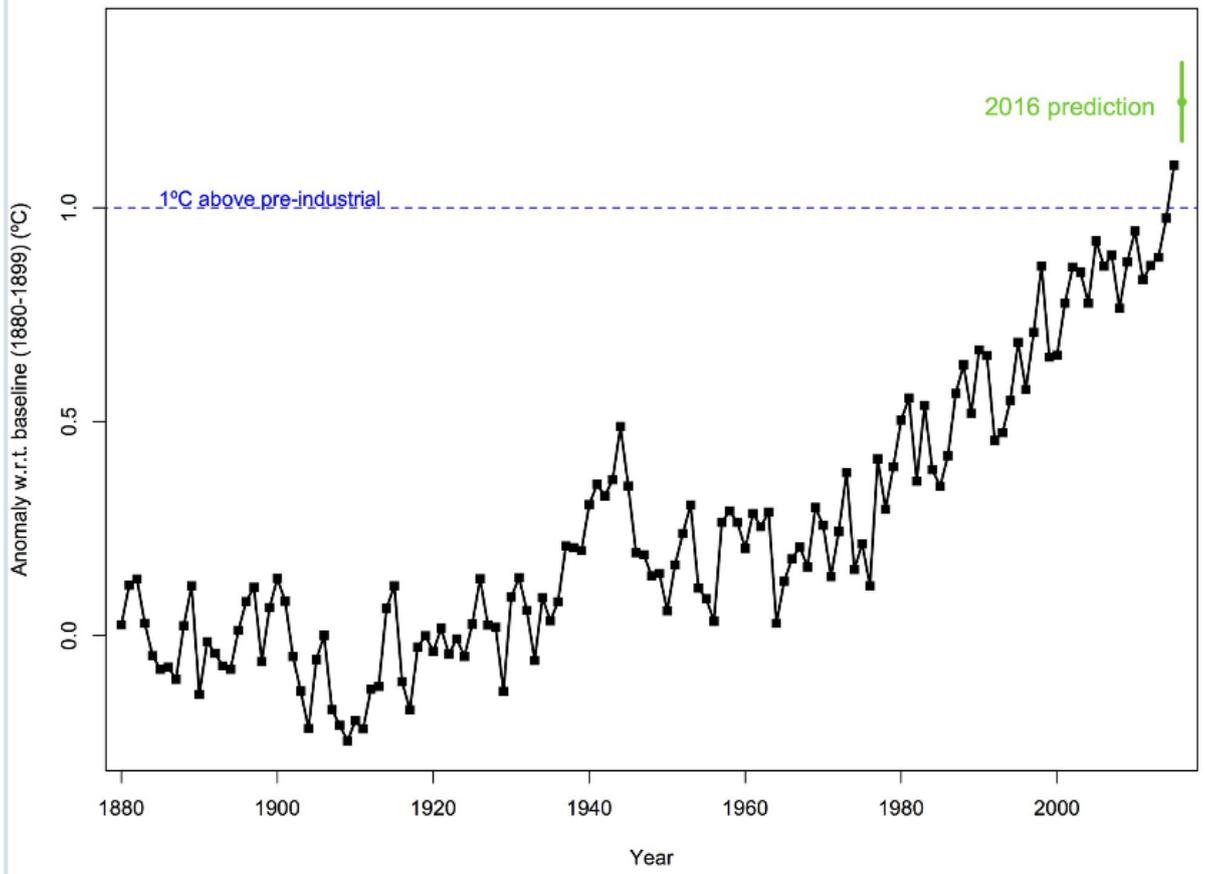


Source: NASA Aug 16, 2016 available at

<http://climate.nasa.gov/news/2479/nasa-analysis-finds-july-2016-is-warmest-on-record/>

NASA has also announced that the first 6 months of 2016 were the hottest on record and averaged 2.4 degrees F above pre-industrial levels. In fact, the months of January to June this year were each the hottest since 1890.

GISTEMP LOTI (incl. 2016 prediction)



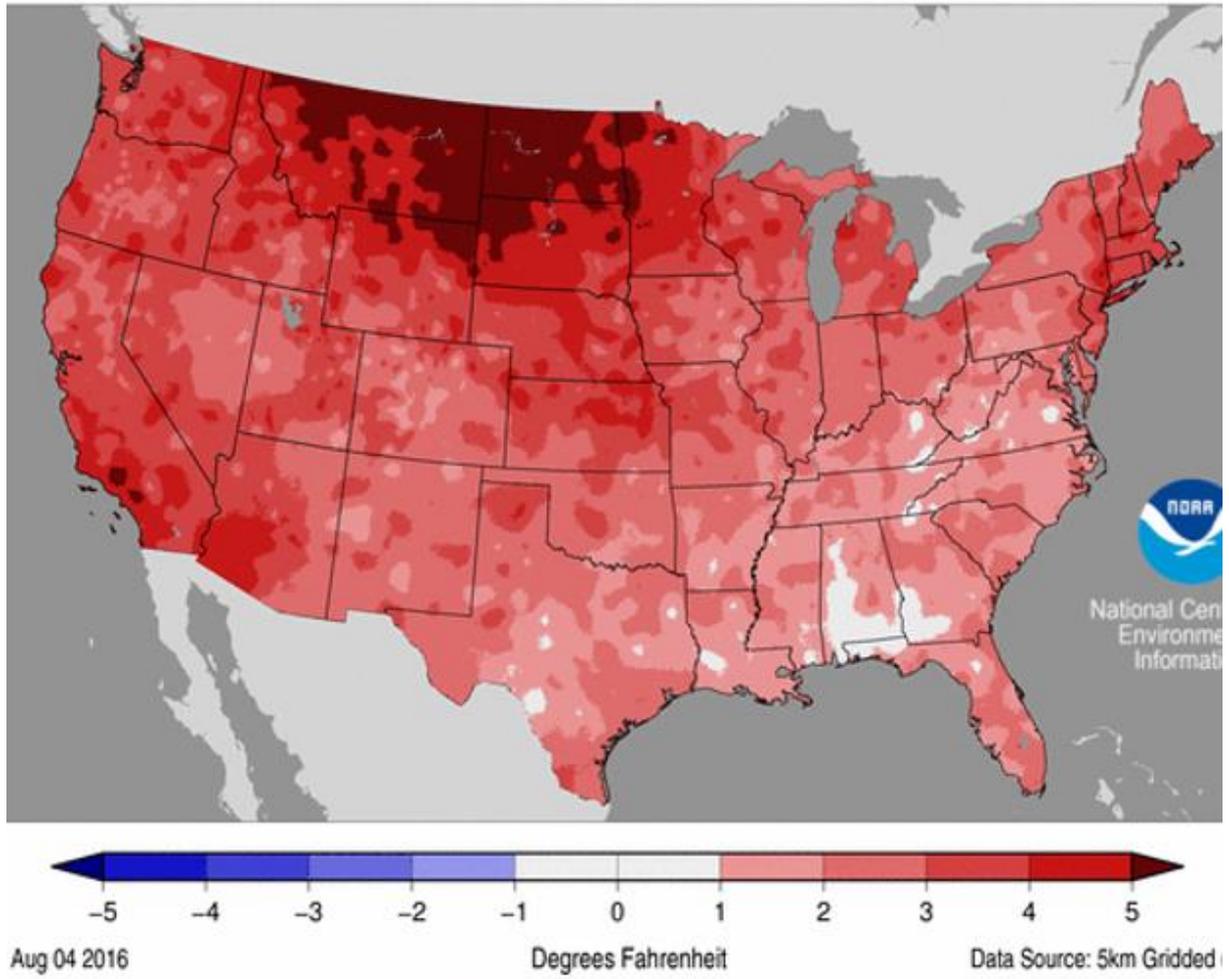
That means the first half of this year already averaged 1.3 deg C and close to the goal of the Paris Accord signed just this year of 1.5 degrees by 2030. In Alaska, the temperature in June was 9 degrees F (4.95 degrees C) above this long term average and more than twice the Paris Accord global cap.

