

A Comparison of Options for the U.S. Petroleum Industry in Dealing with Climate Change – Regulations, Carbon Fees, or “Business as Usual”*

James M. Rine¹

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¹Geology, Wayne State University, Detroit, Michigan (james.rine@wayne.edu)

Abstract

This study examines three options going forward for the U.S. petroleum industry in dealing with climate change prior to 2050, a period in which ~200 nations agreed to limit their CO₂ emissions to prevent an increase in global temperatures 2°C (3.6°F) above pre-industrial levels. The options explored are: (1) regulatory controls on emissions, such as the “U.S. Intended Nationally Determined Contributions” pledge from COP21 (US INDC); (2) implementation of a national fee on carbon with fees returned to taxpayers as monthly dividends (CFD); (3) business-as-usual (BAU) but with accompanying decline in global gross domestic production (GDP) due to the negative effects of climate change. The analyses presented herein utilize government reports, professional publications, and publicly available policy studies, such as from Regional Economic Models, Inc. (REMI). Both U.S. INDC and CFD plans reduce CO₂ emissions ~80% from 2005 levels by 2050. REMI analysis of a 20 year CFD plan (initial \$10/ton CO₂ fee with annual increases of \$10/ton) indicates US energy producers are incentivized to replace coal-sourced power with natural gas (NG) and renewables by 2030. By 2035, CFD drives 80% of NG power usage to employ carbon capture and storage.

Published models indicate increasing temperatures with BAU decrease GDP (~1% GDP/+1°C). EIA reported reductions in carbon emissions due to the Great Recession period (2005-2012) equaled ~4% with a drop in ~1% GDP. Since maximum temperatures are projected to be “only” +2.9°C (5.2°F) by 2050 with BAU, GDP should drop less than 3% and fossil fuel use drop ~15%. This is a fraction of U.S. INDC mandated reductions or those induced by CFD. Obviously, a desire for short-term economic gains favor fossil fuel producers promoting BAU. But even assuming a catastrophic climate tipping point is avoided, other industries (and the general public) will increasingly grow weary of a deteriorating economy on a warming planet. In contrast, a REMI study of CFD indicates most regional economies within the U.S. are improved (0.35% to 0.65% above baseline GDP) by redistribution of carbon fees to taxpayers. So the choice for the petroleum industry appears to be between a slow decline with BAU, which in turn will bring down the rest of the economy (at the very least), or choosing a reasoned path to a low carbon future that preserves the overall economy but with a much transformed or a much diminished role for itself.

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A Comparison of Options for the US Petroleum Industry in Dealing with Climate Change – Regulations, Carbon Fees, or “Business as Usual”

James M. Rine

Adjunct Professor

Department of Geology, Wayne State University
Detroit, Michigan



Scenarios Explored:

1. Following COP21 goal

- Avoid exceeding +2°C (+3.6°F)

2. Business As Usual (BAU)

- With negative effects of climate change

Objective:

Assess “logical” course for **US** O&G

Comment: Talk presents possible business models for O&G companies while pointing out threats to bottom line resulting from climate change and possible government measures to reduce green house gas (GHG) emissions.

Talk is based on:

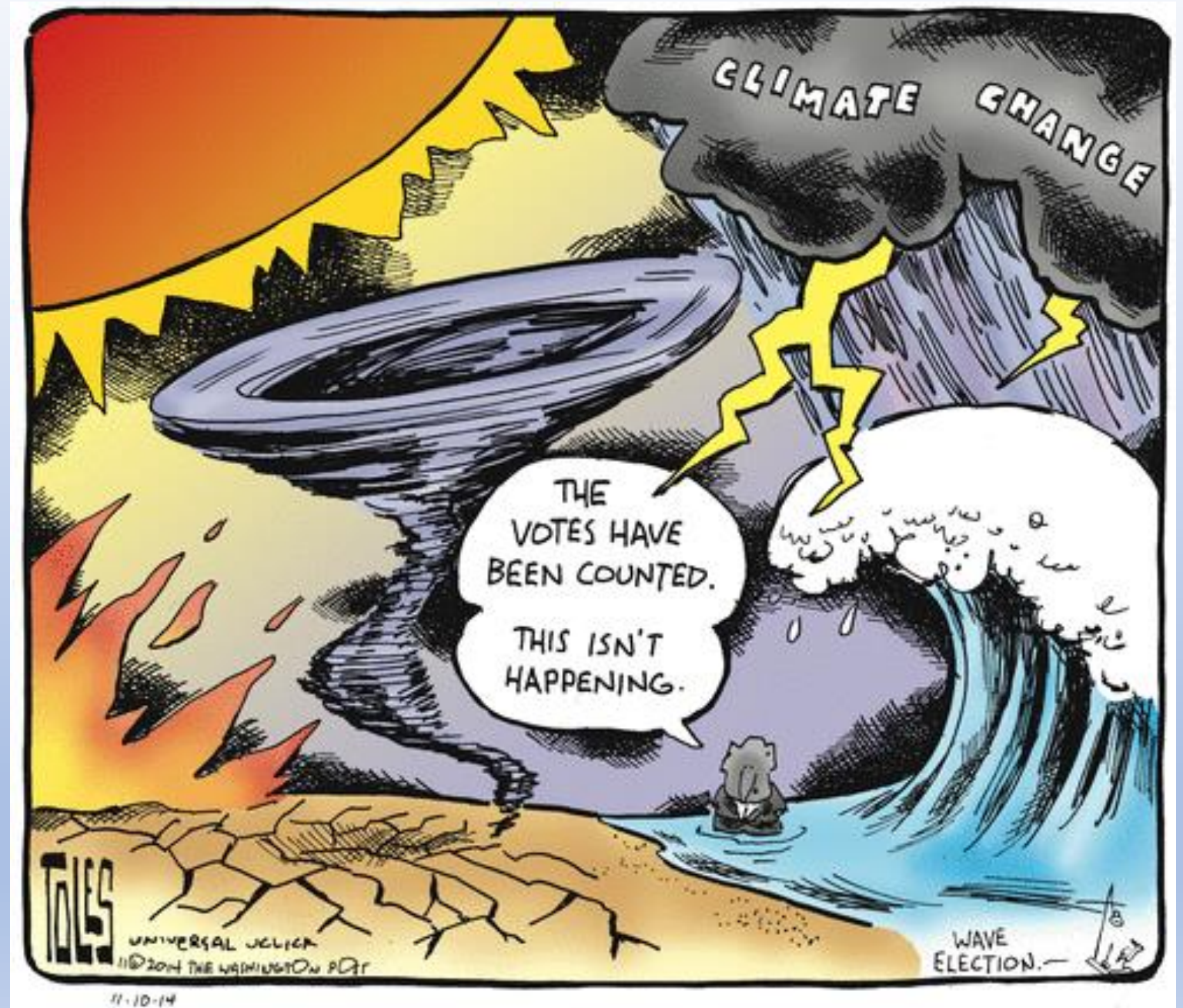
1. Published open source data:

- **Peer reviewed technical pubs**
- **Government publications (e.g., US EIA, IEA)**
- **Recognized government/private publications (e.g., BP Annual Energy Review, World Bank)**
- **Corroborated NGO or private firm publications**

2. Simple calculations of public data

Comment: This talk is based on two major assumptions.

Assumption #1:
climate change is real
ExxonMobil: "... serious risks
***of climate change.*"**



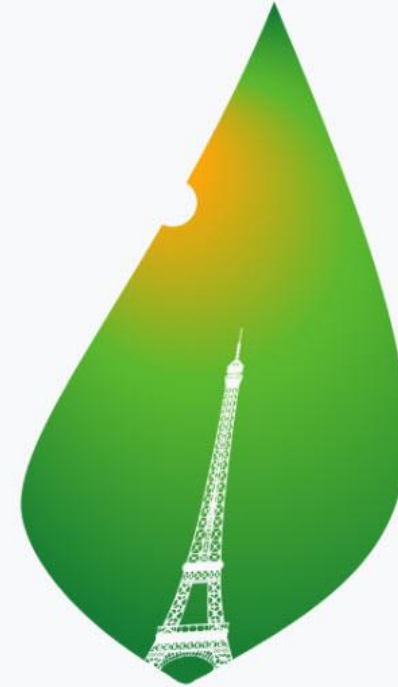
Assumption #2:

GLOBAL UPHOLDING of COP21 AGREEMENT

Shell Global: “We welcome the efforts made by governments to cooperatively reach the global climate agreement”

Comment: Even if the US fulfills promise to drop out of COP21, the other 195 countries may not. Consequently, US fossil fuels and products may be cheaper within US but border adjustment tariffs can be imposed on our exports to COP21 countries.

