25 June 2013 | 13 pages
North America

Much Ado about Climate Change

President Obama promotes renewables and gas at the expense of coal yet again; vague on Keystone but net supportive…

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With thanks to
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- **President Obama's new Climate Action Plan is highly supportive of renewables and natural gas, but negative for coal**. Overall, the President's plan raises natural gas production demand, limits coal use and raises coal production costs, lowers oil demand and turns the US into an energy exporter in this climate change proposal.
- **Natural gas use should increase further in electricity generation, transport, exports and industry.** (1) Imposing limits on power plant emissions and phasing out fossil fuel subsidies should hit coal use the most. Natural gas-fired generation would partially substitute the decrease in coal generation and act as a backup to renewables. (2) The Plan also encourages the use of heavy duty natural gas vehicles and the use of alternative fuels in general. (3) The Plan encourages the development of a global gas market, US LNG exports are critical in adding supply worldwide and using lower cost US gas to bring down LNG prices globally. This is consistent with the President's recent remarks on the US as a net natural gas exporter by 2020. (4) Low cost gas as a feedstock and fuel source should boost US industrial competitiveness.
- **For the electricity sector, the President's plan would pursue regulation of carbon emissions for new and existing power plants in particular.** CO_2 regulation of existing generation will likely drive retirement of additional coal-fired generation and favor a combination of renewables and gas. An analysis of the "US coal supply curve" in terms of emissions intensity offers insight into which power plants are most exposed.
- **The US government is expected to end its support for public financing of new coal plants globally**, except for clean coal, carbon capture and sequestration, and the most efficient coal-fired generation in the poorest countries that have no other options.
- **The President's speech was cautious in its wording, but seemed net supportive for Keystone XL.** The Plan does not mention the pipeline. Obama suggested approval of KXL would be based on the "nation's interest", which would be served if the project would "not significantly exacerbate" GHG emissions. Based on the State Department's March 2013 Draft Supplemental Environmental Impact Statement, Canadian oil sands production would be basically the same whether or not KXL is approved, given that other transportation methods are credible; this could be reasonably interpreted as "not significantly [exacerbating]" GHG emissions. An independent study by the National Research Council released Tuesday found that bitumen pipelines were not at a greater risk of a spill than other types of crude oil due to corrosion or erosion.
- **The support to the renewables sector for domestic use and exports should appease local industries and level the playing field with China and other low cost producers of renewable technologies.** The overall benefit should be a net reduction of emissions. Reduction of fugitive emissions should also have more negative impact on coal but favors infrastructure upgrade for gas pipes; further encourages gas use.
- **The President's Plan is ambitious but short on details at the moment.** Delays are expected, especially at the rule-drafting stage and the high likelihood of major litigations. Past emission rules from the EPA suffered multiple setbacks in the Courts.

Overview

President Obama's new Climate Action Plan[1] is highly supportive of renewables and natural gas, but negative coal. In all, the President's plan raises natural gas production demand, limits coal use and raises coal production costs, lowers oil demand and promotes the US into an energy exporter in this climate change proposal.

The use of natural gas should increase in multiple sectors: electricity generation, transport and exports. (1) Imposing limits on power plant emissions and phasing out fossil fuel subsidies may have the most impact on coal. Natural gas-fired generation would partially substitute the decrease in coal generation and act as backups to renewables. (2) The Plan also encourages the adoption of heavy duty natural gas vehicles and the use of alternative fuels in general. (3) In an effort to encourage fuel switching from coal to gas globally and developing a global market for gas, US LNG exports should play a key role adding to supply worldwide, using lower cost US gas to bring down LNG prices globally and encouraging fuel switching to gas. This is consistent with the President's remark several weeks ago in turning the US as a net natural gas exporter by 2020.

Power

As markets were broadly anticipating, President Obama announced that he would pursue regulation of carbon emissions from new and existing power plants.