Gavin Schmidt, Director of NASA's Goddard Institute for Space Studies (GISS) has predicted that the remainder of 2016 will remain hot. He has predicted a greater than 95% chance that we will finish the year as the hottest on record.

Mean Temperature Departures from Average

January–July 2016

Average Period: 20th Century



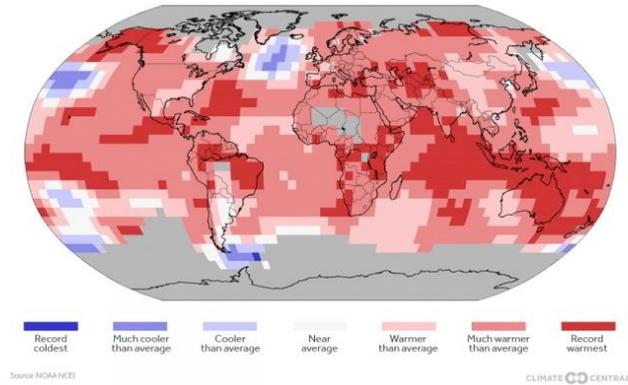
Source: NOAA National Centers for Environmental Information, State of the Climate: National Overview for July 2016, published online August 2016, retrieved on August 11, 2016 from <http://www.ncdc.noaa.gov/sotc/national/201607>

In the United States as well, NOAA analyses of temperature anomalies from Jan through July 2016 (See map above) are showing much of the country well above historical averages and some parts of the country showing the highest temperature since the end of the 19th Century.

Clearly we are losing the battle against Global Warming and It indicates that at the present rate of fossil fuel burning we will blow past the 2.0 degree C cap well before 2030. If production increases as the Energy Information Administration (EIA) forecasts and we continue to release methane and carbon dioxide at increasing rates, it is conceivable that we could surpass this cap by 2020 just when countries are expected to begin implementing their carbon reduction plans.

