Key Findings from the Economic Analysis of the USCAP
Blueprint for Legislative Action

The U.S. Climate Action Partnership (USCAP) has conducted an economic analysis of its *Blueprint for Legislative Action* – a detailed framework for legislation to address climate change. At the core of the USCAP *Blueprint* is an economy-wide cap-and-trade program, supplemented with cost containment measures and complementary policies designed to ensure rapid technology transformation. To help put key findings of the USCAP analysis in a broader context, recent analyses of H.R. 2454, the American Clean Energy and Security Act of 2009 (ACESA), were also reviewed.

The results of the current analysis are best viewed for their potential to provide policy insights as opposed to predictions of the future. Thus, none of the scenarios the USCAP modeled, which are described below, predict future economic conditions or the likelihood of any particular policy outcome. Rather, they are designed to provide insights into the economic ramifications of various policy options. This caveat applies equally to all other modeling analyses of climate and energy legislation that deal with long time horizons and unpredictable policy, economic, and technology pathways.[1] In addition, the current analysis does not attempt to model the potential economic benefits of controlling greenhouse gas emissions that may be realized from the *Blueprint* recommendations.

The USCAP analysis employed two state-of-the-art economic models, ADAGE and NEMS-USCAP, both of which are used by the U.S. Environmental Protection Agency (EPA) and the U.S. Energy Information Administration (EIA) for their own ongoing analyses of proposed climate and energy legislation.[2] The business-as-usual or reference case comparison is based on EIA's most recent *Annual Energy Outlook* projections.[3] Where the *Blueprint* was insufficiently detailed for

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[1] For a discussion on the limitations of economic modeling of climate policy, see "Climate Change: Costs and Benefits of the Cap-and-Trade Provisions of H.R. 2454," Congressional Research Service, September 14, 2009.

[2] ADAGE is a multi-region computable general equilibrium (CGE) model developed by RTI International and NEMS is a U.S. energy–economy model developed by the U.S. Energy Information Administration. NEMS-USCAP is a version of NEMS developed by OnLocation Inc. for the USCAP modeling exercise.

[3] Released in April 2009 and includes the Energy Independence and Security Act of 2007, updated projections for a deeper recession, and the February stimulus package.

modeling purposes (e.g., allowance allocation), the provisions contained within H.R. 2454 were modeled. Use of any provisions included in H.R. 2454 should not convey official USCAP endorsement of those provisions.

USCAP was interested in exploring key points of debate among those engaged in the policy making process. Some of the questions that USCAP focused on in its analysis include:

Will the cap-and-trade program damage the economy or destroy jobs?
What are the risks of having either too many or too few offsets?
Will a price on carbon be sufficient to incentivize the development and deployment of new non-emitting technologies?
Will allowance prices be too high, thereby causing excessive fuel switching within the power sector to natural gas and driving up prices?

The USCAP analysis of the economic impacts of the *Blueprint* examined several scenarios (see the annex for a description of scenarios). Two scenarios modeled the *Blueprint* recommendations, including complementary policies for coal, transportation, and energy efficiency and a reduction of 17% of 2005 levels by 2020 (which is within the range recommended by the USCAP). As noted above, where the *Blueprint* was insufficiently detailed for modeling purposes (e.g., allowance allocation), the provisions contained within H.R. 2454 were modeled which does not convey USCAP endorsement of those provisions. These scenarios limited offset availability to a total of 2 billion tons at the start of the program (which is the policy recommended in the *Blueprint*), with no more than 1.5 billion tons from international sources. These scenarios are referred to below as the “core” and “more conservative” scenarios.

The use of the term “core” scenario is not intended to convey that this is the most likely scenario. The “more conservative” scenario imposes a more restrictive set of market and technical assumptions than the core scenario (see the annex for a description of market and technical assumptions). Because there is significant concern among USCAP members regarding the likelihood of availability of those 2 billion tons of offsets at the outset of the program, the modeling analysis includes an alternative scenario (the “delayed offsets” scenario) that uses the same market and technology assumptions as the core case but assumes that the availability of offsets is constrained for the first ten years of the program. Again, none of these scenarios predict future economic conditions or the likelihood of any particular policy outcome, but rather provide insights into the economic ramifications of various policy options.

Key findings from the USCAP analysis of economic impacts are the following:

1. **A well designed climate policy is compatible with robust economic growth of about 2.7% per year. Gross Domestic Product (GDP) is projected to increase approximately 70-71% between 2010 and 2030, as compared to approximately 71-72% in the no-policy case.**

2. **USCAP modeling results are comparable to several recent analyses of H.R. 2454, the American Clean Energy Security Act (ACESA), including those by EPA, EIA, and ACCF/NAM. All studies, including those using much more restrictive assumptions for offsets and technology deployment, show continued growth in GDP and employment over time, measured from both current and pre-recession levels.**

3. **All studies show that households are better off in the future than they are today even with an aggressive climate policy, and even when the potential economic benefits of greenhouse gas (GHG) emission reductions are ignored.**

   a. **USCAP analysis of the *Blueprint* projects that household consumption (a measure of real household purchasing power) will be $8,000, $17,300, and $35,600 greater in 2015, 2020, and 2030, compared to 2010. The average annual household cost of implementing the *Blueprint*, defined as a reduction in real consumption from the no-policy case, is projected to be $57, $89, and $269 in 2015, 2020, and 2030, respectively. All figures are in undiscounted 2005$.**

   b. **Depending on the region, U.S. families are projected to see very low to moderate increases in their electricity and natural gas bills compared to the no-policy case. During the transition to a low-carbon economy, price increases will be dampened by the allocation of allowance value to local distribution companies (LDCs) and the realization of energy efficiency opportunities.**

4. **Allowance price projections vary widely across USCAP modeling scenarios and across the various studies reviewed. High prices are nearly always the result of scenarios with highly restrictive offset assumptions and delayed technology deployment. Lower prices are typically the result of high offset availability and rapid deployment of technology. However, even in those studies that produce the highest allowance prices, growth in employment and the economy continues.**

5. **Offsets are essential for cost containment and limits or delays in the development of either a domestic or international offsets program will very likely increase program costs. In the event that a large supply of offsets is available early in the program, the application of a minimum "floor" price on the auction of allowances will provide a critical incentive for capital investments in low- and zero-carbon technologies.**

6. **Complementary policies can drive emission reductions through improvements in energy efficiency, transportation, and the accelerated development of carbon capture and storage (CCS). The complementary policies for CCS recommended in the *Blueprint* are especially important as a means of reducing emissions from existing coal fueled electric generation plants, particularly under scenarios that generate low allowance prices.**

7. **USCAP modeling results indicate that a wholesale "dash to gas" is unlikely to occur under the *Blueprint* proposal. This finding of a relatively small impact on natural gas consumption is consistent with other modeling studies that assume ample offset availability, support for low GHG emitting technologies, and other cost containment measures to protect against very high allowance prices.**

Examining USCAP and Other Modeling Results

1. The USCAP *Blueprint* Recommendations Do Not Hinder Strong Growth in GDP and Employment

Under all USCAP scenarios the economy is expected to grow robustly through 2030. In the *Blueprint* core case, the ADAGE model projects that GDP will grow 70.7% over 2010-2030, whereas in the reference case without any climate policy, the model projects GDP will grow by 71.5%. In the more conservative and offset delay scenarios, GDP grows 70.0% and 70.6%, respectively. Comparable results are found using the NEMS-USCAP model -- GDP is expected to grow 70.1% over 2010-2030 in the *Blueprint* core case versus 71.3% in the reference case. In the more conservative case, GDP would grow by 70.7%.[4]

Figure 1 shows modeling results of the USCAP *Blueprint's* impact on GDP. Climate policy causes a slight drag on overall economic activity as compared to the reference case, but it is barely perceptible in relation to overall growth. The effect on the economy can also be expressed as a time delay: under the reference or business-as-usual case, total output of the U.S. economy is projected to reach $22.3 trillion by January 2030. With climate policy in place, the models estimate that the economy would arrive at this point 2-4 months later, with the difference between the three *Blueprint* scenarios being nearly imperceptible.