Regulation of CO_2 emissions from new plants was old news. The EPA announced a New Source Performance Standard in 2012 which capped the emissions intensity of new power plants at 1,000 lb/MWh. That rule has since been delayed and a final rule is yet to be released. The announcement today reinforces support for this rule, which effectively sets a CO_2 performance threshold for new power plants at the level of an efficient combined cycle gas plant. As written the rule prohibits even the most efficient coal-fired power plants that do not have significant carbon capture technology. But carbon capture technology (CCS) has to date proven prohibitively expensive and is likely to remain so before 2020. This effective prohibition on new coal-fired generation has limited impact on the markets, however. Market and EIA forecasts projected that almost no coal capacity will be built before 2030 anyways due to cheap gas, comparatively cheaper capital costs of CCGTs vs. coal plants, and existing regulations of emissions at coal-fired plants. Thus this part of the announcement was both old news and no news with comparatively lesser relevance for power, coal, and gas markets.

The news with greater potential market impact was the President's plan to issue a "Presidential Memorandum directing the Environmental Protection Agency to work expeditiously to complete carbon pollution standards for both new *and existing power plants* [our emphasis]". The largest source of power sector emissions is coal-fired power, so this rule will necessarily address regulation of emissions from coal-fired generation. The crucial and remaining question is how this standard or policy will be set and designed. Tuesday's speech did not provide specific details. Depending on how the eventual EPA rules are implemented, potential market impacts could be significant. The central question is what level of *marginal*

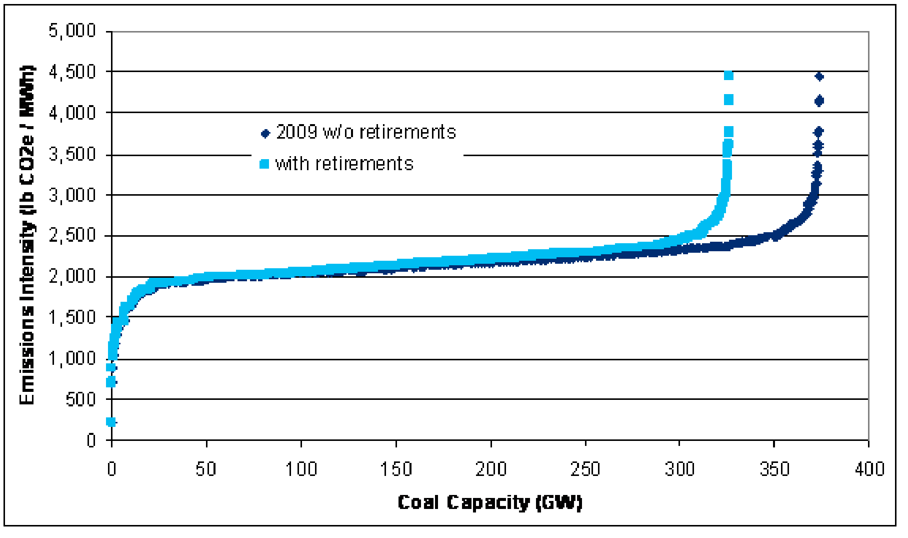
[1] http://www.whitehouse.gov/sites/default/files/image/president27sclimateactionplan.pdf

retirements (on top of MATS and potential CSAPR) this new policy will force when Citi's forecast already calls for 50 GW of coal retirements due to MATS (MACT).

We find two frameworks are useful for starting to quantify this marginal impact on the power sector. While we expect any policy to be subject to both delay and litigation, two broad policy types could emerge.

The first would entail an emissions standard for existing plants similar to the standard for new plants, expressed in terms of emissions intensity of generation (lb CO2/ MWh). The emissions threshold for existing generation will have to be higher than that for new plants, or nearly the entire coal fleet would be facing retirement. In order to quantify the amount of existing coal capacity exposed to such a rule, we develop a supply curve of all US coal capacity in terms of emissions factors (lb CO2e / MWh). The figure below has the supply curve as of 2009 and an additional curve that includes recent retirements and all announced future retirements, thus incorporates impacts of existing policy to the extent possible. This provides an instructive look how different levels of emissions limits would impact the existing fleet and illustrates the marginal impact of a CO2 emissions limit on US coal capacity. Notice that 2,000 lb CO2e / MWh vs. 2,500 would have very different implications for total capacity affected. Retirements will be highly sensitive to how this target might be set.

