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Shale Gas, Carbon Pricing and Petro-Politics: The Changing Geopolitics of Natural Gas

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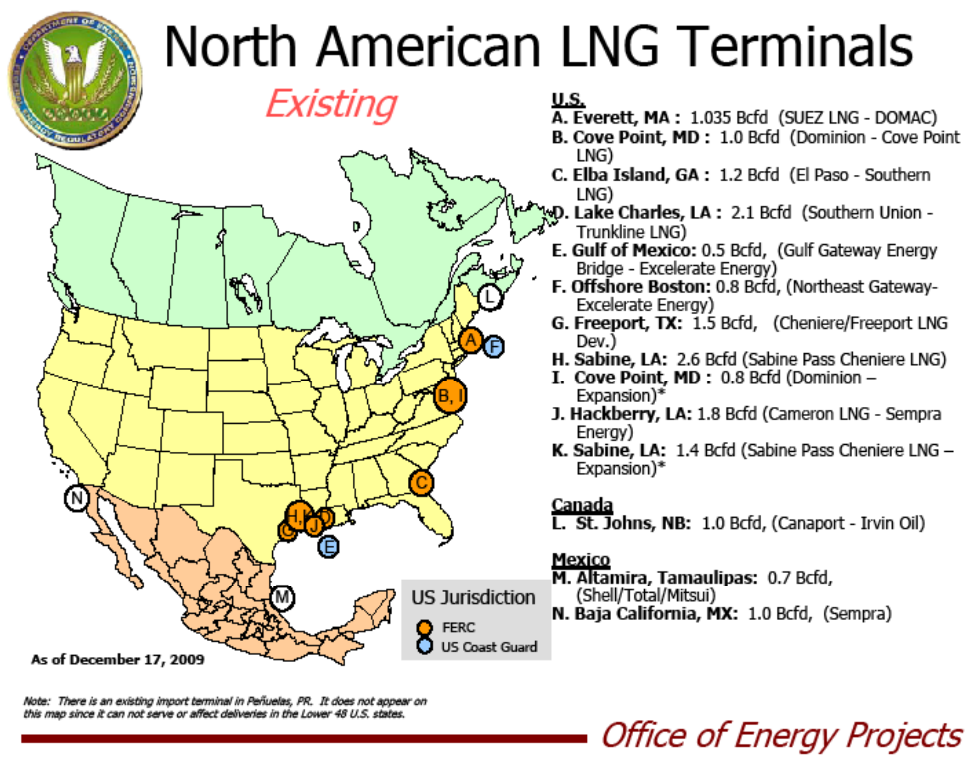
Changes Always Come After A Price Spike Cycle Peak

- In past cycles, demand growth has not returned to the same growth pace as soon as the global economy bounces
- Demand slump leads to supplemental OPEC spare capacity which in the past has capped prices
- This cycle was accompanied by expansion into market of financial players who are investing in oil commodity markets based on stimuli other than oil market fundamentals
- High prices tends to stimulate new resource plays in high cost resources, followed by cost reductions in those plays based on technology advances and experience
- High prices usher in new energy efficiency gains and technologies
- Energy efficiency gains may come also in the developing world
- Emerging U.S. energy and climate policy driven by generational change and could lower U.S. oil demand over time, while potentially increasing demand for natural gas