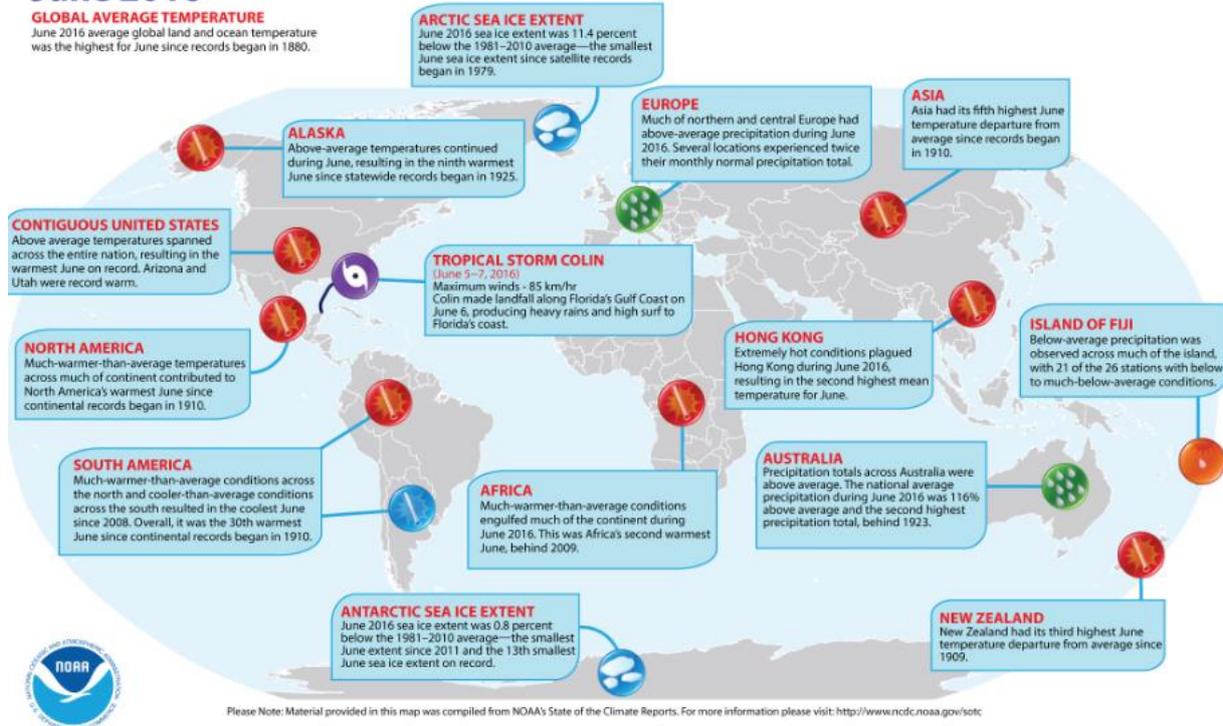
2016: Hottest Year So Far

Land and ocean temperature percentiles Jan-Jun 2016



The NOAA Temperature map for 2016 through June above shows that nearly half of the Ocean Temperatures around North America and Australia are at record highs and waters surrounding North America, South America, Africa and Australia are nearly all much warmer than average. Since oceans retain heat more than land areas these warmer ocean temperatures are likely to persist for quite a while. We are already in our third year of coral bleaching and die offs due to elevated temperatures. No one knows how long our reefs can survive temperature and alkalinity changes of this . Some of the significant climate events during June 2016 are displayed on the NOAA map below.

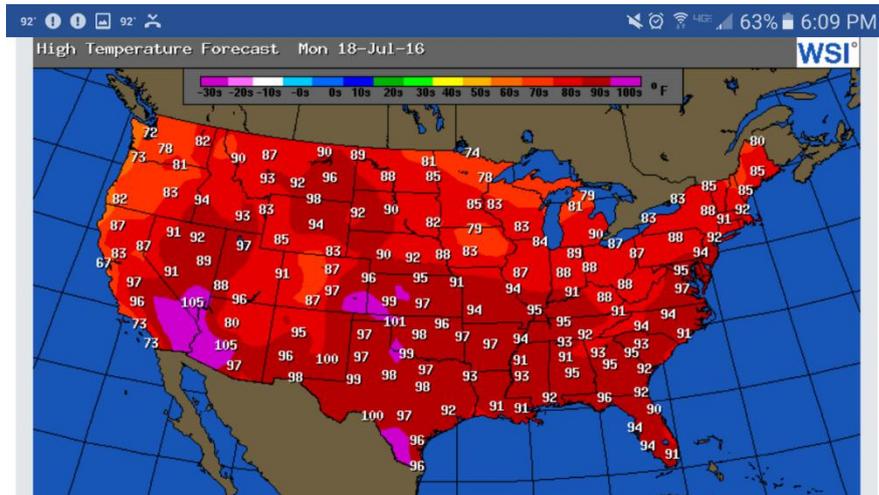
Selected Significant Climate Anomalies and Events June 2016



4 JULY 2016

So far in July 2016, we have seen widespread high temperatures (see map below showing max temp forecast for July 18 2016) which suggests a month which may go down in history

as one of the hottest months on record in the northern hemisphere. Therefore, it is appropriate to talk about how hot it could get in the next two decades.



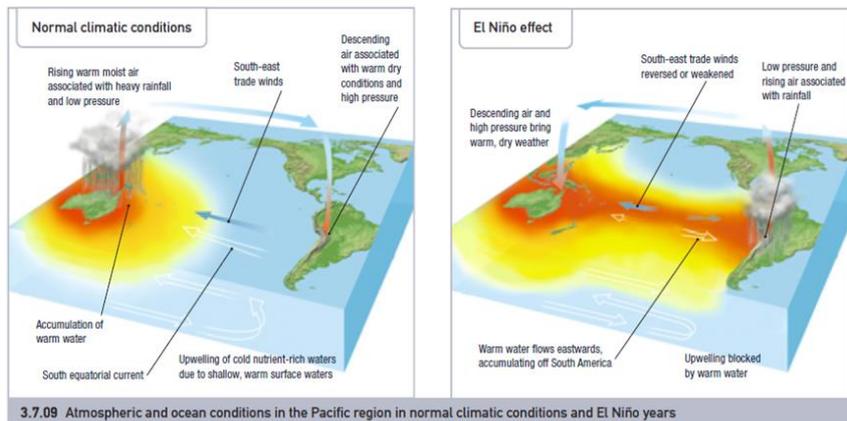
Many people could die this month alone as elevated humidity and nighttime lows become just as dangerous as Daytime highs in the 100's across many states. When we factor in the heat index our current forecasts look more like the map below.

U.S. Forecast of maximum heat index for July 23, 2016

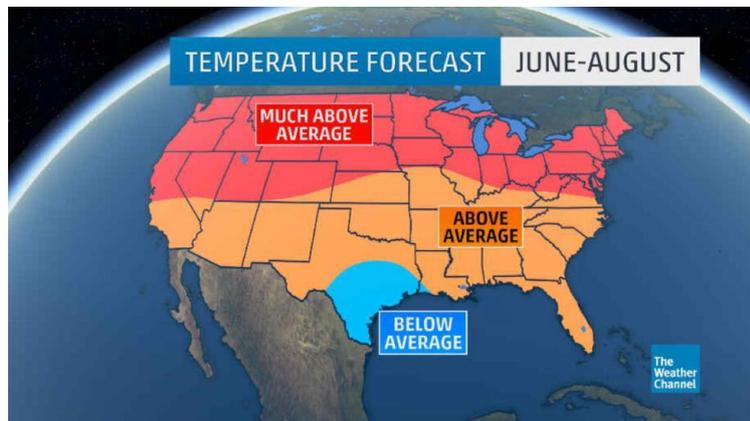


We know that global heat related deaths generally exceed hurricanes, tornadoes and lightning combined. According to CNN more than 100 million people are facing excessive heat advisories, watches and warnings this week in the US. July has also been the warmest month on record in the Middle East with new temperature records above 128 degrees in Kuwait, Iran and Iraq. These are the hottest certified temperatures ever recorded outside of Death Valley Calif (ground temperature 201 degrees F). It has been estimated that the maximum heat index for human survival is about 170 deg F and maximum possible ground temperature of 212 degrees F. Much of this current record heatwave has been attributed to the tail end of El Nino but what happens if it is the beginning of a pattern which repeats throughout our lifetimes.