United Nations
Climate Change Conference



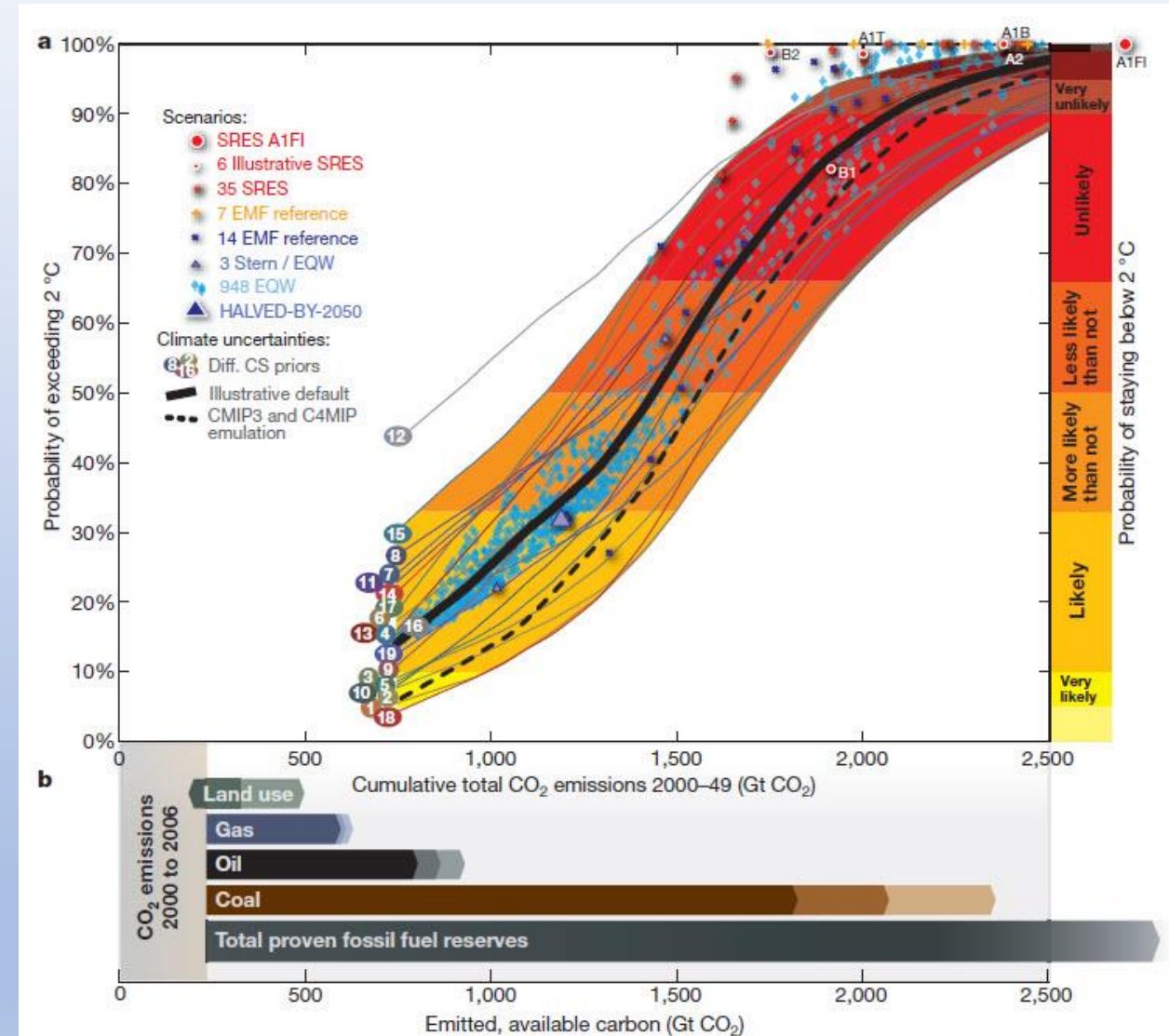
PARIS2015
UN CLIMATE CHANGE CONFERENCE
COP21·CMP11

Date 30 November 2015–
12 December 2015

Background... a (concerned) research geologist



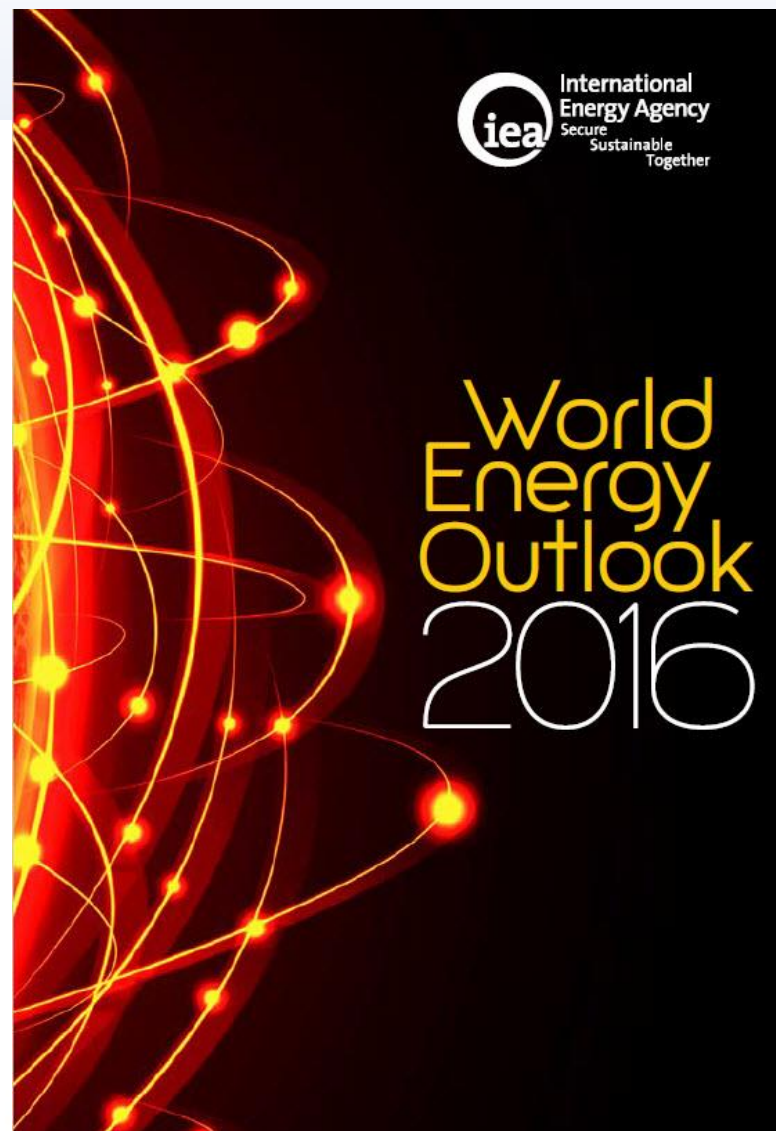
Comment: Author's 2014 paper shows AAPG and petroleum companies by ignoring climate change are helping coal companies more than themselves. Rine (2014) points out world could consume all known reserves of O&G (as of 2012) if we stopped burning coal and still be at a 50% chance of staying below 2°C. This emission level is actually the goal of COP 21 agreement.



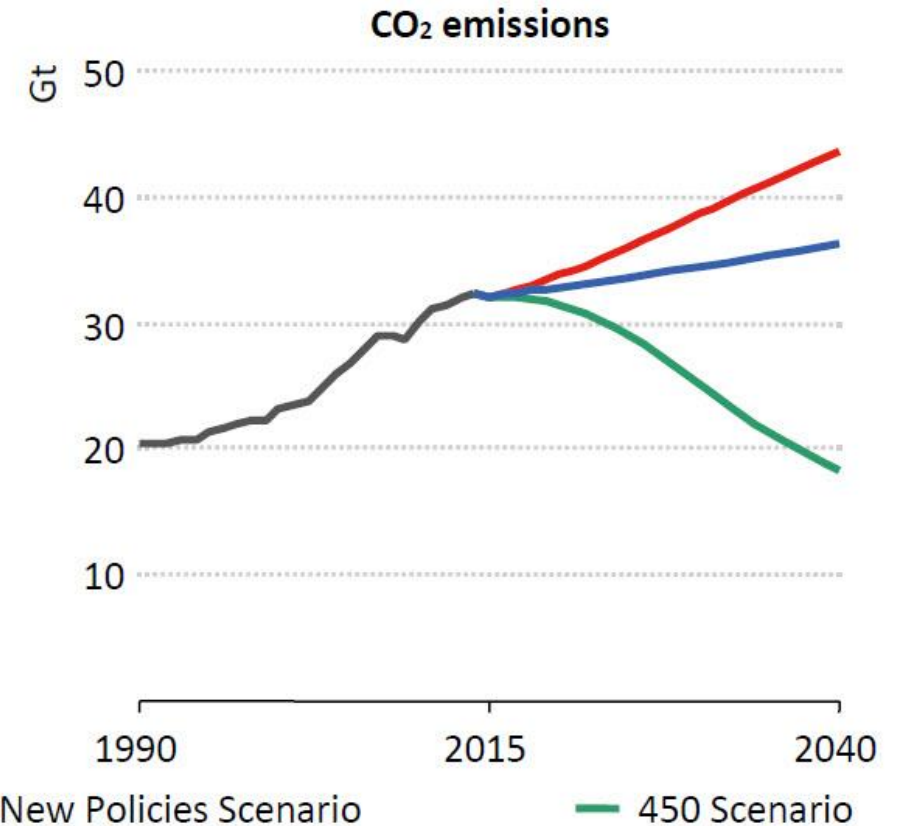
Meinshausen et al. (2012)

Comment: Emission scenarios according to iea World Energy Outlook 2016

- 450 (ppm) Scenario = emissions below 1990 levels by 2040 to stay $< +2^{\circ}\text{C}$
- New Policy Scenario = present policies and NDC pledges
- Current policies scenario = no COP21 implementation



IEA projection for emissions to 2040



While energy sector CO₂ emissions rise by 4 Gt in the New Policies Scenario, they fall by 14 Gt in the 450 Scenario