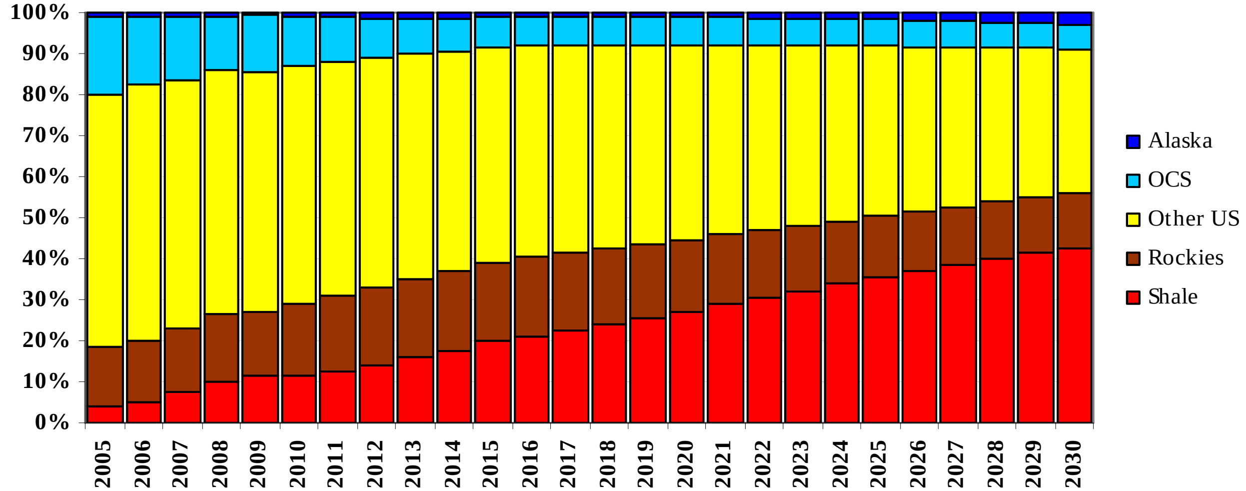
A Paradigm Shift

- **The view of natural gas has changed dramatically in only 10 years**
  - **Most predictions were for a dramatic increase in LNG imports to North America and Europe. Today, growth opportunities for LNG developers are seen in primarily in Asia.**
- **LNG share may only grow to about a third of global market by 2025 instead of the 50 % previously expected versus a mere 5% in the 1990s**

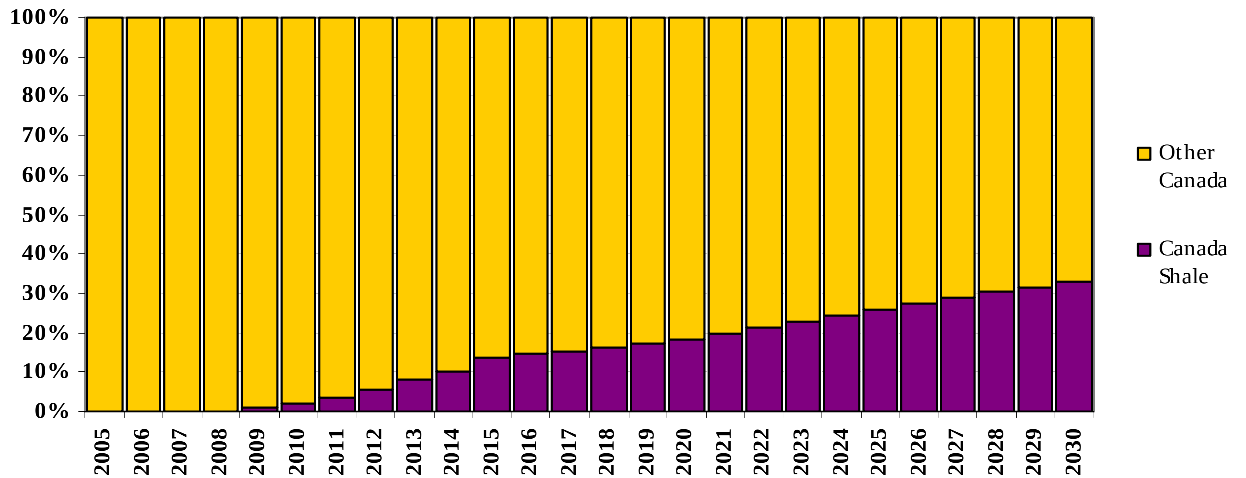
- Since 2000, 2 terminals were re-commissioned and expanded (Cove Point and Elba); 9 others were constructed.
  - In 2000, import capacity was just over 2 bcfd; It now stands at just over 17.4 bcfd.
  - By 2012, it could reach 20 bcfd.
- A similar story in Europe
  - In 2000, capacity was just over 7 bcfd; It is now over 14.5 bcfd.
  - By 2012, it could exceed 17 bcfd.
- Shale gas developments have since turned expectations upside-down



