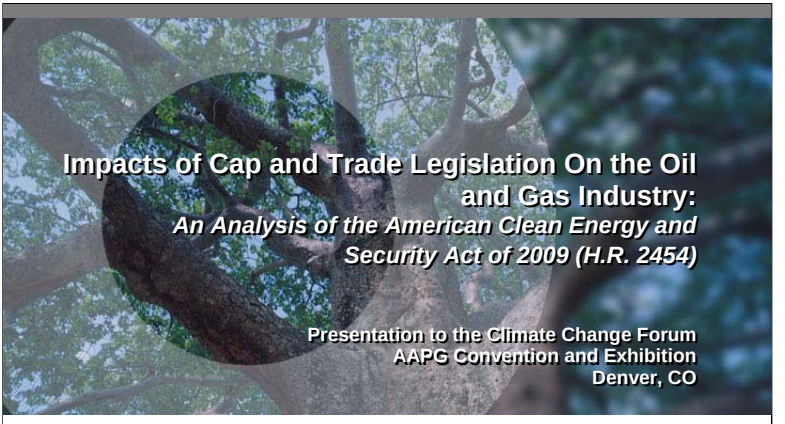

Impacts of Cap and Trade Legislation On the Oil and Gas Industry:

An Analysis of the American Clean Energy and Security Act of 2009 (H.R. 2454)

Presentation to the Climate Change Forum
AAPG Convention and Exhibition
Denver, CO

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June 7, 2009

- **Political and Market Uncertainties of Cap & Trade**
- How We Modeled H.R. 2454
- Macroeconomic Impacts of H.R. 2454
- Fossil Energy Impacts of H.R. 2454
- Major Drivers Affecting the Impact of Cap & Trade

While political uncertainties exist now, market uncertainties will remain even if cap and trade is implemented

Political Uncertainty

When and how will different countries act on climate policy?

- Timing of action
  - How much and by when?
- Regulation vs. legislation
  - EPA regulation under Clean Air Act
  - "Energy bill" regulations
  - Market based approach to climate
- Market based climate policy mechanisms
  - Cap & trade vs. tax or hybrid system
- Design of the policy
  - Cost containment mechanisms -- banking, offsets, price caps, etc.
  - Coverage of emissions and emitters
- International negotiations
  - Willingness of developing countries to act
  - Pressure on US to make commitments

Market Uncertainty

When and how will financial, economic, and technological developments impact prices?

- Energy markets
  - Long run uncertainty about the carbon price expected under a cap
  - Short run volatility when hard caps run into unpredictable changes in emissions
  - Hedging against carbon price volatility
- Technological developments
  - Timing of technology innovation, development and deployment
  - Cost and performance of new technology
  - Constraints in ramping up infrastructure needed for low to zero carbon technologies
  - Likelihood of adequate basic research
- Finance/economics
  - Likelihood of mistakes in investment decisions because of long run uncertainty
  - Costs of managing increased market volatility
  - Option value of waiting versus early action

CRA INTERNATIONAL

Presenter's Notes: The risks associated with global warming are drawing increased attention and governments are developing policies to curb greenhouse gas emissions.

Will EPA regulate before our elected officials can agree on a policy?

Could a hybrid system be the answer to dealing with uncertainty and volatility associated with a cap and trade?

Will inaction by China, India, and other developing countries derail the process?

How will energy markets respond due to price uncertainty and volatility? Wait-and-see resulting in lower investment thus excerbating the volatility?

Will CCS, energy storage, renewable cost declines, smart grid, and advancements in energy efficiency keep pace with declining cap?

How will global economics impact emissions and willingness to accept costs associated with reducing emissions?

