EOR CCS Incentives:

Win for environment, economy, security, treasury

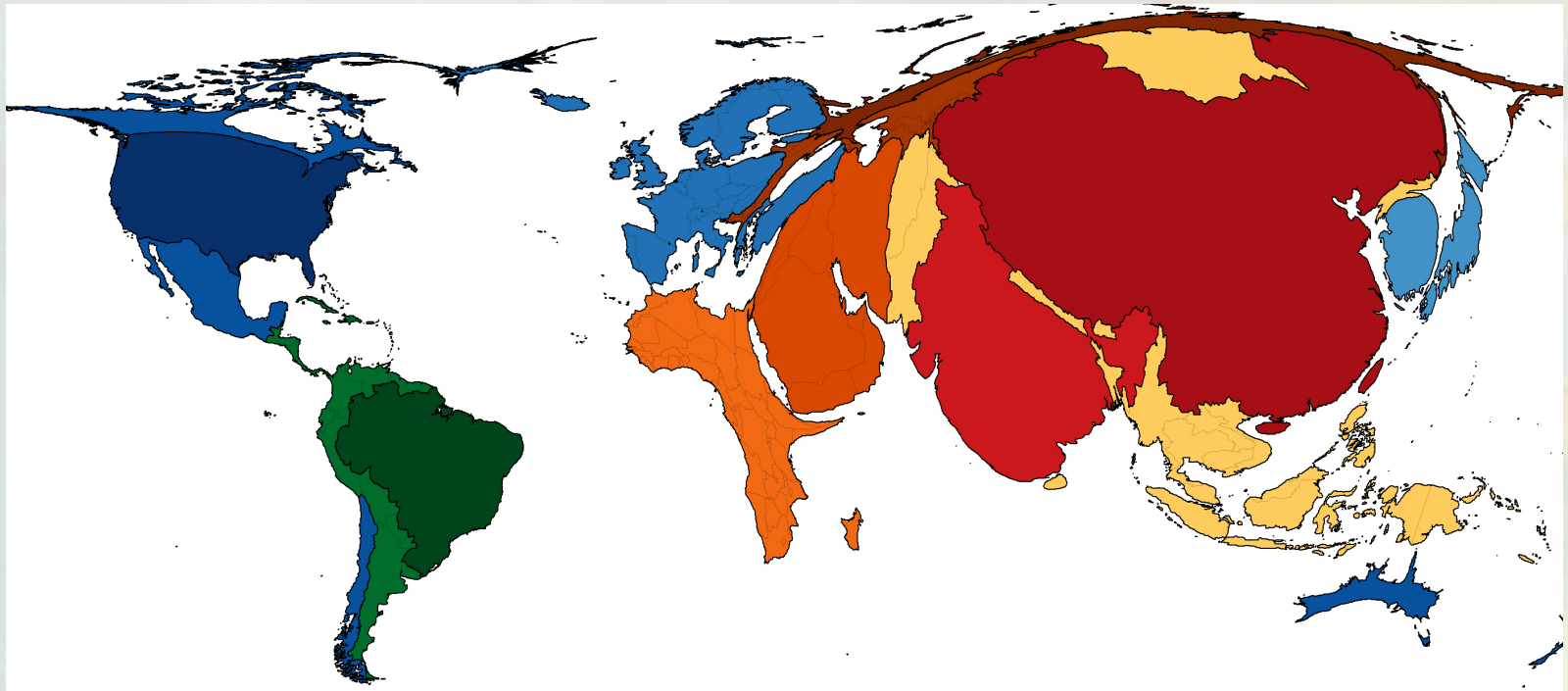
Kurt Waltzer
Clean Air Task Force
IOGCC Midyear Meeting 2012
Vancouver, BC

Overview

CLEANAIR TASK FORCE

- In order to address climate change, CCS must be globally affordable
- Scale is the key to drop costs
- The Value proposition for EOR-CCS
- Recommendations from the National EOR Initiative

