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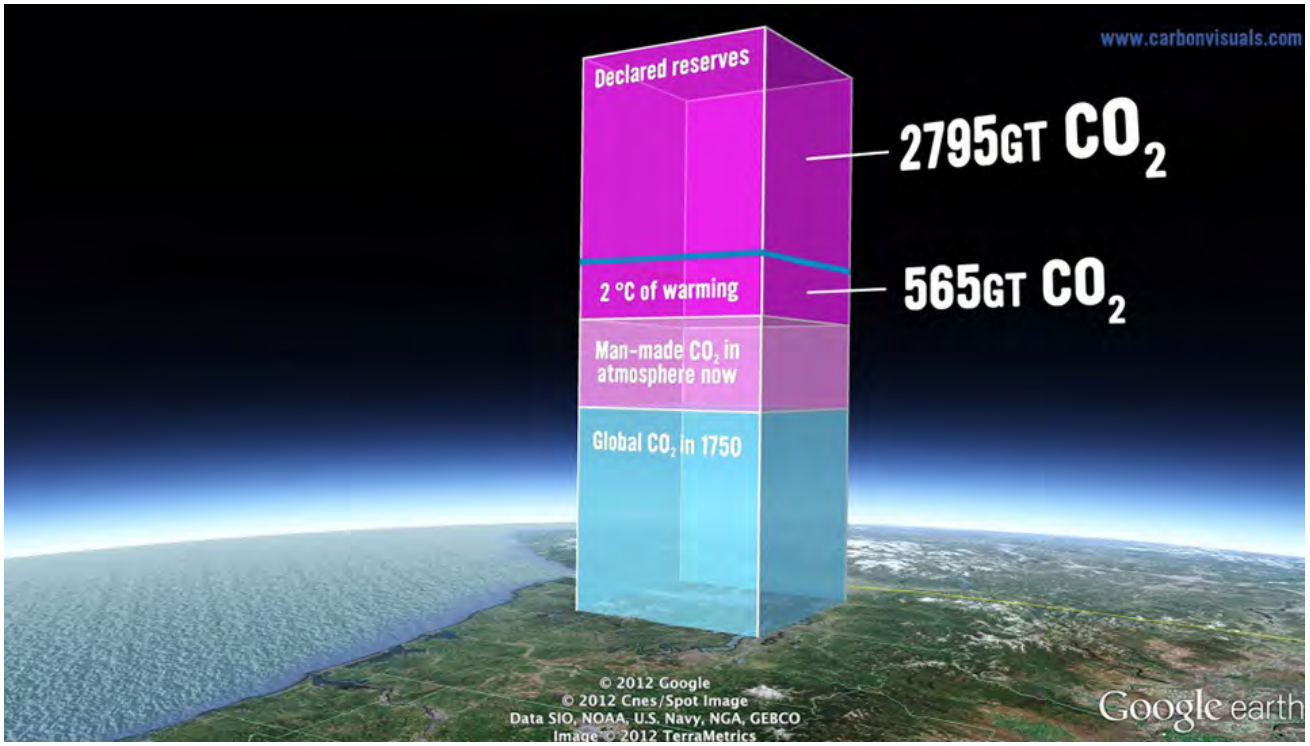
Council On Foreign Relations

Project LINK Meeting 2019

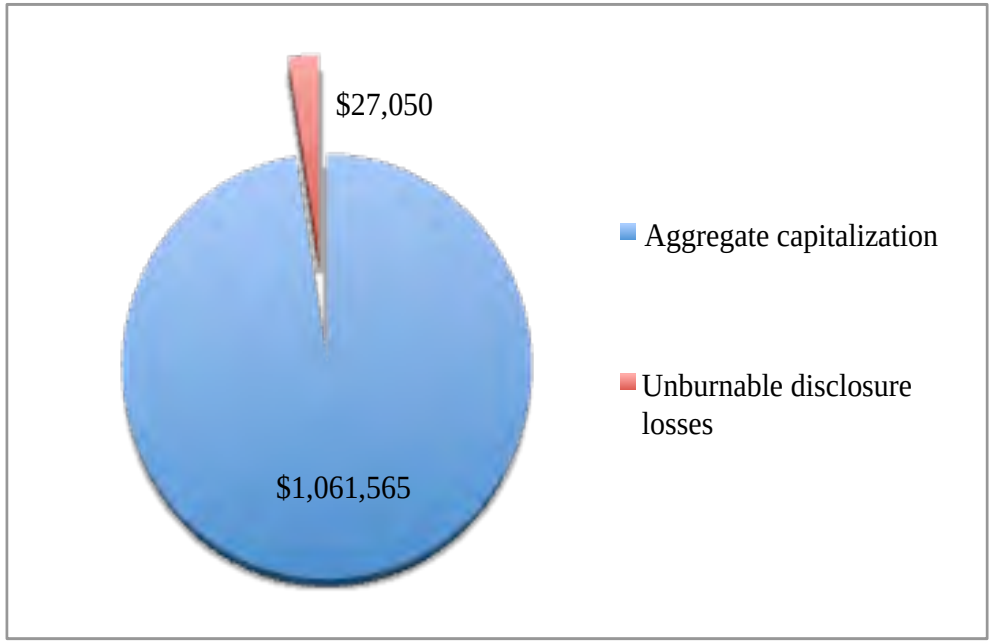
"Coping with Stranded Asset Risk"