How the debate and ACESA have evolved

Focus on cap and trade but…

- Increasing industry support for carbon tax even though the political process has remained focused on cap and trade (and almost unanimous support by economists)
- Increasing regulatory ("energy") detail has been added (e.g., RES, specific efficiency standards, technology mandates and subsidies)
- EPA regulation under Clean Air Act (*Mass. v. EPA)* or further litigation a wild card

Battle over allowances

- First salvo was nearly 100% auction with some rebates for trade vulnerable industries
- Backed off to compensate electricity, natural gas consumers and others
- Oil refiners receive 2% of allowances, and there is no Federal LCFS
- Nearly 100% free distribution of allowances opens door to protracted battles over reallocating allowances to additional constituencies

Uncertainty about passage

- Democrats representing energy-producing and heavy industry regions provided enough votes to move bill out of Committee – by getting free distribution of allowances to their constituents
- Republican opposition remains and other claims on allowances will appear
- Possible modification and extended debate in Senate – e.g. until 2010 even without filibuster
- Competing legislative priorities – e.g. health care
- Questionable WTO status of border protections

Presenter's Notes: Pro-tax: large utilities, integrated oil companies, and industrial conglomerates.

Regulatory detail has been added to the bill. While reducing CO2 prices, the layering on of regulatory provisions increases overall costs.

Who gets allowances will the biggest issue to derail the process of enacting cap and trade. There are too many winners and losers even within the same sectors (e.g., nuclear intensive utilities vs. coal intensive utilities).

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Major Drivers Affecting the Impact of Cap & Trade

CRA INTERNATIONAL

What we analyzed in our report

Provision	Details
Combined efficiency and renewable electricity standard	• Required specified percentages of a baseline level of electricity sales to be met with qualified renewable resources • 20% by 2020 (5% through energy efficiency) • Baseline level excludes certain existing hydroelectric generation, sales from small LDCs and generation from new nuclear and carbon, capture and storage units

Greenhouse gas cap & trade	• Cap on covered emissions from 2012-2050
	• Allows banking/borrowing
	• Annually allows for up to 2 billion in offsets (split between domestic and international offsets)
	  • Split between domestic and international offsets: 1 billion each
	  • If domestic offsets are not fully utilized (1 billion), there is a provision allowing for 1.5 billion international offsets

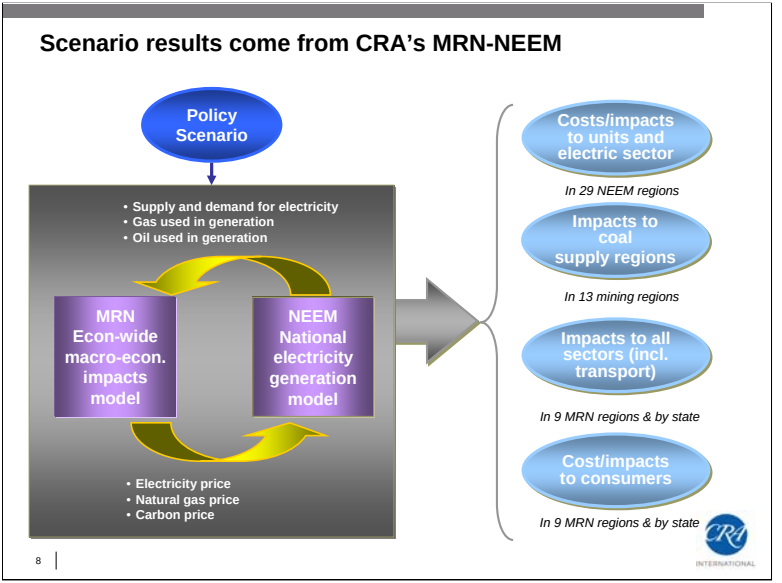
Allowances for carbon capture and storage (CCS)	• Funds from allowances are used to bring online 3 GW of new CCS in 2020
Allocations provisions and revenue recycling	• Regional and U.S. welfare impacts reflect ACESA's provisions for free allocations to industries and utilities for consumer rebates, for investments in CCS and adaptation. All auctioned revenues are recycled to U.S. consumers.