Figure 1. Emission intensity curves of coal-fired generation (2009 vs. post-retirement curve assuming 50-GW of coal-fired generation retirement due to MATS)



Source: EPA, Reuters, Citi Research

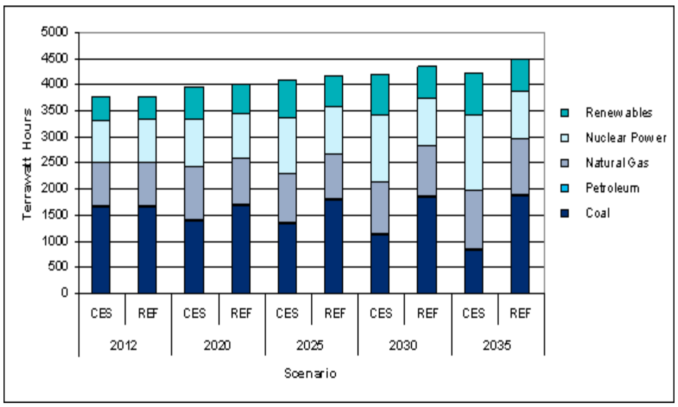
A second category of policy that could emerge might allow for "flexibility" through tradable permits or allocation of emissions across generation portfolios (similar to existing policies under the Clean Air Act). The President's instructions to the EPA to "provide flexibility" and "take advantage of a wide range of energy sources" point in this direction. We think that the 2012 Clean Energy Standard (CES) proposed by former Senator Jeff Bingaman is a useful benchmark here for quantifying possible policy impacts.

Former Senator Jeff Bingaman proposed the 2012 CES, which required covered electricity retailers to supply a mandated share of their sales from specific clean energy resources. The bill targeted 24% of retail electricity sales from "clean sources" by 2015, ramping up to 84% in 2035.

Under this version of a CES, new and existing wind, solar, geothermal, biomass, municipal waste, landfill gas earned full credits. Hydro and nuclear generation from capacity in service after 1991 earned full credits. Certain coal or gas-fired technologies with qualifying carbon intensities could also qualify for partial credits. Credits were bankable to future years and compliance could be met through payment of fees rather than use of credits.

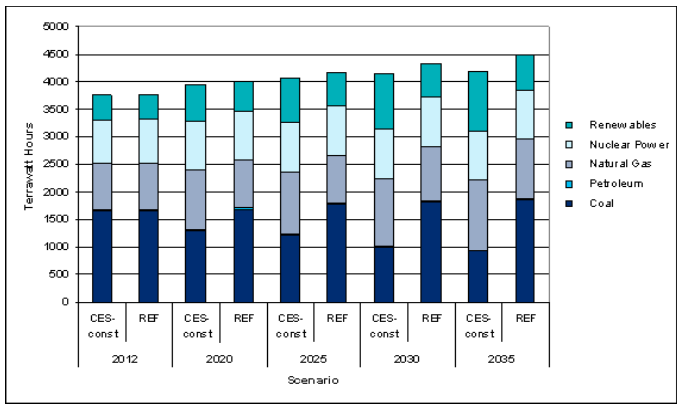
EIA modeled the impacts of the policy in 2012. Key results included a significant reduction in coal-fired generation coupled with an increase in nuclear, natural gas, and renewables generation. Not surprisingly, coal retirements to 2035 increased from 33 GW in the AEO 2012 reference case to 97 GW. The 2012 AEO analysis includes CSAPR, which was vacated in 2012. But the Supreme Court announced this week it will review the decision. EIA also runs an alternative "nuclear constrained scenario" – which we think may be more realistic given escalations in nuclear costs – in which gas and renewables take a larger share of generation and coal's losses are cushioned slightly. Both scenarios are shown in figures below, and provide an initial benchmark for how permit-based policy might affect US generation.