June 18, 2019

The Science of Unburnable Carbon

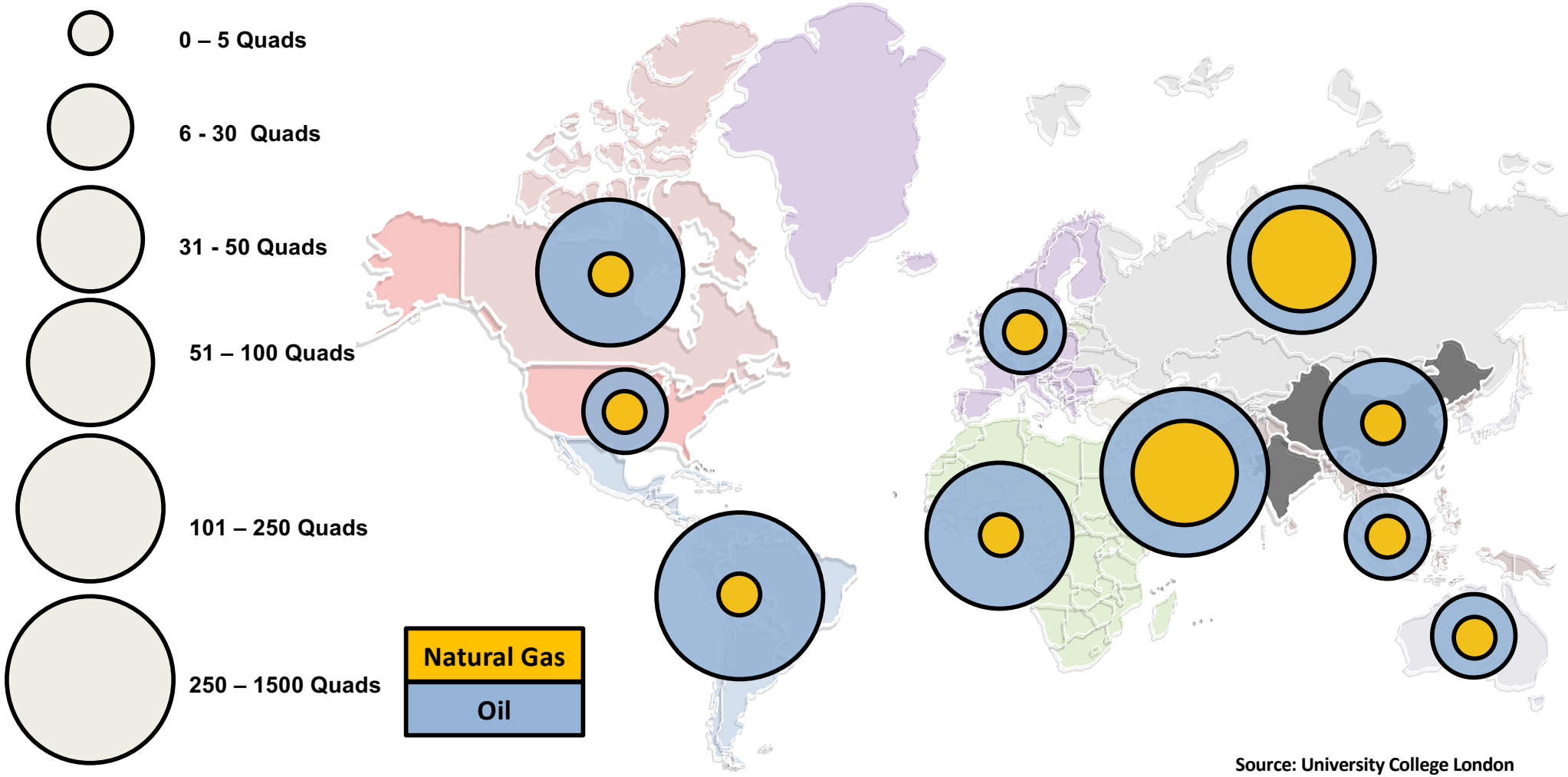


Markets Recognize That Science of Stranded Assets is Real: 2009 Stock Market Aggregate Loss = 2.48% of market capitalization