[4] Only the ADAGE model was used to examine alternative offset scenarios.

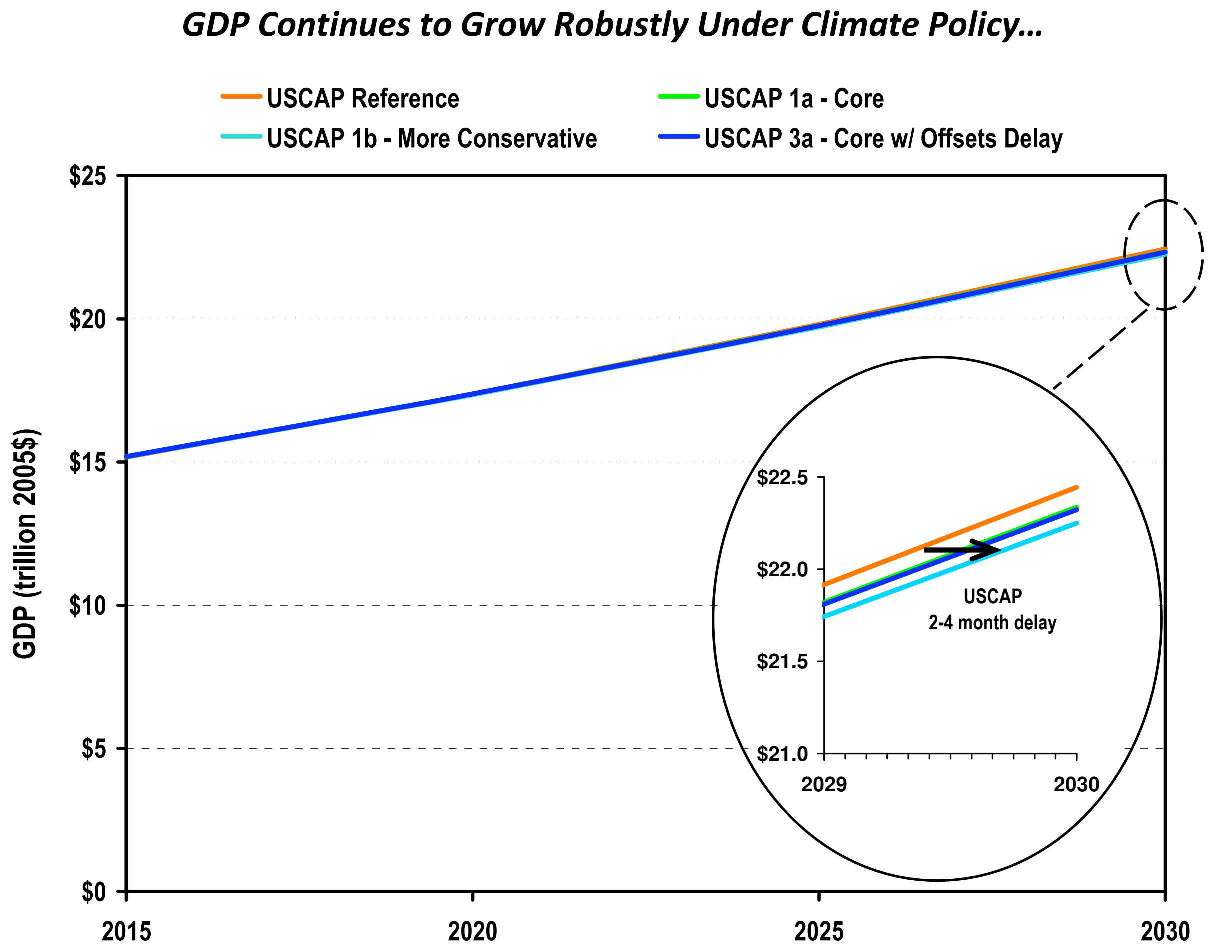

Figure 1: Projected growth of U.S. GDP in USCAP modeling scenarios (ADAGE)

The USCAP *Blueprint* recommendations also do not significantly hinder normal growth in employment. According to the NEMS-USCAP reference or no-policy case, total non-farm employment begins at 133.3 million in 2010 and grows to 165.2 million in 2030, an increase of 23.9%. In the *Blueprint* core case, employment grows to 164.8 million in 2030, an increase of 23.6%. Even with the *Blueprint* in place, the total number of jobs increases by over 1.6 million on average each year during this 20-year period. Without climate policy, the annual average increase in jobs would be about 17,400 more, or about a one percent increase in new jobs over the *Blueprint* core case. In 2030, the increase in new jobs without climate policy would amount to just .011% of total employment. These results do not materially change under the *Blueprint* scenario with more conservative market and technical assumptions.

2. All Recent Analyses of the Waxman-Markey Bill Show Continued Growth in GDP and Employment

As discussed above, under the *Blueprint* the economy is expected to grow more than 70% between 2010 and 2030. This is very similar to what was found in analyses by the EIA and EPA of H.R. 2454, in which the U.S. economy is expected to grow about 70% over the same time frame.[5] Other modeling analyses, using much more restrictive offsets and technology assumptions, also conclude that the U.S. economy still grows strongly with climate policy. For example, the ACCF/NAM analysis of H.R. 2454 projects growth of 67 to 68% (high and low costs cases) between 2010 and 2030 versus 71% in the reference case. In other words, in the ACCF/NAM analysis, achieving the 2030 reference level of GDP happens 8-9 months later under H.R. 2454.[6] These results are roughly a half-year longer than the delay calculated for the EPA and USCAP analyses, which are 2-5 months and 2-4 months, respectively. Figure 2 clearly demonstrates that the differences in projected economic growth under all modeled scenarios, whether from USCAP, EPA, EIA, or ACCF/NAM, are barely discernable from one another or the no-policy base case.

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[5] EIA Basic Case and EPA Scenario 2.

[6] The ACCF/NAM analysis only presents results from 2020, 2025, and 2030. The ACCF/NAM reference case GDP in these three years is virtually identical to EIA's reference case (when converted to 2007$). Therefore the EIA reference case GDP for 2010 is used to calculate GDP growth over the 2010 to 2030 horizon.