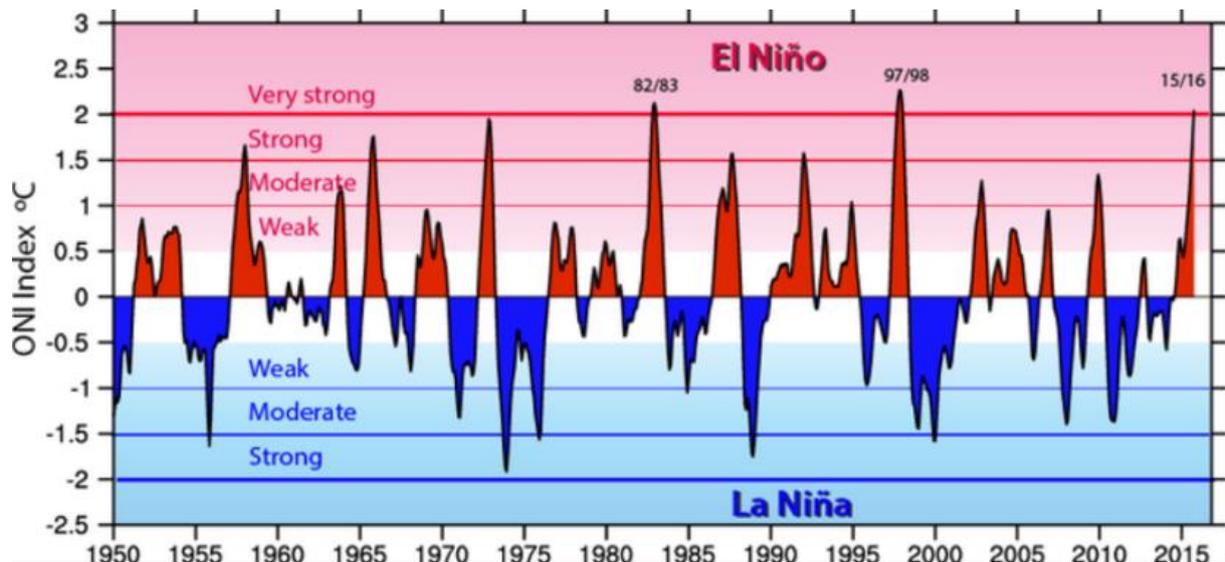
5 EL NINO



To find out what Global Warming might mean for the near future, let us now look at El Niño from a different perspective. We understand that El Niño is a cyclic climate phenomenon which occurs whenever the Central and Eastern parts of the Pacific Ocean warm periodically influencing the trade winds and ultimately the global path of the jet stream.



In the US. It is generally agreed that the super El Niño pattern of 2015 and 2016 is largely responsible for the spread of summer droughts and proliferation of wildfires in Western US. Globally, it has also been blamed for extreme heatwaves in Australia, Africa and the Middle East and the failure of the Monsoons in India. The key issue is how many of those cycles of the intensity of the last one do we think that we can tolerate before the temperature becomes unbearable for many people in the northern hemisphere.

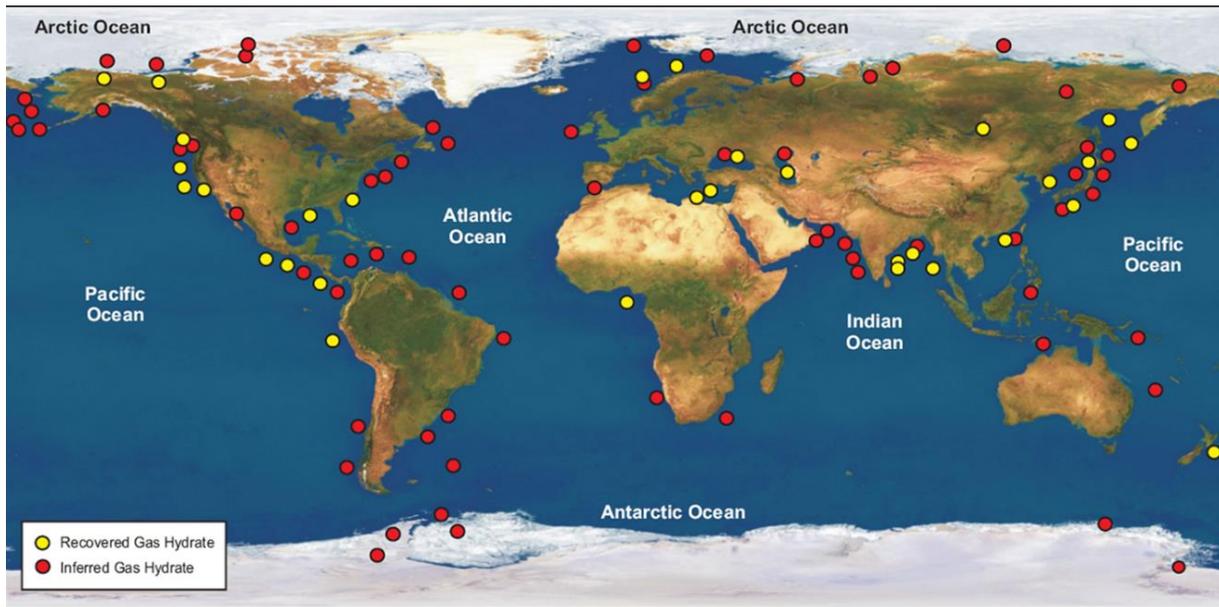


How many El Niño cycles will you have to endure in your lifetime? Remember, that while average El Niño cycles occur roughly every 5 years, in the past 25 years, strong to moderate events have been occurring about every 3 to 4 years. Evidence indicates that warmer oceans favor El Niño conditions. So let's assume that in the next 25 years El Niño cycles will occur on average every 4 years so that we might expect another six El Niño events during that period.

If each of those six El Niño's occurs on top of an ever warming ocean and atmosphere, we might expect for each to be more intense than the previous one. Can you imagine just how hot it could get during that period? Remember the past 5 years which culminated in the 2015 super El Niño was associated with a 1/2 degree C rise in average global temperature. If each of the next six El Niños was of equal intensity, we could be looking at a 3 degrees C average global temperature rise by 2040. This would not only be intolerable heat for many of the world's largest cities, the melting rates at our poles (where much of the temperature rise would occur) would be unprecedented. The impacts on our ecosystems, our agriculture and our civilization would be catastrophic.