Most of the World's Energy Growth is not in the US and Europe



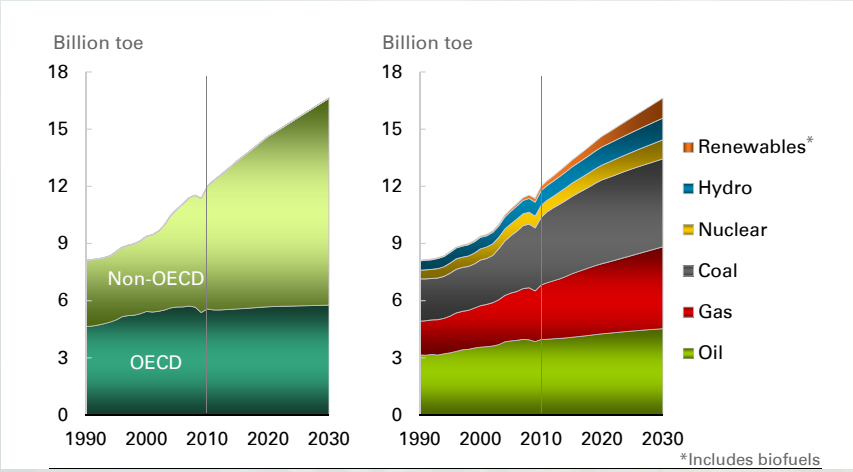
Increase in Global Energy Demand 2010-2035

Source: U.S. Energy Information Administration (EIA), International Energy Statistics database (as of March 2011), website www.eia.gov/

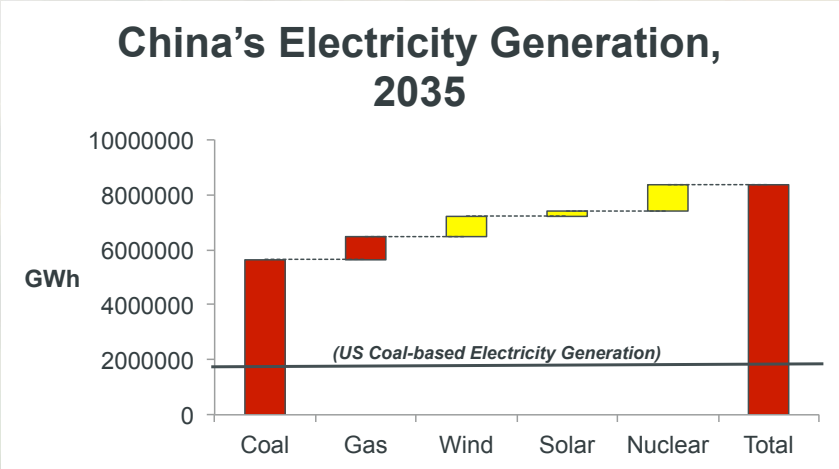
Affordable CCS for Coal will be Crucial for countries like China and India

CLEANAIR TASK FORCE

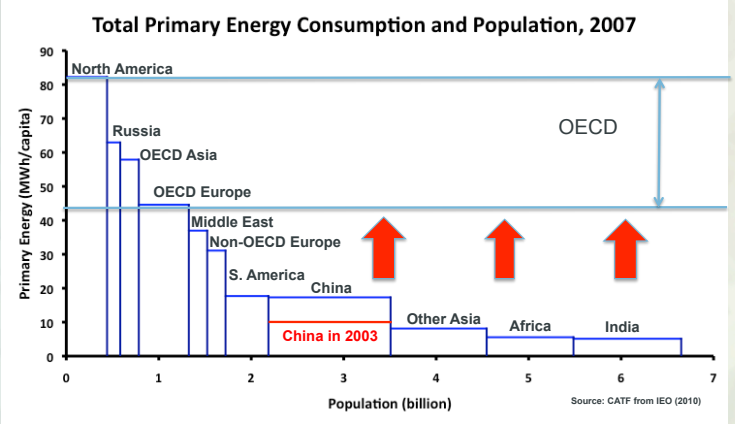
Fossil fuel use will increase, driven by developing country demand



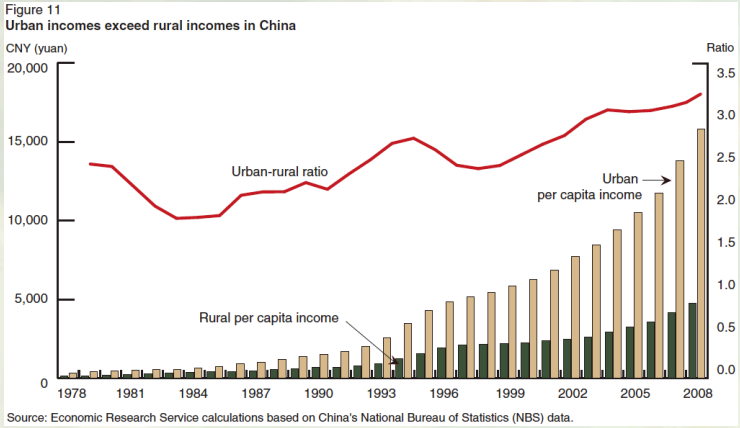
China will have 3X the current level of US central-station coal plant emissions for the several decades