Figure 2. Comparisons between the reference case vs. the Clean Energy Standard – reduction in coal use and higher gas and renewables



Source: EIA, Citi Research

Figure 3. Comparisons between the reference case vs. the Clean Energy Standard with nuclear development constrained – this is more similar to the situation the US is facing



Source: EIA, Citi Research

The bottom line for either type of policy design is that to lowering the CO2 emissions intensity of the US power sector is likely to entail reducing coal generation and replacing it with a combination of renewables, nuclear and gas. In reality, nuclear costs and lead times mean that the bulk of any coal retirements will be made up by gas and renewables. Final policy design will be instructive as to which generation sources and regions are most affected.

Second Order Effects

A few seemingly more minor comments in the proposal could have more subtle effects on the energy markets. First, as we already witnessed when 2012 became a record year for US coal exports, further declines in US coal consumption could be supportive of continued robust coal exports to Europe (where CO2 prices are 4.28 Euro and a large share of gas is oil-indexed). Thus there arises a question of whether US CO2 limits on coal emissions could divert some of those emissions to the EU. Second, the policy states it will focus on reducing methane emissions, including at coal mines. Regulating fugitive methane emissions from coal mines

was a contentious issue in Australia when the country was drafting its carbon policy, as depending on how “gassy” US mines are, there can be significant impacts on the cost of coal production. Different producing regions are likely to witness different impacts.

Keystone XL

President Obama said the following on Keystone XL (KXL): "I do want to be clear. Allowing the Keystone pipeline to be built requires a finding that doing so will be in our nation's interest. And our national interest will be served only if this project does not significantly exacerbate the problem of carbon pollution. The net effects of the pipeline's impact on our climate will be absolutely critical to determining whether this project is allowed to go forward."

This was not a crystal clear pronouncement on the prospects for KXL, but appears more supportive than not, with the broader agenda intended to burnish the President's climate change credentials. The "nation's interest" may signal considerations of employment and energy security as well as carbon emissions. And though some reports before the speech had suggested that KXL would only be approved if it would not mean any net increase in GHG emissions, the President's wording was more cautious, saying that "the national interest will be served only if this project does not significantly exacerbate the problem of carbon pollution", rather than mentioning a strict net zero condition. This would jibe with the State Department's Draft Supplemental Environmental Impact Statement (SEIS), which concluded that whether or not the project permit is approved, Canadian oil sands production would be basically unchanged (falling only slightly by 0.4-0.6% versus the base case by 2030, representing lower GHG emissions by 0.07-0.83 MMTCO2e per year at that time), due to markets finding other transportation routes. And the SEIS focused on the rail alternative in this analysis, but other credible pipeline options not considered by the SEIS further buttress this assessment. These pipelines include TransCanada's Energy East from Alberta to eastern Canada, a possible expansion of the Enbridge Mainline from Canada into the US, and Kinder Morgan's Trans Mountain expansion to the west coast. Thus, this likely signals the Administration's permissive view for KXL. There is no explicit reference to KXL within the text of the Climate Action Plan.

The SEIS did compare lifecycle GHG emissions for oil sands production versus those from the average crude refined by the US in 2005, finding that oil sands were 81% greater on a well-to-tank basis and 17% greater on a well-to-wheels basis, or 18.7 MMTCO2e annually (0.06 metric tons CO2e per barrel per day). Because an oft-cited objection to Keystone XL is that oil sands is “dirty oil”, an interesting perspective is to compute the cost of offsetting the additional carbon embodied in oil sands versus the level of the average US barrel. Buying carbon to offset the incremental emissions would cost \$0.34/bbl at current European CO2 prices (EUA), \$0.89/bbl at current California prices (CCAs), or \$2.16/bbl at the EPAs recently updated "social cost" of carbon.

