Issues and "Unburnable Fossil Fuels, Leave it in the Ground and Divestment" How CCUS fits in.

Michael E. Moore

VP Energy Commodities and Advisory Services
FearnOil Inc. a division of Astrup-Fearnleys

December 6th, 2016 Midland, Texas

FearnOil Inc.

Astrup Fearnley

ROZ 2016 Conference

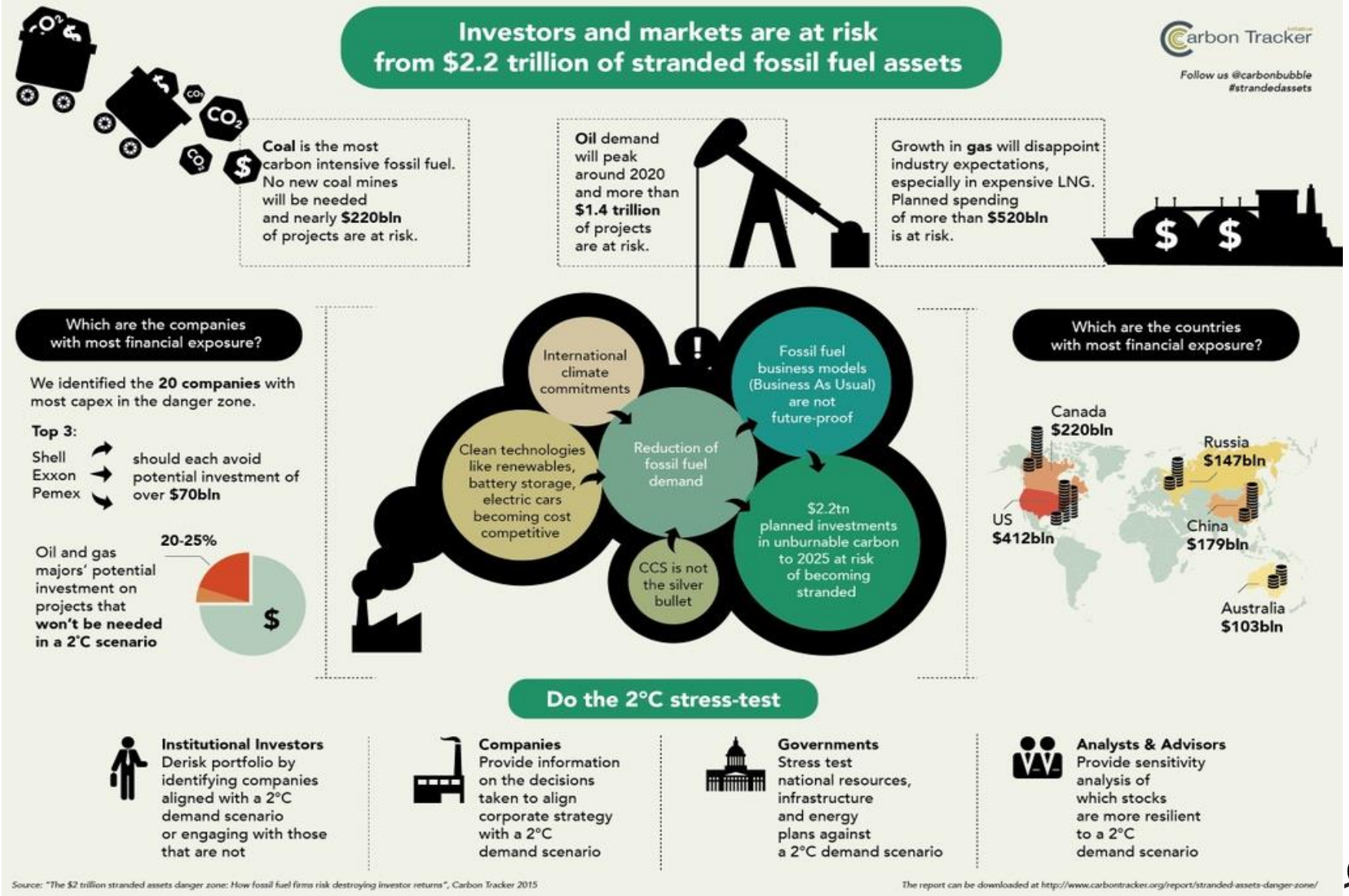
Historic Paris Agreement on Climate Change

