

## Mother Up Valentines Day 2019 - Exhibit explanations

1. Mother Up! Day at the State House on Valentines Day VT Climate Caucus meeting.
2. Might climate presentations have always begun with pix of my grandsons, who are now 21 and 18.
3. What we don't see in the papers that display visual aids are the assumptions transparently explained. Careful study of the shape of these curves reveals flaws in the inputs and algorithms used to "work-around" specific premises and designs of the models, which are unable to determine CO2 reductions with carbon price levels in aggregate when the various fuel-types and sectors are dissimilar in their "elasticity." Simplifying assumptions and failure to test the sensitivity of results to a range of assumptions invalidate key conclusions
4. To establish the context of the final messages, I begin with the ginormous size of my first employer, Humble Oil & Refining (now ExxonMobil)
5. (Each square on this slide is 1/30th or 3.3% of the total area.) In spite of ExxonMobil's dominance in the petroleum industry, it produces only 3% of the global crude oil, and there are 30 times as many refineries globally as ExxonMobil operates or has an interest. The \$17.1tn is a foreshadowing of the next two slides: estimate of possible "final expense" as the petroleum industry winds down and is replaced by carbon-free energy.
6. Reliable estimates to dismantle and detoxify a typical refinery range from \$7bn to \$10bn each. The total cost to retire and decommission ExxonMobil's 25 refineries is in the range of \$175bn to \$250bn. Extrapolating that globally, we are faced with \$5.2tn to 7.5tn in decommissioning expenses. As a low-ball WHAT IF, at \$1bn per refinery, the decommissioning expense could be in the range of \$750bn.

## Mother Up Valentines Day 2019 - Exhibit explanations

7. In order to protect the economy and pension funds from a panic sell-off and collapse of the markets, outstanding shares would have to be bought back from investors at an equitable price over a number of years. There is not enough annual earnings (aka profits) to buy back shares quickly enough to avert exceeding 1.5°C and 2.0°C, so it is likely that less-than-full-share-value would be offered in a forced and managed buy back, so WHAT IF is done for three possible valuations (50%, 75% and 100% of current market value). The range of funds required to buy back all shared globally could be \$5tn to \$10tn. In addition, the cost to remove CO<sub>2</sub> from the atmosphere and oceans will be a burden to the economy and young people's life styles, another issue so far not addressed.
8. In addition to decommissioning costs and share buy back, outstanding debt must be paid down in order to protect the financial markets. ExxonMobil has about \$40bn in debt at this time. Extrapolating that across the industry, it is plausible that a total of a trillion dollars is on the liability side of the global ledger. Adding up the three categories of "final expenses" we have a possible range of \$6tn to \$18tn. Nobody that I know of has this on their radar, especially troubling that the economic modeling organizations seem to be oblivious to this situation. The lack of consideration likely invalidates or casts uncertainty on many critical economic model conclusions.
9. When legislators commission economic modeling of various endgame scenarios, or when the Joint Fiscal Office reviews proposed legislation, be sure to ask for the fundamental assumptions upon which the analysis is based, and do not neglect to include the "final expenses." Our children, grandchildren and great grand-children will be left with the tab if we we don't arrange to have those expenses paid by the oil and gas corporations out of future earnings (profits) or shareholder equity. This is a conundrum because profits are insufficient to cover all the "final expenses."

## CO2 Removal (CDR) is the answer to the conundrum

I want what the IPCC report directs us to do.

I want what the Sunrise Movement kids want.

I want what Alexandra Ocasio-Cortez wants.

I want what all of you and Peter Welch want.

I want what Bernie Sanders and Patrick Leahy want.

I want what the Diane Feinstein and Sheldon Whitehouse want.

But I also understand the economic realities that CDR should be the #1 gigaton-scale priority, and we'd collapse the economy if we don't manage the endgame of shutting down petroleum, making Oil & Gas pay to dismantle and detox their own toxic infrastructure and messes all across the oil patch with their annual earnings while ending stock dividends, bonuses, stock options, CapEx, expansion of any sort and paying down billions in debt.