6 METHANE HYDRATES

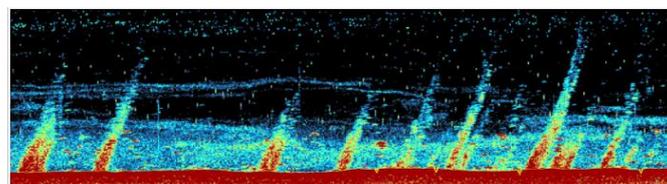
One of the first consequences of increased melting rates near the poles will be the release of methane hydrates. Hydrates form when methane and water combine at low temperature and pressure into ice crystals at ocean and sediment depths of 1500 to 3000 feet. These are generally found along shallow continental slopes but are also seen onshore in permafrost as shown on the map below.



Source: Global Carbon Project 2009

Avail @ http://www.globalcarbonproject.org/global/images/general/MethaneHydrates_1a.JPG

EPA scientists have recently learned that methane is leaking from our entire energy infrastructure (*Oil and Natural Gas Sector Leaks*, EPA 2014). We already knew that over a 20-year period methane is 60 times more effective as a greenhouse gas than carbon dioxide. We also knew that methane is contained in frozen hydrates both under the sea and in the permafrost. Both of these are leaking at phenomenal rate as the temperature rises. These shallow methane deposits can be seen on sonar and seismic as disruptions of bottom simulated reflectors (BSR's). They are routinely seen on shallow gas surveys (see section below) required before offshore wells are drilled and platforms are positioned.



In 2007, the IPCC estimated that in the unlikely event that 0.1% of the available methane hydrate were to escape into the atmosphere at one time it could raise the levels by 60%. Such an event could initially be triggered by an earthquake, a landslide or even a meteorite impact and then a series of feedback loops could result in additional methane being released.

Japan has recently announced that it has successfully mined offshore hydrates and is working to make it economic. Japan estimates that that there is enough methane off their coasts to fuel their energy needs for 100 years. Korea and India are also investigating the feasibility of production.

Offshore drilling for these methane deposits could lead to dangerous blowouts especially in arctic areas.

7 SOOT



Slash and burn agricultural clearing (such as for palm oil trees in Sumatra, Indonesia above) have created plumes of black soot across entire countries. Some of this soot makes it way to the poles and joins with smoke from massive wildfires.



Source: ESRI

Wildfires Burning in the US on July 24, 2016

These wildfires (like the ones that recently spread across California) will likely become more frequent and more intense. Already thousands of firefighters are being stretched to their limits as the fire season now lasts thru most of the year.



Extraordinary measures will be required as in Australia and military men will be enlisted to fight the infernos racing along the deadly canyons. As the drought spreads and intensifies fresh water to fight the fires will be scarce and equipment will have to be adapted to utilize seawater along the coast which will be resistant to saltwater corrosion.

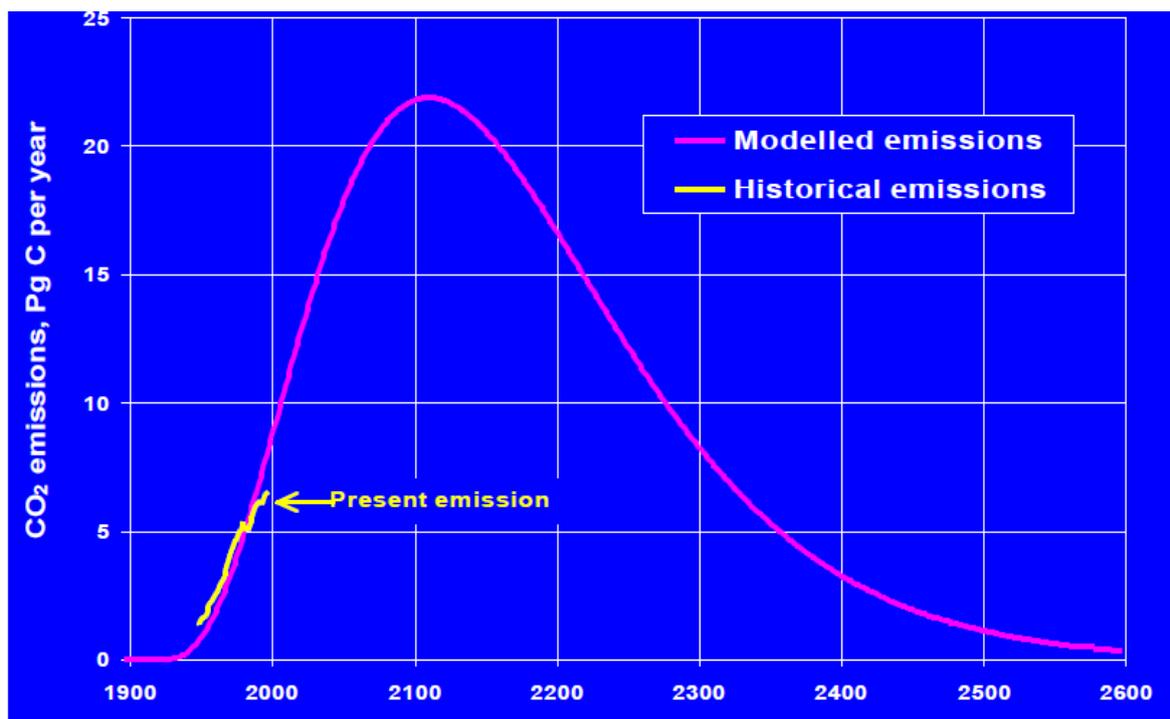


Figure 4.1 The CO₂ emission profile for a “business as usual” scenario only based on the increasing demand for fossil fuel and the depletion of the resources