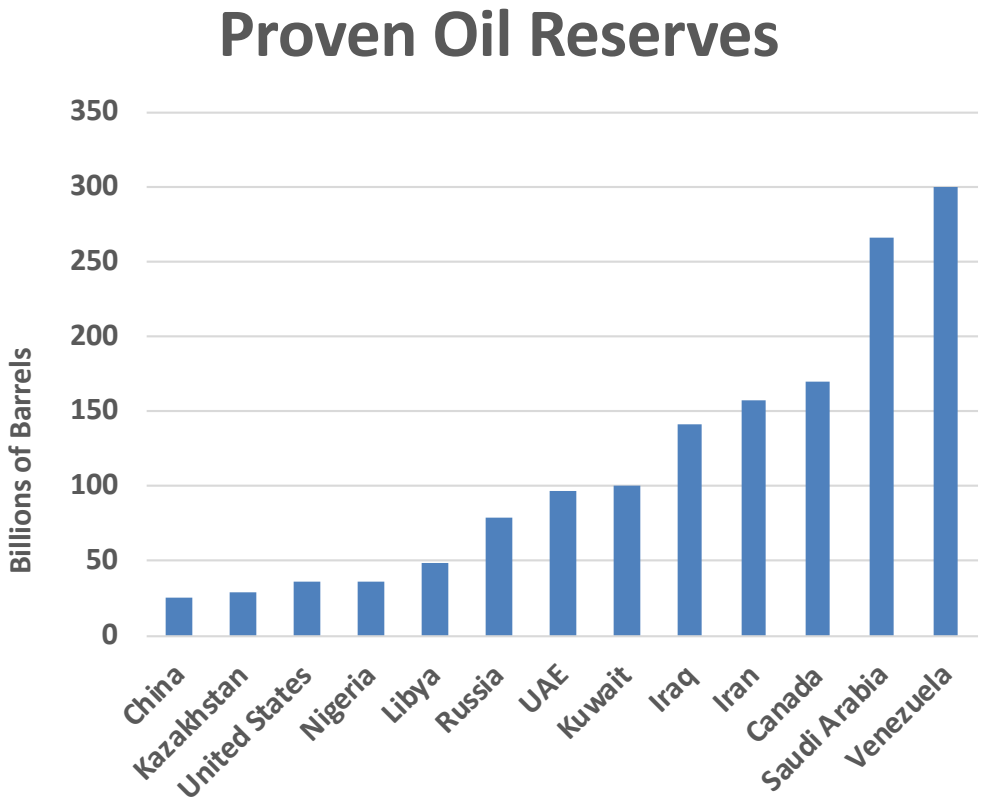
Griffin, Lont, Jaffe, Dominguez-Faus, *Energy Economics*, Fall 2015

Unburnable Fuel Reserves Before 2050 Under 2°C Scenario



Source: University College London

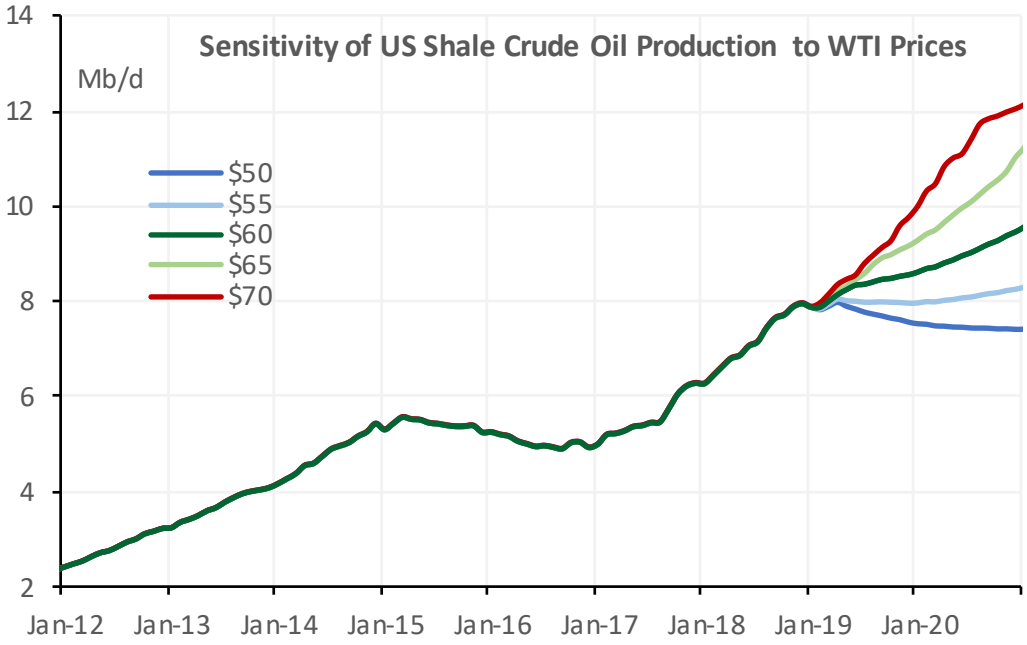
Larger and Expensive Resources Most at Risk for Stranding