195 Nations Set Path to Keep Temperature Rise Well Below 2 Degrees Celsius

What does "de-carbonization of energy (fossil fuels) by 2050…." mean?

http://newsroom.unfccc.int/paris/

$2.2 Trillion Fossil Fuel Assets At Risk



Six Oil and Gas Majors Call for Carbon Pricing June 1, 2015

- Major oil and gas companies BG Group plc, BP plc, Eni S.p.A., Royal Dutch Shell plc, Statoil ASA and Total SA, today announced their call to governments around the world and to the United Nations Framework Convention on Climate Change (UNFCCC) to introduce carbon pricing systems and create clear, stable, ambitious policy frameworks that could eventually connect national systems. These would reduce uncertainty and encourage the most cost effective ways of reducing carbon emissions widely.

- The six companies set out their position in a joint letter from their chief executives to the UNFCCC Executive Secretary and the President of the COP21. This comes ahead of the UNFCCC's COP21 climate meetings in Paris this December.

- With this unprecedented joint initiative, the companies recognise both the importance of the climate challenge and the importance of energy to human life and well-being.

- http://www.statoil.com/en/NewsAndMedia/News/2015/Pages/01Jun_carbon.aspx

IMF: The Price of Oil and The Price of Carbon

http://blog-imfdirect.imf.org/2015/12/02/the-price-of-oil-and-the-price-of-carbon/

- "The human influence on the climate system is clear and is evident from the increasing greenhouse gas concentrations in the atmosphere, positive radiative forcing, observed warming, and understanding of the climate system." —Intergovernmental Panel on Climate Change, Fifth Assessment Report

- Fossil fuel prices are likely to stay "low for long." Notwithstanding important recent progress in developing renewable fuel sources, low fossil fuel prices could discourage further innovation in and adoption of cleaner energy technologies. The result would be higher emissions of carbon dioxide and other greenhouse gases.

- ***Policymakers should not allow low energy prices to derail the clean energy transition. Action to restore appropriate price incentives, notably through corrective carbon pricing, is urgently needed to lower the risk of irreversible and potentially devastating effects of climate change.***

Decarbonization: "leave it in the ground", divestment and unburnable fossil fuels…

In 2013---Turning Point

November 7th 2013'Unburnable' carbon fuels investment concerns-Investors group with €7.3 trillion of assets asks energy giants about their exposure and response to the risk of falling demand for oil and coal.
http://www.theguardian.com/sustainable-business/unburnable-carbon-investment-agenda

Norway Confirms $900bn Sovereign Wealth Fund's Major Coal Divestment May 27th, 2015

- The decision to divest Norway's $945m fund from coal assets was made on 27 May, when an agreement between political parties was reached. It was formally passed by a parliamentary vote on Friday. Svein Flaatten, of the governing Conservative party, said coal investments were both a global warming risk and financial risk. A global deal to cut carbon emissions at a crunch UN summit in December could leave some fossil fuel reserves unburnable and worthless.
- Norway's parliament has formally endorsed the move to sell off coal investments from its $900bn sovereign wealth fund, the world's biggest.
- It is the largest fossil fuel divestment yet, affecting 122 companies across the world, and marking a new success for the fast-growing and UN-backed climate change campaign.
- A new analysis said the fund would sell off over $8bn (£5bn) of coal-related investments as a result.
- The biggest single sell-off from Norway's fund will be the UK utility SSE, in which the fund holds $956m of shares. The fund is also set to sell its $49m stake in Drax, which runs the UK's biggest coal-fired power station.
- Other major energy companies identified in the analysis by German and Norwegian NGOs are Germany's E.ON ($685m) and RWE ($320m) and the Danish company Dong ($30m), which is often associated with wind energy but has a significant coal business.
- Sweden's Vattenfall and Italy's Enel are also set to be affected by the coal ban as are 35 groups in the US, including Duke Energy ($434m). A dozen coal-related companies on China are set to lose their Norwegian investment, as are eight in Japan and five in Australia.