Winding down refineries and feedstocks is a logistical challenge and a huge conundrum. Exxon alone (3% of the global industry) has \$175tn - \$250bn in refinery "final expenses," \$40bn in debt, and \$330bn in share buy-back (total \$545bn - \$620bn) with \$20bn annual earnings, which will decline to zero. Divide by \$10bn average annual earnings ... that is about 6 decades for a "just transition" that requires Oil & Gas to clean up their own toxic messes!

## CO2 Removal (CDR) is the answer to the conundrum

Do we want our grandchildren to be left that tab? Globally it's \$6tn - \$18tn to wind down Oil & Gas in a way that won't wreak havoc on every man, woman and child on earth—if we force them into bankruptcy, everybody loses.

Hence, we've got to remove tens of gigatons of CO2 from the atmosphere and oceans annually while we lay oil to rest, stopping the fracking and land grabs and subsidies.

Frankly, I've given up on DC, and am presently working to educate Vermont Representatives and Senators and Climate Solutions Caucus about CDR.

### The Brave Little State of Vermont

- can be most effective,
- can be a role model, and
- can demonstrate global leadership

by putting a symbolic million dollars to work in the Climate Budget, actually removing CO2 and sequestering it as limestone aggregate for road and building construction materials.

## Resolved: Include \$1,000,000 in the Climate Budget for a CO2 Removal Facility and Limestone Aggregate Plant

WHEREAS: The Brave Little State of Vermont contributes a very small portion of the United States and global carbon footprint, but our ability to contribute to the overall reduction of carbon dioxide, methane and other greenhouse gas emissions can be disproportionately large and influential with judicious leveraging of bold unconventional acts of leadership.

WHEREAS: It is within Vermont's means to budget a relatively small amount, say \$1,000,000 to begin to implement a significant means toward restoration of a healthy climate well below the Paris COP 23 aspirational 1.5°C, which is in fact assured hardship and suffering—if not a death sentence—for millions of species including humans.

WHEREAS: A community of scientist, engineers, entrepreneurs and activists are collaborating to bring about a healthy climate with a target atmospheric CO2 concentration below 300ppm, in the range of the 280ppm pre-industrial level in which human civilization evolved and matured.

WHEREAS: The German Advisory Council on Global Change published a paper in January 2009 with three pathways to achieving 2°C target maximum temperature increase over pre-industrial, including a 3.7% maximum annual decline in emissions beginning in 2011, a 5.3% maximum annual decline beginning in 2015, and a 9.0% maximum annual decline beginning in 2020. (Refer to chart below.)

Solving the climate dilemma: The budget approach

[Bit.ly/WBGU-2009](https://www.wbgu.de/en/special-reports/sr-2009-budget-approach/) (<https://www.wbgu.de/en/special-reports/sr-2009-budget-approach/>)

WHEREAS: Dr. James Hansen and his colleagues published a paper on December 3, 2013, suggesting a 6% annual decline in emissions beginning in 2014, including carbon sequestration through soil restoration in agricultural and reforestation in order to restore the planet to 350ppm CO2 concentration.

Assessing "Dangerous Climate Change": Required Reduction of Carbon Emissions to Protect Young People, Future Generations and Nature

[Bit.ly/HansenPLOS](https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0081648) (<https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0081648>)

WHEREAS: The Intergovernmental Panel on Climate Change (IPCC) recently issues an urgent call for global reduction of CO2 emissions by 50% within twelve years and to near zero by 2050.

WHEREAS: Vermont's Climate Action Plan aims to reduce State-wide CO2 emissions 90% by 2050.

WHEREAS: Transportation CO2 emissions reductions within the State of Vermont depend heavily on eliminating our reliance on burning gasoline and diesel in vehicles operated within the state of Vermont of heavy-duty trucks and equipment within or outside the state—irrespective of their domicile.