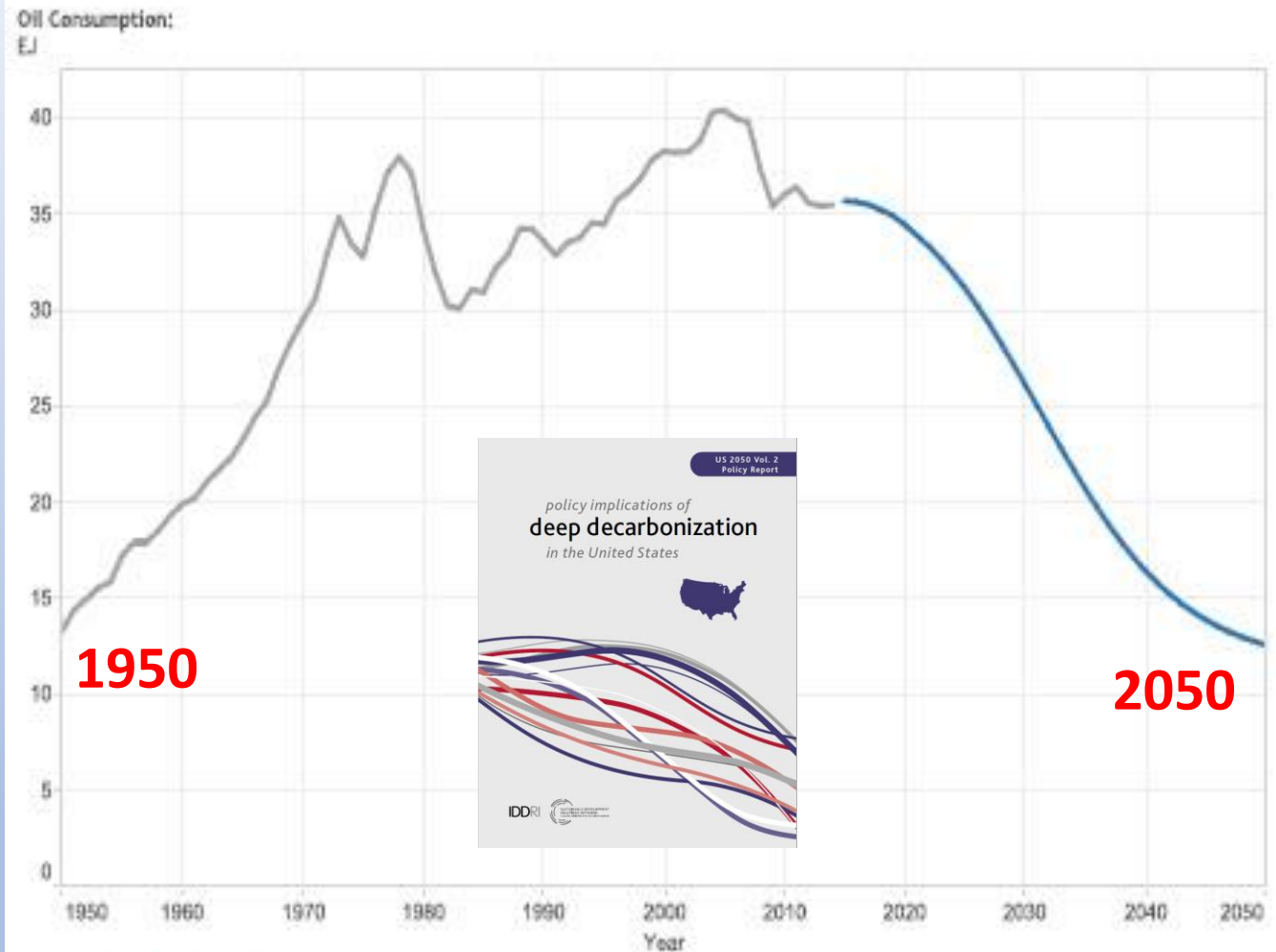
Comment: US oil consumption based on analyses of the following:

- Energy and Environmental Economics, Inc. (E3)
- Lawrence Berkeley National Laboratory (LBNL)
- Pacific Northwest National Laboratory (PNNL)

WHAT DOES THIS LOOK LIKE for **US Oil**?

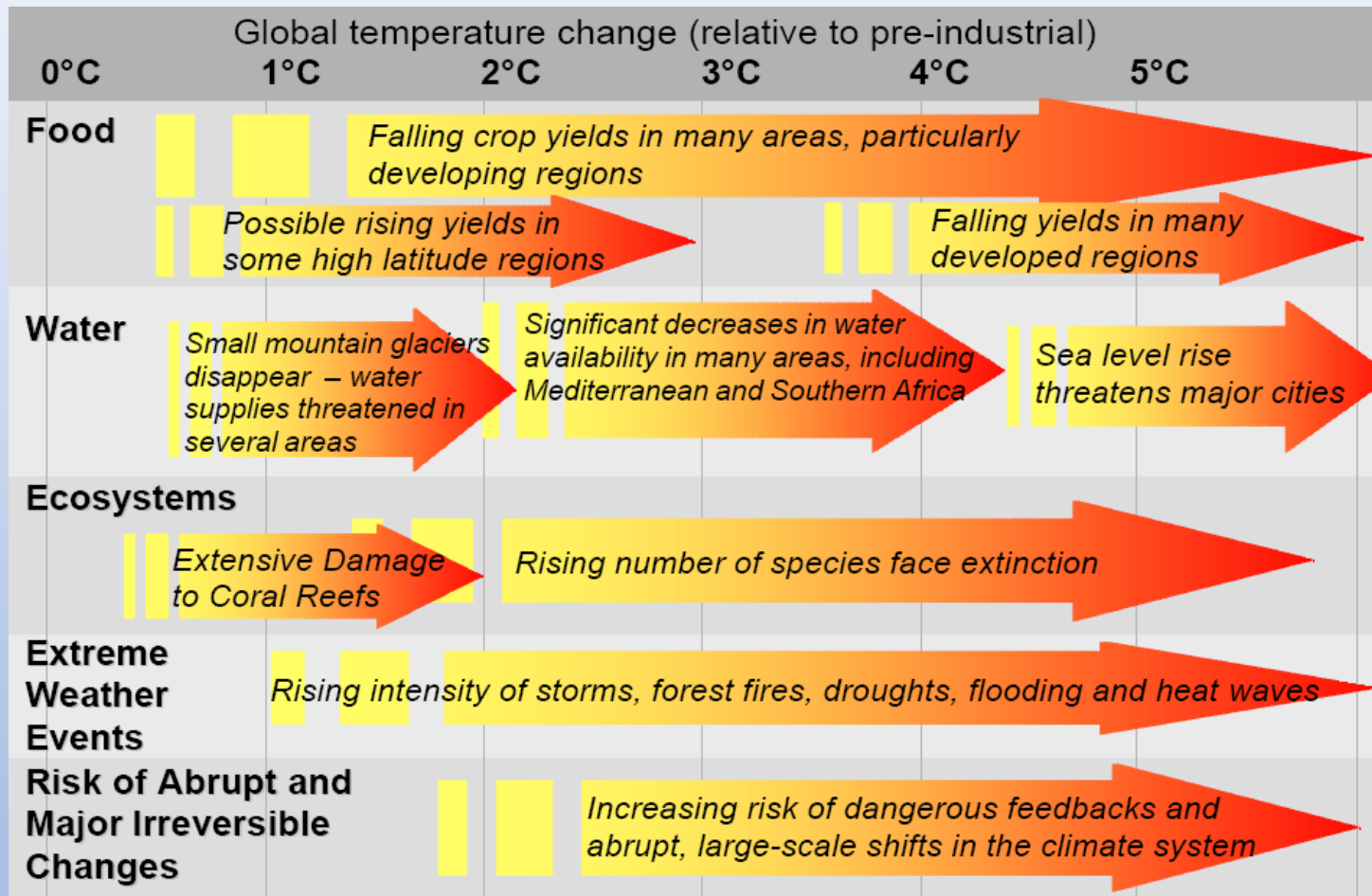
COP21 GOAL:
decrease of all GHG emissions
80% from 2005 levels by 2050

Figure 16. U.S. Oil Consumption, Historical 1950-2014 and Projected 2015-2050 for Deep Decarbonization, Mixed Case



Source: (DOE, 2015)

Why avoid +2°C? The projected impacts...



What, Me Worry?



What about

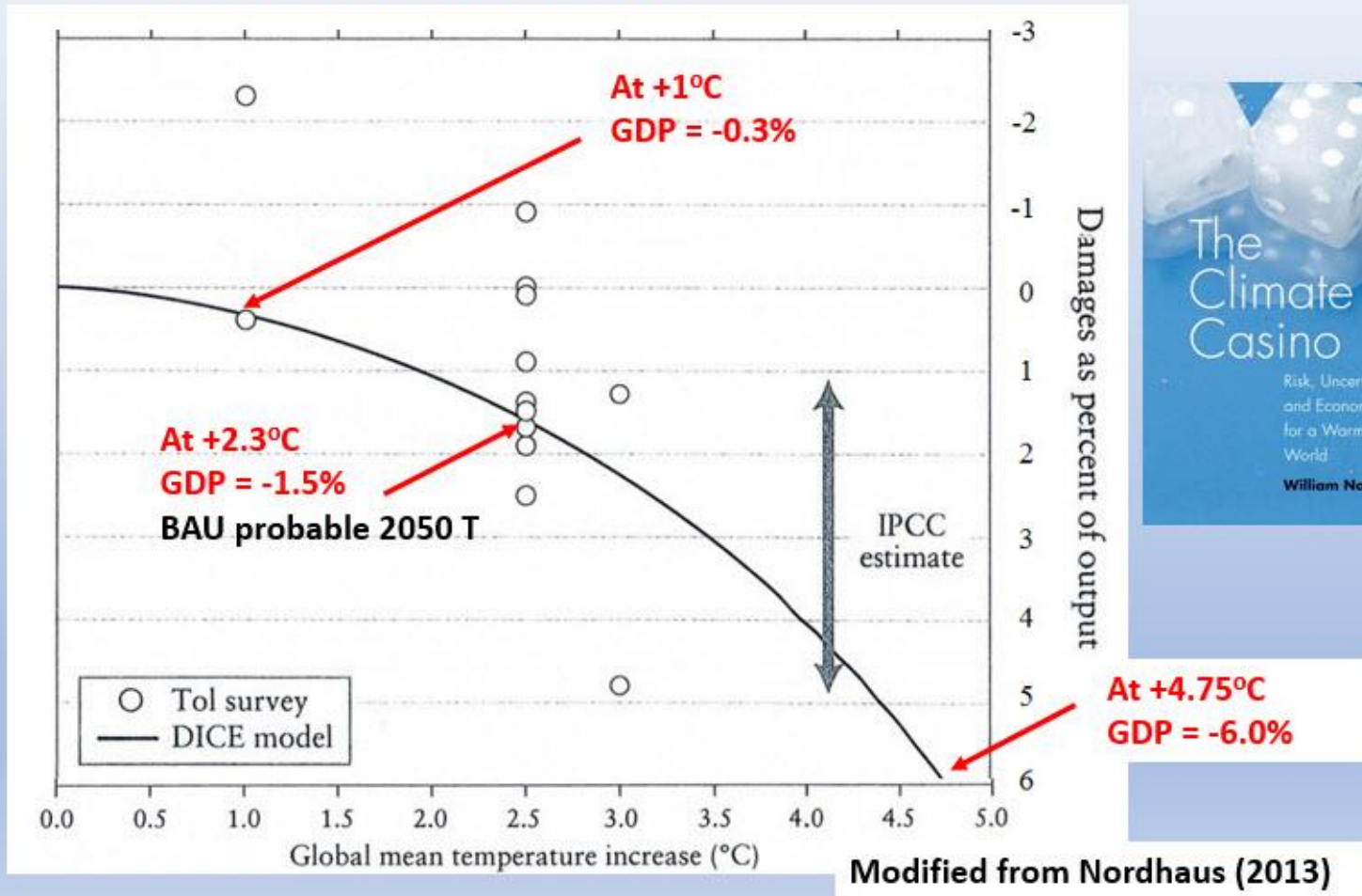
\$\$\$\$\$\$\$\$?