- http://www.theguardian.com/environment/2015/jun/05/norways-pension-fund-to-divest-8bn-from-coal-a-new-analysis-shows

Ambitious Plan To Keep Fossil Fuels In The Ground

- By Carolyn Lochhead February 13, 2016
- Rep. Jared Huffman of San Rafael introduced the House version of the Keep It in the Ground Act on Thursday. In the Senate, the legislation is co-sponsored by Sen. Barbara Boxer of California.

- It would block all new leases for coal, oil, gas, oil shale and tar sands on public land, including millions of acres the federal government owns in the West.

- The legislation would also slap a moratorium on new leases for offshore drilling — and end current leases that are not producing fuel — in the Pacific Ocean and the Gulf of Mexico, where the nation's oil and gas industry is centered. And it would prohibit all offshore drilling in the Arctic and along the entire Atlantic seaboard.

http://www.sfgate.com/science/article/State-Dems-ambitious-plan-to-keep-fossil-fuels-6828872.php

Movement Against US Shale Gas

- ***Segolene Royal told lawmakers May 10, 2016 she is willing to find a "legal way" to prevent the import of non-conventional US LNG and asking French companies in contact with Cheniere Energy to look for other sources of supply producing only conventional gas.***

- http://www.naturalgaseurope.com/france-schilansky-questions-ban-on-us-imports-proposed-by-energy-minister-29565?utm_content=buffer28cdc&utm_medium=social&utm_source=twitter.com&utm_campaign=buffer

Beyond Coal, Oil and Natgas

- *April 19th, 2016 Mark Hand SNL S&P Global Market Intelligence spoke with Lena Moffitt of Sierra Club* ***https://www.snl.com/InteractiveX/articleabstract.aspx?id=36149158&KPLT=8***
- ***The Sierra Club's top priority in recent years has been shutting down coal-fired power plants across the U.S. The group's Beyond Coal effort has been described as "the most extensive, expensive and effective campaign in the environmental group's 123-year history."***
- ***Hoping to build on the success of its Beyond Coal campaign, the Sierra Club launched initiatives targeting both oil and natural gas. In late 2014, the Sierra Club decided to merge its Beyond Natural Gas and Beyond Oil efforts into a campaign called Beyond Dirty Fuels.***
- ***We are doing everything we can to bring the same expertise that we brought to taking down the coal industry and coal-fired power in this country to taking on gas in the same way. I look forward to seeing the same success brought to taking down gas plants to ensure that we're actually moving to a 100% clean energy future. That is the one Sierra Club policy that we are all working toward: getting us to 100% clean energy, which, of course, would include no new gas.***