Composition of North American Production

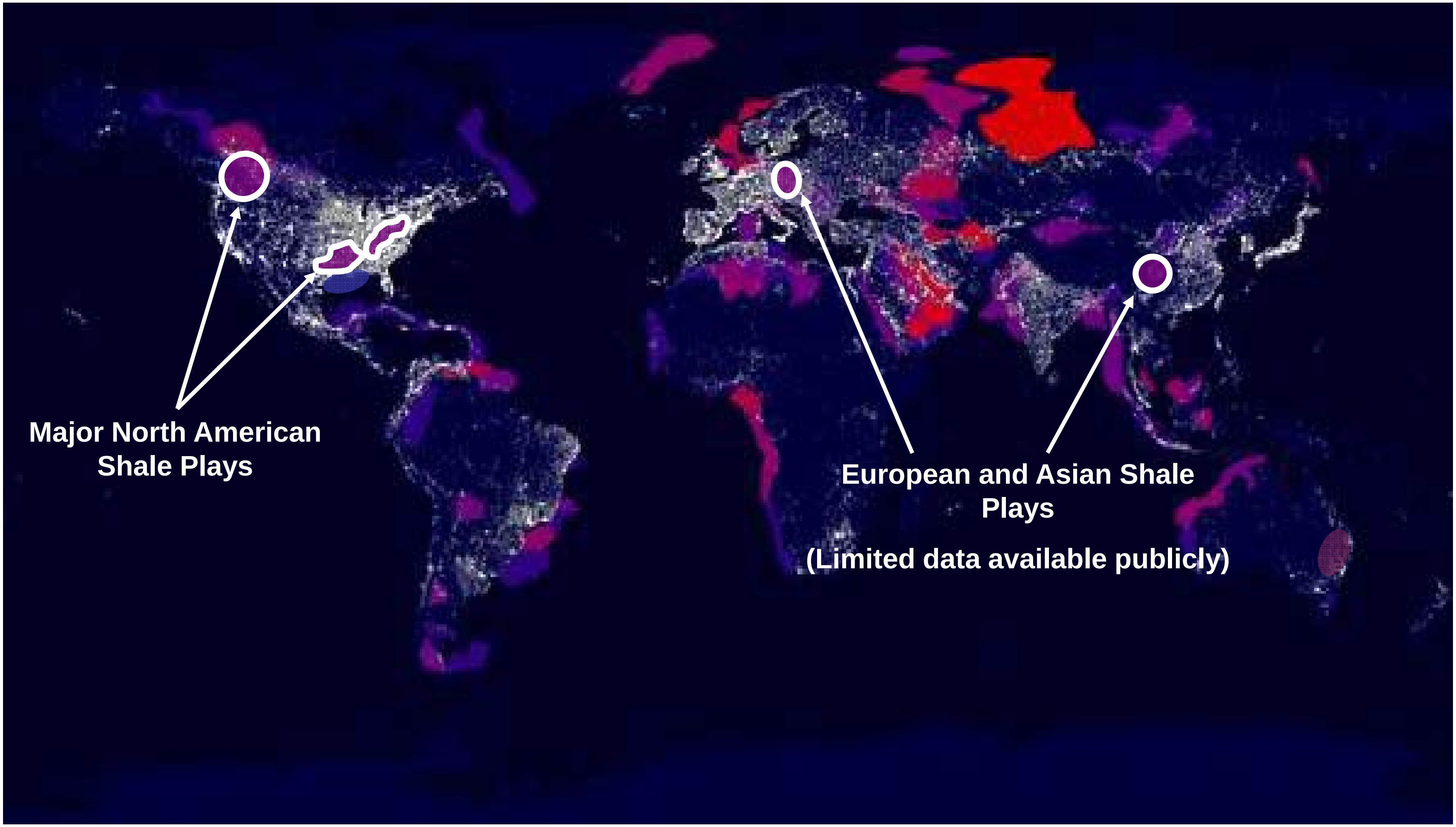


- US shale production grows to about 45% of total production by 2030.



- Canadian shale production grows to about 1/3 of total output by 2030. This offsets declines in other resources as total production remains fairly flat.

Shale is not confined to North America, and it has significant implications for the global gas market



The Emergence of Shale Gas

- Shale Gas resource assessments are large.
  - BIPP research indicates the technically recoverable resource in North America at over 580 tcf
    - Navigant Consulting, Inc. estimated a high of almost 900 tcf (2008).
    - The Potential Gas Committee estimates exceed 680 tcf (2009).
    - Advanced Resources International estimates exceed 1000 tcf (2010).
  - Estimates outside of North America are also large.
    - Recent assessment from ARI (2010)
      - European technically recoverable shale at over 170 tcf (Poland, Romania, Sweden, Austria, Germany, Ukraine)
      - China at over 100 tcf.
      - Southern Africa at 35 tcf.
- Shale is not the only unconventional gas source…
  - Coal Bed Methane estimates in China, India and Australia are also large, and likely to reach market sooner than shales in those countries.

Geopolitical Implications

- LNG cargoes already being diverted to Europe, easing dependence on Russia
- Limit the ability of a GasOPEC to gain market power by breeding market competition of domestic supply close to end use markets
- LNG share may only grow to about a third of global market by 2025 instead of the 50 % previously expected versus a mere 5% in the 1990s
- Limit exporter "Petro-power" as U.S. and Canadian decline rates fail to materialize in the size previously expected and European and Chinese consumers eventually opt for domestic sources
- Revival of the IOCs (versus NOCs) through technology and new resource access –costs will come down over time as learning improves:
- If China is less dependent on foreign energy, how might that impact its future foreign policy?
- If Iran cannot export its gas so it could be used at home, will its public still support domestic nuclear power?
- More gas for Middle East regional electricity grids?