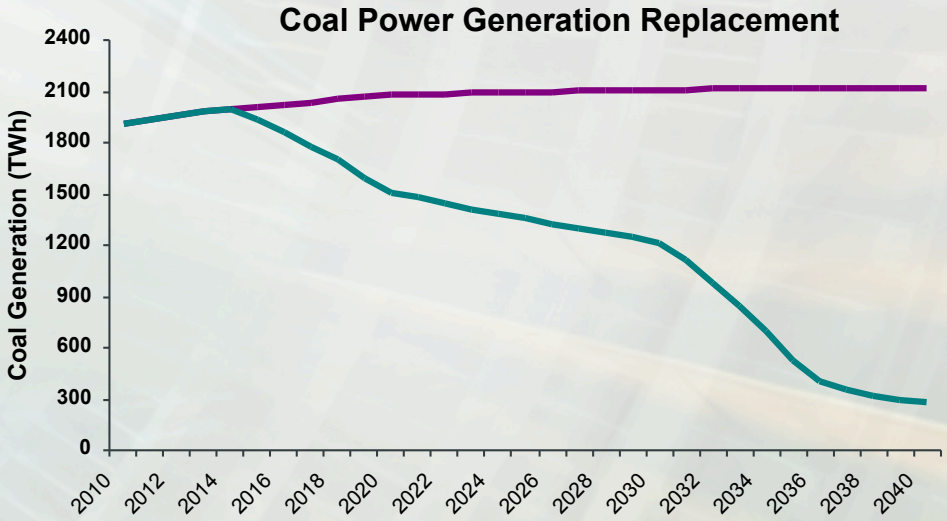
….India and the remaining developing world won't be far behind

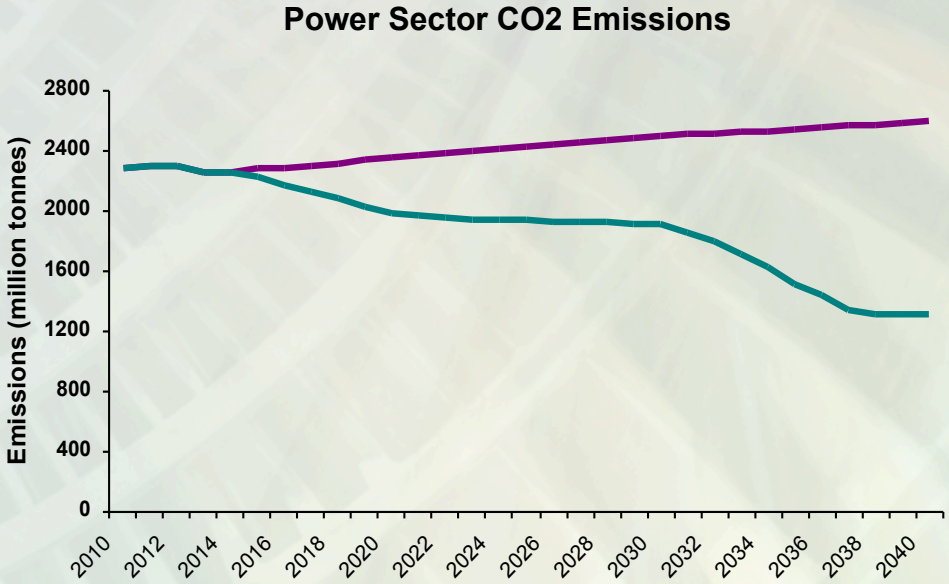


Affordability is the key: Affordable power pulled $500M people of of poverty in China



In the US, moving from coal to gas power still leaves a need for Ccs





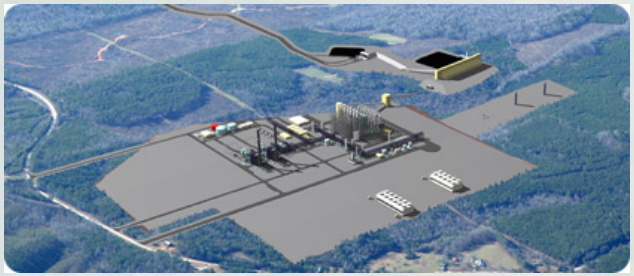
Source: NorthBridge Associates
Assumes $25 carbon price, $5.25/mmbtu 2018