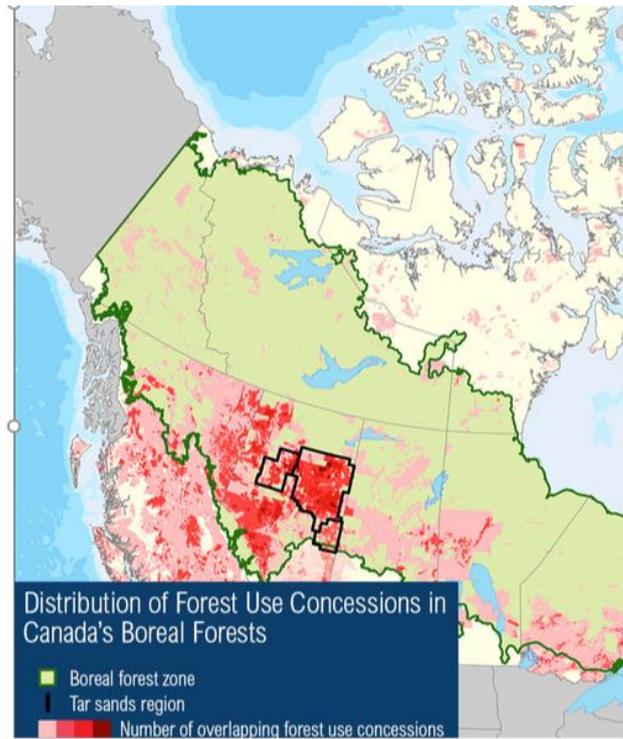
Source: Lindeberg 1999

We are also seeing evidence that glaciers and ice are melting at much faster rates than previously anticipated. We now know that glaciers are melting both at the top and at the base which endangers the structure of glaciers and accelerates their slide into the ocean. This is in part due to additional soot from burning of coal and fossil fuels which is turning the ice black and causing greater absorption of solar energy and therefore faster melting. The chart above shows the annual carbon emission levels (equivalent to about 10 Gigatonnes or PG per year in 2014. If we continued to ignore the causes of global warming and burned all the available fossil fuels as the denialists in Congress are proposing, we could expect the carbon emissions to double to 20 Gigatonnes per year before 2100. This would result in a Carbon Dioxide level in our atmosphere would raise the average global temperature to a point which would be unlivable.

8 FORESTS AND TAR SANDS



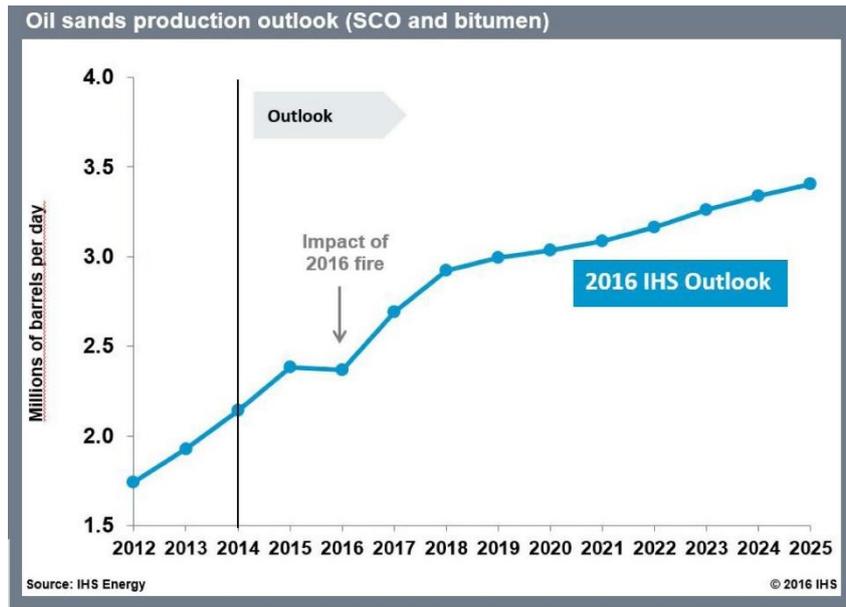
We now understand that the Boreal forest and the Amazon are far less capable of storing carbon dioxide than we had previously estimated. As we cut down the Boreal forest for access to fossil fuels and the Amazon dries out due to long-term drought conditions, we are seeing that CO₂ released back into the atmosphere.



Global Forest Watch reports that Canada possesses the world's largest Boreal Forest ecosystem and contains more than half of all of the Boreal Forests. In the Tar Sands region of Alberta, Canada has lost more than 2 million acres of forest since 2000.



Despite the recent fall in oil prices, IHS Energy still forecasts an increase in tar sands production of 1 million barrels per day by 2025. That represents a 45% increase in Tar Sands pollution in less than 10 years (shown by the blue line on the chart below). Clearly, this rate of tar sands expansion is not sustainable. It would be accompanied by an intolerable level of CO₂ emissions and methane escape which could warm the planet to insufferable conditions.

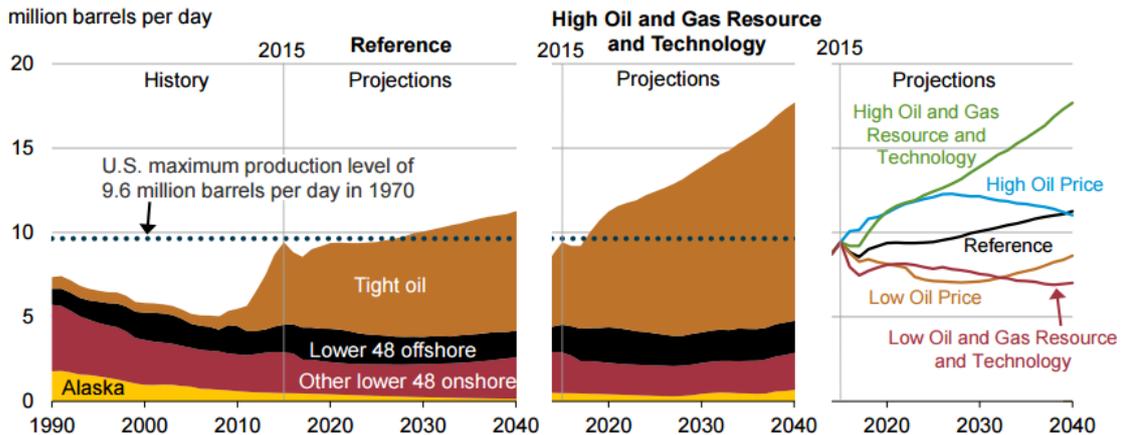


9 OIL PRODUCTION 2040

This brings us to oil forecasts by 2040. This is a good timeframe to analyze because conveniently the oil companies have projected fossil fuel usage to this year and distributed this nightmare scenario with the help of the Energy Information Administration (EIA) in ANNUAL ENERGY OUTLOOK June 2016.