Comment: Analysis in this paper concentrates on climatic impacts on economy and not other impacts .

Nordhaus (2013) DICE model indicates global GDP decreases at faster rate with increasing temperature.

- Chart show aggregate damage due to global warming
- Max number is -6% global GDP at +4.75C which projected temp at 2100 with BAU (IPCC)
- Rate of change GDP/ +1°C ranges from -0.3% to -1.3%

Nordhaus/DICE model projects **decrease GDP** of **~0.3% to 1.3% per +1°C...**



Global non-linear effect of temperature on economic production

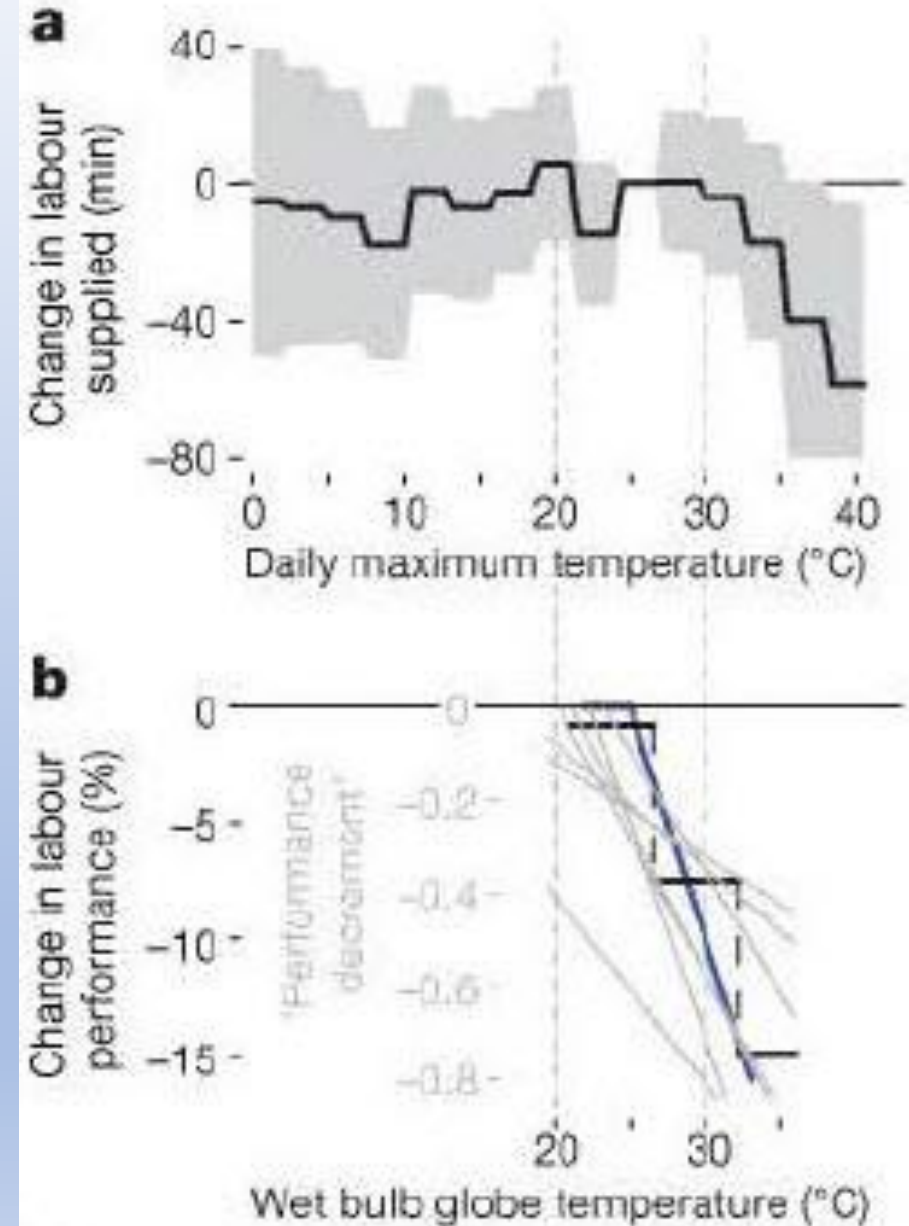
Marshall Burke^{1,2*}, Solomon M. Hsiang^{3,4*} & Edward Miguel^{4,5}

Burke et al. (2015) analysis based on observed effects of temperature increases on productivity

Comment: The Burke et al. (2015) shows a much higher rate of decrease in GDP than Nordhaus (2013) based on analysis of:

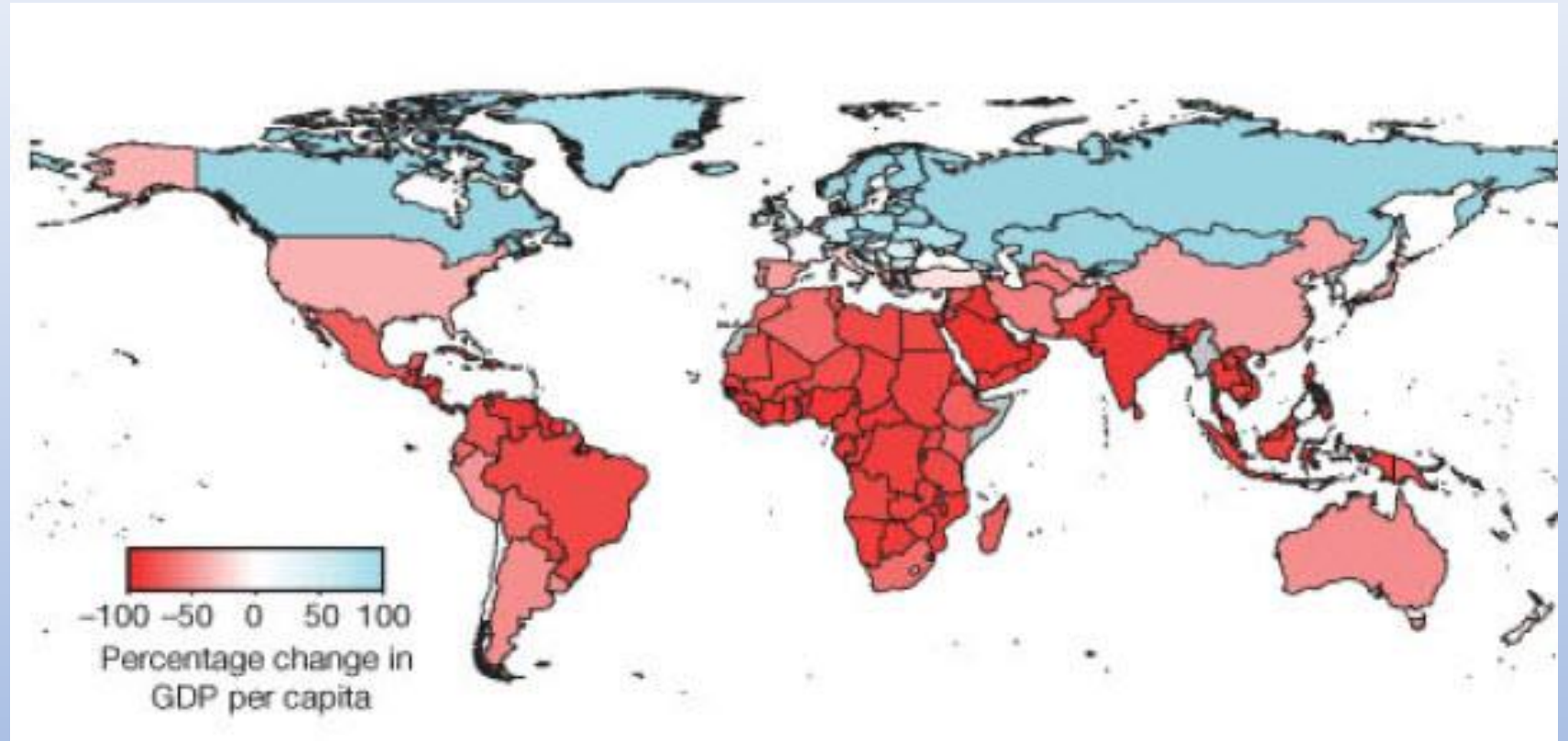
- Change in labor supplied vs. max temperature;
- Change in labor performance & decrement vs. temperature.

Burke et al. (2015)



Decrease in average global GDP of 23% by 2100 (~12% by 2050)

Burke et al. 2015



Comment: Burke et al.(2015) analysis

- -23% global GDP by 2100
- Rate of change GDP/ +1°C = -4.9%
- Note that greatest negative effect is with low latitude, poorer countries
 - Counters “moral case for fossil fuels” argument