Canadian producers have been facing heavy discounts versus WTI and even steeper discounts versus Brent due to insufficient pipeline takeaway capacity, and the much-delayed Keystone XL - while not the only option - would be a major debottleneck that would raise Canadian crude values. WCS currently stands at \$16.50/bbl below WTI, but was as much as \$40 below WTI at end-2012. As a thought experiment, if buying carbon offsets to bring Canadian oil sands to emissions parity with the average US barrel were a condition for Keystone XL, the

cost of these offsets are clearly minimal compared to the potential increase in Canadian crude prices (particularly WCS) with sufficient pipeline takeaway capacity to reach US markets.

LNG exports

In an effort to encourage fuel switching from coal to gas globally and developing a global market for gas, US LNG exports should play a key role adding to supply worldwide, using lower cost US gas to bring down LNG prices globally and encouraging fuel switching to gas. This is consistent with the President's remark several weeks ago in turning the US as a net natural gas exporter by 2020.

The US Department of Energy has approved 3.6-Bcf/d of LNG export liquefaction projects already. It looks likely that more approvals will be made throughout this year. Government officials indicated that it takes about two months to review a project and make a decision on approvals. It is possible that the number of approved liquefaction facilities could even exceed the current industry estimates, so as to encourage the development of a global market for gas and make allowance for projects receiving approvals but not necessarily get built.

With the LNG export-positive election result in British Columbia, North America could be poised to supply 9- to 12-Bcf/d (70- to 90-mtpa), or nearly 20% of the global market and the largest export source by 2020.

Citi examined the impact of North American gas exports in the following pieces: "Alert: 2nd US LNG Export Approval: Baby Steps - Question is how many more approvals to expect in 2013?" (May 2013); "Canadian Election Win to Boost Global LNG" (May 2013); "Obama Signals Wave of US LNG Licenses" (May 2013); and "Natural Gas: Bumpy Road to Global Markets – Turbulence before the Golden Age and Competitive Markets" (Dec 2012)

Transport

The President's Plan also explicitly targets improvements in the heavy-duty trucking segment of the transport sector, in addition to encouraging alternative fuel use and raising fuel efficiency standards. Boosting fuel-economy standards is a continuation of policies that favor renewable and electricity use in the transport sector, while reducing oil demand. Further, the Plan also encourages the adoption of heavy duty natural gas vehicles globally. The momentum is already building across the globe, with Asia, especially China, and South America leading the way. But the wide oil-gas price spreads in the U.S. also makes the gas-for-oil substitution economics favorable. Citi examined the impact of natural gas penetration in the transportation sector in a major report "Energy 2020: Trucks, Trains and Automobiles – Start Your Natural Gas Engine" (June 2013)

The tables below present the projected gas demand increase and oil demand displacement as a result of natural gas-for-oil substitution in the transportation sector globally. These tables are broken out in four sections: "On-Road Vehicles," "International Marine," "Other U.S." and "Total Demand." In the "On-Road Vehicles" section, in addition to projections for Europe, Asia and South America, three cases are constructed for the U.S. In the "base" case, NGVs as a percentage of new heavy-duty truck sales will reach 50% in 10 years; in the "complete turnover" case, NGVs as a percentage of new heavy-duty truck sales will reach nearly 100% in a little more than 15 years, following similar fuel-switching patterns as outlined in the

next section. In the "slow adoption" case, NGVs as a share of new sales would not reach 20% until 25 years later. In the "International Marine" section, projections from Lloyd's Register and TOTAL, SA are used. "Other uses in the U.S." include rail and domestic marine transport (e.g. barges). Finally, three cases of total demand are presented to show the range of possible impact: (1) the base case consists of the U.S. NGV "base" case and Lloyd's Register's "base" case in international marine transport; (2) the high case is made up of the "complete turnover" case in U.S. NGV adoption and TOTAL, SA's scenario for marine transport; (3) the low case is composed of the "slow adoption" scenario in U.S. NGV and Lloyd's Register's "low" case.