CCUS Value Chain

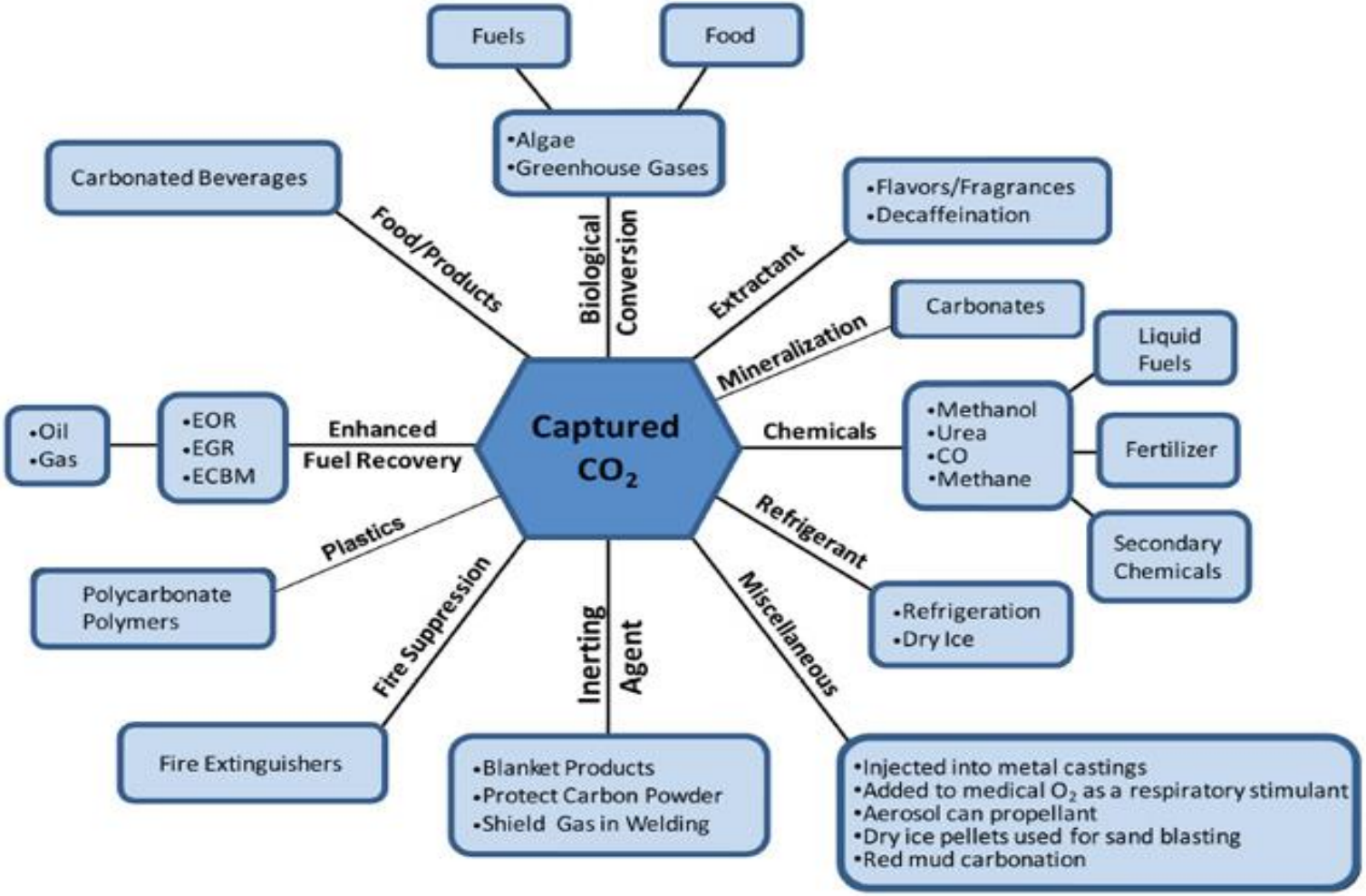
- Coal and natgas producers can utilize CCUS to provide a low carbon pathway for their continued production in power and industrial applications
- In turn Oil and NGL producers can/do/could utilize the captured CO_2 to provide low carbon feed-stocks for refineries and petrochemical processes
- In turn the refineries and petrochemical industries can provide a lower carbon product
- Provides a counter to shutting fossil fuels in.

