Sierra Club Three Lakes Group
Fall 2013 Newsletter

Three Lakes Group Officers: Roger Blanchard, Chair; Annemarie Askwith, Treasurer; Cathy Akre, Secretary; Carol Ward, Forestry; Diane Meyer, Conservation Chair.

Fall Program Schedule

Fall programs will be held at Bayliss Public Library in Sault Ste. Marie. Cookies and drinks will be supplied at the programs.

Tuesday October 8, 6:30 pm-Wild Cats in the U.P.: Cougers, Bobcats and Lynx-David Jentoft, DNR Wildlife Biologist. We will discuss big cats found in the UP and some of their characteristics, including those that help in their identification.

Saturday Nov. 9, 1:00 pm-A Forum on Fracking (This program is co-sponsored by the League of Women Voters): Craig Brainerd, a leader in the Michigan Beyond Natural Gas and Oil Campaign, will give a PowerPoint presentation about a technique used to extract unconventional oil and natural gas called hydraulic fracturing or fracking. There has been considerable controversy about the technique associated with its impacts upon the environment and the people who live in fracking zones.

Craig's presentation "Don't Frack Up Our Future" is a 45 minute investigation of what's happening with oil and gas drilling in Michigan, and what actions we need to take to protect our beautiful state, her resources and public health. Craig's presentation will be followed by individuals who have been directly impacted by fracking. Amy Hjerstedt will then give a presentation about The League of Women Voters position on fracking.

Thursday November 19, 6:30 pm, Oil & Water Don't Mix: The Threat of an Enbridge Pipeline in the Mackinac Straits- Jim Lively, Program Director at the Michigan Land Use Institute

While the president continues to deliberate on the fate of the Keystone XL pipeline which would bring millions of gallons of tar sands oil from Canada through the midwest, the Great Lakes continues to be threatened with oil spills from existing pipelines. Enbridge Corporation - the same company responsible for the pipeline that ruptured in the Kalamazoo River three years ago resulting in the largest mainland oil spill in America - owns a 60-year old pipeline that crosses just beneath the Mackinac Bridge carrying crude oil. On July 14th global climate change activist Bill McKibben visited the straits to warn not only of the threat of a direct spill into our lakes, but the very real threat of CO_2 spilling into our atmosphere when we burn highly polluting tar sands oil., will discuss these threats and how you can get involved.

The Three Lakes Group Has Talent (Maybe)

On Saturday Nov. 2 at 7:00 pm, the TLG will have a Music Night at the Soo Theatre Arts Resource Studio (STARS), Studio D (Most northern of the studios) in downtown Sault Ste. Marie. STARS is part of the Soo Theatre.

If you have a musical instrument you'll have an opportunity to play some songs. If you want to sing along, you are welcome to do so. If you just want to listen, you are welcome to do so.

If you would like to bring some food for a potluck, you're welcome to do so. We'll supply some beverages.

Recent Commentary

What's Going On?

In May 2013, the atmospheric CO_2 concentration reached the 400 ppm level for the first time in at least 800,000 years, and probably at least several million years. Because the CO_2 concentration fluctuates with the seasons, the average CO_2 concentration won't reach 400 ppm for a year or two.

The last time the atmospheric CO_2 concentration was 400 ppm, the Arctic was 14^{o}F warmer than at present. The arctic will warm quite a bit more than the global average due to global warming because of Arctic amplification. As the reflectivity of the earth's surface is reduced with increased melting of ice and snow, more incoming solar radiation is absorbed by the earth's surface in the arctic region increasing the warming in the arctic region relative to non-arctic regions.

A temperature increase of anything remotely close to 14^{o}F would have significant consequences because arctic permafrost has huge quantities of CO_2 and CH_4 lock up in it that would be released upon melting. Also, there are huge quantities of CH_4 locked up in methane hydrates in the Arctic Ocean, particularly in the East Siberian Continental Shelf. CH_4 has a warming effect that is approximately 100 times stronger than CO_2 over a 20 year time horizon and approximately 25 times stronger over a 100 year time horizon. Over time, CH_4 gets oxidized to CO_2, thus the decline in the warming effect of CH_4. The release of CO_2 and CH_4 upon warming is an example of positive feedback.

Of course there are many voices who are saying that it's not important that CO_2 and other greenhouse gases are rising because the global atmospheric temperature hasn't risen in 16 years. There are problems associated with that statement.

First, NASA's Goddard Institute for Space Studies (GIFF) has the two warmest years globally as 2010 and 2005 with 1998 being third. The organization that has 1998 as the warmest year on record is the Meteorological Office (MET), in the U.K. Why the difference?