WHEREAS: Building heat CO2 emissions reductions within the State of Vermont depend heavily on eliminating our reliance on burning propane, fuel oil and natural gas (methane) in conventional furnaces as well as increasing sustainably grown and harvested wood in advanced wood (pellet) stoves and convention wood stoves (expanding the latter may increase harmful air quality effects).

WHEREAS: Electric vehicles and charging infrastructure are expanding in popularity exponentially, but the costs of purchase are unaffordable to the middle and lower income individuals and families.

Vermont State Legislature  
Climate Solutions Caucus  
Springfield Hearing  
February 25, 2019

**Resolved: Include \$1,000,000 in the Climate Budget for a  
CO2 Removal Facility and Limestone Aggregate Plant**

WHEREAS: The Institute of Physics Publications' (IOPscience) paper published on August 25, 2015, demonstrates that carbon fee levels in the range of \$20/tCO<sub>2</sub> to \$40/tCO<sub>2</sub> are needed to switch from from gas and coal, respectively, to carbon-free electric power generation. (Refer to chart below.)

WHEREAS: The Institute of Physics Publications (IOPscience) paper published on August 25, 2015, demonstrates that carbon fee levels an order of magnitude higher than those that impact gas and coal electric power plants are needed to provide an effective price signal for industrial boilers, space heating and water heating and freight vehicles, and another order of magnitude higher in order to impact transportation fuels for ICE (internal combustion engine) passenger vehicles, airplanes and ships. (Refer to chart below.)

Assessing carbon lock-in  
[Bit.ly/IOP25Aug15 \(https://iopscience.iop.org/article/10.1088/1748-9326/10/8/084023\)](https://iopscience.iop.org/article/10.1088/1748-9326/10/8/084023)

WHEREAS: Federal legislation to impose a carbon fee on all fossil fuels, if and when adopted, will likely start low in the \$15/tCO<sub>2</sub> range and rise annually at a rate of \$10/tCO<sub>2</sub>, which is an effective price signal to induce switching from coal to natural gas and finally to renewable wind and solar.

WHEREAS: Federal carbon fee legislation will likely not rise to the level that would effectively induce switching from gasoline, diesel, propane, kerosene and fuel oil to carbon-free energy technologies for decades, giving the petroleum industry a free-pass to continue unfettered exploration, drilling, fracking and extraction, along with eminent domain seizure of private land for more gas and oil pipelines.

WHEREAS: Vermont's electric power carbon intensity is relatively low, marginal improvement at diminishing returns is likely at the onset, and will become more cost effective only as the cost of wind, solar and other carbon-free energy technologies decline and as efficiencies increase in the future.

WHEREAS: Electric vehicles and electric heating appear to be the most effective means of reducing our reliance on gasoline, diesel, propane, fuel oil and natural gas, the limiting constraint on our ability to achieve reductions is the physical and financial considerations of the petroleum industry, which presents a conundrum so far not discussed in any transparent public forum. Since Houston is the symbolic epicenter of the petroleum industry, quite literally "Houston, we have a problem."

WHEREAS: The overwhelming consensus is that the transition from fossil fuels to carbon-free energy should be a "just transition" which does not adversely impact the economy and taxpayers.

WHEREAS: The "final expenses" of the fossil fuel industry will be enormous due to the complexity of the infrastructure and toxic cleanup of some 750+ refineries and 2,300+ power plants worldwide, the timeframe to wind down petroleum refining alone could be in the range of six decades to a century, given the declining earnings from operations needed to fund their dismantling and detoxification.

WHEREAS: The average petroleum industry price-earnings ratio is in the range of 20 to 25, and the total market capitalization, dismantling costs and debt are yet to be determined, an estimate of the challenge is to assess one representative corporation, which can be a benchmark to extrapolate, say ExxonMobil, which is presumed to be among the most efficient, integrated and well managed.