CO_2 – A Valuable Resource

Fossil Fuels, CCUS & Commodity CO_2 For Utilization & EOR

- CO_2 utilization as a commodity feedstock
- Conventional mature MPZ CO_2-EOR
- CO_2-EOR in ROZ under MPZ and green field fairways
- CO_2-EOR in Shale

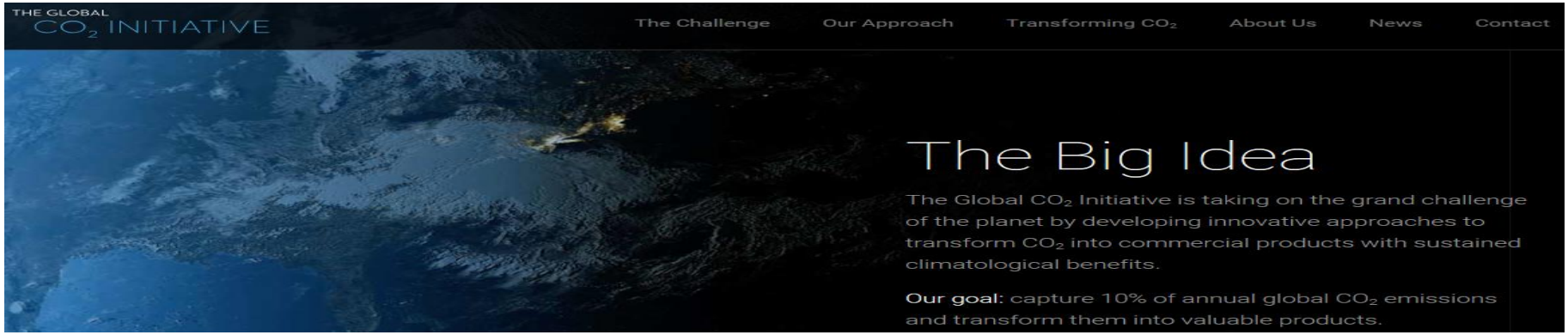
Physical CO_2: A Valuable Commodity



Source: www.netl.doe.gov/research/coal/carbon-storage/research-and-development/co2-utilization

The Global CO_2 Initiative

www.co2sciences.org/



THE GLOBAL
CO_2 INITIATIVE
Turning a Liability into an Asset

A SPECIAL INVITATION TO BE A PART OF HISTORY
AN EVENT HIGHLIGHTING HOW CO_2 CAN BE TRANSFORMED INTO AN ASSET

WHEN
Thursday, January 21, 2016 from 6:00 p.m. - 8:00 p.m.

WHERE
Rotary Room, Belvedere Hotel, Davos, Switzerland

OVERVIEW
The Global CO_2 Initiative is a market-based solution to address one of the grand challenges of our planet: the catastrophic impact of excessive CO_2 emissions in our atmosphere and oceans. By investing in innovative approaches to capture and transform CO_2 into commercial products, we believe we can create economically viable solutions that offer sustained climatological benefits.

THE NEED
Global CO_2 emissions, currently at 35 gigatons per year, continue to accelerate. At an all-time high, the atmospheric concentration and longevity of CO_2 create a multi-generational problem. Without significant intervention, the impact will be catastrophic for society and the environment. Government awareness is rising, but progress is limited and uncertain. With the COP21 agreement to target a 1.5°C global temperature rise, we urgently need a multifaceted strategy to decarbonize, adapt to the changing climate, and create new uses for existing CO_2.

THE OPPORTUNITY
Rather than view CO_2 as a worthless and overabundant environmental hazard, the Global CO_2 initiative is taking a fresh perspective, approaching CO_2 as an asset that can be transformed into useable products for which there is current market demand. Early efforts have demonstrated that it can be transformed into many products, including bio-fuels, methanol, cement, aggregates, fertilizer, carbon fiber, plastics, food, beverages, chemicals, refrigerants, fragrances and it can be used to enhance recovery of oil. However, more scientific innovation is needed and current transformation efforts remain small and disparate. We will invest in both the science, product creation and commercialization in order to transform more CO_2 on a larger scale.

THE SESSION AT THE WORLD ECONOMIC FORUM
We invite you to attend our session at the World Economic Forum which will highlight the market-based approach we are pursuing. It will include a high level explanation of the grand challenge and findings from an exciting new global market assessment of applications for CO_2, currently being created by McKinsey & Company for the Global CO_2 Initiative.