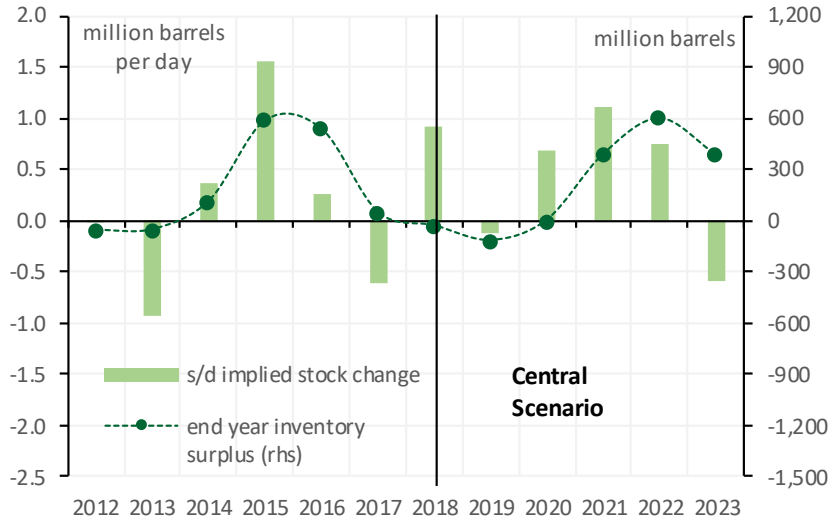


- Canada – Oil Sands Reserves are 166.3 billion barrels
- Venezuela – Orinoco Belt reserves are 235 billion. Some other regions are damaged beyond repair such as the El Furrial Field.
- Russian Arctic oil reserves are 90 billion barrels and 47 trillion cubic meters of gas
- Will countries develop their unconventional oil from shale? *(Mexico, Colombia, Paraguay, Algeria, Jordan, South Africa, Argentina, Russia…)*

Peabody Energy stock collapse from 2015-2016 highlights risk of disorderly decapitalization as competitive market conditions change and carbon gets repriced more accurately

CORNERSTONE MACRO: FIVE YEAR MODEL: $50-$55/B WTI IS TOO LITTLE; $65/B SEEMS TOO MUCH





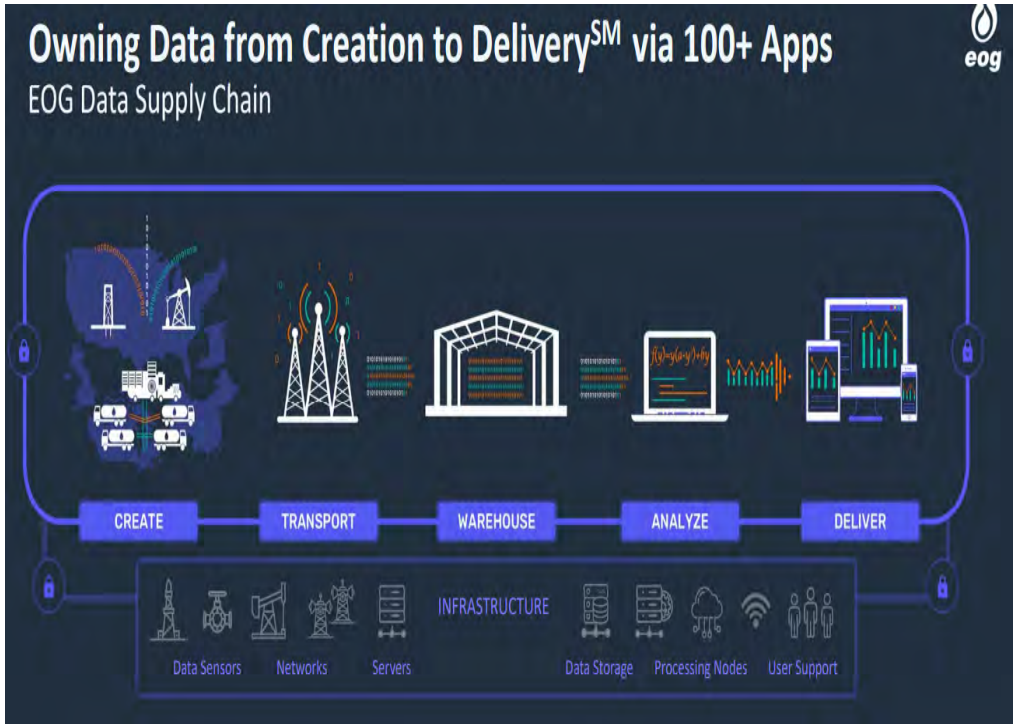
sensitivity of 5 year global oil balance to shale production growth global stock change (Mb/d) running shale model at various WTI prices	2019	2020	2021	2022	2023
$50	-0.9	-1.5	-2.4	-3.6	-5.6
$55	-0.6	-0.5	-0.8	-1.6	-3.6
$60	-0.1	0.7	1.1	0.7	-0.6
$65	0.2	2.1	3.8	4.1	3.5
$70	0.5	3.6	4.7	5.2	4.3
$75	0.7	4.1	5.5	5.7	4.7

Source: CORNERSTONE MACRO

Is the WTI Boom-Bust Price Cycle Shortening?