Calculated change in
US O&G production
per 1% drop in GLOBAL GDP

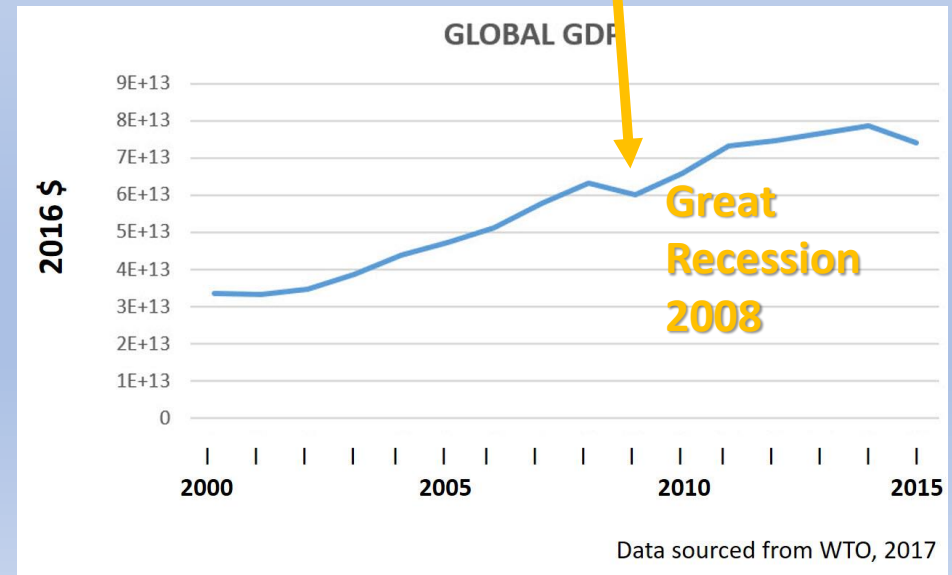
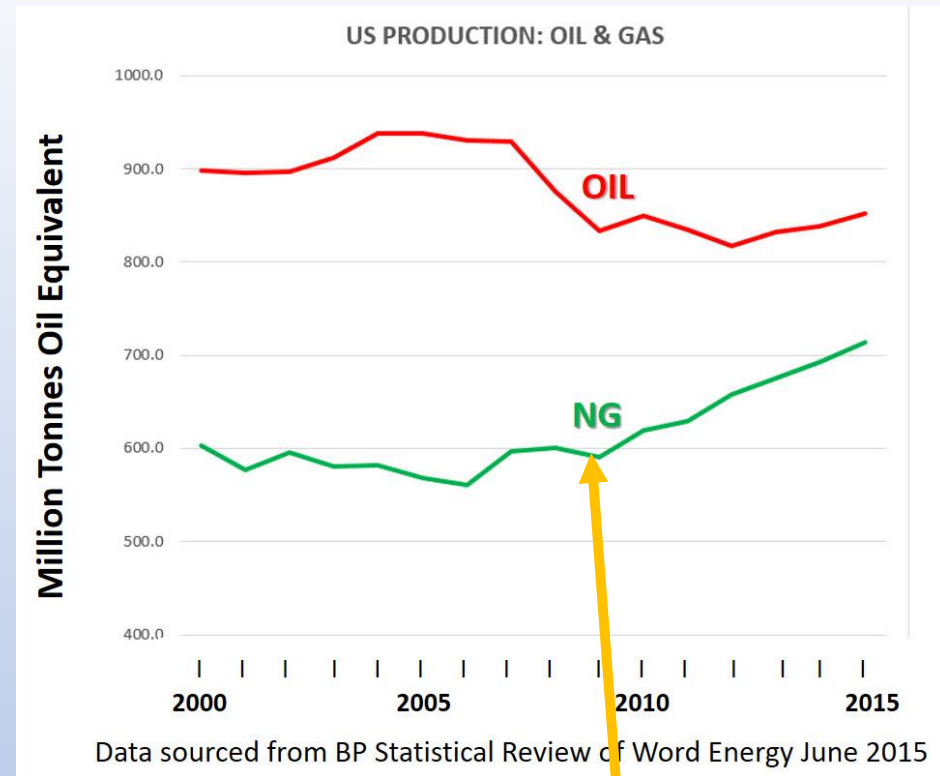
= Drop US O&G
Drop Global GDP (-5.2%)

US Oil = -0.93%

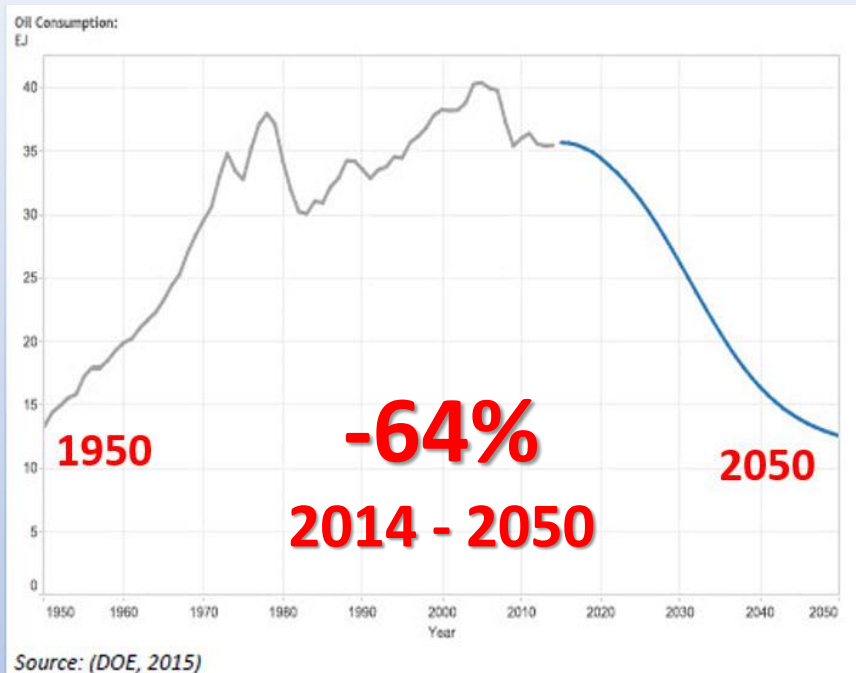
US NG = -0.35%

Comment: Since the models are climate impacts on global GDP we need to use it to:

- calculated rate of impact in US O&G from decrease global GDP of -5.2%;
- calculate total drop in combined O&G is -0.67% (~0.7%) production / -1% Global GDP.



COP21 GOAL - 2050



Deep Decarbonization Project (2015)

Comment: This decrease in oil production is far greater than decrease called for by COP 21.

- This decrease is similar to poor oil showing in EIA AEO 2017 projections with a poor US economy and low oil prices
- Iea2016 450 scenario projections for OECD countries is -50% by 2040 from 2015 levels.

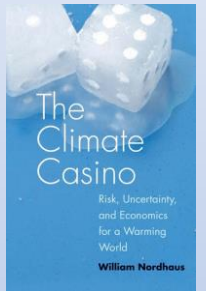
CHOICE for US Oil?

BAU @ 2050

Nordhaus /DICE model

@ 2050 with BAU +2.3°C = -1.5% GDP

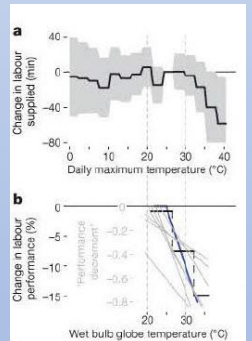
US Oil = -1.4%



Burke et al. (2015) model

@ 2050 with BAU +2.3°C = -11.3% GDP

US Oil = -10.5%



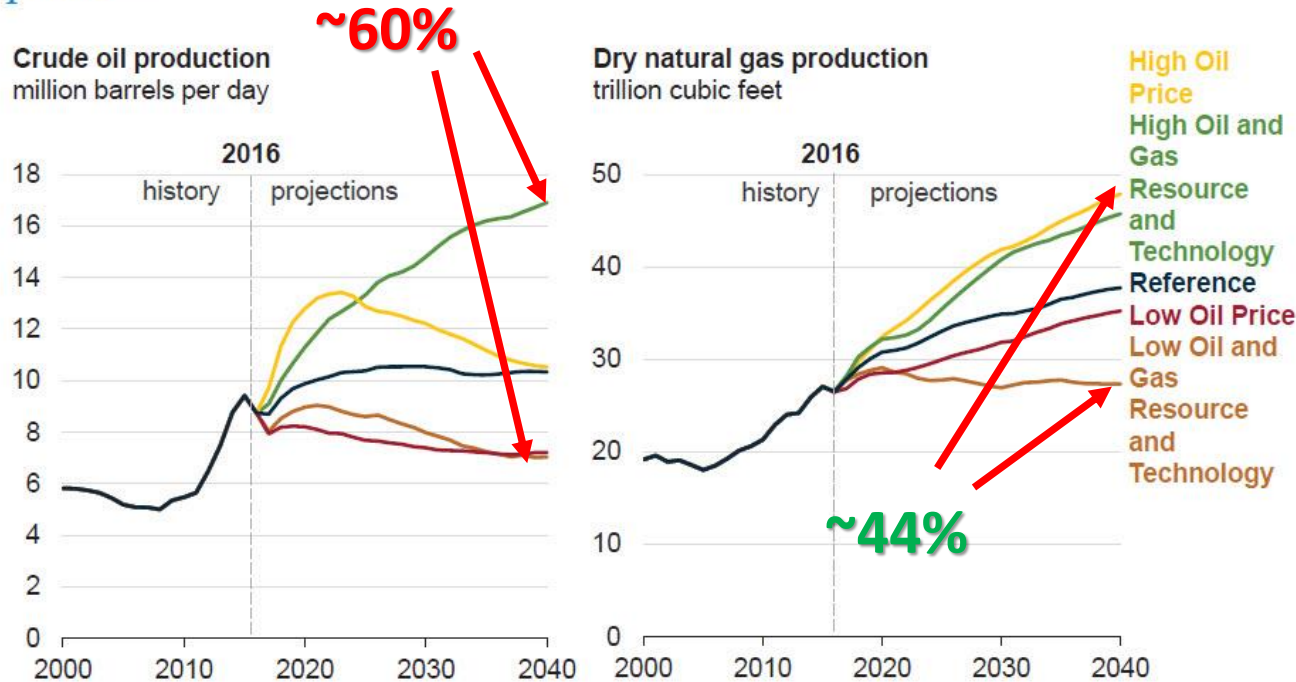
IEA projects OECD oil drop of 50% by 2040 from 2015 level

US EIA AEO 2017 Drop in production per -1% US GDP

Oil = ~3%

NG = ~2%

United States crude oil and natural gas production depends on oil prices—



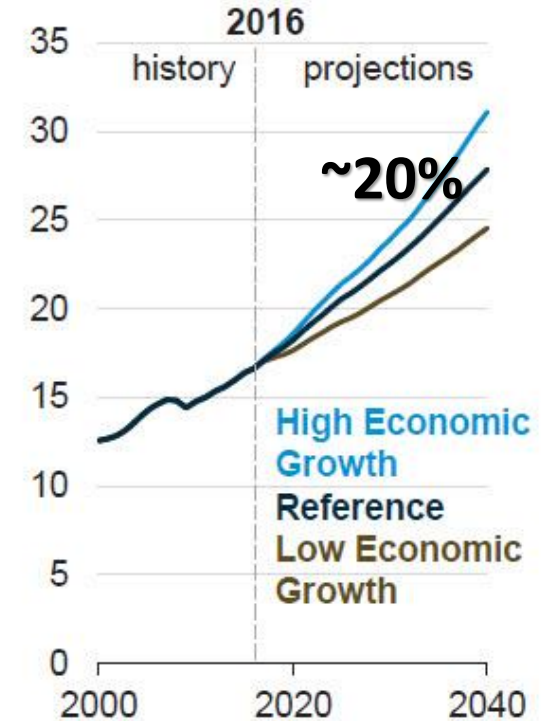
U.S. Energy Information Administration

#AEO2017

www.eia.gov/aeo

29

Gross domestic product
trillion 2009 dollars



Comments: But how does decrease in GDP effect O&G?