- The Global CO2 Initiative was created to realize the ambitious goal of capturing 10% of global CO2 emissions and transforming it into valuable products.
- CO2 Sciences, Inc., our innovation platform, is designed to aggressively catalyze innovative research in carbon capture and reuse by granting $100 million per year for ten years to scientific research.
- In parallel, the Global CO2 Initiative will accelerate the commercialization of carbon capture and transformation products and services. We will partner with investment funds, joint ventures and corporations to invest in companies to enable them to grow market demand for carbon-based products.
- In order to achieve these ambitious goals, we have brought together a multidisciplinary group of the world's leading scientists and business leaders

National Coal Council

CO_2 Building Blocks Report-Assessing CO_2 Utilization Options

- http://www.nationalcoalcouncil.org/Documents/CO2-Building-Blocks-2016.pdf
- "CO_2 Building Blocks: Assessing CO_2 Utilization Options" – that calls for support for RD&D and adoption of incentives to advanced carbon dioxide (CO_2) utilization technologies. The report identifies CO_2 for enhanced oil recovery (CO_2–EOR) as the most immediate, highest value opportunity to utilize the greatest volumes of anthropogenic CO_2 and thereby incentivize the more rapid deployment of carbon capture utilization and storage (CCUS) technologies to control emissions of CO_2 from fossil generation and industrial sources.

National Coal Council Report

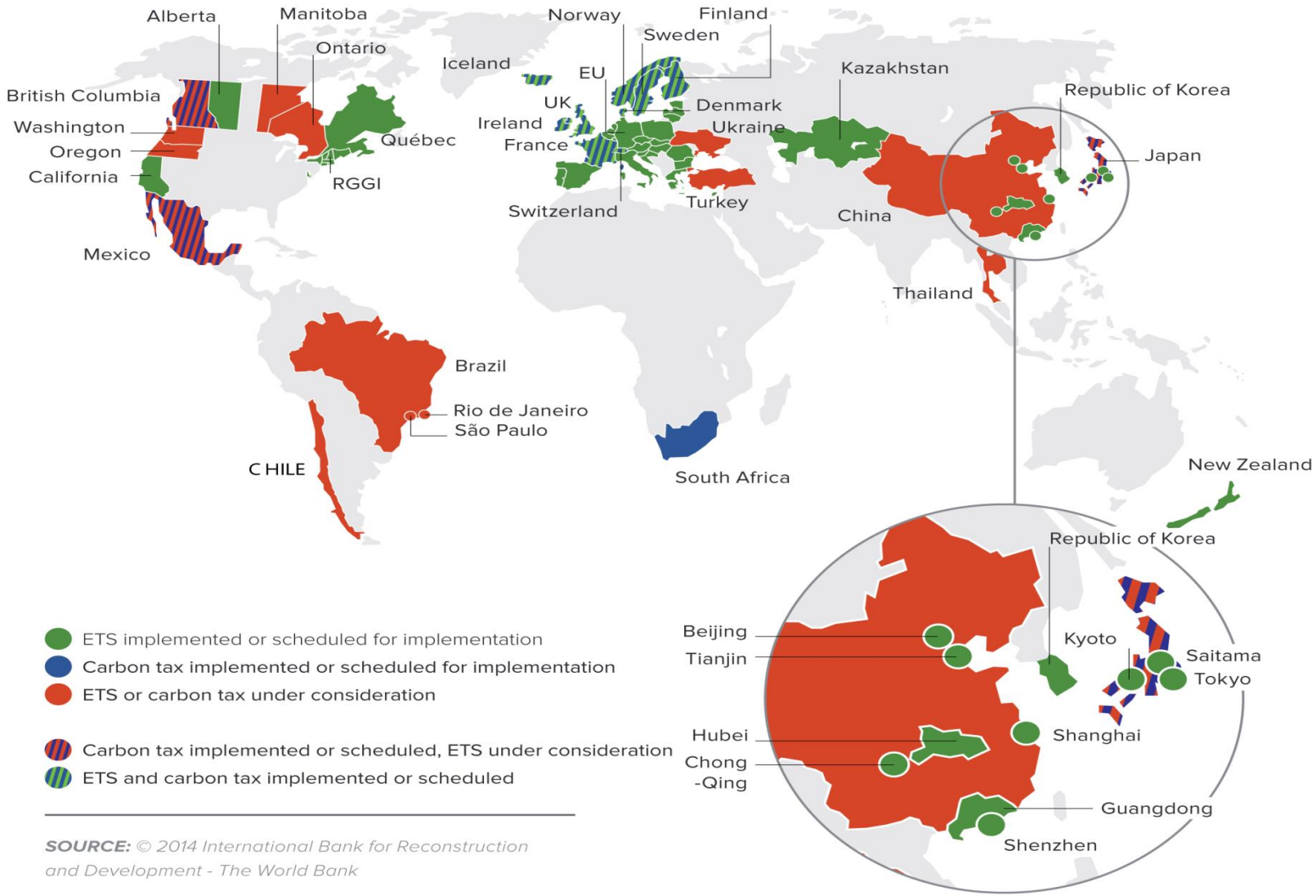
"Leveling the Playing Field for Low Carbon Coal"