- Shorter cycle times for oil price rises potentially weakens the investment response in regions with large scale conventional reserves that take longer to develop.

DATA SCIENCE IS DELIVERING FOR US TIGHT OIL: TECHNOLOGY IS BRINGING ABUNDANCE



Digitalisation & innovation
Potential

Value creation producing fields
Above 2 bn USD

Automated drilling – cost
Around
-15%

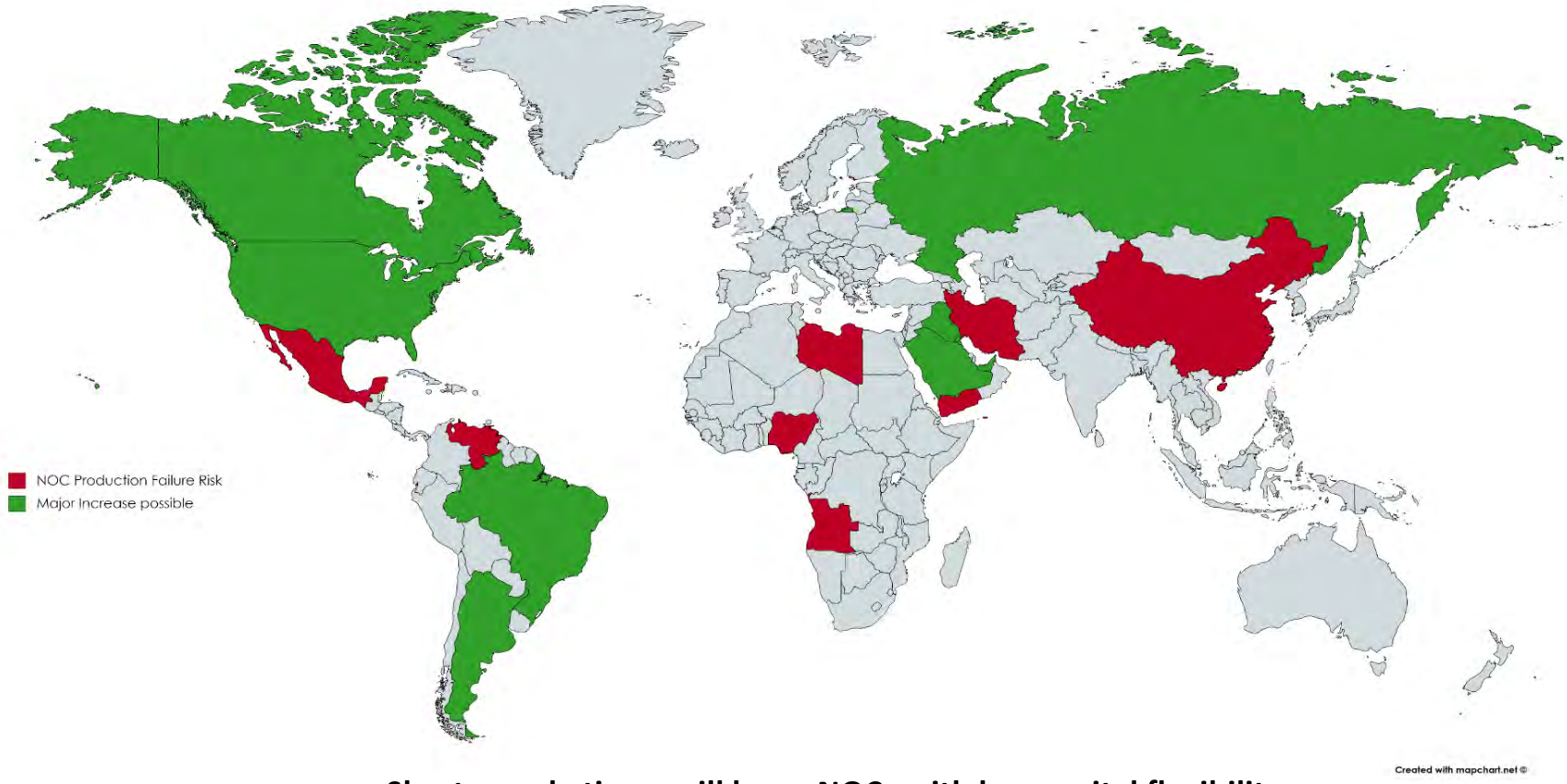
Field of the future – capex
Around
-30%

Field of the future – opex
Around
-50%

Integrated remote operations US Onshore
Around 500 million USD
Added value

Source: CORNERSTONE MACRO

Rising Oil Production Potential VS NOC Supply Risk
Corruption Scandals, Failing States, and States Raiding NOC Finances