Figure 4. Projected Gas Demand for Transportation (Bcf/d)

	2013	2015	2020	2025	2030
On-road vehicles					
U.S.					
Base	0.1	0.2	1.8	4.5	6.7
Complete turnover	0.1	0.3	2.2	5.9	9.8
Slow adoption	0.1	0.1	0.3	1.1	2.5
EU	**0.2**	**0.3**	**0.5**	**0.7**	**0.8**
Asia	**2.9**	**3.8**	**6**	**8.1**	**10.1**
South America	**1.1**	**1.2**	**1.4**	**1.6**	**1.8**
International Marine					
Lloyds Register (High)	0	0.1	0.3	3.2	5.1
Lloyds Register (Base)	0	0	0.1	1.1	1.7
Lloyds Register (Low)	0	0	0	0.4	0.6
TOTAL*	0	0	1.5	4.4	7.1
Other U.S. (rail + marine)	**0**	**0.1**	**0.4**	**0.9**	**0.9**
Total Demand					
Base + Lloyds Register (Base)	4.3	5.5	10.2	16.7	22.1
Complete turnover + TOTAL*	4.4	5.6	11.9	21.4	30.6
Slow adoption + Lloyds Register (Low)	4.3	5.4	8.6	12.7	16.9

Source: IEA, Lloyd's Register, TOTAL, Citi Research

Figure 5. Projected Oil Demand Displaced (mb/d)

	2013	2015	2020	2025	2030
On-road vehicles					
U.S.					
Base	0	0	0.3	0.8	1.2
Complete turnover	0	0.1	0.4	1	1.7
Slow adoption	0	0	0	0.2	0.4
EU	**0**	**0**	**0.1**	**0.1**	**0.1**
Asia	**0.4**	**0.6**	**0.9**	**1.2**	**1.5**
South America	**0.2**	**0.2**	**0.2**	**0.2**	**0.3**
International Marine					
Lloyds Register (High)	-	0	0	0.3	0.5
Lloyds Register (Base)	-	0	0	0.1	0.2
Lloyds Register (Low)	-	0	0	0	0.1
TOTAL*	-	0	0.2	0.5	0.7
Other U.S. (rail + marine)	**0**	**0**	**0.1**	**0.1**	**0.2**
Total Displacement					
Base + Lloyds Register (Base)	0.7	0.8	1.6	2.6	3.4
Complete turnover + TOTAL*	0.7	0.9	1.8	3.2	4.5
Slow adoption + Lloyds Register (Low)	0.6	0.8	1.3	1.9	2.6

Source: IEA, Lloyd's Register, TOTAL, Citi Research

Coal

Coal is negatively affected in the President's plan in a number of areas. (1) While phasing out of fossil-fuel subsidies would affect coal, natural gas and oil production, the production cost of coal has little room to fall to offset the loss of subsidies. Without mountain-top removal mining, the cost of coal production in the Eastern half of the country rose because of the need to go underground in long-wall mining. With increased safety inspections, mining efficiency has decreased. In contrast, the cost of unconventional oil and gas production continues to fall on learning-by-doing and technological improvements. (2) Imposing emission standards on new and existing power plants will disproportionately affect coal-fired generation, as a typical coal-fired power plants emit double the amount of carbon dioxide as a combined cycle natural gas-fired power plants.

The US government is expected to end its support for public financing of new coal plants globally, except for clean coal, carbon capture and sequestration, and the most efficient coal-fired generation in the poorest countries that have no other options. This is similar in nature to what the IEA proposed in its latest in-depth report on Climate Change: "Redrawing the Energy-Climate Map" (Jun 10, 2013).[2]

2 http://www.worldenergyoutlook.org/media/weowebsite/2013/energyclimatemap/RedrawingEnergyClimateMap.pdf

The potential positive for coal is possibility of greater US coal exports. With lower domestic coal demand, coal exports to Europe and Asia could rise. The increase of gas and coal exports and the reduction in oil imports effectively raises global supply, all else equal. As Europe continues to import lower cost coal from the US and eventually LNG from North America, the use of high cost, oil-indexed natural gas could be eroded further. Major gas exporters to Europe that insist on oil-indexed pricing should see their market shares dwindle further. Those countries that rely on oil and gas exports should see export revenue decline.