- National Coal Council--A Federal Advisory Committee to the U.S. Secretary of Energy. The NCC provides advice and guidance on a continuing basis as requested by the Secretary of Energy on the general policy matters relating to coal

- Report issued the Fall of 2015
- Policy Parity http://www.nationalcoalcouncil.org/studies/2015/Leveling-the-Playing-Field-for-Low-Carbon-Coal-Fall-2015.pdf

Monetizing Carbon Emissions

International Carbon Markets



http://newclimateeconomy.report/economics-of-change

China Announces World's Largest Cap & Trade Program

http://news.discovery.com/earth/global-warming/china-announces-worlds-largest-cap-and-trade-program-150927.htm

- Sept 24, 2015 Chinese President Xi Jinping announced that China will develop a carbon trading system as a way to reduce the country's greenhouse gas emissions.
- The announcement, made jointly with U.S. President Barack Obama, comes as both countries prepare to strike a global carbon emissions agreement at the Paris climate negotiations in December. The U.S. and China are the top greenhouse gas emitting nations in the world.
- China plans to launch the world's largest emissions trading program in 2017, creating a carbon market for electric power generation, steel, cement and other industries producing most of the country's greenhouse gas emissions. The program is meant to complement the Obama administration's Clean Power Plan, which was finalized in August and aims to slash carbon emissions from electric power plants by 32 percent below 2005 levels by 2030.

France Seeks German Support for Carbon Emissions Floor Price

- French Environment and Energy Minister Segolene Royal plans a domestic floor price for carbon of about five times the current European level and hopes Germany and other European nations will follow.
- "The idea is that we decide on it together with Germany, and that we create a momentum for other European countries," Royal said Tuesday in an interview in Paris.
- The price, about 30 euros ($34) a ton, will be included in the finance bill for next year, she said.

http://www.bloomberg.com/news/articles/2016-05-11/france-seeks-to-convince-germany-to-mirror-30-euro-carbon-price

Global Storage Standards

- ISO work underway to provide a global standard for the use of captured CO_2 in EOR and storage.
- Kipp Coddington and US CO_2 EOR interests have been spearheading these efforts for the past several years.

Today

- We have a “Trifecta” of very cheap fossil fuels.
- At same time global movement to push fossil fuels away.
- Vello in his first 8 pages shows the size of using CCUS to provide CO_2 for US lower carbon energy independence--80 billion bbls not imported.
- Fred told us about the new political arena in Washington with the new Trump administration.
- Brad shows us the intense interest in Congress to find a process to advance CCUS.
- DOE through its research, partnerships and projects giving confidence to utilization and storage.
- Ongoing and constantly improving work on showing verifiable low carbon processes via “Life Cycle Analysis”
- US technology innovation constantly upping the ante.
- US political climate dramatically changed on November 8th.
- And so have the opportunities….