Replacing Coal with Gas (no CCS) in the US leaves half the CO2 on the Table

Coal With CO_2 Capture Capture (And Sequestration) Is Commercially Available

Dakota Gasification, Beulah, ND

- Built as part of US Synfuels program; now fully paid off
- 18,500 tons per day of lignite converted to substitute natural gas
- 3 million tons of CO2 per year captured and transported by pipeline to Weyburn for EOR



Plant Ratcliffe, Kemper County, MS

- Under Construction Groundbreaking- Dec 2010
- 65% capture, to be used for EOR
- 582 MW
- Plant Cost: $2.4 billion

Searles Valley plant (coal utility boilers)

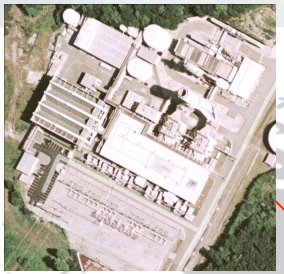
- Amine-based process operating since 1978
- 900 tpd / 270,000 tpy CO2 removal - equivalent to approximately 35 MW
- CO2 used for soda ash

There Is Even More Industrial Experience With CO_2 Capture From Natural Gas Exhaust

CLEANAIR TASK FORCE

==> Now Flour Corp. says their PCC is "ready for full scale deployment" in gas-fired power plants

==> MHI also says they are "ready to go" and offering NGCC with CCS "on a commercial basis"



Bellingham, MA NGCC

NGCC ~350 tpd (~50MWe)

Boiler ~1000 tpd

Boiler ~175 tpd

Boiler ~175 tpd

Boiler ~450 tpd

Boiler ~175 tpd

Boiler ~330 tpd

Boiler ~400 tpd

Boilers ~4x450 tpd

Boiler ~240 tpd

Boiler ~200 tpd

Boiler ~100 tpd

Lubbock, TX gas electric power boilers

200 T/D Malaysia 1999 | 330 T/D Japan 2005 | 450 T/D India 2006 | 450 tpd India 2006 | 450 T/D India 2009 | 450 T/D Bahrain 2009

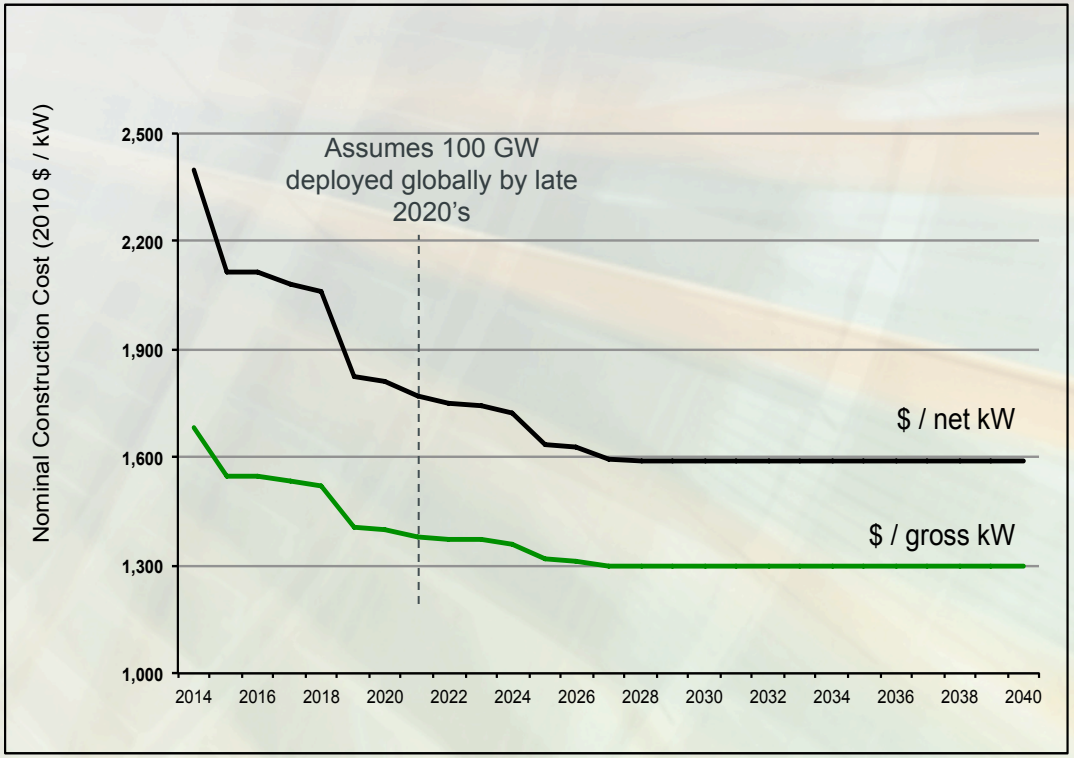
"Boiler" is gas reformer outlet, ~68% v/v N2, 22% H2O, 8% CO2, 1% O2