- EIA gives projections for high and low economic growth/
- But this paper needs to compare with global GDP
- Do not know what modelling used by EIA
- Note EIA does not take into consideration 450 scenario of IEA 2016.

	NG Neg. % CHANGE 2008- 2009	Oil Neg. % CHANGE 2008- 2009	O & G Neg. % CHANGE 2008- 2009
USA	1.80%	4.82%	3.47%

OPTIONS FOR **US** O&G?

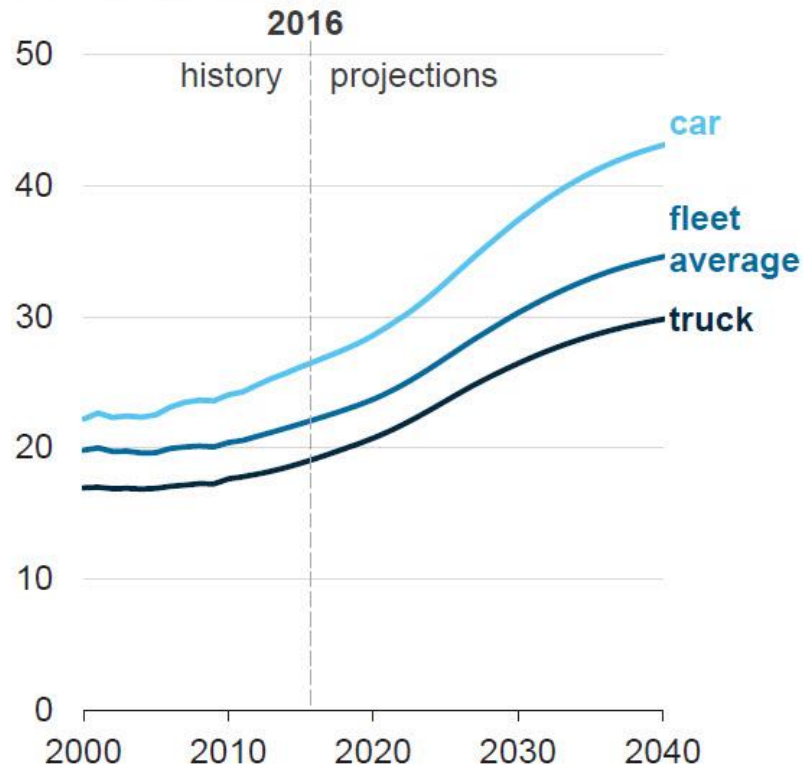
1. Economically, choice for oil companies appears obvious...BAU.
2. Assuming recognition of climate change... what?
 - Voluntarily lower production => sued by stockholders
 - “Hope” for public policy guidelines
 - Regulations (?)
 - Cap & trade (?)
 - Carbon tax (?)

REGULATIONS?

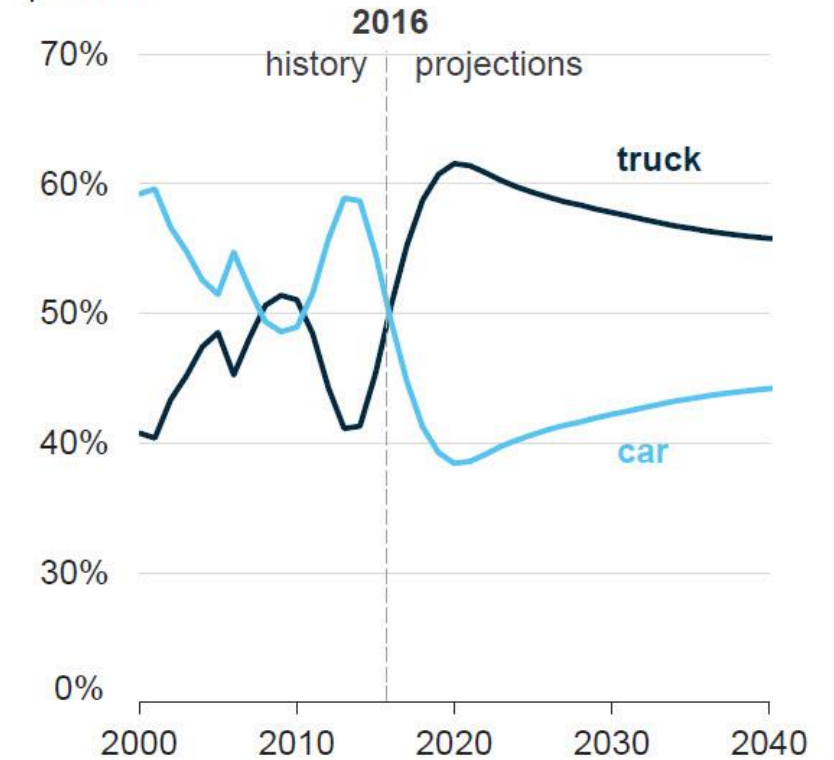
- CAFE standards aren't working
- May change with elections

Average light-duty fuel economy improves in the Reference case—

Light-duty stock fleet fuel economy
miles per gallon



Light-duty vehicle sales shares
percent



The Pope and Cap and Trade



By William A. Sundstrom



ASSOCIATED PRESS

Pope Francis didn't win many friends among mainstream climate economists when his recent environmental encyclical [Laudato Si'](#) condemned the notion of buying and selling carbon credits, suggesting that it could "lead to a new form of speculation which would not help reduce the emission of polluting gases worldwide" (§ 171).



"Cap and Trade" is a market-based strategy for lowering global warming emissions and has long troubled EJ advocates. (WE ACT, 2016)

CAP & TRADE?

James Hansen rails against cap-and-trade plan in open letter

Nasa scientist advocates using fee-and-dividend approach to reducing carbon emissions



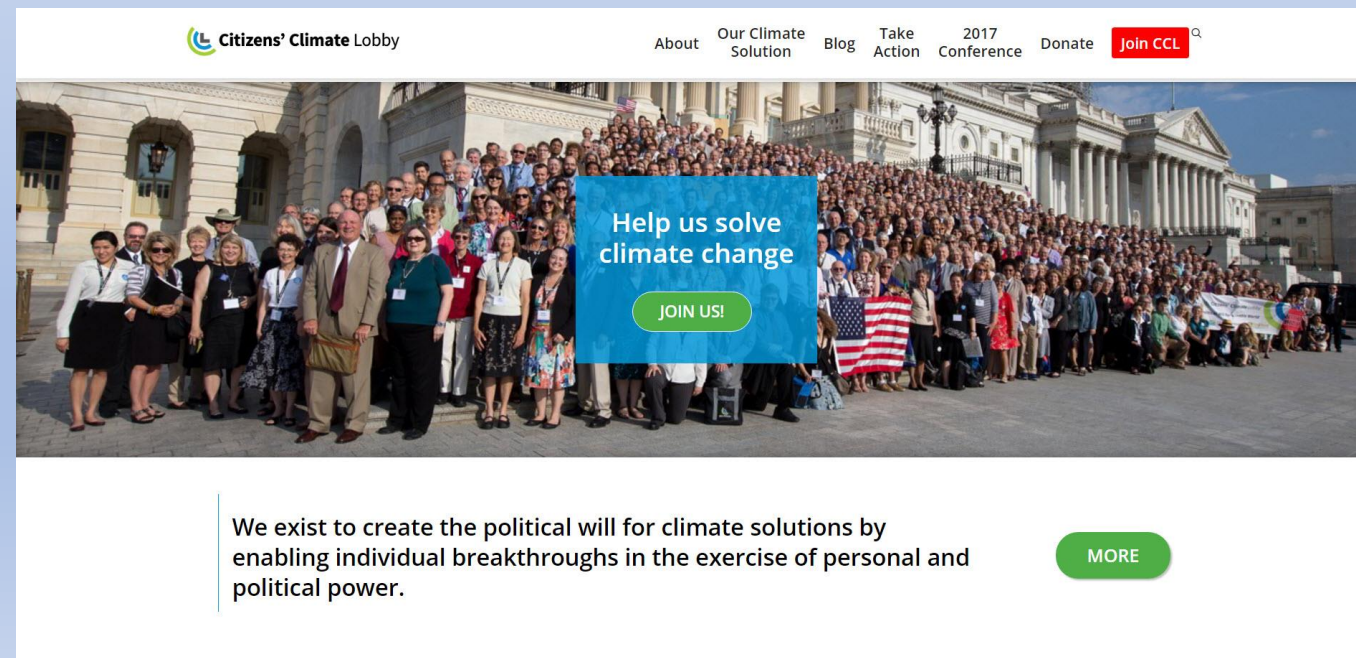
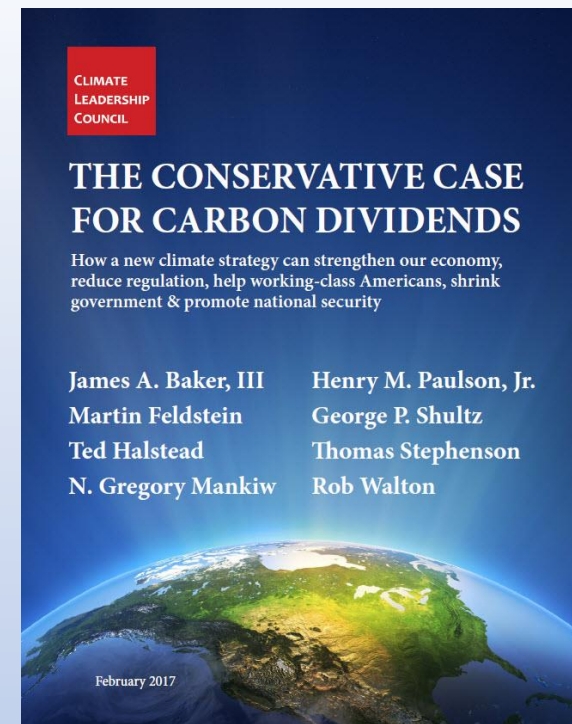
 Dr James Hansen. Photograph: Gareth Fuller/PA



CARBON TAX

BG Group, BP, Eni, Shell, Statoil, and Total...