Vermont State Legislature  
Climate Solutions Caucus  
Springfield Hearing  
February 25, 2019

**Resolved: Include \$1,000,000 in the Climate Budget for a  
CO2 Removal Facility and Limestone Aggregate Plant**

WHEREAS: ExxonMobil owns or has an interest in some twenty-five refineries world-wide, five of which are located in the United States, which represent one-thirtieth of the global inventory and presently produces 3% of the global petroleum production.

WHEREAS: The cost of dismantle one typical refinery has been estimated by an industry insider prior to this recent death at between \$7 billion and \$10 billion, the total estimate cost for ExxonMobil to decommission its twenty-five refineries is in the range of \$175 billion to \$250 billion. Even if the costs were \$1 billion per refinery, ExxonMobil's decommissioning cost would be \$25 billion. Globally, that extrapolates to \$750 billion (low) and likely range of \$5.2 trillion to \$7.5 trillion for all 750+ refineries.

WHEREAS: ExxonMobil presently has about \$40 billion in debt, assuming other refining corporations have a proportionate amount of debt relative to their respective number of refineries, that extrapolates to \$1.2 trillion using the global/ExxonMobil factor of 30, or say, a rounded \$1 trillion total.

WHEREAS: ExxonMobil has a \$330 billion market capitalization which the corporation would have to eventually reimburse to investors at an equitable share price. In order to avert a panic sell-off of XOM shares, there would have to be some managed process to allocate annual earnings to institutional investors, pension funds, superannuations, ma and pa investors, day-traders and, lastly, to past and present company employees, Officers, Management and members of the Boards of Directors.

WHEREAS: ExxonMobil's price-earnings ratio for the industry is presently about 17 based on 2017 earnings of \$19 billion. The global average price earnings ratio of the industry is in the range of 20 to 25. Assuming the market capitalization of the global industry is in proportion to oil production, the total market capitalization for the industry would be approximately \$11 trillion, which would need to be bought back in order for the transition to be just for all people of the world and world-wide economies.

WHEREAS: The total of ExxonMobil's market capitalization, debt and final expenses for refineries (excluding well sites and pipelines) is in the range of \$545 billion to \$620 billion.

WHEREAS: ExxonMobil's annual earnings will decline from the 2017 \$19 billion level to zero, hence average annual funding would be approximately \$10 billion at today's oil price and cost of operations.

WHEREAS: It would take on the order of 55 to 62 years to equitably wind down operations, decommission refineries, pay down debt and buy back current outstanding shares of stock.

WHEREAS: At higher price-earnings ratios for the petroleum industry by a factor of 1.2 to 1.5, the time for the industry at large to wind down could be in the range of 70 years to 90 years.

WHEREAS: The IPCC has advised that the world must reduce CO2 emissions 50% in twelve years (2030) and nearly 100% in 32 years (2050), we have a conundrum, given a 70-90 year "just transition" dictated by the need to avert refining and production corporations filing bankruptcy and leaving their physical and financial messes for We the People to clean up.

WHEREAS: The CO2 emissions in excess of what the science dictates must be removed from the atmosphere (refer to chart below which compares 30-year and 50-year scenarios), which requires technology that is being developed by start-up businesses who supply the CO2 to the likes of carbonated beverage producers. On a gigaton scale, CO2 can be used to make synthetic limestone aggregate for road construction and building materials. Assessments indicate that markets exist.