GIFF interpolates temperature data across the arctic to provide full data coverage for the region of the globe that is warming faster than any other region. The MET has very limited temperature data for the arctic so their data set is incomplete for the region.

Another important point concerning 1998 is that that year had the strongest El Nino on record. An El Nino involves a warming of the equatorial Pacific waters. That warm water is carried up along the west coasts of North and South America. In an El Nino, energy is transferred from the warm water to the atmosphere. An El Nino can have a significant warming effect. In the case of 1998, the previous global high temperature record was smashed.

In 2010 a La Nina developed in the equatorial Pacific. What happens in a La Nina is that there is an upwelling of colder water from below which leads to surface cooling. That cooler water moves along the west coasts of North and South America. During a La Nina, energy is transferred from the atmosphere to the cold water. A La Nina can have a significant cooling effect.

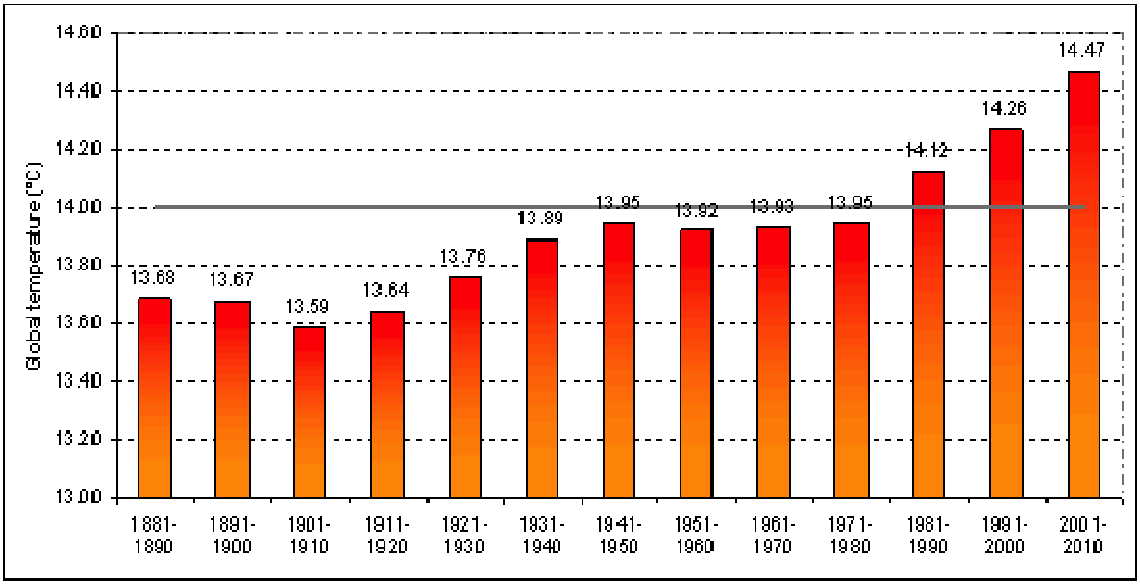
The La Nina starting in 2010 technically ended in the middle of 2012 but water temperatures in the equatorial Pacific and along the west coasts of North and South America continue to remain below average.

What has been happening in recent years is that a higher percentage of the energy trapped by atmospheric gases has been transferred to the oceans. Because water has a very high specific heat, relative to dry air, the oceans can absorb a lot of energy without causing much of a temperature change when compared to if the energy remained in the atmosphere.

At some point in the near future we'll have another El Nino. I wouldn't be surprised to see the global temperature record get smashed again because there is now a lot of stored energy in the oceans that can be transferred to the atmosphere.

It should be pointed out that sea levels continue to rise which implies that water temperatures of the oceans are increasing, causing thermal expansion. Sea level rise is a good proxy implying that the global system temperature continues to increase.

Because there can be quite a bit of variation in the global temperature from year-to-year, it's important to average data over a 10 year period or longer to see trends in the global average. When that is done, 2001-2010 was considerably warmer than 1991-2000 (See graph below).



Decadal global combined surface-air temperature via World Meteorological Organization

It takes decades for thermal equilibrium to be reached between the oceans and the atmosphere so even if we stopped putting greenhouse gases in the atmosphere now, the atmospheric temperature would continue to rise for a considerable time period. This is an example of thermal inertia, a resistance to temperature change that slows the change, in this case due to the high heat capacity of the oceans. Few people appreciate thermal inertia and its consequences. I expect future generations to suffer the consequences for that lack of appreciation or caring.