All Models Show Continued Economic Growth under Climate Policy…

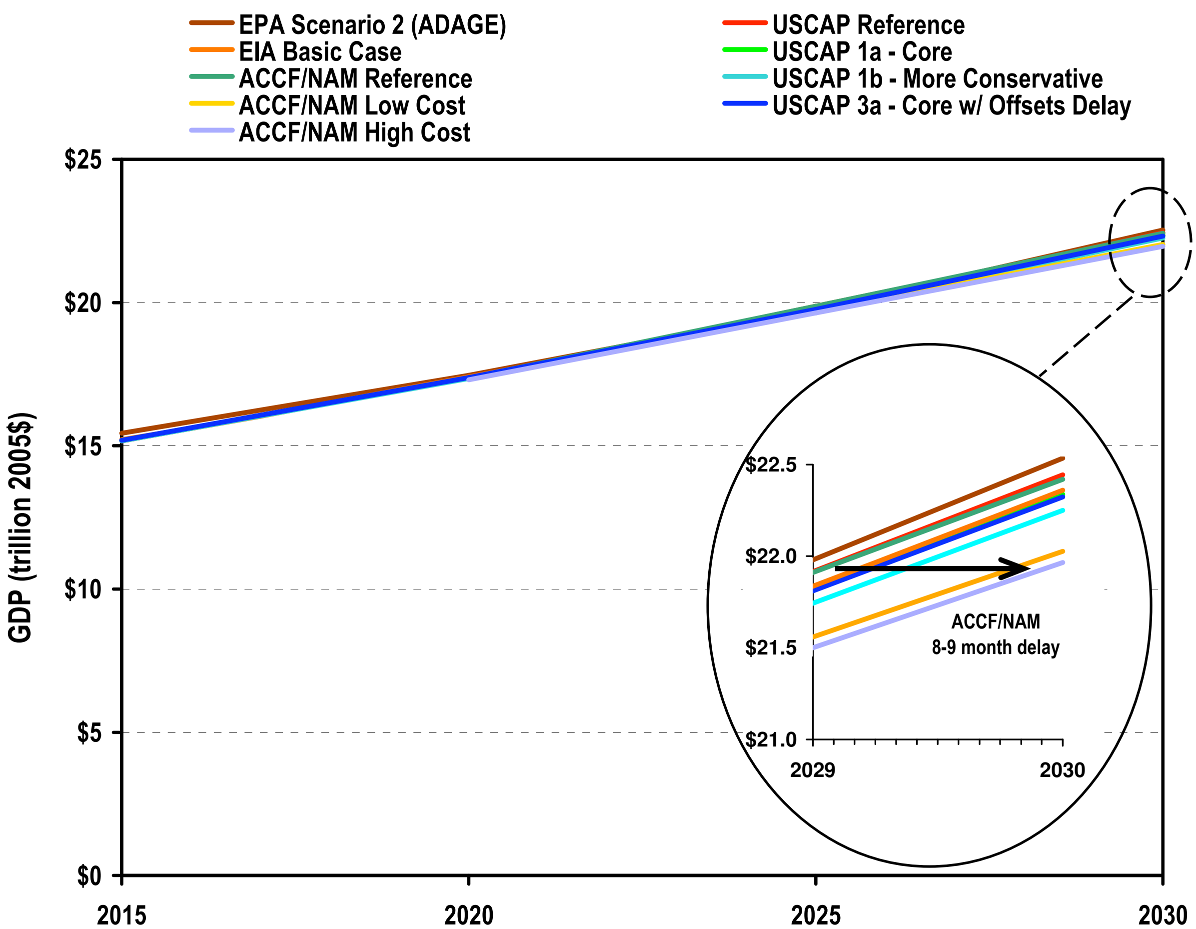

Figure 2: Projected growth of U.S. GDP in USCAP scenarios and selected modeling analyses of H.R. 2454

As for employment, two recent analyses of H.R. 2454 used the NEMS model, or variants of it, and can be compared to NEMS-USCAP results (see Figure 3). The EIA "basic" case projects that total non-farm employment will grow from 132.6 million to 164.7 million during 2010-2030 under H.R, 2454, an increase of 24.2% or an average job growth of 1.6 million per year. The EIA "zero bank" case, which is the EIA scenario most similar to the NEMS-USCAP *Blueprint* core run, projects growth of 24.3% over this same period or an average job growth of 1.61 million per year.[7] Meanwhile, the EIA reference case projects employment growth of 24.6% over this same period or an average job growth of 1.63 million per year. The EIA results, therefore, are very

[7] Because the EIA model ends its projections in 2030, it must make an assumption about how many allowances are "banked" in 2030. The greater the assumed bank in 2030, the more reductions are forced to occur earlier in the model horizon, thus pushing up cost impacts.

comparable to those of NEMS-USCAP (in fact, the EIA and NEMS-USCAP employment projections overlap in Figure 3). Even the ACCF/NAM study – which produced some of the least optimistic economic projections among studies that have analyzed H.R. 2454 – projects that total employment will increase from 157.2 million to 164.0 million between 2020 and 2030 in the low cost case (data for only a 10-year period is provided in this study and shown in Figure 3). In the high cost case, total employment will increase from 157.1 million to 164.0 million over the same 10-year period. This means that even under highly restrictive modeling scenarios of H.R. 2454, ACCF/NAM still projects that job growth would average 680,000 new jobs each year in the low cost case, and 630,000 new jobs in the high cost case.

All Models Show Continued Employment Growth under Climate Policy...