Source: CATF from DOE and MHI (open circles no longer operating)

But driving Costs Down will Require Deployment at Scale

CLEANAIR TASK FORCE

- Deployment is necessary to drive CCS costs down
  - 100GW will drop post combustion capture capex a projected 30%*
  - High levels of deployment will drive more R,D&D into the commercial pipeline
  - Lower cost suppliers (e.g. China) will enter the market

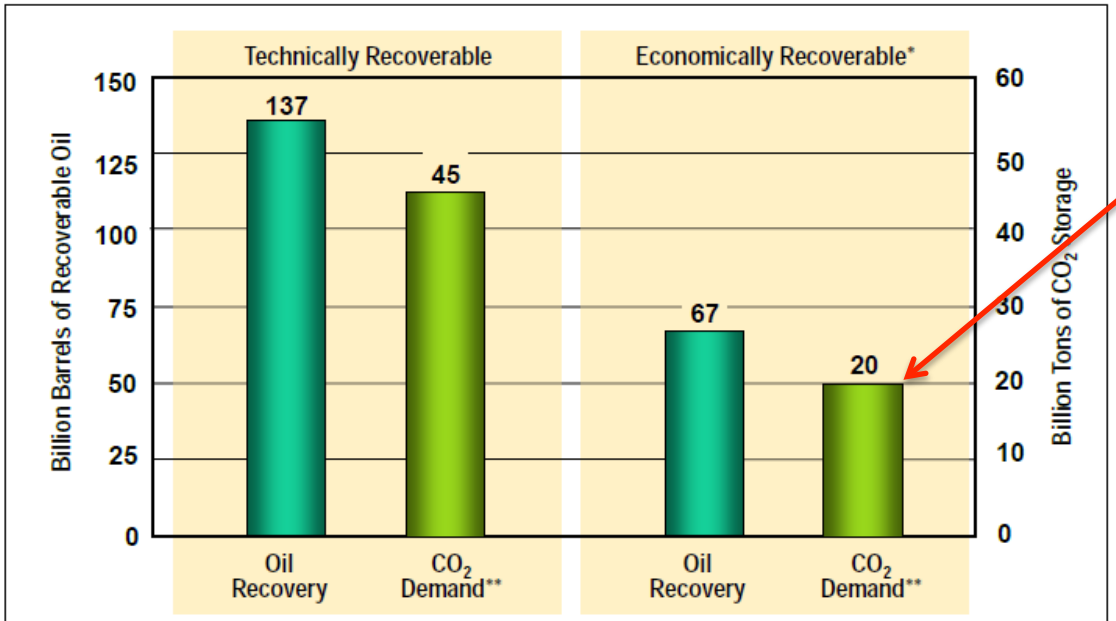


Source: NorthBrdige & Associates

*2014 cost estimate is for a scale "Nth" unit,
not a first-of-a-kind demonstration project.

CO2 EOR Demand Can Meet the "Scale" Challenge

Figure II-4. Domestic Oil Supplies and CO_2 Demand (Storage) Volumes from "Next Generation" CO_2-EOR Technology**



*At an oil price of $85/B, a CO_2 market price of $40/mt and a 20% ROR, before tax.
**Includes 2,300 million metric tons of CO_2 provided from natural sources and 2.6 billion barrels already produced or being developed with miscible CO_2-EOR.
Source: Advanced Resources Int'l (2011).

JAF028247.PPT

Recent NETL study estimates economic EOR as equivalent to thirty years of the CO_2 emissions from 93 GWs of coal plants (about 1/3 of the U.S. coal fleet).