Four policy scenarios were developed to illustrate the uncertainty in policy costs

Input	Low Cost	Reference	High Cost
Electricity Demand	AEO09 April Release (0.90% 2010-2030 CAGR)	AEO09 Early Release (1.00% 2010-2030 CAGR)	AEO09 Early Release + Difference from April Release
Natural Gas Prices	Same as Reference	AEO09 Early Release through 2030, with a 2050 wellhead target of $9/MMBtu (in 2003$)	Same as reference
Demand Elasticity	Higher demand elasticity	CRA Standard	Lower demand elasticity
Low-Carbon Fuel Transportation Technology	Reduce zero- and low-carbon alternative fuels down to cost parity with motor gasoline	CRA Standard	Assume no zero-carbon fuel available
Capital Costs for New Generating Technologies	Same as reference	AEO 2009 Early Release, save for nuclear (public filings) and geothermal (EPA NEEDS 2006)	Flat-line costs at first-year AEO 2009 Early Release
CCS Capacity Limits	270 GW by 2050	180 GW by 2050	Same as reference
Nuclear Capacity Limits	EPA W-M (266 GW by 2050)	206 GW by 2050	Allow existing nuclear fleet (103 GW) to be replaced, but no more
Offsets	Same as reference	Wealth transfers out of U.S. from international offset purchases priced at marginal cost of international offsets	Wealth transfers are priced at CO_2 allowance price; no international avoided deforestation offsets

- A fourth scenario "No International Offsets" also was modeled to illustrate how CO2 prices would change from the Reference if there were no international offsets available

Presenter's Notes: High Cost: The idea was that the same kind of countries that refuse to give oil and gas leases unless they get a very large share of the rents are the countries that would be allowing offset projects -- and likely to make the same kind of demands.



Presenter's Notes: MRN is a a general equilibrium (or top-down) model of region-specific impacts and regional interaction in the U.S. economy.

NEEM, a an investment and technology decision-based linear programming (or bottom-up) model, simulates a competitive electricity market for the continental United States. NEEM minimizes the present value of incremental costs to the electric sector while meeting electricity demand and complying with relevant environmental limits.

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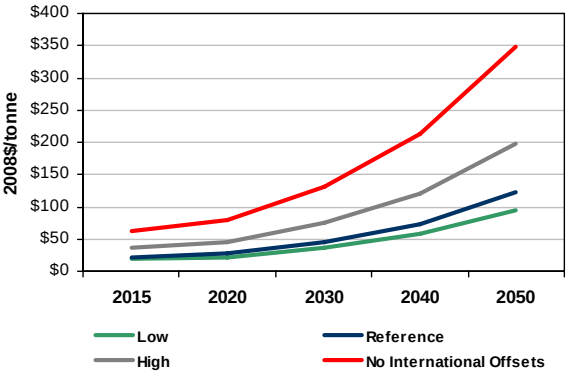
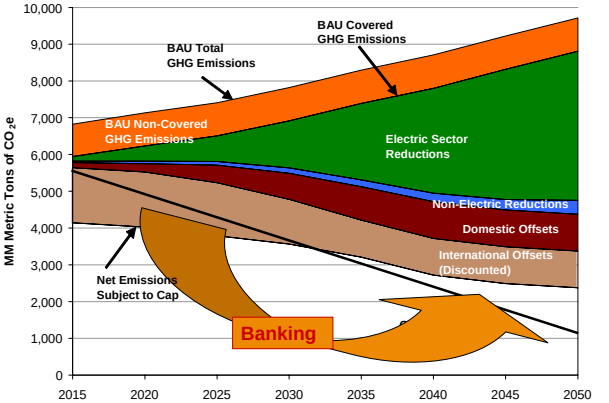
Major Drivers Affecting the Impact of Cap & Trade

The wide range in forecasted CO_2 prices is indicative of the price uncertainty associated with a cap and trade policy