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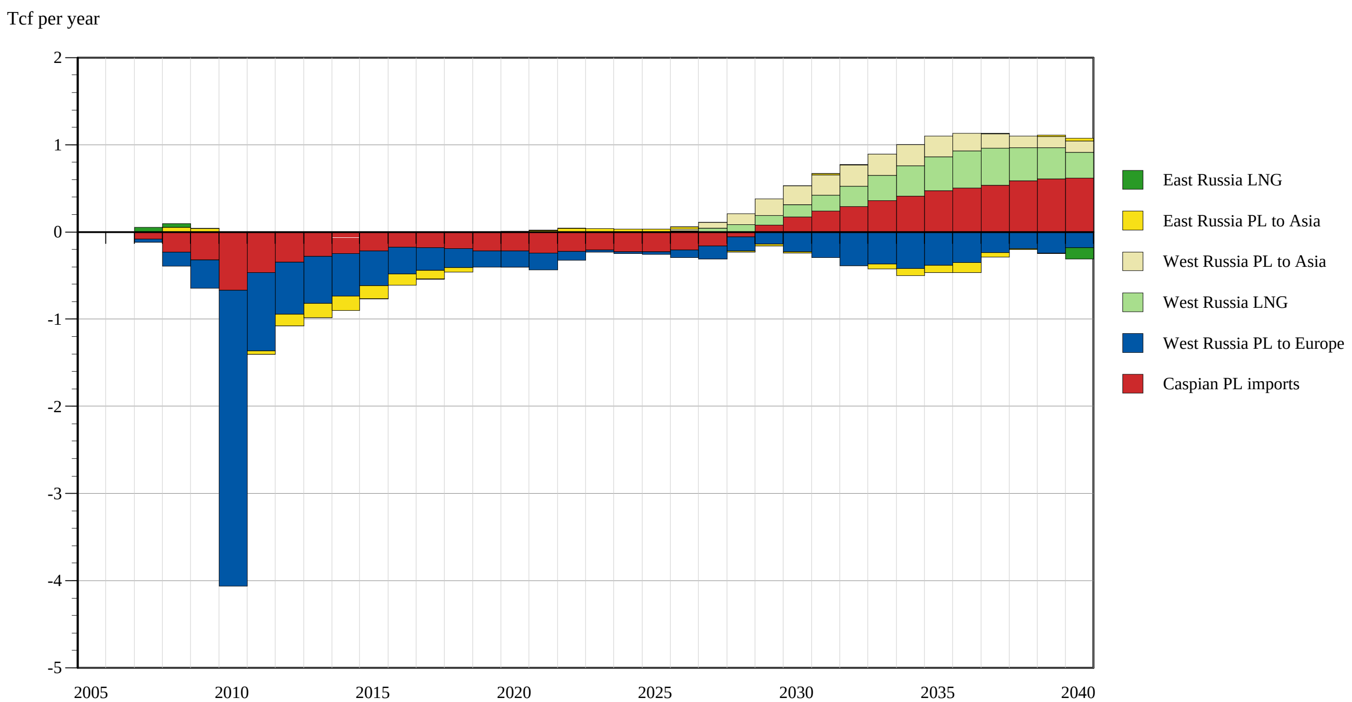
Stakes are costly to Kremlin for Russia to use a natural gas cutoff as a geopolitical level

- Russian gas would lose EU market for an extended period relative to a business as usual case. Already, threat of a disruption is prompting anticipatory responses. Russia could be the big loser from shale. Also has to worry about future competition from Iraq.



Current BIPP Study:
Energy Market Consequences of Emerging Renewable and Carbon Dioxide Abatement Policies in the United States