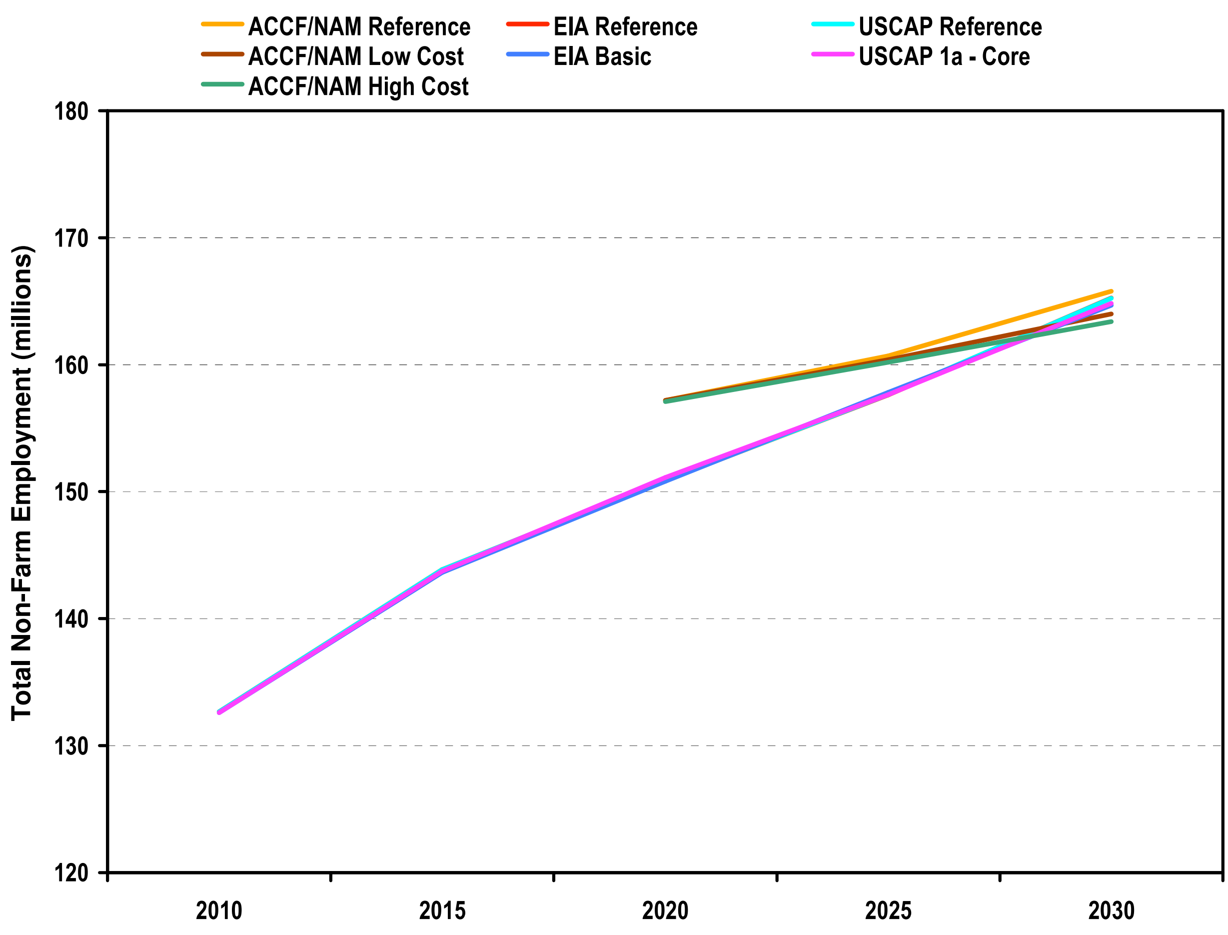

Figure 3: Projected growth of total employment in USCAP scenarios and selected modeling analyses of H.R. 2454

3. All Studies Show Households Are Better Off in the Future

While the change in GDP gives a sense of the impact of the USCAP *Blueprint* on the overall U.S. economy, there is considerable concern regarding the effects on consumers, both in the aggregate and at the household level. What are the projected impacts on consumers and do the USCAP allowance allocation recommendations protect them?

Consumption and Income Impacts

Real consumption (i.e., real purchasing power), is a standard measure of consumer well-being. It is projected to grow robustly under the *Blueprint* core case by 70.2% during 2010-2030 compared to 70.6% under the reference case, according to the ADAGE model.[8] This calculation takes into account higher prices for fossil fuels and goods produced with energy, impacts on wages and returns to capital, and the savings from energy efficiency and the funds that are returned to households, primarily via allocations to local distribution companies (LDCs), in the earlier years of the program. Translated into dollar terms, this means that under the *Blueprint*, annual household consumption in 2015, 2020, and 2030 is projected to be $8,000, $17,300, and $35,600 higher than in 2010.[9] Under the reference or no-policy case, household consumption would have grown about $57, $89, and $269 more in each of these years.

Results are similar for the NEMS-USCAP model. Real consumption grows 66.1% under the *Blueprint* core case during 2010-2030 compared to 67.5% under the reference case. In dollar terms, this means that average household consumption in 2015, 2020, and 2030 is projected to be $5,800, $12,400, and $29,300 higher than in 2010.[10] Under the reference case, household consumption would be $187, $204, and $827 higher in each of these years.

Real household disposable income (personal income less taxes), according to the NEMS-USCAP model, also grows over time. Under the *Blueprint* core case, income in 2030 is projected to be $54,500 higher than 2010 income, and $35,400 higher than 2020 income. Without policy, income in 2030 would be $55,000 higher than 2010 income and $35,900 higher than 2020 income. These may be compared with the ACCF/NAM study, which also found that the imposition of climate policy did not prevent real household income from growing over time. In 2030, household disposable income is $20,300 higher than reference income in 2020 in their high cost case.[11] In their no-policy case, household income would have been $21,500 higher than reference income in 2020.

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[8] The change in real GDP is a broad measure of the change in overall economic activity. The components of GDP – consumption, investment, government expenditures, and net exports – may shift around differently, though consumption generally tracks GDP over time.

[9] In undiscounted 2005$ assuming an average family size of 2.5.

[10] In undiscounted 2005$ using the number of households in each year provided by NEMS-USCAP.

[11] ACCF/NAM does not report results before 2020. Results were converted to 2005$.

The above comparisons of consumption or income under climate policy to reference case levels can also be expressed as household "cost".[12] For example, when looked at through this lens, the ADAGE consumption results above ($57, $89, and $269) can be reported as average household cost in 2015, 2020 and 2030. If discounted to account for the time value of money, these costs would instead be $43, $52, and $97.[13] Similarly computed figures from the EPA analysis of H.R. 2454 are $16-53, $49-61, and $99-132 in these same years (IGEM and ADAGE models). Compared to the projected growth in household consumption and income described in the preceding paragraphs, these estimates of annual net costs to households could reasonably be regarded as *de minimis*. This insight holds true when looking at even the most conservative, least optimistic analyses.[14]

Household energy price changes

The allocation of a large share of allowance value to end-use electricity and natural gas customers as recommended in the USCAP *Blueprint* (modeled as 39% of allowance allocation to electricity and natural gas LDCs through 2025) lowers expected household energy price changes. In addition, energy efficiency improvements help to moderate any increases in electricity bills, which in some scenarios actually decline relative to reference levels. Cost containment and allowance allocations are of vital importance to ensure that rate impacts do not become excessive, particularly in coal-dependent states.

According to the ADAGE model, for the *Blueprint* core case, which assumes a large amount of offsets are immediately available to the market (and results in a 2015 allowance price of $10.40), increases in residential electricity prices in 2015 are expected to increase about 4% in states that do not depend heavily on coal and 8% in coal-dependent states, with an average residential price increase of 6% above reference levels. Residential natural gas and home heating fuel prices in 2015 increase on average about 2% and 1.5%, respectively. By 2030, in this same core scenario, average residential electricity prices rise 15% (12% in non-coal-dependent states and 18% in coal-dependent states), natural gas rates increase 8%, and home heating fuel 7% above reference levels.

Higher allowance prices, not surprisingly, produce larger impacts. In the *Blueprint* scenario with more conservative market and technical assumptions (which results in a 2015 allowance price of $16.56), the ADAGE model projects that average residential electricity prices will increase 9% above reference levels (6.5% and 12.5%, non-coal-dependent and coal-dependent states). By

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[12] The term "cost" or "household cost" as typically used in economic studies, including those looking at climate polices, is the reduction or loss in future private consumption (which generally tracks income), computed at the aggregate or household level. In the present context it is a monetary measure of the reduction in consumer well-being caused by climate policy.