Other impacts

Fugitive emissions

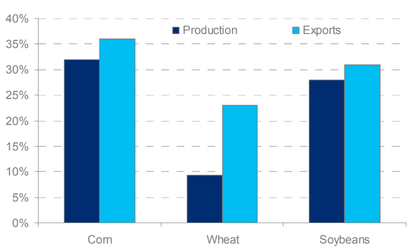
Reducing fugitive methane emissions is a key area of the plan. It will target emission from coal production, agriculture, landfills and oil/gas development. Reducing emissions from coal production should raise production cost, further eroding the competitive edge of coal vs. other higher cost fuels. Limiting emissions from landfills may mean the use of more landfill gas for power generation. Upgrading the pipeline infrastructure with government support should lower the amount of methane leakage present in some of the older pipelines. Although reducing venting and flaring of natural gas in the production of crude oil (in an effort to turn methane as a potent greenhouse gas to the much less potent carbon dioxide) could raise the cost of production, the revenue from gas sales should offset the cost of capturing the fugitive gas.

The renewables sector

The President's Plan also pushes for exports of renewables and sharing of best practices in unconventional gas, through the Unconventional Gas Technical Engagement Program. The support to the renewables sector for domestic use and exports would not only appease local industries within the U.S., but it should level the playing field with China and other low cost producers of renewable technologies. The overall benefit should be a net reduction of emissions as well.

Agriculture

Figure 6. US Grains Production and Exports as % of World



Source: USDA, Citi Research

President Obama also spoke to the detrimental effects of climate change as related to the agriculture sector. The speech made particular note of the adverse impact of the 2012 US drought which significantly curtailed farm-belt crop production and led to record nominal prices for staple cereals last summer. This was followed by what was an unusually wet sowing season this past spring causing significant delays in row crop plantings. The speech identified that such production volatility could be an ongoing risk absent policy change. This is relevant because the US remains the leading international producer of major grains and livestock; the world's 'bread-basket' representative of about 1/3 of global corn and soybean output and about 23% of world wheat trade. The US is also amongst the largest global consumers of each of those underliers as well as meat.

But it is not just output shortfalls that the Administration outlined as a concern since the agriculture industry itself is a meaningful emitter of methane. Methane contributes to about 10% of domestic greenhouse gas emissions but can be about 20x more potent for the atmosphere vis-a-vis carbon. Nitrogen fertilizers, livestock cultivation and associated manure are amongst the most substantial activities leading to domestic methane emissions alongside the hydrocarbon sector, coal mining and landfills. The Obama plan singles out the reduction of methane

emissions (a non-power sector related GHG contributor) as part of its agenda. Although meaningful clarity is lacking, the President's climate action plan seeks to encourage greater interagency cooperation in the reduction of methane output. The US Department of Agriculture (USDA) might look to create seven new Regional Climate Hubs to educate stakeholders including farmers and ranchers. The USDA is also likely to further partner with the EPA on key areas of agriculture sustainability; to buttress efficient use of water, land restoration, climate resilience and in better managing drought preparedness although specific proposals are not outlined at this time. President Obama taking a stance on agriculture sustainability is notable, as it suggests a holistic outlook towards the climate change challenge. But the ag complex was clearly a secondary focus of his proposal and in the short-term there is likely to be little to no impact for producers or the sector as a whole.

The President's Plan is ambitious though short on details at the moment. Delays are expected, especially at the rule-drafting stage and the high likelihood of major litigations. Past emission rules from the EPA suffered multiple setbacks in the Courts. The original Clean Air Interstate Rule (CAIR) was vacated by the Appeals Court and the EPA returned with a proposed rule entitled Clean Air Transport Rule (CATR) in addressing the Court's vacature. After the public comment period, the final rule became Cross-State Air Pollution Rule (CSAPR), which was struck down.

Appendix A-1

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