When will the atmospheric CO_2 concentration stop increasing? I personally don't see that happening anytime soon. I expect global CO_2 emissions to continue to rise for at least the near future (A recent US DOE/EIA report projected that CO_2 emissions will increase from ~30 billion metric tons/year to ~45 billion metric tons/year by 2040). Assuming at some point they do start declining, I expect the decline rate to be fairly minor. I expect atmospheric CO_2 concentrations to rise at least above 600 ppm and probably well above 600 ppm. Presently, the atmospheric CO_2 concentration is increasing at approximately 2.1 ppm/year.

Climate experts make the case that we don't want to increase the global atmospheric temperature more than 2°C (3.6°F) and we certainly don't want to increase it 4°C. At this point we're on a path to at least a 4°C increase and probably more. Climate scientists generally consider a warming of that degree to be catastrophic. We're going to test out that belief.

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The biggest concerns regarding global warming involve food production and sea level rise. In terms of food production, regions like the U.S. Midwest are expected to get significantly hotter and drier. It's certainly possible that most or all of states like Texas, Oklahoma and Kansas could become so unfavorable for agriculture that agricultural production is significantly curtailed, particularly once the Ogallala Aquifer is depleted.

Sea level rise would create substantial problems for coastal cities throughout the world including Miami (see http://www.rollingstone.com/politics/news/why-the-city-of-miami-is-doomed-to-drown-20130620). According to a recent research study, each 1°C temperature increase leads to a ~7.5 feet increase in sea level so a 4°C temperature increase would lead to 30 feet of sea level rise. Just as in the case of thermal inertia, thermal expansion will occur over many decades. In the last few years, the average sea level has risen nearly 1 cm/year, quite a bit faster than in the past but the sea level will rise at an increasing rate in the future.

The American way of life is non-negotiable and it's increasingly the lifestyle of people in China, India and other developing countries. Shouldn't all Chinese and Indian adults have motor vehicles to drive whenever convenience or desire calls? Why shouldn't they have a motoring future even if it requires full exploitation of the Canadian Tar Sands or any other non-conventional source of oil?

If we were to seriously do something about global warming, what would we have to do? Minimally, U.S. CO_2 emissions would have to be cut by at least 80% and probably 90-95%. That's not in the cards. The prevailing view of many in the U.S. is that if only coal burning power plants in the U.S. were shut down, America would have done what it has to do. In reality, we would have to do a lot more than that. Interestingly, coal use for electrical generation in the U.S. has increased in 2013 to ~29% of total electrical generating fuel, relative to 2012 at ~25%, as the price of natural gas has increased.

Last year, a representative from the Tyndall Center on Climate Change made the case that global CO_2 emissions had to be cut 10%/year starting right away. That isn't in the cards. Should we do anything in the U.S. to cut emissions in-as-much as China roughly tripled coal use since 2000? China has a lot of relatively new coal-burning power plants. I don't see them abandoning those plants except if they are unable to obtain coal.

U.S. CO_2 emissions have actually declined in recent years for a variety of reasons but even with that decline, global emissions have risen substantially. That is because China, India and other developing countries have rapidly increased their use of fossil fuels. Per capita CO_2

emissions for the U.S. dwarf those of developing countries so there is a lot of room for global CO_2 emissions to increase assuming that people in developing countries can afford fossil fuels. Remember, people in developing countries want to live like you do, and why shouldn't they live like that?

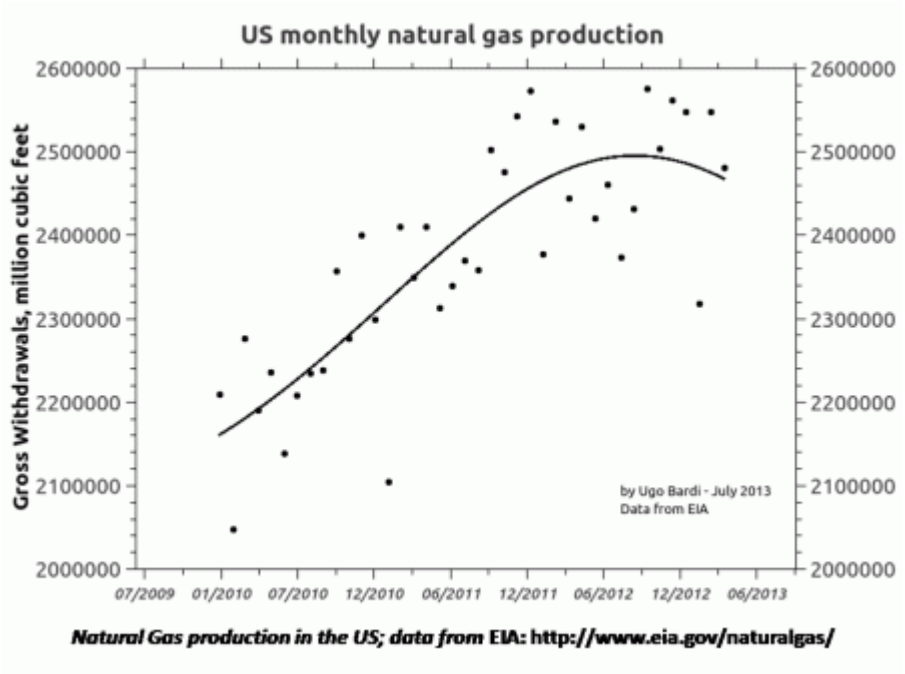
Americans, in general, appear to have no qualms about the environmental effects of oil and gas production, such as fracking and oil sands development as long as they get the oil and gas they want. Americans need the oil and natural gas to maintain their American lifestyle. The point is that we have short-term desires that must be met and meeting those desires is more important than the long-term consequences that result. Increasingly, those short-term desires for oil and gas are being meet by fracking in the U.S. and tar sands development in Canada.