[13] Annual household cost in 2005$, present value terms, using a 5% discount rate and an average family size of 2.5.

[14] ACCF/NAM does not report results for aggregate or household consumption, despite using a variant of the NEMS model (NEMS/ACCF-NAM 2).

2030, in this more conservative scenario, residential electricity rates increase approximately 23% on average (18% and 28%, non-coal-dependent and coal-dependent states). The difference in electricity price increases across these two *Blueprint* scenarios is in rough proportion to the difference in allowance prices across them.

Household energy bills take into account impacts on prices (which are moderated by the return of allowance value to households through LDC allocations) and impacts on energy consumption (which can decline due to improved energy efficiency). According to ADAGE, average household electricity bills, which take into account declines in electricity use, are projected to rise by less than electricity prices – electricity bills increase 2% above reference levels in 2015 and 7% in 2030. (In the ADAGE model, electricity expenditures account for 1.3% of total household expenditures in 2010.) Notably, the NEMS-USCAP model projects *declines* in household electricity bills compared to reference levels of 2% in 2015 and 6% in 2020.

Gasoline price impacts

Prices for gasoline are expected to be minimally affected.[15] In the year 2030, both ADAGE and NEMS-USCAP models indicate that petroleum prices will be about 15% higher than they would be without any climate policy. To put this in perspective, EIA projects gasoline prices to be $3.84 per gallon in 2030 (expressed in 2007 dollars) in the absence of climate policy. Applying a 15% increase to this price would amount to an additional 58 cents. In other words, the price of gasoline under the *Blueprint* recommendations would rise by around 3 cents a year through 2030, compared to the reference case.

4. Comparison of Allowance Prices

Projected allowance prices are simply an indicator of overall program cost and not an estimate of such costs, yet they generally receive a great deal of attention. USCAP scenarios that assumed that the level of offsets recommended in the *Blueprint* would be immediately available produced allowance prices that are generally lower than those found in EIA's and EPA's analyses of H.R. 2454, the American Clean Energy and Security Act (ACES). They are a great deal lower than those projected in the ACCF/NAM analysis whose allowance price in 2030 (low cost case) is about six times higher than the USCAP *Blueprint* runs (see Figure 4 and the annex for a description of USCAP scenarios).

[15] Gasoline prices do not represent the full range of costs of transportation for consumers, which were not modeled in the USCAP analysis. The USCAP *Blueprint* recommends the judicious use of allowance value to ensure that consumers' transportation fuel impacts from allowance prices are generally proportionate to the impact arising from other types of energy used in the home.

Allowance Prices Can Vary Significantly Across Modeling Scenarios…

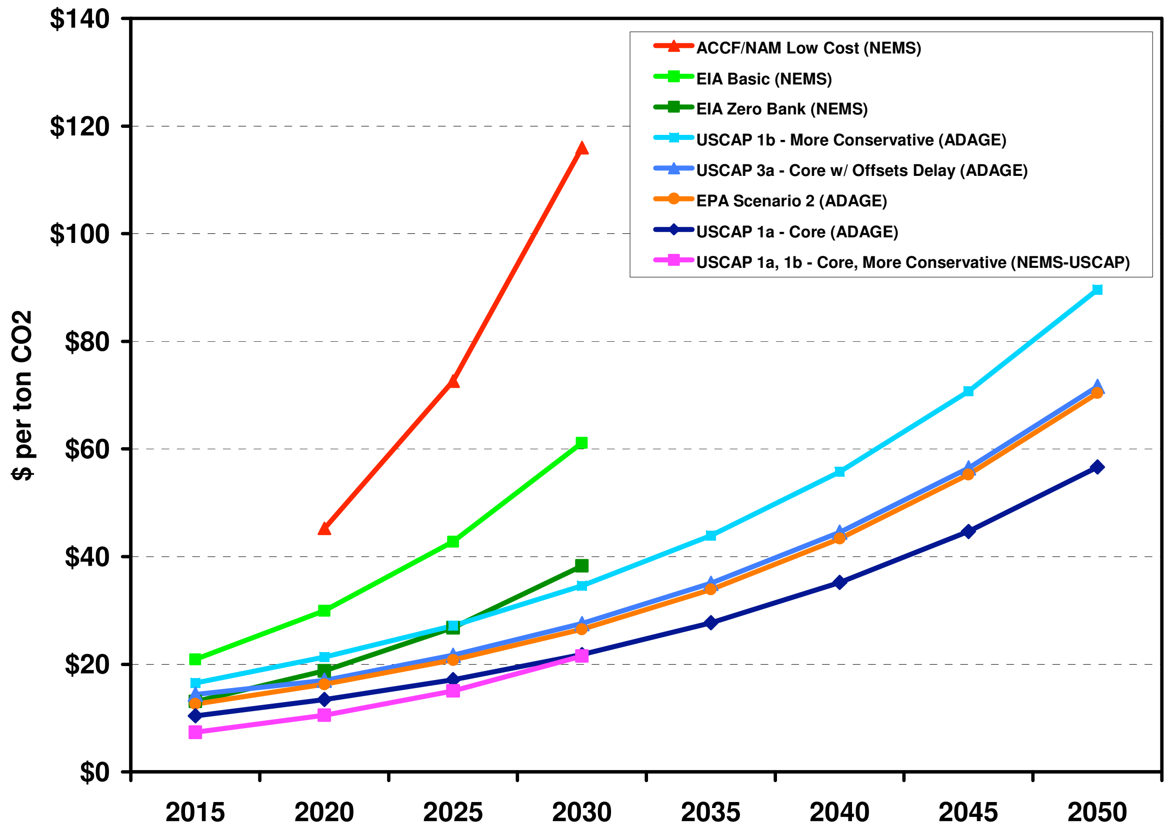

Figure 4: Projected allowance prices in USCAP scenarios compared to selected modeling analyses of H.R. 2454

The following insights can be derived from generalizing across these models:

- The more offsets that are available, the lower the allowance price;
- If technology is not deployed and/or offsets are not permitted or available (as per the NAM/ACCF study), allowance prices will go much higher;
- The key drivers of allowance prices are the availability of offsets, the cost of new technologies, and the ability of those technologies to deploy. All of these variables are highly uncertain.

Ensuring that prices are neither too low nor too high is very important, especially in the early years of the program. If prices are too low, technology will deploy slowly and will require greater subsidies to achieve a given target; if allowance prices are too high in the early years of the program, energy price increases become large enough to create economic hardship. This highlights the importance of an effective "price collar" mechanism whereby the minimum bid or floor price for the auction and the trigger price for releasing allowances from the Strategic Reserve serve to constrain the range of allowance prices (see USCAP Recommendations and Options for Effective Containment of Allowance Prices).