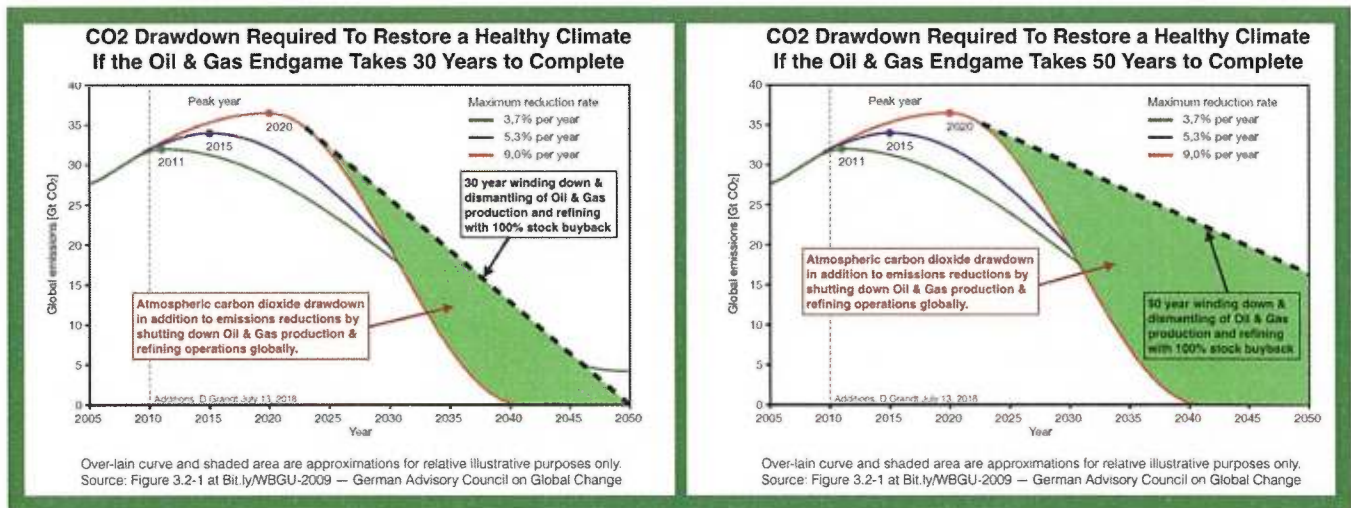
## Resolved: Include \$1,000,000 in the Climate Budget for a CO2 Removal Facility and Limestone Aggregate Plant

WHEREAS: Vermont has space and funds to construct a cost effective size CDR facility and limestone production plant, using technology presently developed and in operation in the UK, Europe and U.S.