Current BIPP Study

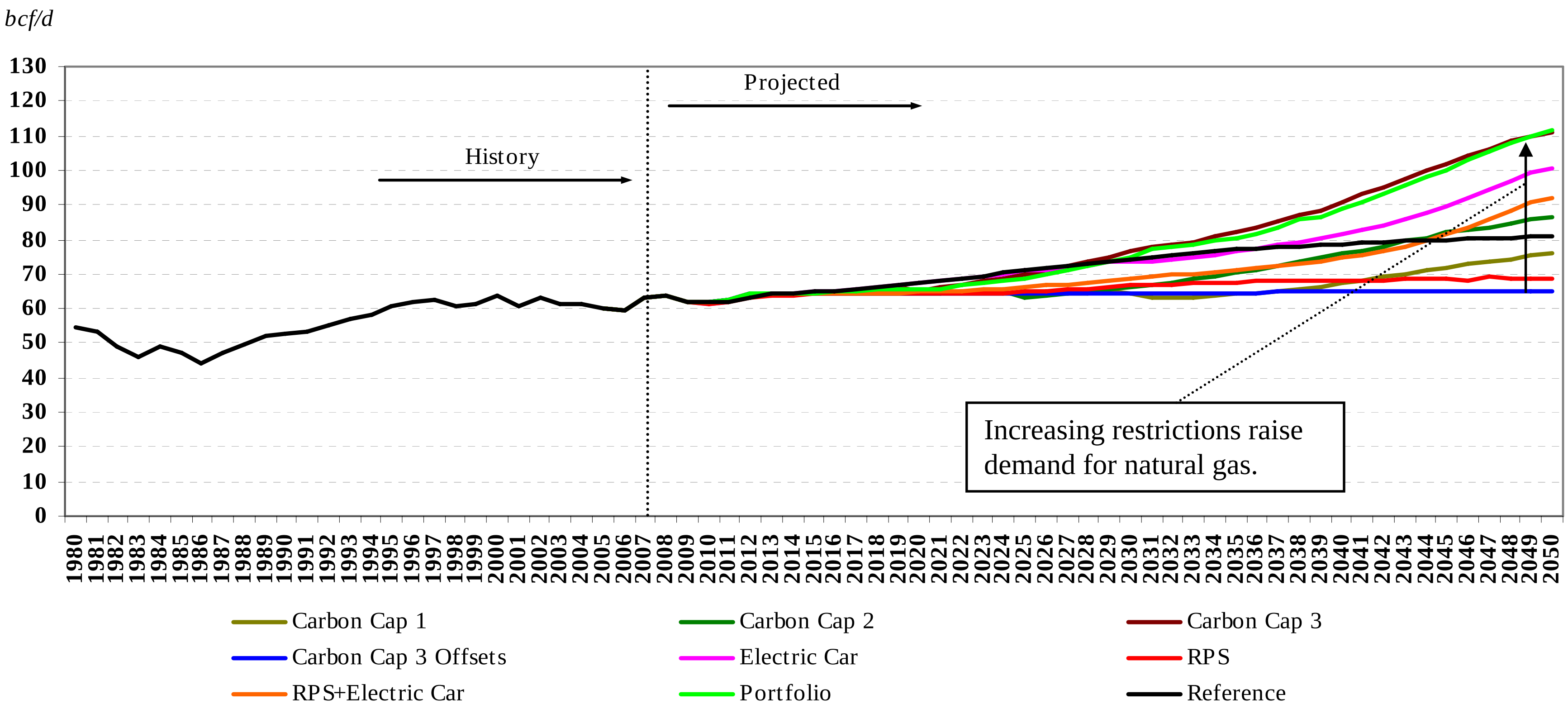
- "Energy Market Consequences of Emerging Renewable and Carbon Dioxide Abatement Policies in the United States"
  - Development of the Rice World Energy Model (RWEM) – a derivative of the Rice World Gas Trade Model (RWGTM) – developed using *MarketPoint* software.
  - 2 year study with final reporting in May 2010.
  - Preliminary results are available.
- A scenario approach is being used to examine and compare various outcomes under different sets of assumptions.
  - Degree of CO_2 emissions cuts (no clear policy yet, so we are choosing to investigate effects by degrees)
  - Safety valves and offset programs
  - The operating and capital costs of various end-use technologies (there is wide disagreement between government and industry here)
  - Elasticity of supply of various fuels
  - Elasticity of demand in different sectors
  - Rate of technological innovation (ongoing parallel study examining the effect of R&D spending on breakthroughs)
  - Regional policies versus harmonized federal and international policies.
  - "Carbon leakage"

Modeling the Impacts of CO_2 and Other Regulations

- A scenario approach is used (see Hartley and Medlock, "Energy Market Consequences of Emerging Renewable and Carbon Dioxide Abatement Policies in the United States" (2010)). Note that all scenarios use industry costs.
  - **Carbon Cap 1** – CO_2 emissions are forced to fall to their 1990 levels by 2050. The manner of enforcement is through a cap-and-trade scheme in which trading begins in 2012. The CO_2 permits allowed for trade are slowly decreased to the target level from the date at which CO_2 permit trading begins. No assumptions about renewable portfolio standards or electric vehicles are explicitly made, although investments in renewables and electric vehicles are allowed.
  - **Carbon Cap 2** – Same as Carbon Cap 1 except CO_2 emissions fall to 80% of their 1990 levels by 2050.
  - **Carbon Cap 3** – Same as Carbon Cap 1 except CO_2 emissions fall to 50% of their 1990 levels by 2050.
  - **Carbon Cap 3 Offsets** – Same as Carbon Cap 3 except investment in offsets is allowed.
  - **Electric Car** – The electric car is adopted at a rate such that it represents 40 percent of vehicle fuel demand by 2050. Note penetration increases over time, reflecting the time it takes for vehicle stock turnover to occur. No assumptions are made about renewable portfolio standards or the existence of a CO_2 market.
  - **RPS** – Renewable portfolio standards (RPS) are introduced such that renewable energy sources must account for 20 percent of electricity generation by 2030 and 40 percent by 2050. Also, ethanol must account for 20 percent of vehicle fuel by 2030. No assumptions are made regarding electric vehicles or cap-and-trade.
  - **Electric Car plus RPS** – The Electric Car case and the RPS case are combined.
  - **Portfolio** – This case combines assumptions made for the Electric Car case, the RPS case, and the Carbon Cap 3 case.