5. Offsets are Essential for Cost Containment

The use of offsets as an effective cost containment mechanism was tested by running some model sensitivities which restricted their availability in a variety of ways. In the *Blueprint* core case we assumed that the amount of offsets we recommended in the *Blueprint* – 2 billion tons total, with no more than 1.5 billion tons each from domestic or international sources – is immediately available to the market. In other scenarios, we delayed the time period for offsets coming to the market to understand the impact of such a delay, as well as other scenarios as described below. The results show that the early development of a pool of good quality offsets should be prioritized.[16] Restrictions in the availability of offsets resulted in allowance prices that were 25-140% higher as compared to the core case (see Figure 5 below and the annex for scenario details).

Offset Availability Impacts Allowance Prices…

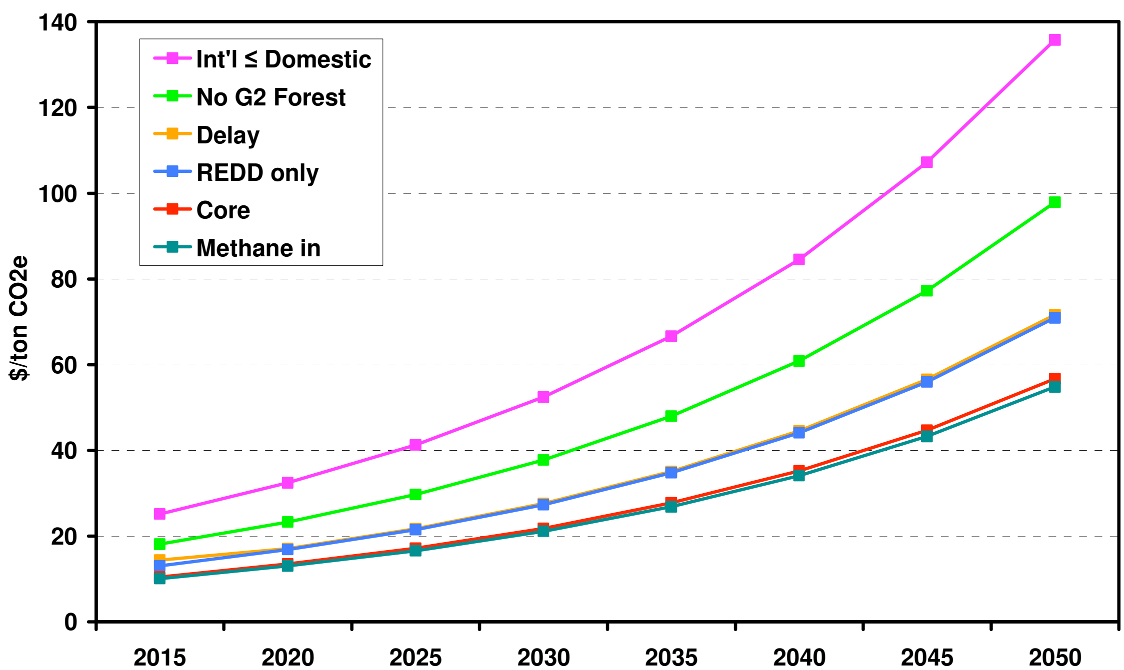

Figure 5: Projected allowance prices under alternative USCAP offsets scenarios (ADAGE)

[16] See *Blueprint* for more information on USCAP's recommendations.

When looking at alternative offset policies in comparison to our core case which produces an allowance price of $22 per ton by 2030:

> If international offsets are required to be less than or equal to the amount of domestic offsets, allowance prices are projected to be $52 (140% higher);
> If no forest offsets from G2 countries are allowed (G2 countries are developing countries and the former Soviet Union), allowance prices are projected to be $38 (73% higher);
> If all offset sources are delayed from 2015-2025, allowance prices are projected to be $28 (26% higher);
> If forest offsets from G2 countries are restricted to reduced emissions from deforestation and degradation (REDD) credits, allowance prices are projected to be $27 (25% higher);
> If methane from domestic sources is allowed as offsets, allowance prices are projected to be $21 (3% lower).

6. The Role of Complementary Measures

Modeled *Blueprint* complementary policies include: for coal, early grants for demonstration CCS-enabled coal plants and direct cash payments for sequestered CO2 from power plants; for energy efficiency, allowances allocated to LDCs for the purpose of promoting energy efficiency; and for transportation, the low carbon fuel standard (LCFS) for transportation fuels and increases in vehicle efficiency standards.[17] Please see the USCAP *Blueprint* for more specifics on recommended complementary policies.

Our modeling results indicate that complementary measures for coal will accelerate the development and deployment of CCS that would otherwise not be economic for decades due to the higher costs of early stage technology. Additionally, complementary measures to promote energy efficiency can reduce consumers' energy bills relative to the no-policy case and drive domestic emission reductions farther and faster than cap-and-trade alone, and complementary transportation policies can increase the level of reductions from this sector. Such measures tend to change where reductions occur under the economy-wide cap, rather than creating additional reductions.

The *Blueprint's* recommended complementary policies for **transportation**, particularly the low carbon fuel standard and increases in vehicle efficiency standards beyond reference case levels, help reduce more than 2,800 MMT of emissions in this sector by 2030 (see Figure 6).

[17] The performance standards for new coal plants recommended in the *Blueprint* were modeled as a requirement that all new coal plants include CCS technology.

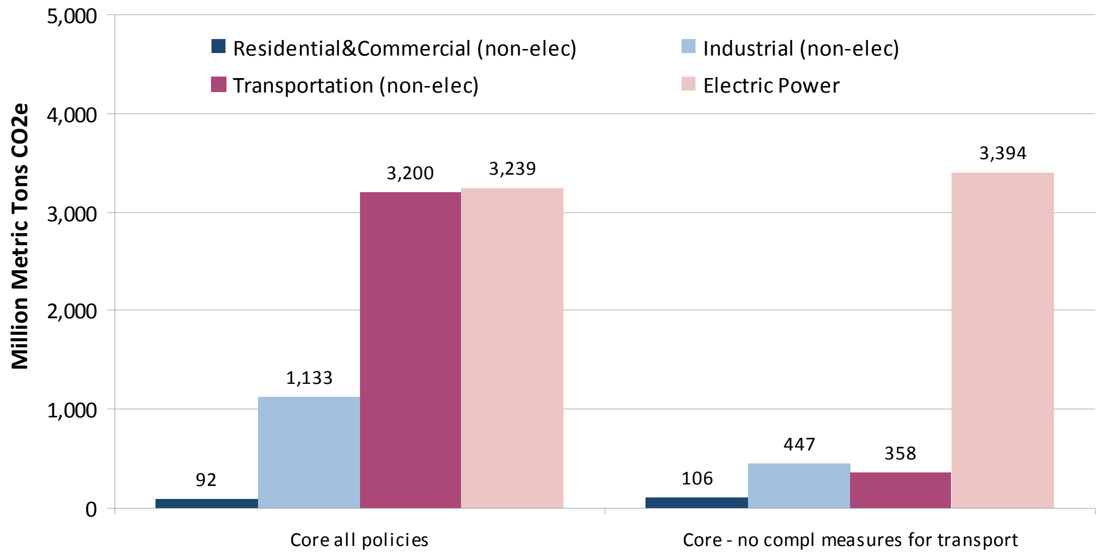

Figure 6: Cumulative (2010-2030) GHG reductions by sector (NEMS-USCAP)

The allocation of about 15% of total allowance value to **energy efficiency** leads to marked reductions in residential and commercial electricity consumption by 2020 (annual savings of about 200 billion kWh, or 6.5% from business-as-usual by 2020, see Figure 7). The analysis did not determine whether this level of allocation is cost effective, i.e., the cost effective level may be higher or lower than 15%.