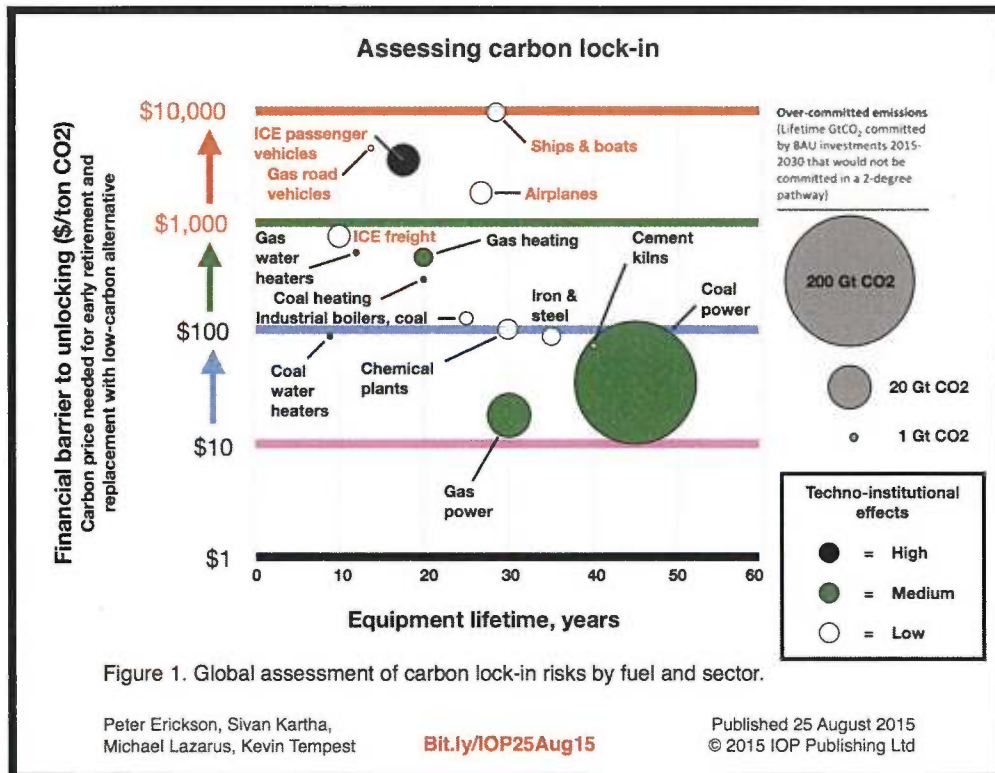
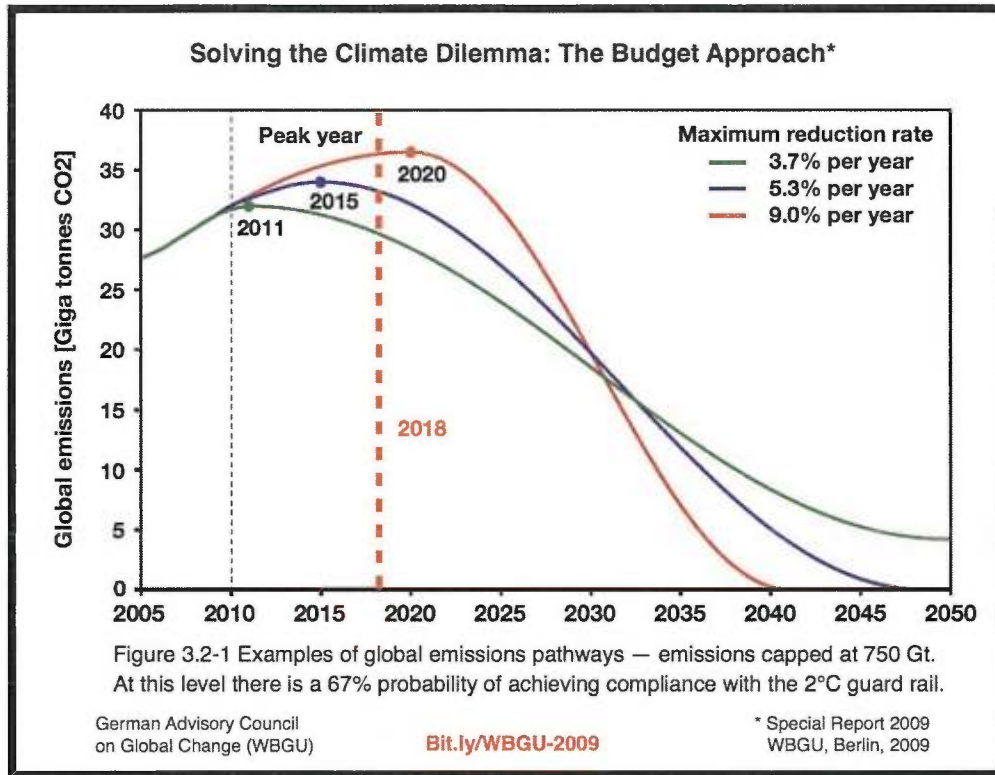
**THEREFORE:** To make a real physical contribution to reducing atmospheric CO2 concentration while striving to reduce emissions by concomitant reducing combustion of fossil fuels, Vermont can position itself as a role model and leader in the desperately urgent need for the new for-profit industry drawing down CO2 and supplying limestone aggregate for road construction and building materials.

**THEREFORE:** It is recommended that Vermont's Climate Budget include \$1 million for implementation and operation of a facility designed and operated by one of the existing CDR start-up businesses, and if the amount needed to implement and operate a facility is greater than \$1 million in the first year, additional funds could be generated by a joint venture with the likes of [NORI.com](http://NORI.com) or other sources.