Natural Gas Demand Trends are Sensitive to Policy Design

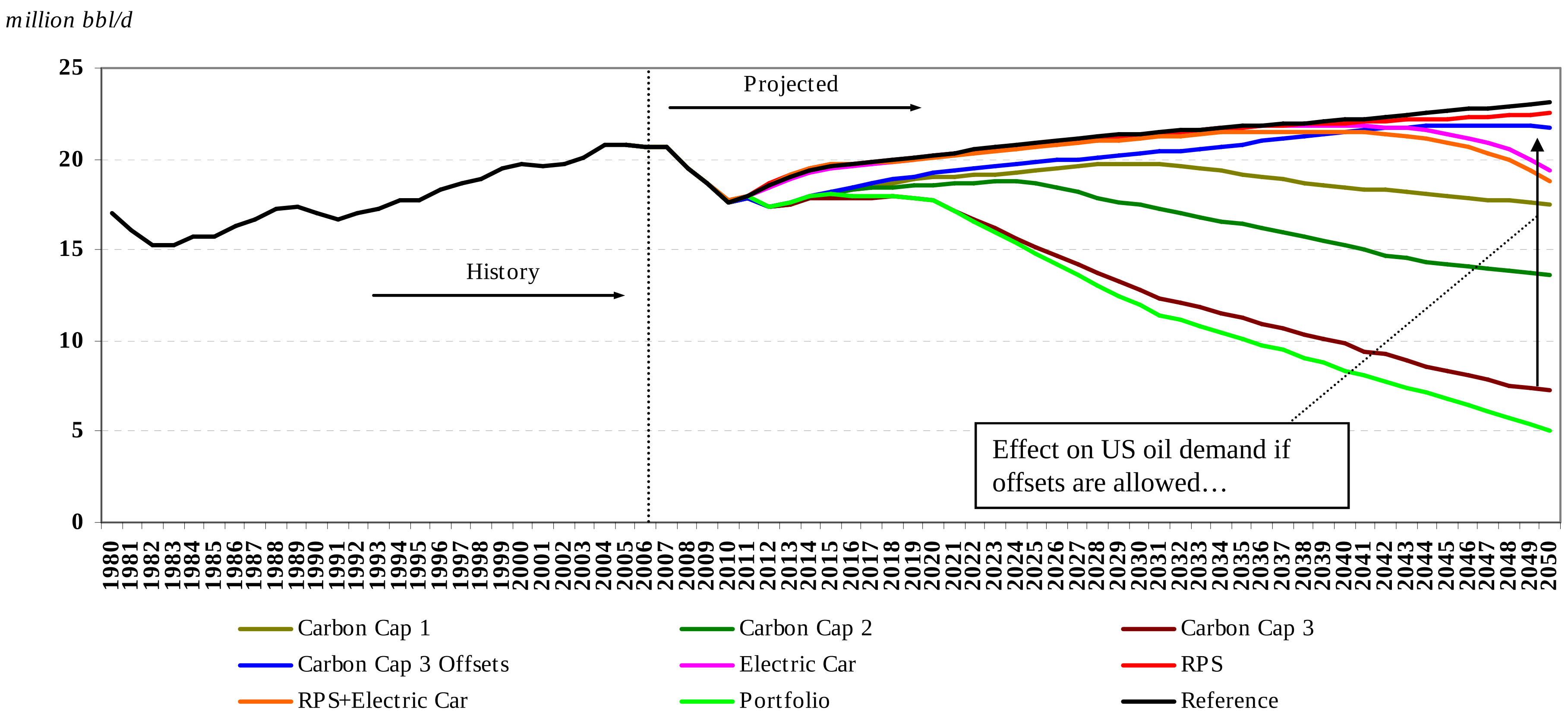
- In no case does natural gas demand decline.
- Faster penetration of EVs raises the demand for natural gas.
- Strong RPS standards result in natural gas demand that is below the reference case. Even in the highest demand case, LNG imports do not gain due to prominence of shale gas in North America.