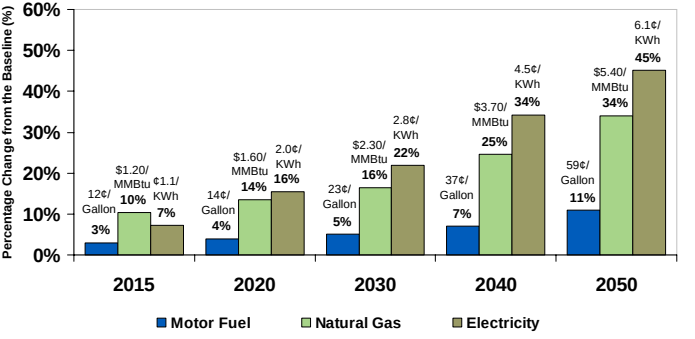
Source: CRA Model Results, 2009

Sources of emission reductions in reference case



Source: CRA Model Results, 2009

Potential impacts on energy prices to households, inclusive of carbon costs



Note: Absolute values are shown in 2008$

Source: CRA Model Results, 2009

Why such small effects on petroleum markets?

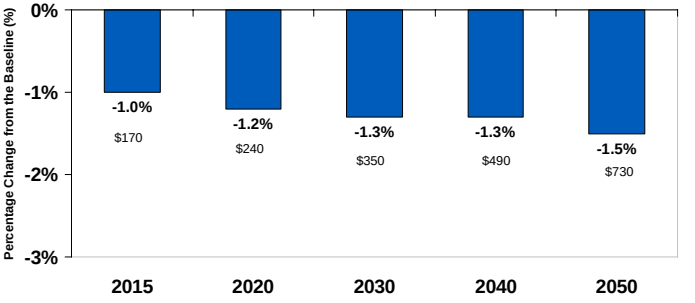
Offset provisions hold carbon prices are too low to stimulate incremental production of low- to zero-carbon transportation fuels

- The same amount of biofuels would be consumed in a business-as-usual scenario as in a policy scenario with a binding carbon cap
- Ambitious biofuels production mandate set forth in the Energy Independence and Security Act of 2007 (EISA 2007) are the main drivers of the amount of biofuels consumed

Prospects for biofuels production are the largest uncertainty in impacts on the petroleum sector

- A federal LCFS would force biofuels production above the EISA 2007 mandate
- Higher carbon prices due to limited offsets would drive up prices of petroleum fuels and provide an incentive for biofuels development and production

GDP impacts relative to no climate policy



Note: Absolute values are shown in Billions of 2008$

Source: CRA Model Results, 2009

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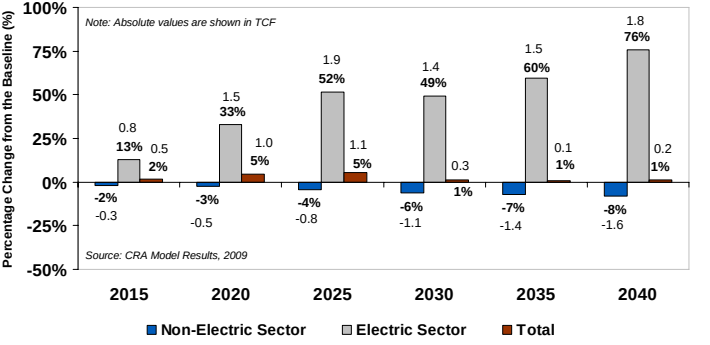
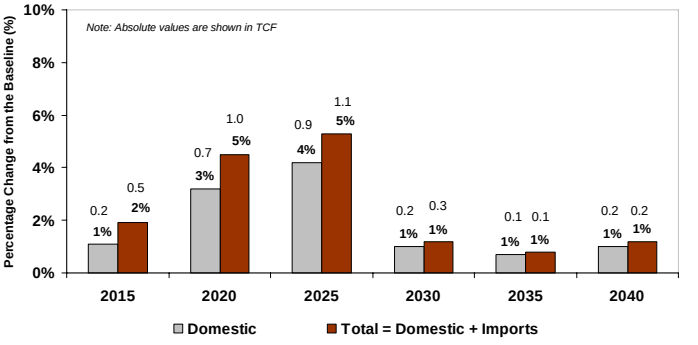
Major Drivers Affecting the Impact of Cap & Trade