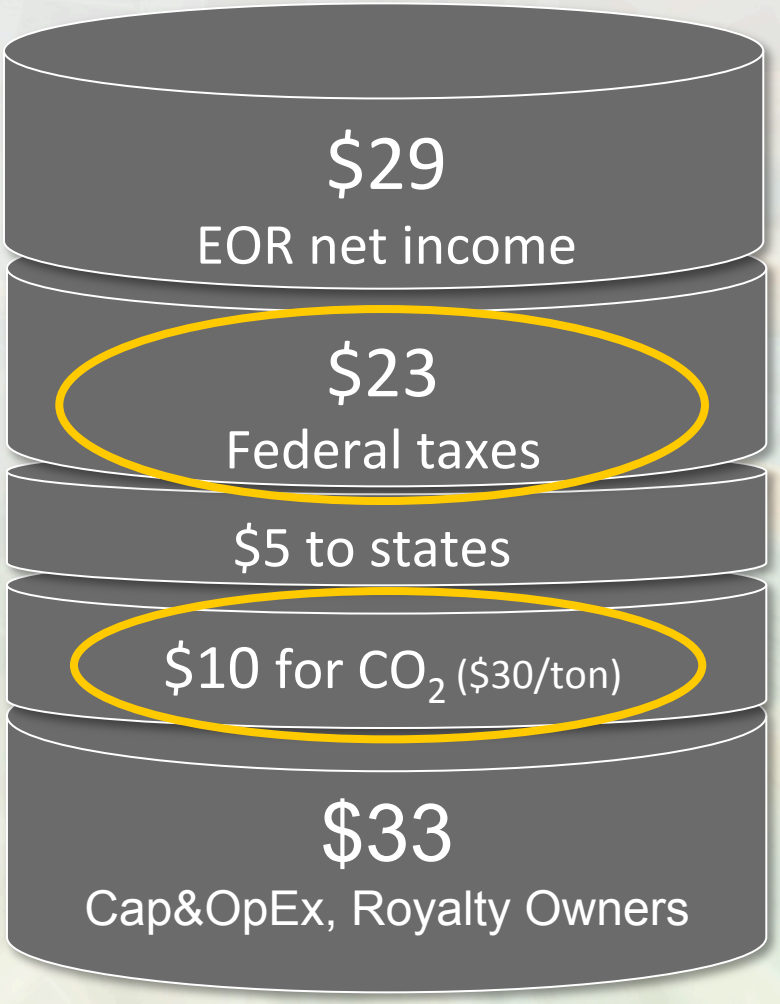
The Value Proposition in US for EOR CCS

CLEANAIR TASK FORCE

Simple Illustration

- 3 barrels of oil produced by 1 ton of CO2
- $69 in additional tax revenues per barrel of oil
- $30 per ton of CO2 to supplier
- Supplier (power plant) cost CCS costs: $90/ton

- $60 tax incentive and $30 CO2 cover supplier cost
- Leaves $9 additional tax revenue



$100

Source: Advanced Resources international

National EOR Initiative

- Collaboration of ENGOs, coal, gas, bioenergy, and oil companies, and labor unions

- Recommended self-financing federal production tax credits to:
  - Drive CCS technology deployment
  - Increase domestic CO2 supply
  - Increase domestic oil production

- ***Win, win, win:*** GHG reduction, national security, economic development

Participants:
- Air Products, Inc.
- AFL-CIO
- Arch Coal, Inc.
- Archer Daniels Midland Co.
- Basin Electric Power Cooperative
- Clean Air Task Force
- Enhanced Oil Recovery Institute, University of Wyoming
- GE Energy
- Natural Resources Defense Council
- Ohio Environmental Council
- Southern Company
- Summit Power
- Tenaska Energy
- United Transportation Union
- Wyoming Outdoor Council

Observers
- Chaparral Energy LLC
- Core Energy, LLC
- Interstate Oil and Gas Compact Commission
- North American Carbon Capture and Storage Association