Source: Hartley and Medlock, "Energy Market Consequences of Emerging Renewable and Carbon Dioxide Abatement Policies in the United States" (2010)

Trends in Oil Demand Sensitive to Policy Design

- Oil demand reduction could be significant under aggressive policies such as those originally proposed by the Obama administration
- But even US politically feasible scenarios (such as a cap and trade market with active offsets (Carbon Cap 3) would shave 1.5 million bbl/d off projected demand growth.
- Note: All scenarios incorporate improvements in CAFE standards.



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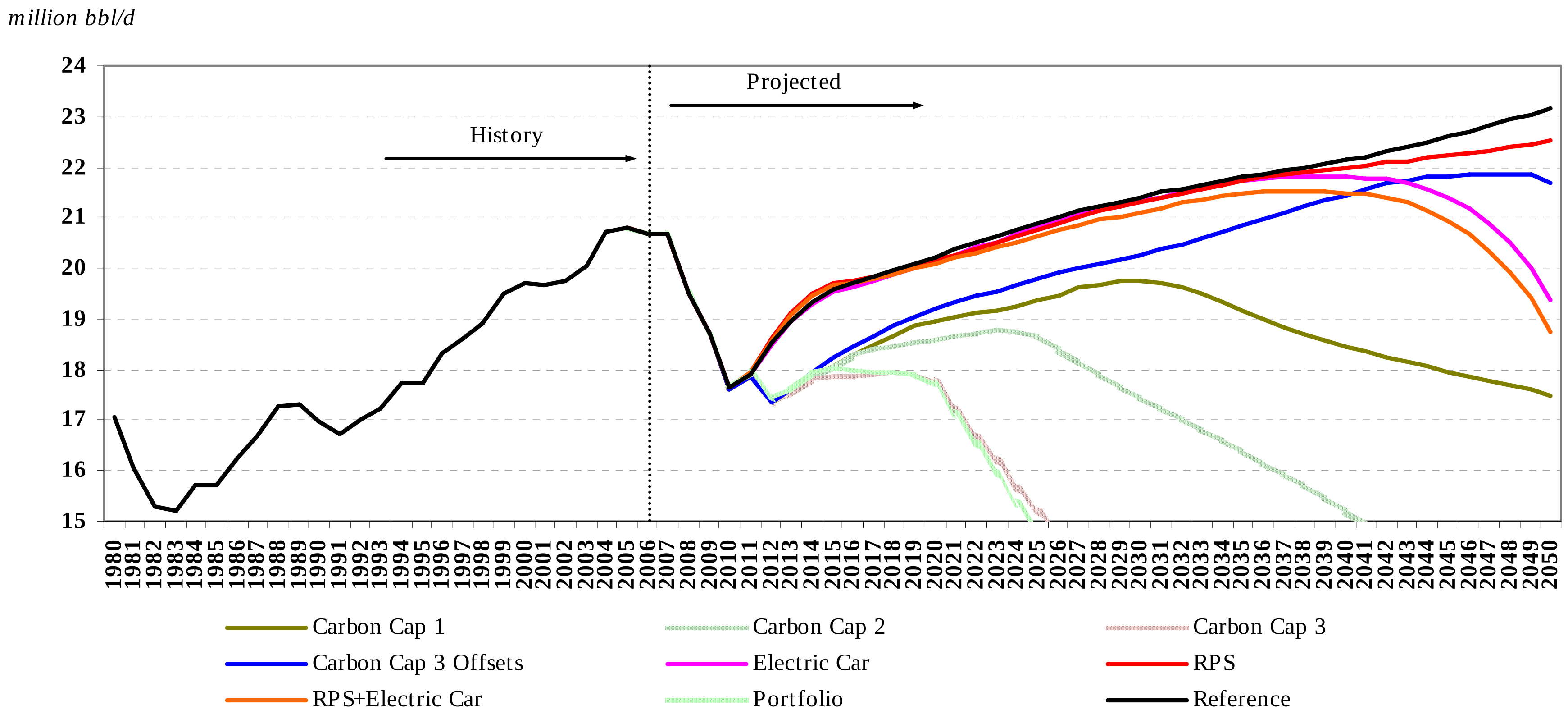
Oil Demand is Sensitive to Policy Design

- Focusing on the less aggressive scenarios, we see…
  - RPS has almost no effect on oil demand.
  - An aggressive target for electric vehicles results in a decline in oil demand that accelerates with EV penetration.