Increased natural gas demand in the electric sector is mostly offset by the non-electric sector through 2040



(relative to EIA forecast of relatively flat demand)

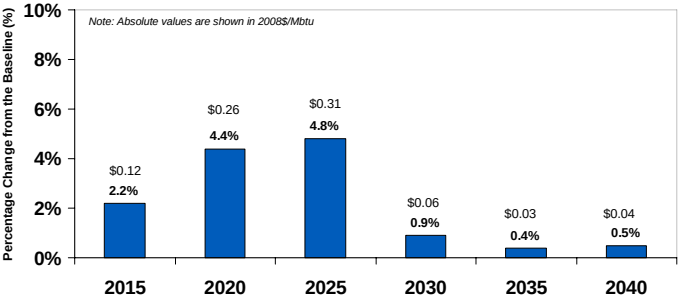
Domestic production is forecasted as the primary source for meeting increased natural gas demand



Source: CRA Model Results, 2009

(relative to EIA forecast of flat domestic production with only 4.2 TCF production from gas shales in 2030)

Impact on natural gas wellhead prices



Source: CRA Model Results, 2009

(relative to EIA forecast of natural gas prices rising to about $10 at Henry Hub in 2030)

Overall energy market picture resulting from ACESA if all international offsets can be utilized

The majority of emissions reductions by 2050 (63%) would come from the electric sector with the non-electric sector contributing to only 5%

Major contributions to emission reductions in the electric power sector would come from natural gas, CCS, and nuclear

- Gas demand in the electric sector would increase by almost 80% above the baseline by 2040, but overall demand barely change from the baseline due to offsetting reductions in the non-electric sector
- Nuclear and CCS would begin to provide large reductions in 2025 - 2030

Minor reductions in demand for domestic crude production and imports due to generous offsets

- Low- to zero-carbon transportation fuels would not increase relative to the baseline due to EISA 2007 mandates and the lack of an LCFS

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Major Uncertainties in the Analysis

Risk factors that could significantly impact the results of the analysis, especially for natural gas and oil

Limited use of international offsets, either through legislative measures and/or lack of availability, would encourage more use of natural gas for electricity and reduce petroleum product demand

- Highly likely due to institutional constraints on adequate assurances of permanence, verifiability and additionality in most supplier countries

Inclusion of an LCFS would force biofuel consumption at the expense of petroleum fuels

Adopting binding renewable electricity standards would force in costly renewables at the expense of gas

With a clean market-based policy that let energy sources compete on their carbon content and economics the picture could be very different

- Depends on whether the promise of gas from shales is fulfilled
- Considerably more gas could be available at much lower prices than assumed in these scenarios
- Costs of near term reductions in greenhouse gas emissions could be reduced and markets for natural gas greatly increased relative to this picture

Prospective developments in gas from shale suggest a much larger role for natural gas

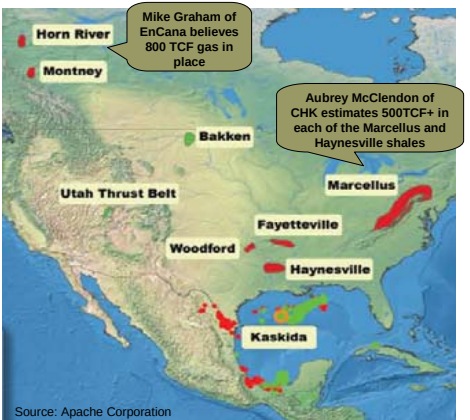
With a favorable regulatory environment, the industry could improve its position further from that described in our model results