U.S. crude oil production rises above previous historical high before 2030; alternative price and resource/technology cases can differ

U.S. crude oil production
million barrels per day



Source: EIA, Annual Energy Outlook 2016

Last week the EIA estimated US production in 2016 would be nearly 9 million barrels of crude oil per day at \$42 per barrel and an average pump price of \$2.12 per gallon of gasoline. This level of

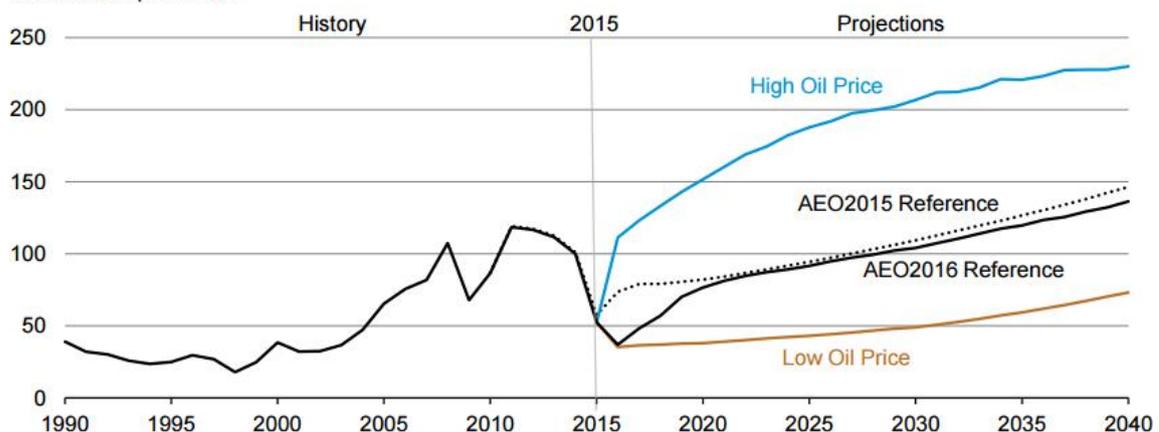
production has been nearly flat in spite of the fact that EXXON has reported 1st half earnings drops of 60% with other majors reporting significant losses. They are projecting gasoline prices of \$2.28 per gallon for all of 2017 and expect crude oil prices to rise to \$52 per barrel. All of the majors are projecting increases in production through 2040 (see production forecast chart above) primarily due to tight oil released through fracking and massive production increases labeled high oil and gas resource and technology. This translates to when high oil prices encourage deep offshore oil and gas fields and exotic fields with high-risk hydrogen sulfide (H₂S) and carbon dioxide (CO₂) contents.

This continued level of production is alarming because the EIA Global Energy outlook special report on Energy and Air pollution recently reported that Energy is by far the greatest source of air pollution. They concluded that Energy production is already responsible for 6.5 million premature deaths from air pollution per year. We can only imagine how many additional deaths can be attributed to the massive increase in energy production over the next quarter century.

They justify this doomsday doubling of US Crude Oil Production in 25 years by projecting an insane oil price between \$125 and \$225 per barrel.

Near-term crude oil price scenario is lower in AEO2016

Brent crude oil spot price
2015 dollars per barrel

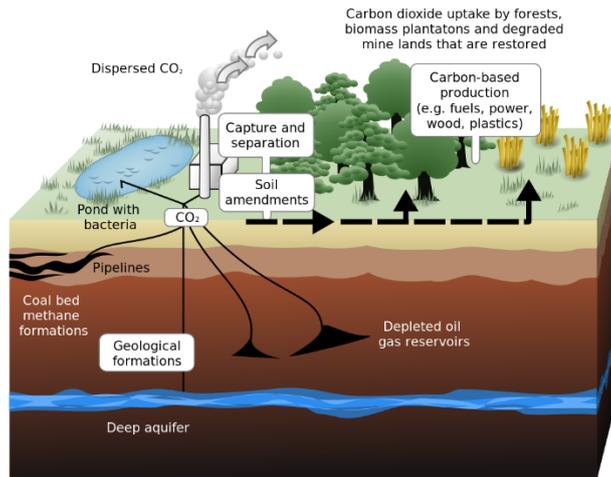


Source: EIA, Annual Energy Outlook 2016 Reference case and Annual Energy Outlook 2015 Reference case

Adam Sieminski, Johns Hopkins SAIS
June 28, 2016

10 CARBON SEQUESTRATION

For decades the gas and coal industries have been peddling the myth of clean coal. This pie-in-the-sky notion has been elevated to the scientific name of Carbon Capture and Sequestration or CCS. Which means that the carbon dioxide emitted in the flue gases of coal and gas fired power plants would be captured and then injected into the ground to be stored indefinitely in underground reservoirs or the oceans (see the diagram below). The industries propaganda for this geoengineering solution to Global Warming has been so successful that it has been adopted in the campaign platforms of both major political parties and it is a critical component of commitments in the Paris Accords.



Not only is this a false promise that has been sucking up government research funds for decades, but a person only has to read wiki or the energy industries own research reports to see that the entire concept is fatally flawed.

“A general problem is that long term predictions about submarine or underground storage security are very difficult and uncertain, and there is still the risk that CO₂ might leak into the atmosphere.”^[8]

Disadvantages of old oil fields are their geographic distribution and their limited capacity, as well as the fact that subsequent burning of the additional oil recovered will offset much or all of the reduction in CO₂ emissions”.^[1]

INJECTIVITY	CONTAINMENT			CAPACITY
	GEOMECHANICS	SEALING	HYDRODYNAMICS	
Reservoir quality, distribution geometry, connectivity, controlling pressure	Fault stability, fracture pressures, sustainable injection pressures	Seal potential, migration pathways, trap mechanisms	Formation water flow systems	3D cellular geological connected pore volumes. Defined top & lateral boundaries
? RE-EVALUATE & MODIFY UNDER REACTIVE CONDITIONS				

Figure 5.2 Main subsurface uncertainties associated with a CO₂ storage complex

In 2009, Shell published its report “*Understanding Carbon Capture and Storage Potential in Indonesia*” which includes the diagram of subsurface uncertainties.” The report discusses all of the various pathways of underground CO₂ leaks such as leaking wells, faults, fractures, and earthquakes shown in the cross section below.