### Examples of Healthy Climate CO2 Drawdown While Petroleum Winds Down Over 30 years vs. 50 years







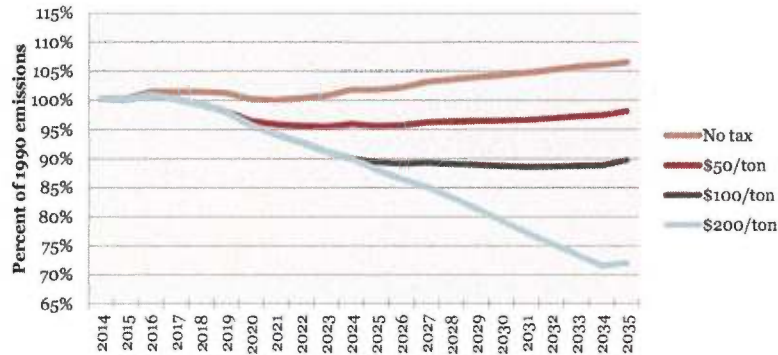
**Climate:  
What's  
Love  
Got  
To Do  
With It?**





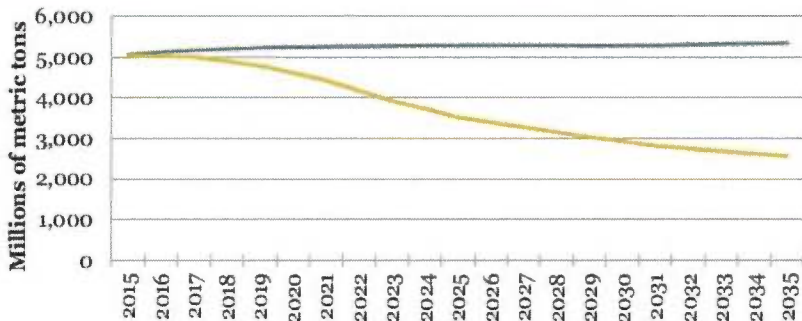
# We're gambling their future on economic model assumptions

CARBON DIOXIDE EMISSIONS (1990 BENCHMARK)