Astrup Fearnley

http://astrupfearnley.no/

- The Astrup Fearnley group represents over a century of history, growth and excellence in the area of shipping services. This fascinating legacy is a success story created by generation after generation of the Astrup Fearnley family. We believe it is a story worth telling.
- Fearnleys traces its history back to the year 1869 when its founder, Thomas Fearnley, established a shipbroking and agency business in Christiania, as the city of Oslo was known in those days. The little company soon prospered and engaged in, among others, the trade in lumber, wine, pitch and ice.
- In connection with its trading activities the company bought shares in vessels and chartered vessels. Although the company began by chartering sailing vessels, by 1880 the age of the steamship had clearly begun. By 1881 the partnership of Fearnley & Eger established the Christiania Steamship Company which contracted two newbuildings at the the Kockums Shipyard in Malmø, the 1235 deadweight 'Oslo' and the 1215 deadweight 'Bygdøy'.
- By the end of the 1880s the company had contracted a further six units. In the beginning of the 1900s Fearnley & Eger became, more or less, a shipowning company and invested in ever larger units. The company engaged in both liner and tramp activities and survived the two world wars. In addition to these shipowning activities, the firm continued to engage in developing its skills in the area of shipping services and was engaged primarily in the area of dry cargo shipbroking. As the tanker industry started to develop at the beginning of the 20th century, Fearnleys became enthusiastically involved in this new field of endeavour. Later on, when the transportation of gas by sea became an important area of commerce, Fearnleys developed a broking department which specialized in this new commodity. All in all, the history of the company has been closely focused on the concept of innovation; whenever new ideas and new industries developed which required seaborne transportation, Fearnleys was quickly on the scene.
- As the 20th century progressed, the need for brokerage services for the transportation industry became so great that Fearnleys began to develop these (along with related ancillary services) as its principal business area. Always on the cutting edge of new trends, the company became involved in car carrier transportation in the 1960s, offshore and rig broking in the 1970s, coinciding with the onset of the development of the Norwegian continental shelf offshore oil fields, and energy trading and financial services in the 1980s. Fearnleys was also a pioneer in the development of transportation industry research and consultancy services, and has been involved in monitoring and analysing shipping markets since the early 1960s when Fearnresearch was first established. Now at the dawn of the 21st century the little company which started in Christiania in 1869 is firmly established in every corner of the world and assumes a global perspective on transportation much to the benefit of its worldwide customer

Shipping	Offshore	Energy	Finance
 Shipping is one of the group's major business areas.	 Fearnley Offshore and Fearnley Offshore Supply offer future-oriented broking and advisory services in the growing offshore sector.	 Libra Fearnley Energy AS is a sizeable participant in the oil broking market through its affiliates in Paris, London, Houston and Singapore.	 Fearnley Finans AS and Fearnley Securities AS offer a wide array of financial services

Questions & Thank You!

Michael E. Moore

- VP Energy Commodities and Advisory Services
- FearnOil Inc. (a division of Astrup-Fearnleys)
- http://astrupfearnley.no/

- mmoore@fearnoil.com Tel: 281-759-0245

FearnOil Inc. Astrup Fearnley

LCA CCUS

How Green is My Oil?
A Detailed Look at Carbon Accounting for CO_2-EOR Sites

Nicholas A. Azzolina and David V. Nakles (The CETER Group, Inc.)
Wesley D. Peck, John A. Hamling, and Charles D. Gorecki (EERC)
L. Stephen Melzer (Melzer Consulting)

Presented at the
21st Annual CO_2 Flooding Conference

December 8, 2015

Midland, Texas

Given 12-8-15 Midland Texas CO_2 Conference Week on the "Life Cycle Analysis of CO_2-EOR/CCUS