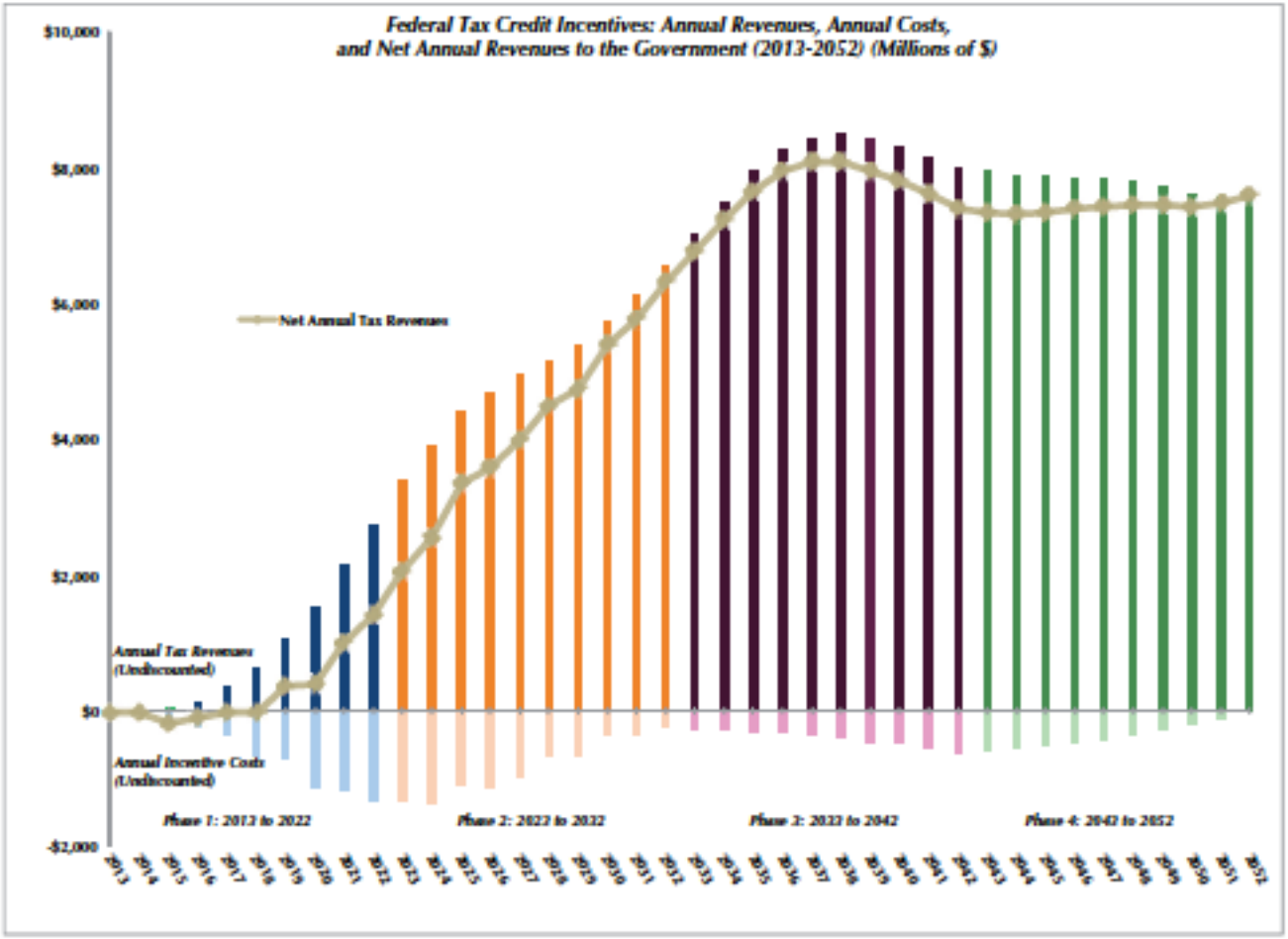
Incentive Recommendation

CLEANAIR TASK FORCE

- 45Q “fix”: ability to register credits and trade along the chain of custody
- Expanded production tax credit:
  - Proposes a 10-year, production tax credit for carbon dioxide (CO_2) capture and transport allocated through a competitive bidding process.
  - Bidding process organized into tranches and sub-tranches, and the bidding qualifications for each tranches and sub-tranches.
    - Pioneer commercial-scale
    - Power
    - Industrial
  - Credit reservation (to facilitate project investment)
  - De-certification resulting from lack of progress

Net Federal Revenue Through Adoption Of EOR-CCS Incentive Recommendation

- Pays for itself within 10 years through increased federal revenues.
- Estimated net return of $100 billion (NPV) over 40 years.
- Reduces the trade deficit by saving the United States about $610 billion over the same period.



Source: NEORI, 2012