Approximately 35% of the natural gas and 20% of U.S. oil production now comes from fracked wells. If the U.S. didn't have that fracked oil and natural gas, the price of oil distillates and natural gas would be considerably higher than they are at present and the American consumer would be screaming loudly.

But there are storm clouds on the horizon in terms of natural gas. I'm sure everyone has seen the commercials from the natural gas industry on the TV in which they expound on how cheap and abundant natural gas is in the U.S.

Could it be that we're not getting the whole truth from the natural gas industry? Of course we're not. It's becoming increasingly obvious that the increased production of oil and natural gas in the U.S. due to fracking is a bubble, a bubble that will burst in the not-too-distant future. What the industry has done in recent years is develop fracked wells as fast as humanly possible in the locations that are most favorable.

Already, the price of natural gas is going up while production stagnates (See graph below-the decline so far has been minimal because the industry continues to develop wells that had been drilled in the past but at some point soon, the undeveloped well inventory will run out). In April 2012 the wellhead price of natural gas was $1.89/mmBtu. In April 2013 it rose to a high of approximately $4.40/mmBtu. It appears likely that the price will rise to $8/mmBtu, or higher, in the next few years for obvious reasons.



When the price of natural gas rose to >$10/mmBtu, in 2008, the natural gas industry went on a drilling frenzy, mainly drilling fracked wells. That led to an oversupply of natural gas which led to the price of natural gas falling below $2/mmBtu.

The problem with <$2/mmBtu natural gas is that for fracked wells, it costs approximately $8/mmBtu to produce the gas. Natural gas producers have been losing a substantial amount of money producing natural gas in the last few years.

That has caused natural gas producers to significantly cut back on drilling (See graph below). The number of rigs drilling for natural gas slipped to near a 14-year low in April 2013 and the current gas rig count is about a fourth of what it was at its September 2008 peak.

Because fracked natural gas wells decline so rapidly, a continuously high rate of well drilling is required just to maintain production. As an example, fracked wells in the Haynesville and Barnett shale plays declined at 68% and 61% respectively in their first year of operation according to a recent report by geologist David Hughes (The Hughes Report is on the Internet and worth reading). By the third year, fracked wells have typically declined by approximately 90%.

There are several issues that will limit U.S. natural gas production in the future even when the price of natural gas rises above $8/mmBtu.

First, with the industry's financial problems associated with the drilling boom of recent years, I expect natural gas producers to be wary of going overboard on drilling in the future.

Second, several of the most productive shale gas plays are in decline, specifically Haynesville, Fayetteville and Barnett. Those are 3 of the 4 most productive shale plays for fracking in the U.S. (Haynesville and Fayetteville shale production peaked in ~4-5 years after initial fracking production, Barnett at ~11 years).

But if there are 30 shale gas plays in the U.S., why should we be concerned about 3 plays that are declining? The problem is that 88% of all shale gas production in the U.S. comes from just 6 shale gas plays. Not all shale gas plays are equivalent. Some are highly productive some will not be productive (most have a high clay content in the shale which makes fracking ineffective). The industry is producing from the most productive plays first.