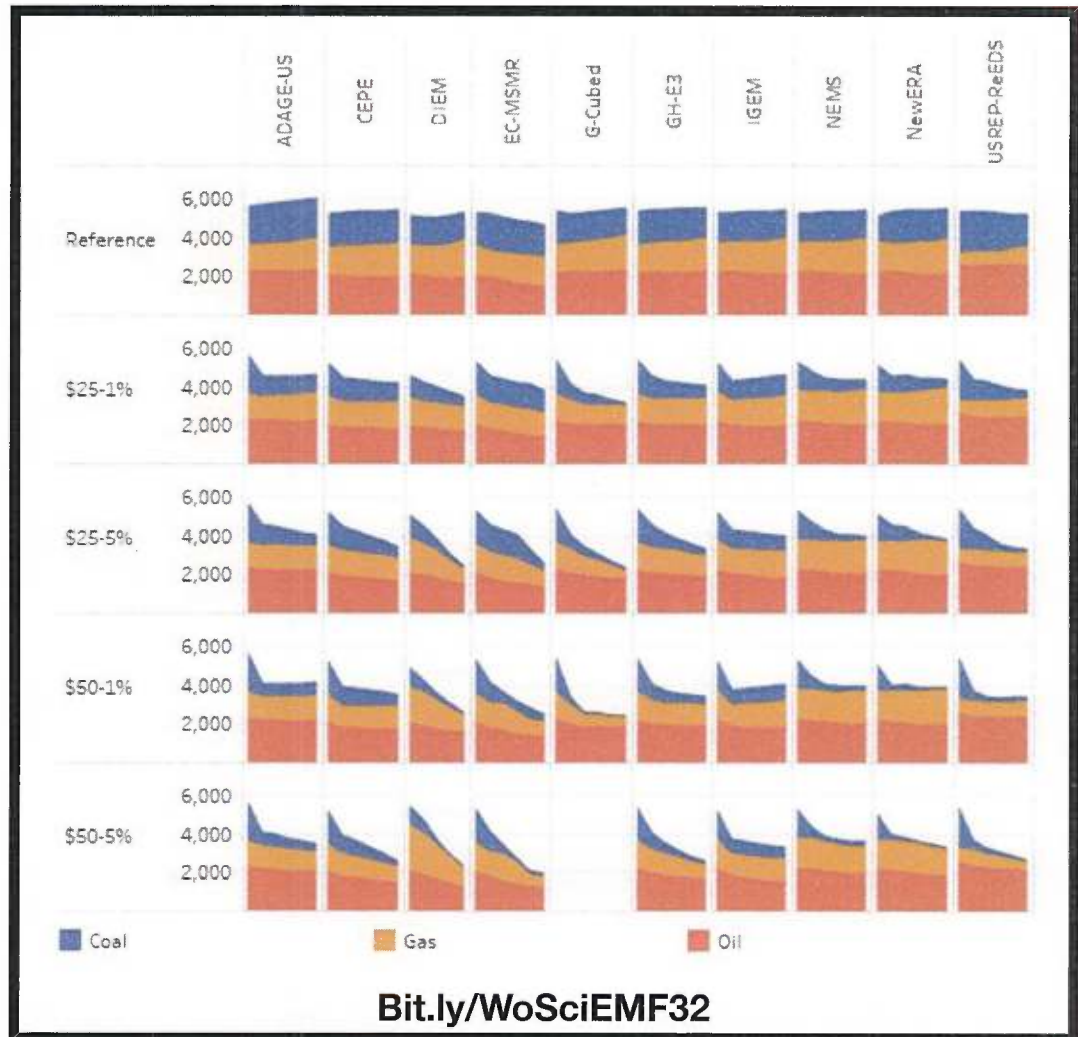


[Bit.ly/CCL\\_REMI\\_3Mar14](http://Bit.ly/CCL_REMI_3Mar14)

Carbon Dioxide Emissions (annual forecast, national level)



[Bit.ly/CCL\\_REMI\\_9Jun14](http://Bit.ly/CCL_REMI_9Jun14)



[Bit.ly/WoSciEMF32](http://Bit.ly/WoSciEMF32)

# **ExxonMobil (Humble Oil)**

**Refineries worldwide**



**Refineries in the U.S.**

**5**

**Daily crude production**

**4 MBOD**

**Daily refining capacity**

**6 MBOD**

\$7.5tn  
\$9.6tn  
\$17.1tn

X 30

750

Total Refineries worldwide



Exxon Refineries worldwide

EXXONMOBIL

3%

# ExxonMobil

3%

Exxon Refineries worldwide



25

Dismantle 1 refinery: IF

\$1bn

\$7bn

\$10bn

Dismantle 25 refineries

\$25bn

\$175bn

\$250bn

Dismantle 750 refineries

\$750bn

\$5.2tn

\$7.5tn

# ExxonMobil

3%

Exxon Refineries worldwide



25

Buyback share value: IF

50%

75%

100%

Exxon buyback shares

\$160bn

\$240bn

\$320bn

Global buyback shares

\$4.8tn

\$7.2tn

\$9.6tn





# ExxonMobil

3%

Exxon Refineries worldwide



25

Dismantle 750 refineries	\$750bn	\$5.2tn	\$7.5tn
Global buyback shares	\$4.8tn	\$7.2tn	\$9.6tn
Global pay down debt	\$1.0tn	\$1.0tn	\$1.0tn





**Look for the assumptions**



**Remember final expenses**

Doug Grandt - Putney VT  
answerthecall@mac.com