- New technologies have revealed an enormous resource of unconventional gas in shale formations accessible at lower costs than previously envisaged
- Domestic gas should be able to compete effectively with imports and increase its share of demand growth above model results
- Further, domestic natural gas might be able to capture power market share through NGCC units in competition with coal plants at predicted CO2 costs
- In the long term, NGCC with CCS could win over coal based IGCC with CCS at high CO2 costs

Requires that gas from shale proves to be available in large quantities and keep domestic gas prices in the ~$8 range through 2050

Presenter's Notes: Existing gas-fired capacity is operating at an annual 20-25% capacity factor while coal is operating around 75%. There are over 400 GW of gas-fired capacity vs. over 300 GW of coal-fired capacity.

Large fields discovered in 2003-2008 include several shale gas fields, leading to hopes for large supplies and low prices



Source: Apache Corporation

Barnett Shale

5 TCF cum

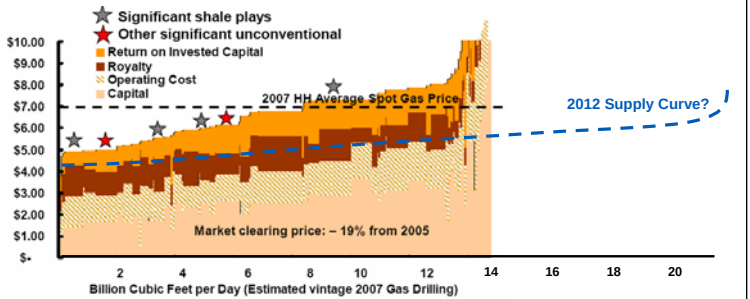
25-50 TCF EUR

8% US production

Will one of these become the largest US gas field?

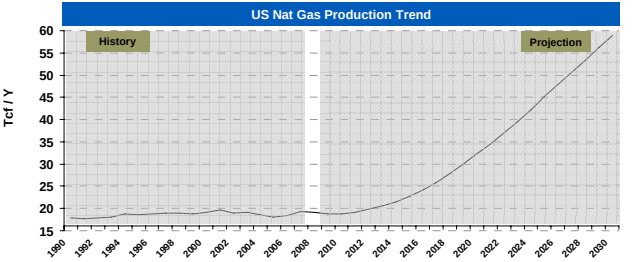
- **Haynesville**
- **Marcellus**

New technology has flattened the supply curve for unconventional gas to levels that could support much greater use to back out coal



Source: JS Herold, CRA estimates

US natural gas resources, technology and costs could enable rapid growth in production



- **Strong technological advance in horizontal drilling and completions in unconventional tight sands and shale plays, along with higher prices has abruptly turned around the prospects for domestic US natural gas production**
- **According to CRA models, the current rig fleet is sufficient to allow rapid growth over the next two decades**

Source: Historical figures from IEA, forecast CRA Internal Models

Implications of climate policy for oil and gas production

Natural gas can make a substantial contribution to GHG mitigation

- An additional 10 TCF annually by 2020 could allow closure of 200 GW of coal plants, reducing GHG emissions by 840 million metric tons per year, or 12% of total GHG emissions in 2007.
- How would natural gas compete with coal with CCS in the 2020 – 2040 time frame if shale gas is abundant and low in cost?

Climate policies could increase natural gas prospects if carbon prices are kept low by offsets and other "energy" mandates do not rule it out

- One superpad can substitute for >150 single well sites
- Recycling of drilling and completion fluids can address water use and contamination

Threats

- Natural gas would be hindered by renewable fuel and low carbon fuel standards that forced uneconomic renewable and electric vehicle technologies into the market
- Petroleum demand would be threatened if international offsets are less readily available or LCFS mandated force transportation to biofuels
- Oil and natural gas production are also vulnerable to proposed tax changes, notably ending the expensing of intangible drilling costs, and limits on access

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