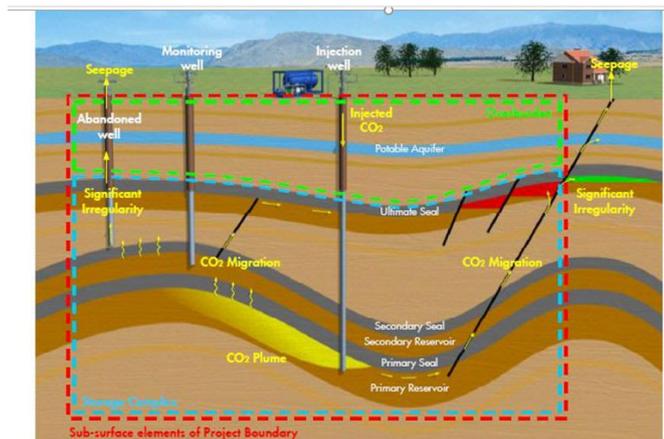


Figure 5.1 Definition of a storage complex and the possible leak paths of CO₂. A storage complex is defined as all the reservoir-seal pairs from the primary reservoir up to the ultimate seal.

Given the uncertainties and potential leaks, the economics of this hypothetical technology are highly unfavorable. Numerous monitoring wells and surface detectors would be required which would raise the costs considerably. Together with the cost of CO₂ absorbers this could double the costs of electricity generation and economics are not the only problem.

Recent studies of deep ocean storage have concluded that CO₂ would eventually result in ocean acidification at levels which are unacceptable over the long term. Furthermore, CO₂ released at shallow depths could be lethal for marine organisms, livestock and adjacent human populations.

CAMEROON

This fear was confirmed when a natural deposit of CO₂ sequestered in a volcanic crater lake in Cameroon was disturbed by a landslide. In the Summer of 1986, I was in Kenya when a report came in from Cameroon that CO₂ had escaped from Lake Nyos asphyxiating 1700 people and more than 3500 livestock. Although the population has been resettled in the area, the threat continues and another outgassing could be triggered by another earthquake or landslide. This catastrophe has led scientists to conclude that any blow-out of a CO₂ reservoir could potentially replace enough oxygen to suffocate people for miles around the event.

NATUNA CO₂ PROJECT

https://en.m.wikipedia.org/wiki/East_Natuna_gas_field

Ironically, the previous year, I was working for Tenneco in Indonesia. I evaluated the Natuna Project in the South China Sea for possible participation using EXXON'S own data and I recommended against it. This EXXON field is probably the largest remaining gas field in the world. Problems with the lease are disputed by China, Philippines, Vietnam and Malaysia; it is nearly 75% CO₂ with significant H₂S, and it costs \$40 billion to develop, so it may not even be profitable when oil price is over \$100 per barrel. Early calculations showed that deliberately bubbling the CO₂ to the surface or a blowout could endanger anyone within a 10-mile radius.

I told the company the gas field was not economic, bad for the environment and too dangerous. I also told them it could not be profitable under any probable scenario. Apparently, James Hansen did some consulting work for EXXON about the same time and gave them the same advice. In short, development could start a war after which production would overheat the planet.

Given the scale of this Natuna Project. it could well have been the beginning of EXXON'S intense interest in the link between CO2 and global warming. Attempts to justify this ill-conceived project could have led to EXXON's much publicized, active role in promoting Global Warming denial. Needless to say, EXXON to this day is continuing to promote this insane Natuna project and denial of man-made climate change It is still looking for additional partners more than 40 years after the fields discovery.

<https://insideclimatenews.org/news/08102015/Exxons-Business-Ambition-Collided-with-Climate-Change-Under-a-Distant-Sea>

This brings us to our own recommendations for combating Global Warming culled from dozens that have been proposed over the years. These are based primarily on removing the financial incentives which accelerate Global Warming. Additionally, we have included recommendations to fight the inevitable consequences such as increased wildfires and dwindling water supplies. If these measures are not implemented soon, we will look back on this time as the point where we allowed our faint candles of hope to be extinguished by the energy companies wielding a blow torch.

Available for download at

<https://www.scribd.com/document/320396507/HOT-as-HELL>

David Lincoln

Aug 21, 2016

Eco-Alert

11 RECOMMENDATIONS

End Fossil Fuel Subsidies

End Wastewater Injection

Ban high volume hydraulic fracturing (Fracking)

Remove the Haliburton Loophole and reinstate the Clean Water and Clean Air authority over hydrocarbon waste products

Establish monitoring and fines for methane emissions

Buy, Lease and Build a fleet of fire-fighting aircraft adapted to use salt water along our coasts.

Recruit and Train Veterans and the unemployed to a permanent Conservation Corps to fight fires and provide flood relief.

Monitor methane emissions above dump sites

Permanently cap and restore land above abandoned sanitary landfills

Stop Deepwater Offshore Leasing

End Govt. Research Funding of Clean Coal and CCS

Prohibit imports of Tar Sands or products from oil sands

Increase tax incentives for Wind and Solar Energy.

Encourage development of fireproof and earthquake resistant affordable housing.

Establish nationwide tree planting programs

Subsidize water filtration and cleanup of drinking water.

12 QUALIFICATIONS

As a petroleum geologist David Lincoln has been studying global warming for the past 45 years. He knows what the oil companies have known for decades and follows the technical articles, conventions and trade journals they publish. He did his GIS Master's Thesis on Vegetation Change in Australia and assisted in satellite research on global climate change. As a college instructor he has

taught this subject for over 15 years. He has seen the technologies evolve as the weight of the evidence mounts.

He has concluded that no serious, objective scientist would challenge the simple fact that man's use of fossil fuels is altering the climate. It is not yet too late to choose alternatives, but we cannot continue with business as usual. We must take a different path and leave many of the fossil fuel deposits in the ground.