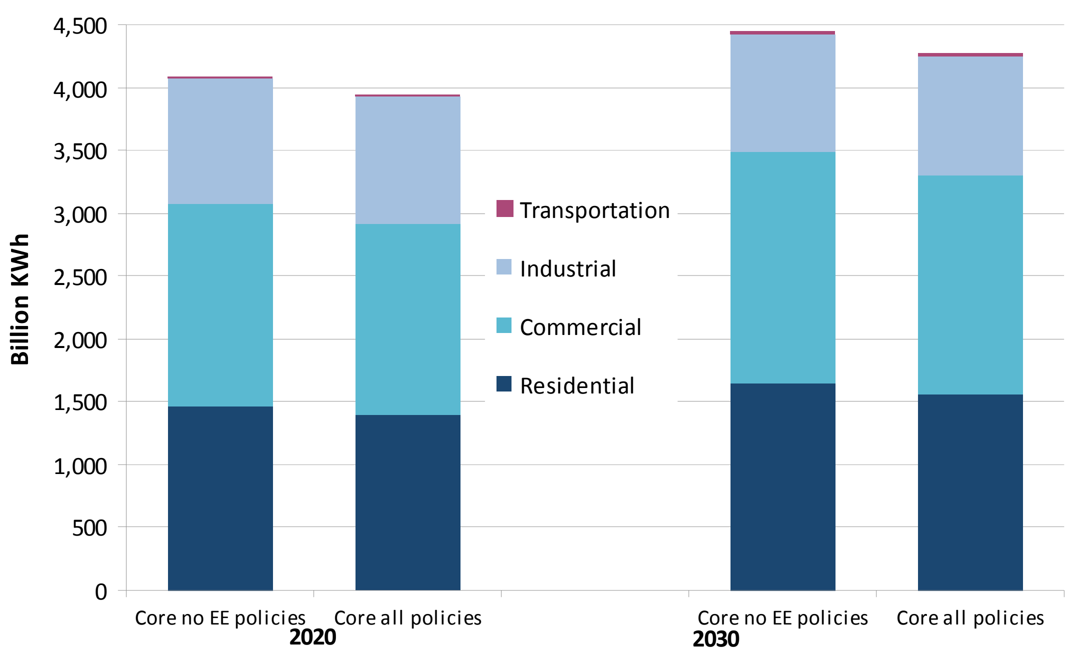

Figure 7: Electricity sales by sector (NEMS-USCAP)

Model runs show that when allowance prices are low, **cash incentives for CCS** are essential to ensure that sufficient capacity will be built to bring the technology to maturity. Without the USCAP recommended incentives for CCS, only 2 GW of CCS are built by 2030 in the NEMS-USCAP Blueprint core scenario that allows the more immediate availability of offsets (red portion of left pie chart in Figure 8).[18] With cash incentives for CCS, 5 GW of CCS demonstration plants are built by 2015 and a total of 20 GW of CCS capacity deploys by 2030 (red portion of right pie chart in Figure 8). In the scenario that used a more conservative set of market and technical assumptions, 33 GW of CCS are deployed, 13 GW of which are economic without the cash incentives due to higher electricity sales and limits on new nuclear capacity (CCS and nuclear compete with each other at the margin, with nuclear providing a backstop if CCS does not materialize and vice versa). Other factors, including future technology costs, CCS regulations and liability rules and commercial availability also influence the amount of CCS deployed.

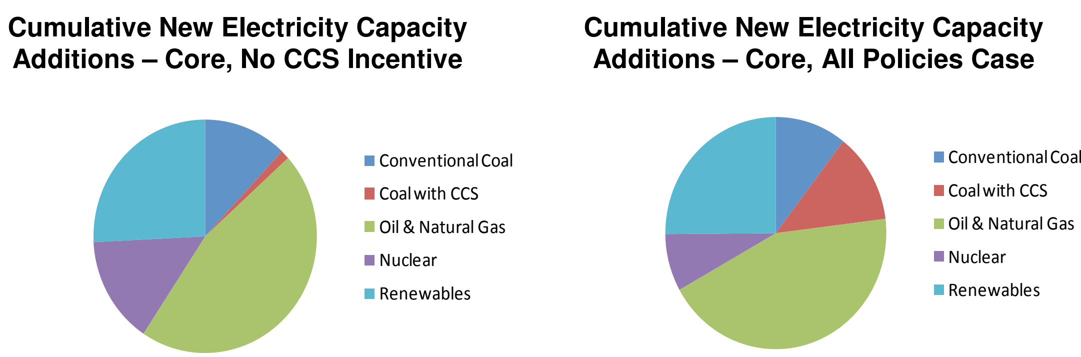

Figure 8: Comparison of 2010-2030 capacity additions with and without CCS incentive (NEMS-USCAP)

While inclusion of the *Blueprint* complementary policies as a package increases the overall program cost – the resulting growth in GDP is only slightly less over 2010-2030 compared to the cap-and trade program without complementary policies – economic growth of 70.1% instead of 70.9% (and compared to 71.3% in the reference or no-policy case). These measures are projected to deliver greater domestic emissions reductions than cap-and-trade alone will produce.[19]

[18] For context, one GW of electric generation capacity is about the size of a conventional nuclear power plant and can serve about 750,000 homes.

[19] The *Blueprint* recommends the use of complementary policies to address market barriers and imperfections that may prevent the carbon price signal, created by the cap-and-trade program, from achieving significant emissions reductions in capped sectors and from incentivizing needed technology transformation. However, as in many other studies, the USCAP modeling analysis did not explicitly model the kinds of market barriers and

7. Impacts on Natural Gas Consumption

USCAP's analysis shows we can prevent or notably reduce the possibility of a "dash to gas" if allowance prices are kept low enough, as per the policies advanced by USCAP in the *Blueprint*. In fact, results from the modeling of the core case of the USCAP *Blueprint* point to a decline in the volume of natural gas used in the economy compared to the reference case of "no policy" (see Figure 9), thereby benefiting natural gas users including those in the agricultural, chemical process, and transportation industries. The analysis shows that with careful policy design it is possible to achieve a smooth transition to a lower-carbon future without necessarily causing a large increase in natural gas consumption.