National governments need to take charge of implement carbon prices to reduce “uncertainty about investment and disparities in the impact of policy on businesses.”
(2015)





Citizens' Climate Lobby
Citizens' Climate Education



Revenue Neutral Carbon Fee & Dividend Proposal



*The Economic, Climate, Fiscal, Power,
and Demographic Impact of a National
Fee-and-Dividend Carbon Tax*

Prepared by
Regional Economic Models, Inc. (REMI) – Washington, DC
Synapse Energy Economics, Inc. (Synapse) – Cambridge, MA

Prepared for
Citizens' Climate Lobby (CCL) – Coronado, CA

Scott Nystrom, M.A.
Senior Economic Associate, REMI

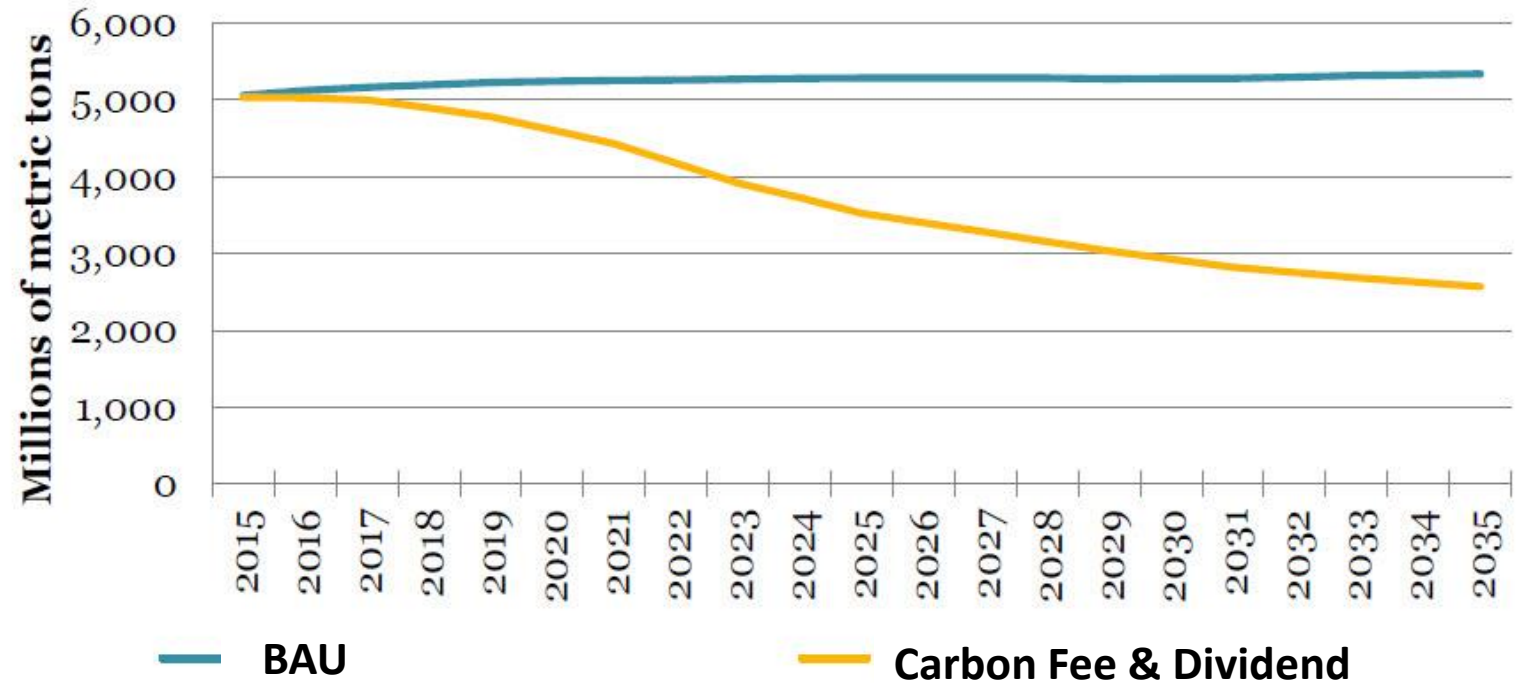
Patrick Luckow, M.S.
Associate, Synapse

1776 I St. NW
Suite 750
Washington, DC
(202) 716-1397
<scott.nystrom@remi.com>



Monday, June 9, 2014

Carbon Dioxide Emissions (annual forecast, national level)



Comment: A tax on carbon would incentivize investment in renewables? In full disclosure, author is a volunteer member of Citizens' Climate Lobby.

- Emissions decrease by 50% within 20 years.
- Revenue returned to individuals gave boost to economy.

PLAN = YEAR 1 => +\$10/year => **YEAR 20**
\$10/ton CO₂ **\$200/ton CO₂**

Electrical Power Generation (national level)

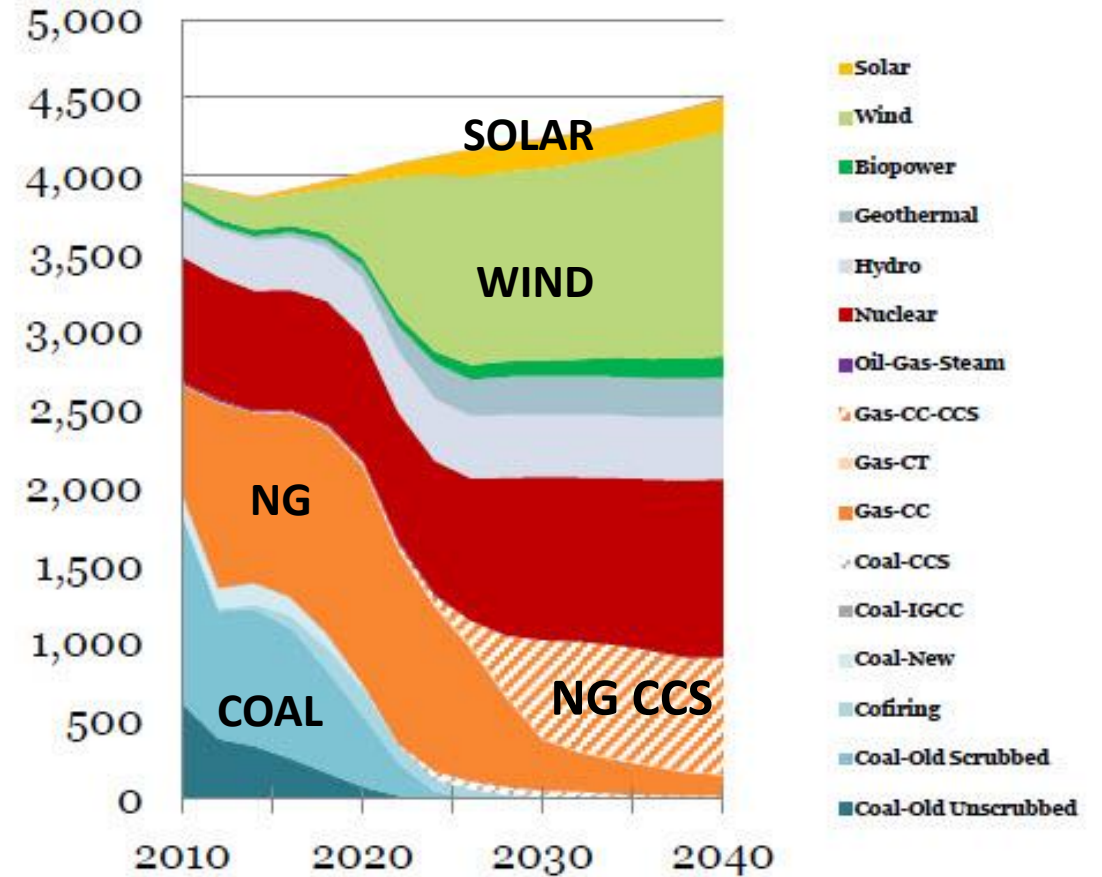
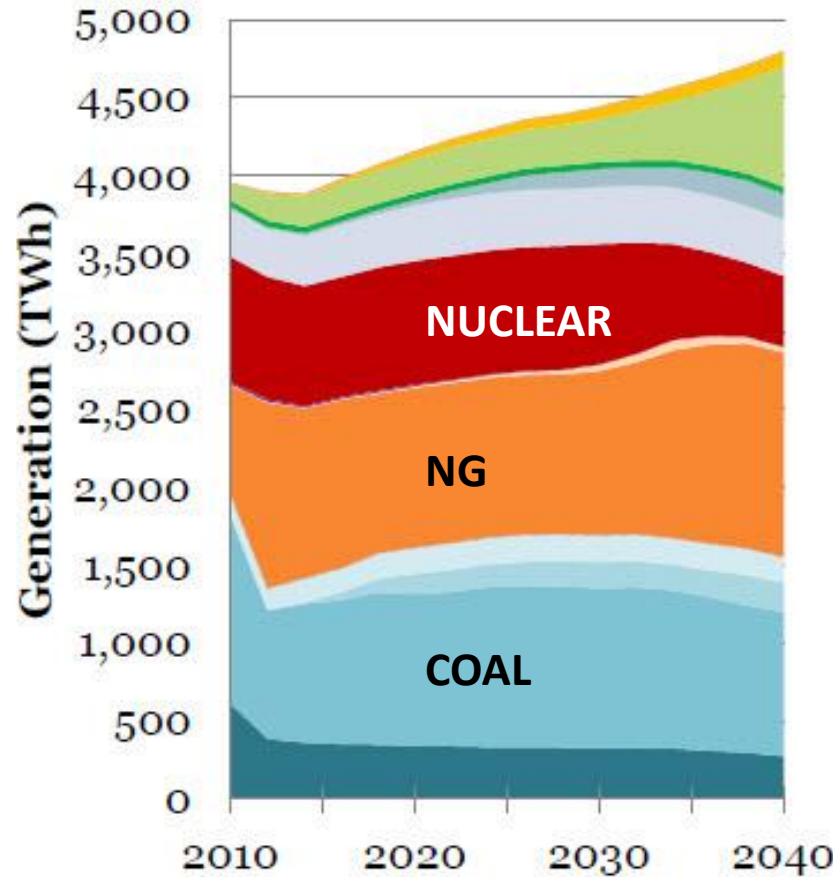


Citizens' Climate Lobby
Citizens' Climate Education



Baseline (\$0/year)

Alternative \$10/year



The Economic, Climate, Fiscal, Power, and Demographic Impact of a National Fee-and-Dividend Carbon Tax

Prepared by
Regional Economic Models, Inc. (REMI) – Washington, DC
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Scott Nystrom, M.A.
Senior Economic Associate, REMI

Patrick Luckow, M.S.
Associate, Synapse

1776 I St. NW
Suite 750
Washington, DC
(202) 716-1397
<scott.nystrom@remi.com>



Monday, June 9, 2014

Comment: Baseline (BAU) and Alternative (carbon fee & dividend; CFD) comparison with power generation in USA. With CFD, which consists of \$10/ton CO₂ with increase of \$10/year and dividends returned to families (<https://citizensclimatelobby.org/remi-report/>), the following will occur: renewable use expanded; coal use ceases within 15 years; NG CCS greatly expanded; nuclear energy expanded.