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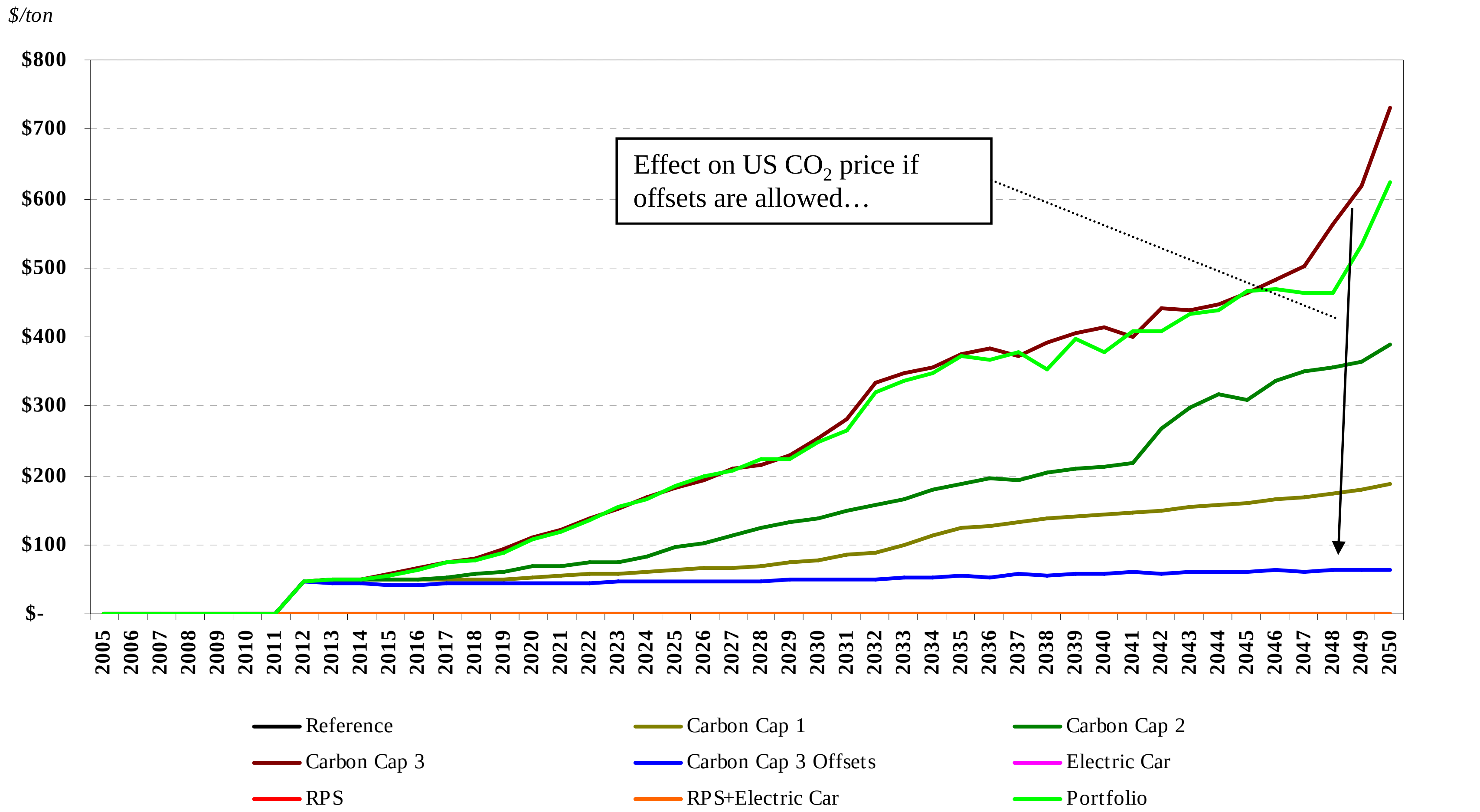
Key Points

- The price of CO_2 is largely determined by the cost of deploying lower carbon alternatives.
- Capital costs are critical
- The bulk of the impact of higher CO_2 prices falls on the petroleum sector
  - Reflecting the difference between mobile sources of emissions versus fixed-point sources of emissions.
- Elasticity of supply of low carbon fuels is important
  - For example, if the supply curve for natural gas is very flat, then the price of CO_2 need only rise to the point at which natural gas substitutes for coal, assuming natural gas is less expensive to deploy and use.
- Elasticity of demand for energy is important
  - If energy demand is very inelastic, so that consumers do not reduce demand very much when price increases, then the price of CO_2, *ceteris paribus*, will be higher to achieve a given reduction.
- Availability of new technologies is critical
  - If new technologies are made available sooner and more cheaply, then the price of CO_2 is influenced lower.

CO_2 *Price* is Sensitive to Policy Design

- Increasing restrictions raises price.
- CCS deployment, demand reduction, and offset mechanisms are critical!



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