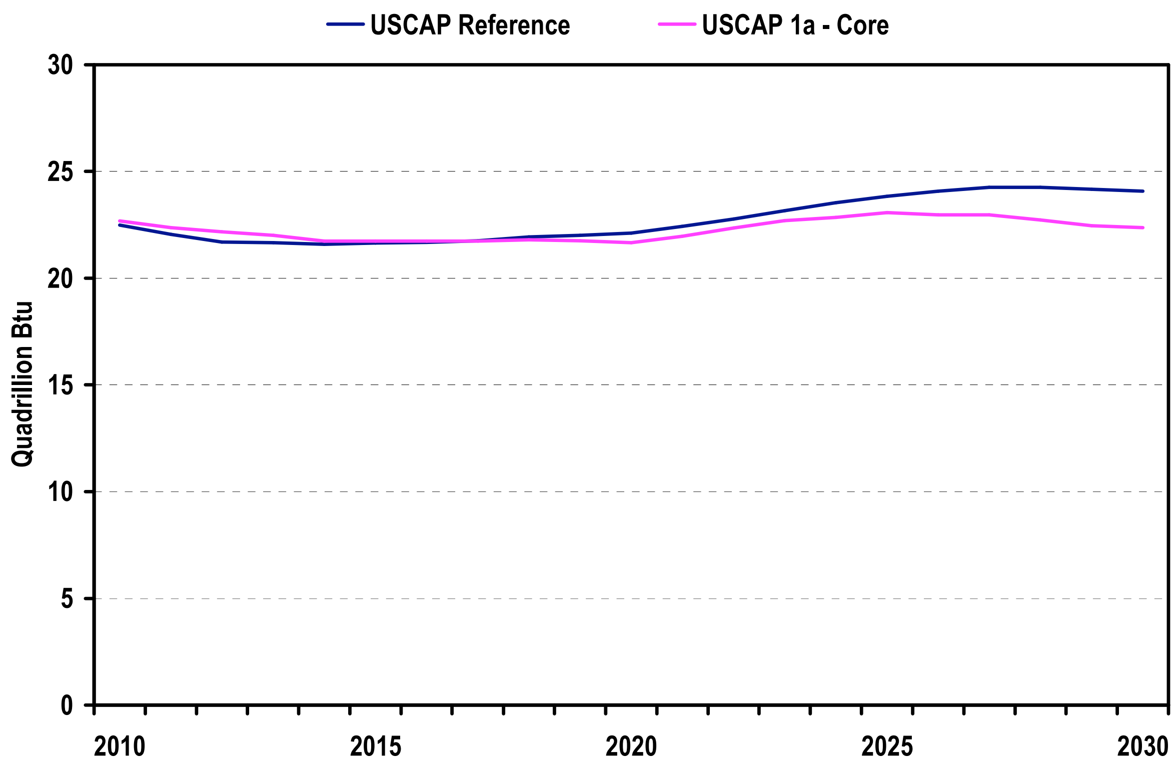

Figure 9: Natural gas consumption (in quadrillion Btu) from NEMS-USCAP

The above results, however, appear not to hold in studies in which deployment of non-emitting technology is constrained and international offsets are severely limited. EIA, for example, found in one of their most conservative scenarios that when these restrictions are imposed and

imperfections that are widely believed to exist because they are difficult to model at the level of aggregation commonly employed.

allowance prices are much higher, natural gas consumption could increase by 68%.[20] The NAM/ACCF study examined scenarios similar to this highly restrictive EIA case and also showed increased gas use. Though all other EIA scenarios support the no "dash to gas" projection, the concern by stakeholders is real. The picture which emerges when looking across studies clearly indicates that the problem can be avoided through strong policies supporting energy efficiency, technology deployment, and international offsets – these policies make this highly restrictive EIA scenario much less likely to become reality. Furthermore, cost containment mechanisms, properly designed, can provide an additional backstop to prevent excessively high natural gas prices.

[20] EIA's most conservative case (called the no international/limited case) assumed that no international offsets were available and constrained nuclear, CCS and biomass to reference levels. EIA's resulting allowance price was $65/ton in 2015, compared to $8/ton in 2015 for the NEMS-USCAP core case.

Assumptions	2009 USCAP MODELING	
	Core Case 2009	More Conservative Case
Market Assumptions		
National Electricity and Peak Demand	AEO 2009+ (~1.0% Average Annual Growth)	1.6% Average Annual Growth
Gas Price Forecast	AEO 2009+	AEO 2009+
Avg Wellhead Price (2007$/mmbtu)	2030: $7.80	2030: $7.80
Henry Hub Price (2007$/mmbtu)	2030: $8.83	2030: $8.83
Technical Assumptions		
Restrictions on New CCS (GW)	2020: 10 2030: 75 2040: 225	2020: 5 2030: 38 2040: 115
Restrictions on New Nuclear (GW)	2020: 10 2030: 60 2040: 75	2020: 5 2030: 23 2040: 46.5
Restrictions on New Biomass (GW)	2020: 20 2030: 75 2040: 80	2020: 10 2030: 25 2040: 40
New Conventional Capacity Cost and Performance	AEO 2009+	AEO 2009+
Renewable Power Technology Cost and Performance	AEO 2009+	AEO 2009+

Notes: "AEO 2009+" refers to the *Annual Energy Outlook* released in April 2009. It includes the Energy Independence and Security Act of 2007, updated projections for a deeper recession, and the February stimulus package.

Scenarios for 2009 USCAP Modeling

SCENARIOS	TECHNOLOGY & COSTS	POLICIES
Modeling the Blueprint (ADAGE and NEMS-USCAP)		
1a – *Blueprint* with all complementary measures (core case)	AEO 2009+ and core technology assumptions (see Market and Technical Assumptions)	BLA targets through 2050 with 17% below 2005 in 2020; 86% coverage; offsets and cost containment policies; full set of complementary measures; methane and HFCs out of the cap and not available as offsets; output-based rebates
1b – *Blueprint* with all complementary measures (more conservative case)	AEO 2009+ and more conservative assumptions (see Market and Technical Assumptions)	Same as 1a
Remove Complementary Measures (NEMS-USCAP)		
2a – Remove transportation measures	Same as 1a	Same as 1a except remove transportation measures
2b – Remove coal measures	Same as 1a	Same as 1a except remove coal measures
2c – Remove energy efficiency measures	Same as 1a	Same as 1a except remove energy efficiency measures
2d – Remove all complementary measures (core)	Same as 1a	Same as 1a except remove all complementary measures
2e – Remove all complementary measures (more conservative)	Same as 1b	Same as 1a except remove all complementary measures
Alternative Offsets Scenarios (ADAGE)		
3a – Delayed availability of domestic and international offsets (0% of assumed supply in 2015, 50% in 2020, 100% in 2025)	Same as 1a	Same as 1a except for offsets provision, BLA offset limits apply
3b – International offsets not allowed to exceed domestic offsets	Same as 1a	Same as 1a except for offsets provision, BLA offset limits apply
3c – All domestic methane sources available as offsets	Same as 1a	Same as 1a except for offsets provision, BLA offset limits apply
3d – No international forestry offsets from G2 countries	Same as 1a	Same as 1a except for offsets provision, BLA offset limits apply
3e – International forestry offsets from G2 countries limited to REDD only	Same as 1a	Same as 1a except for offsets provision, BLA offset limits apply

Notes: "AEO 2009+" refers to the *Annual Energy Outlook* released in April 2009. It includes the Energy Independence and Security Act of 2007, updated projections for a deeper recession, and the February stimulus package. "BLA" is the USCAP *Blueprint for Legislative Action.*