Course forward in low carbon future?

- Petroleum companies?
- Petroleum geologists?

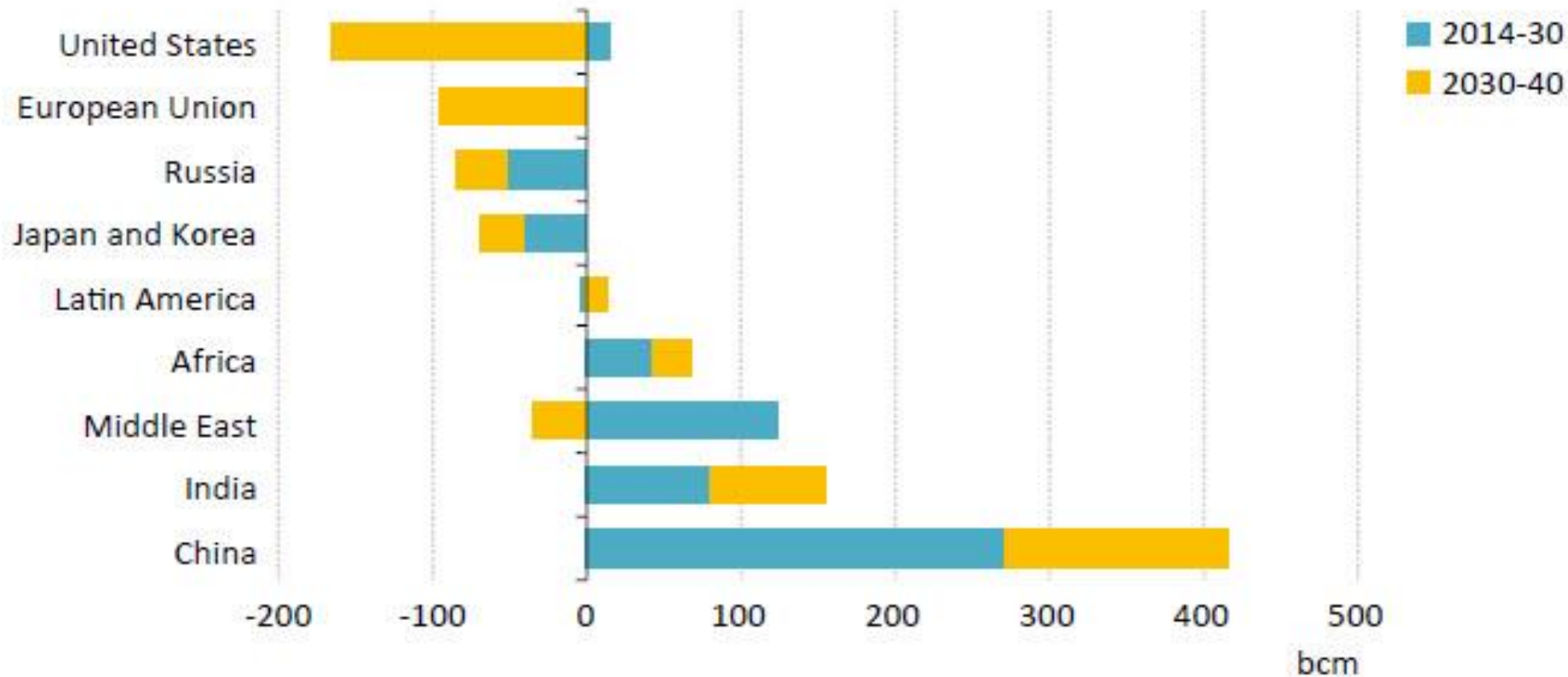
EXPLORER

The Next 100 Years: After the Great Crew Change

March 2017 | By David Brown, Explorer Correspondent

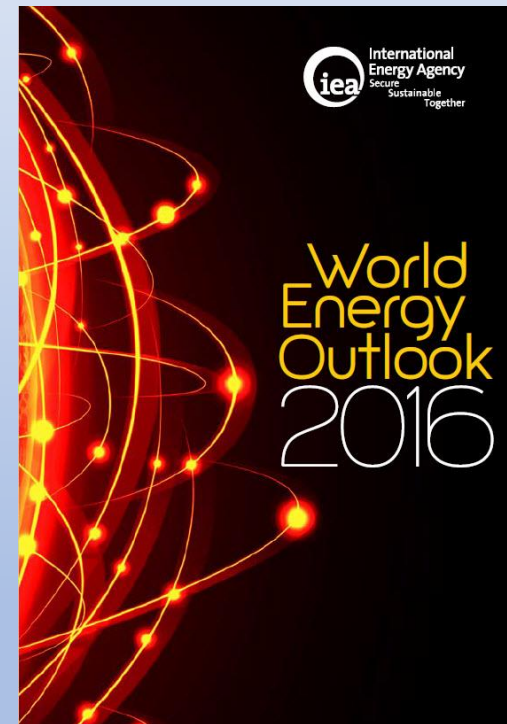


Figure 4.3 ▶ Change in gas demand in selected regions in the 450 Scenario



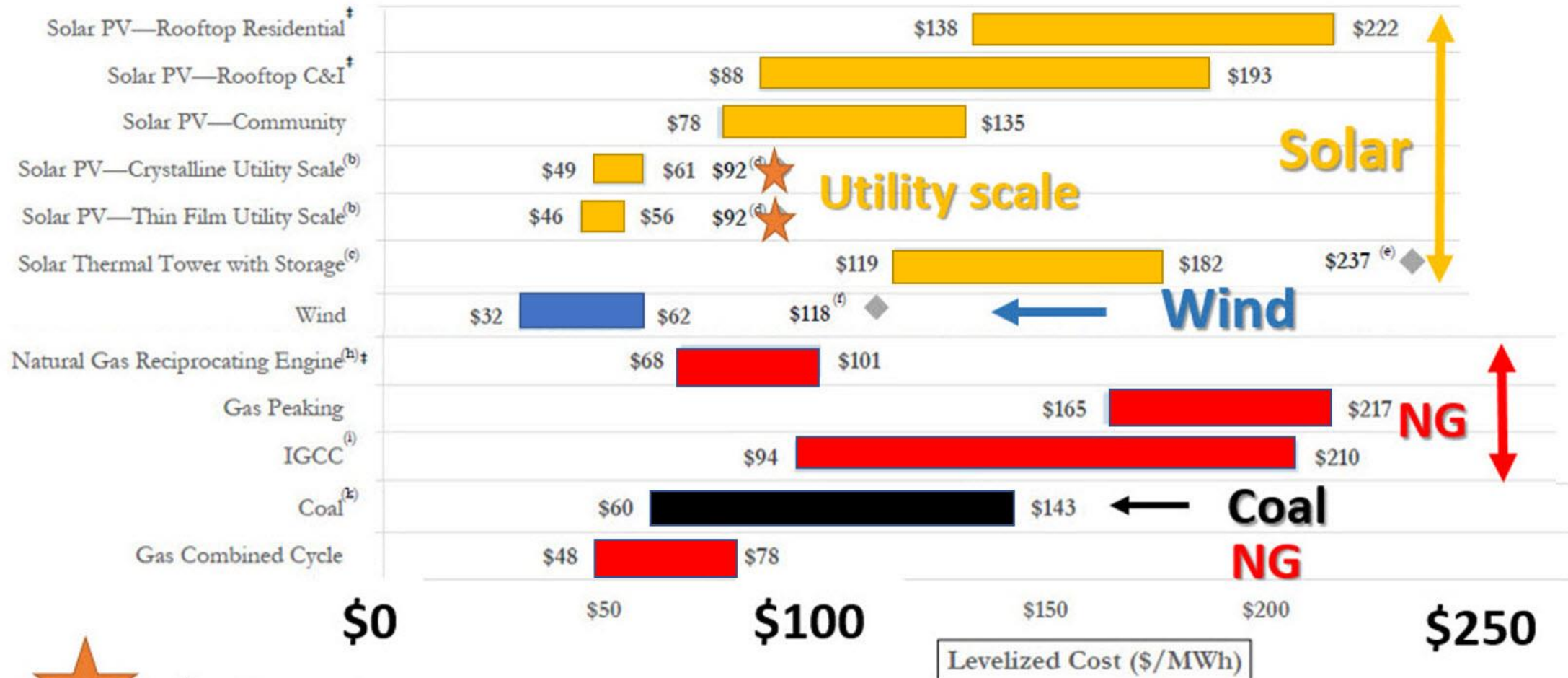
Fuel switching plays a key role in the period to 2030 but efficiency gains and power sector decarbonisation reduce gas demand growth in the long term

NG?



Comment: Based on IEA analysis NG demand in US only increases until 2030 and then decreases with a 450 scenario.

NG + CCS? ... competitive with solar or wind with carbon tax?



Modified from LAZARD LCOE ANALYSIS (December 2016)

Comment: For new power plants, wind or solar with batteries is competitive or cheaper than NG with CCS, definitely cheaper than gas peaking, and cheaper than any coal fired power plant (US). Consequently, window of time for use of CCS maybe small.

Options for **US** O&G:

1. **Go along with mitigation** (carbon tax?)
 - Short term gain for NG but slow demise of most O&G.
 - Fossil fuels are no longer the only economic choice, even discounting costs of pollution and climate change.
2. **BAU?**
 - General economic decline (best case)
 - Social backlash

Thank you... and Good Luck!

James (Jim) M. Rine

Adjunct Professor

Department of Geology, Wayne State University
Detroit, Michigan