Shorter cycle times will leave NOCs with less capital flexibility.
NOCs likely to have more difficulty staving off declines in mature fields.
Majors are favoring short cycle projects such as shale in the Americas, brownfield extensions and development of satellite reserves. Interest in long cycle projects like Venezuelan heavy oil and Arctic development is sinking. Longer term, any higher oil prices could breed structural decline in oil use, creating intractable problem for OPEC.

Technology Revolution is ushering in exponential gains in productivity, via transportational logistics, automation, big data, material science and biotech, artificial intelligence, 3-D printing.

This revolution dramatically change the way we produce, sell and use energy.

Old v. New Forces Impacting Long Term Oil Demand

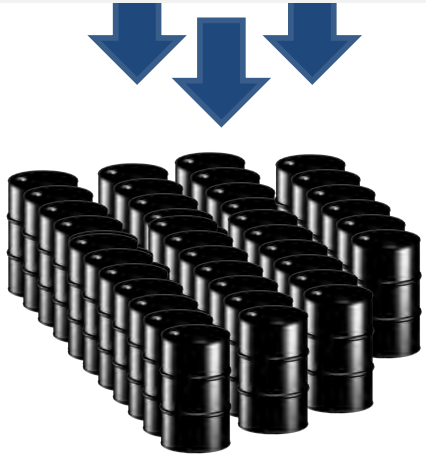
TECHNOLOGY

GROWTH OF ALTERNATIVE ENERGY

MILLENNIALS REJECT VEHICLE OWNERSHIP

LEGISLATIVE + TAX POLICY

ENERGY EFFICIENCY (energy per GDP declining)



~ 100 MIL BBL/DAY
(current)

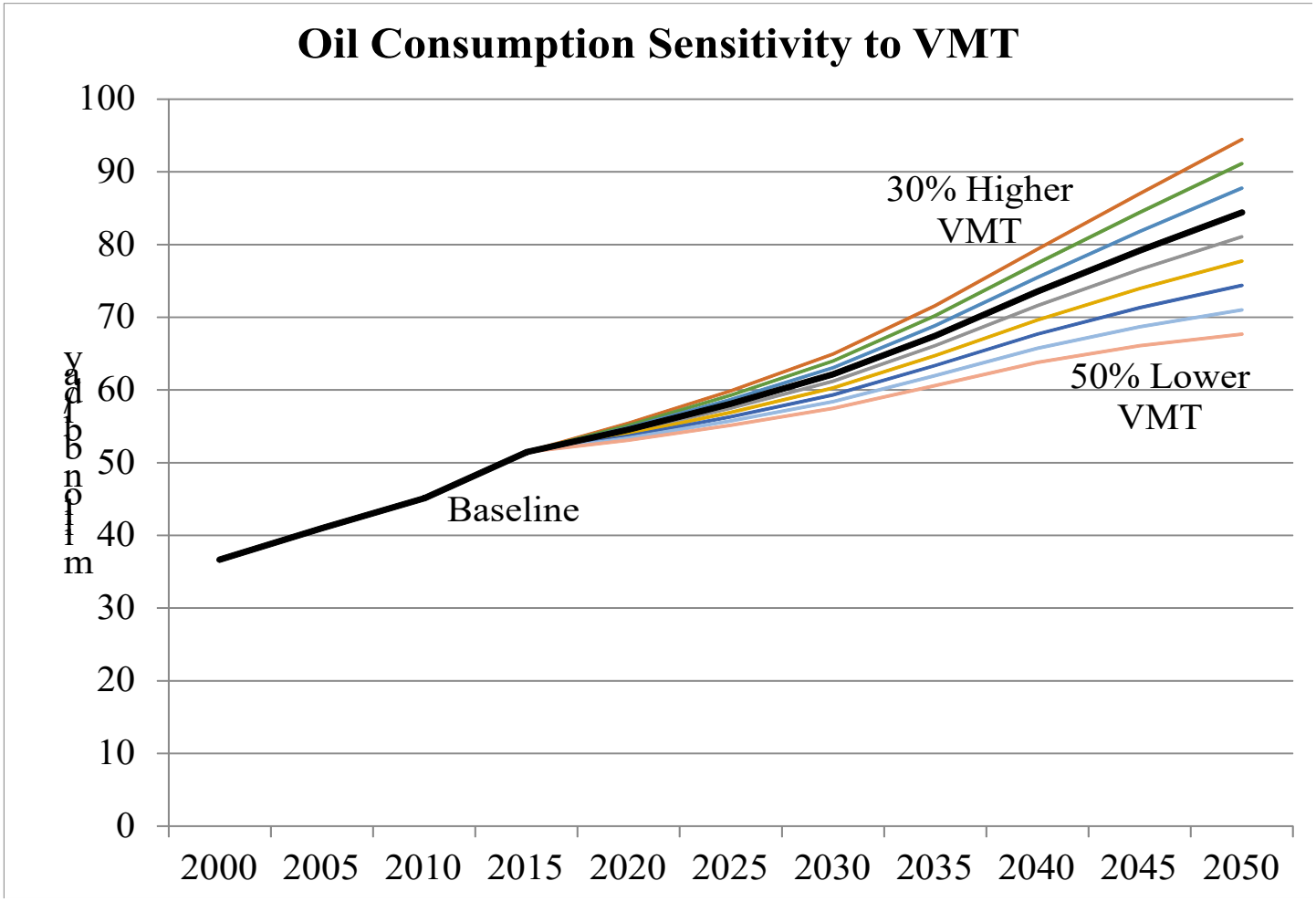
74 MIL BBL/DAY
(2 degrees)