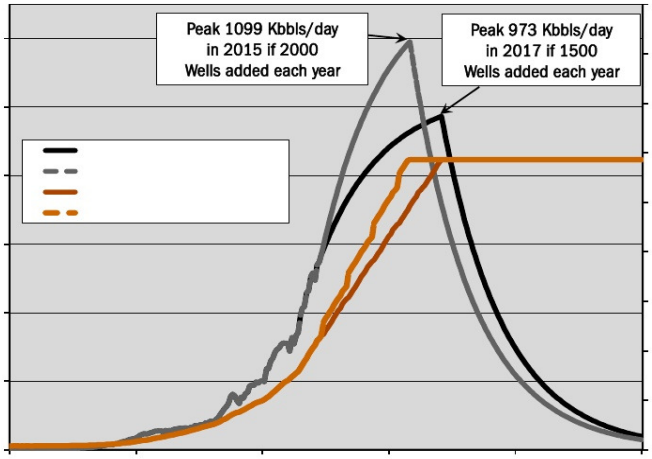
Art Berman, a petroleum geologist with extensive experience in natural gas fields, made the case several years ago that there was 20-25 years worth of natural gas in the U.S. at the 2011 rate of production not the +100 years that is often stated by media sources, politicians and the

gas industry. The moral of this story is that it's wise to be prepared for a significant increase in natural gas prices over the next few years.

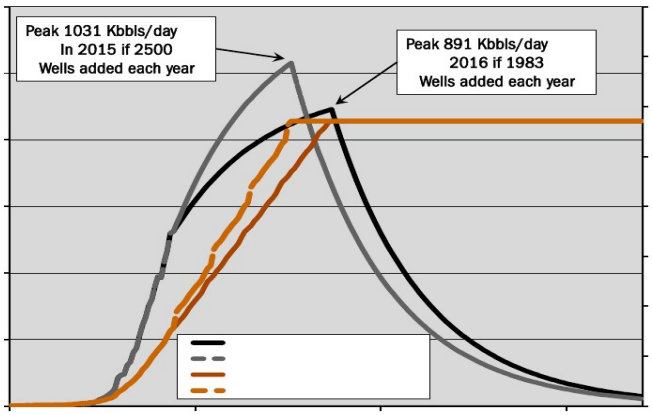
What I've stated about natural gas wells can also be said about fracked oil wells. They decline at very high rates, typically between 40% and 70% their first year, and by the 5th year, they generally have the status of a stripper well, a well that produces less than 10 barrels/day. I've been making the case that oil production from the Bakken play in North Dakota and Eagle Ford play in Texas will be short-term bubbles. David Hughes and others are also making that case. I expect both Bakken and Eagle Ford to peak in 2014+/-1 year. Even some industry insiders are admitting that the shale boom is temporary (see http://peak-oil.org/wp-content/files/por130729.pdf , specifically the interview with Martin Payne).

What goes up quickly can also go down quickly as illustrated by the following two graphs based upon projections from the petroleum services company Baker-Hughes.

Bakken Tight Oil Production vs Operating Wells



Eagle Ford Tight Oil Production vs Operating Wells



The brown lines represent the number of wells to saturation and the dark lines represent production.

Outside of North Dakota and Texas, U.S. oil production was down approximately 160,000 b/d in 2012 relative to 2010 according to US DOE/EIA data. The poor results for oil production in the Monterey Shale (California), Utica Shale (Ohio) and Niobrara Shale (Colorado) highlight the fact that not all shale formations will produce significant quantities of oil.

There will be some increase in oil production in the Gulf of Mexico in coming years due to development of fields such as Jack, St. Malo and Tubular Bells but I don't see those developments negating the decline from Bakken and Eagle Ford.

When oil and gas production start to decline again in the U.S., I expect the oil and gas industry to find a scapegoat in environmentalists and the government. It's necessary to find someone or some organization to blame when things don't go as you want.

Some like to believe that our economic system can be run on wind, solar and a few other renewable sources but I think that is naïve. Our system, as it's presently structured, will require large inputs of fossil fuel energy well into the future. Wider application of renewable sources will run into practical and financial difficulties. And since everything must be sacrificed for the comforts, conveniences and desires of Americans, we will continue to use substantial amounts of fossil fuels well into the future.

Because we don't think about future generations, they will never forget us.
(Henrik Tikkanen, Finnish author)

Sierra Club Calendars

The sale of Sierra Club calendars provides funds for the Three Lakes Group. If you would like a calendar or calendars, they can be ordered from Annemarie Askwith at:

askwitha@lighthouse.net

Price: $12 for wall; $13 for engagement.

Three Lakes Group Meetings

Three Lakes Group meetings will be held on the second Tuesday of the month at 5:30 pm for the months in which we don't have programs: January, May, June, July, August and December. At this point in time it appears that the meetings will be held in one of the meeting rooms at Studebakers Restaurant on the I-75 Spur in Sault Ste. Marie but it's possible that may change. Notices will be sent out prior to meetings with the location included.