POPULATION GROWTH

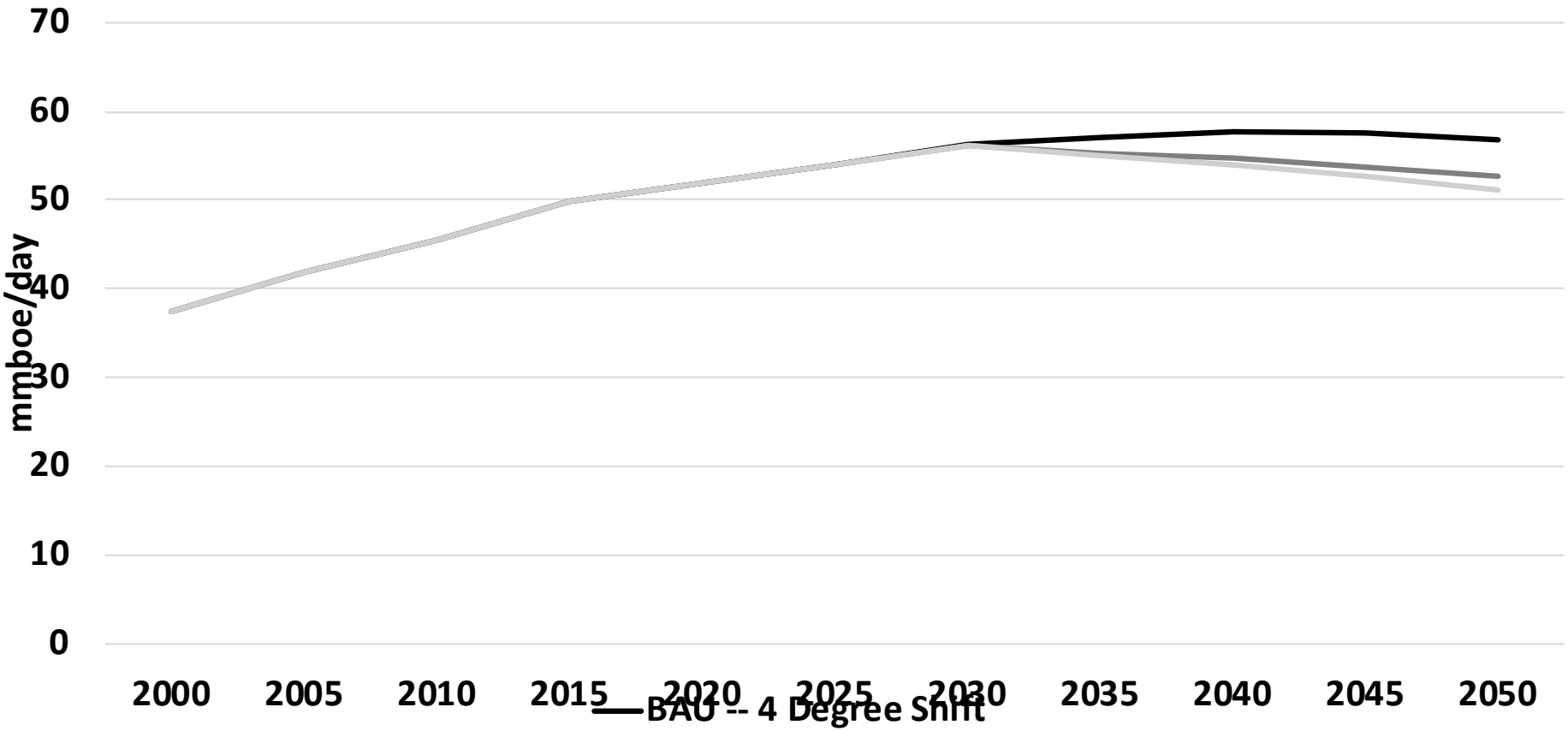
EXPANDING GLOBAL MIDDLE CLASS

EMERGING ECONOMY EXPANSION

Potential impact of increased shared mobility/autonomous vehicles: Oil consumption highly sensitive to changes in VMT

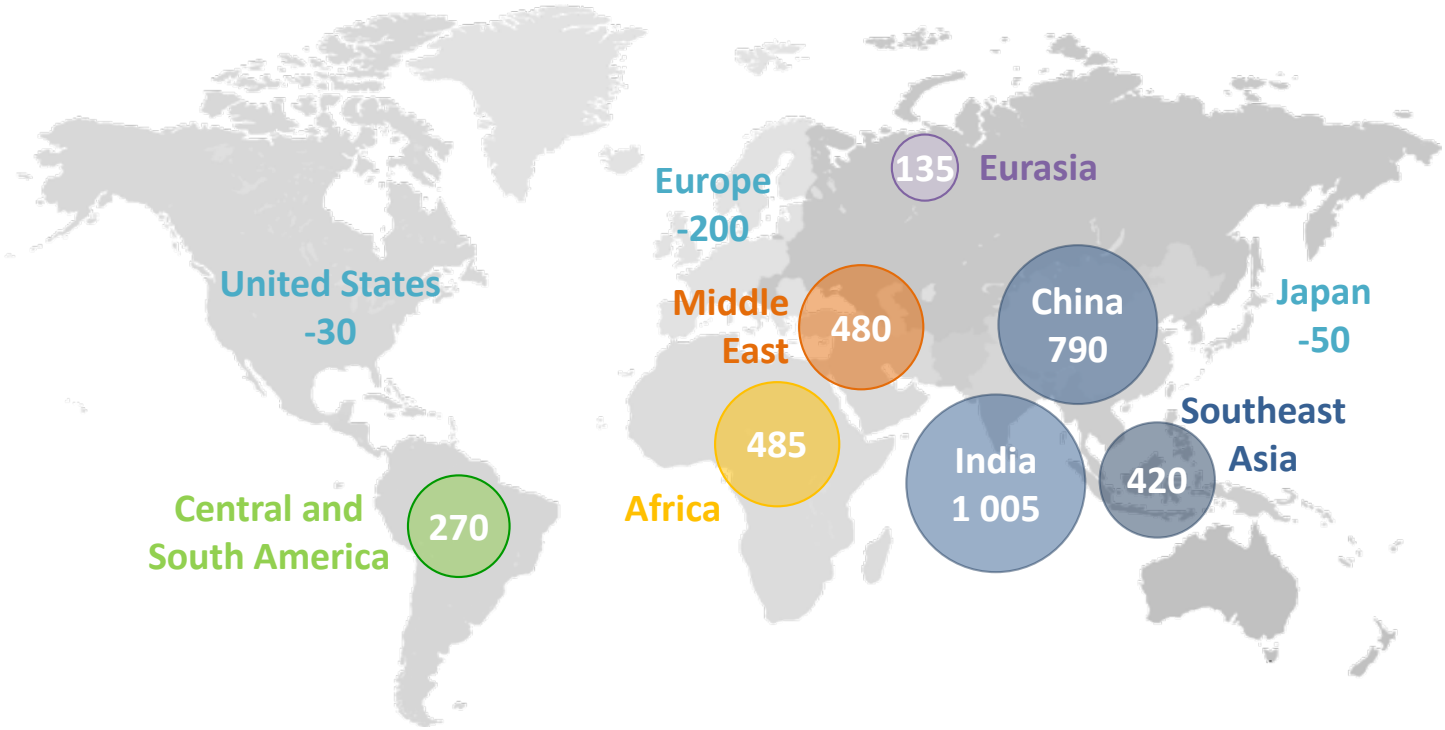


ICE Ban Oil Consumption



Energy demand is expected to peak in OECD. Could China be next?

Change in energy demand, 2016-40 (Mtoe)



GDP across developing world might slow due to climate change, migration, and slowdown in global trade.

How Will Producers Respond?

- Since reserves under the ground will depreciate over time, it makes commercial sense to accelerate production now while demand is still robust
- Green paradox: Higher the likelihood of carbon tax or restrictions, the more it will encourage producers to accelerate production
- Geopolitical implications: petro-states responding to loss of strategic stature by shifting to harder power measures to raise importance on world stage
- Anticipation of failing national budgets is destabilizing legitimacy of petro-governments and prompting intensification of repression

HOW DOES THE UNITED NATIONS PROMOTE A SOFTER LANDING?