Annex II. Descriptions of the Super Options

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This Annex provides brief descriptions of the 23 super options that are the basis of the U.S. REMI analysis that evaluates the impacts of implementing GHG mitigation policy options to the U.S. economy. To provide some context on the selection of the super options, the following is a brief discussion of the work CCS has undertaken in over 20 states to facilitate stakeholder-based state-level climate action plans.

State climate action plan processes

The identification, design and analysis of policy option recommendations in the states' action planning processes involved preliminary fact finding by CCS and state agencies through the development of a draft inventory and forecast of GHG emissions, and a draft inventory and catalog of existing and planned actions that reduce emissions in each state, combined with actions considered or undertaken in one or more other U.S. states (over 300 actions in all sectors). Next, stakeholder advisory groups engaged in joint fact-finding and policy development processes that involved the following sequential steps and stakeholder decisions:

1. Expansion of the initial states' catalog of actions to fill gaps and provide a full range of potential actions of relevance to the state.
2. Narrowing of the catalog of actions to a set of top 10 or so draft policy options for each sector based on screening criteria that included GHG reduction potential, cost-effectiveness, co-benefits or costs, and feasibility considerations.
3. Development of draft policy design parameters for each individual policy option (timing, level of effort, coverage of implementing parties, etc.).
4. Modifications of inventory and forecast estimates if/as needed.
5. Identification of preferred data sources, methods, and assumptions for analysis.
6. Identification of preferred or potentially applicable policy implementation tools.
7. Development of estimated GHG reduction potential and costs/savings per metric ton of GHG removed for specific individual policy options.
8. Identification and qualitative or quantitative assessment of co-benefits and costs for specific individual policy options.
9. Development of estimated GHG reduction potential and costs or savings per metric ton of GHG removed for all policy options combined.
10. Final approval of individual policy option recommendations and related planning goals.
11. Development of final report language.

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12. Transmittal of the final report to the convening body, typically the Governor's office.

Selection of twenty-three 'Super Options'

CCS's work with more than 20 states across the nation has identified more than 900 specific policy options that have been considered by the various states. However, due to the limitations of this project, CCS could not reanalyze all of these policy options. Instead, a list of 23 so-called "super options" was proposed and evaluated by CCS, following review and approval by the 18 governors' offices of the Southern Governors' Association[1]. These super options are actually categories or groupings of more specific policies that have been or could be implemented at the state or local level. They were chosen because they typically (1) have the greatest GHG reduction potential; (2) are gateway options, sometimes with limited near-term reduction potential but holding great promise in later years (carbon capture and storage or reuse, nuclear); or (3) are highly cost-effective and important for other reasons (state lead by example).

Because each state process was conducted independently and focused on individual state needs, and because they were stakeholder-driven and conducted at different times over the past few years, differences exist between their designs, final outcomes and results. But the states also share many common issues and characteristics, therefore the results also overlap substantially in key policy areas.

To ensure consistency of analytical methods, assumptions and data sources across all 23 super options in all 16 state plans, the results of the state plans were updated using methods that addressed:

- The effects of the recession on assumed levels of economic growth and other economy-driven assumptions;
- The effects of changes in fuel prices;
- The impacts of recent state or federal actions on assumed future levels of GHG emissions in the absence of the proposed new GHG reduction policies.

Please refer to the separate document Annex I for a detailed discussion of the methodology used in the extrapolation process. Below please see brief description of each super option by sector.

Energy Supply

ES-1 Renewable portfolio standard

A Renewable Portfolio Standard (RPS) is a requirement that utilities must supply a certain, generally fixed percentage of electricity from an eligible renewable energy source(s). About 20 states currently have an RPS in place. In some cases, utilities can also meet their portfolio requirements by purchasing Renewable Energy Certificates (RECs) from eligible renewable energy projects. With REC "trading," it may be beneficial to consider a variety of renewable resources.

[1] This national scale-up project is in part an outgrowth of work CCS performed for the SGA. The vetting of the 23 super options through those governors' offices was performed as part of that effort. The final SGA report can be found at http://www.climatestrategies.us/template.cfm?FrontID=6081 .

ES-2 Nuclear

Nuclear power has historically been a low-GHG source of electric power. No new nuclear power plants have come on line in the United States since 1996. The Energy Policy Act of 2005 included provisions encouraging the construction of new nuclear units. There are currently nine new plant applications on file with the Nuclear Regulatory Commission. The current Administration has been supportive of nuclear expansion, emphasizing its importance in maintaining a diverse energy supply and its reputation for producing electricity with negligible pollutant emissions during operation. Congress has also offered significant financial subsidies for new nuclear plants in an effort to jump-start the industry, including limitations on liability for nuclear accidents.

ES-3 Carbon capture and storage or reuse

Carbon capture and storage or reuse (CCSR) is a process that includes separation of CO_2 from industrial and energy-related sources, transport to a storage location, and permanent or long-term storage in isolation from the atmosphere. Ideally, the CO_2 from large point sources such as power plants can be compressed and transported for storage in geological formations, in the ocean, in mineral carbonates, or use in industrial processes. Captured carbon can also be used for enhanced recovery of oil and gas. The net reduction of emissions to the atmosphere through CCSR depends on the fraction of CO_2 captured, the relative increase in CO_2 production resulting from loss in the overall efficiency of power plants that capture carbon, energy used for transport and storage, any leakage from transport, and the fraction of CO_2 retained in storage over the long term.

ES-4 Coal plant efficiency improvements

Efficiency improvements refer to increasing generation efficiency at power stations through incremental improvements at existing plants (e.g., more efficient boilers and turbines, improved control systems, or combined-cycle technology). Repowering existing power plants refers to switching to lower- or zero-emitting fuels at existing plants, or for new capacity additions, including use of biomass or natural gas in place of coal or oil. Policies to encourage efficiency improvements and repowering of existing plants could include incentives or regulations as described in other options, with adjustments for financing opportunities and emission rates of existing plants.

Residential, Commercial, and Industrial

RCI-1 Energy efficiency target (DSM)

This policy requires that a certain percent of energy sales (electricity, natural gas, fuel oils) be achieved through demand side management efficiency measures. This policy focuses on increasing investment in electricity demand-side management (DSM) efforts through programs run by utilities or other load serving entities, energy efficiency funds, and/or energy efficiency goals. The policy design includes two key and linked dimensions: achievable/desirable energy savings as mentioned above, as well as and policy/administrative mechanisms to achieve these savings. Policy and administrative mechanisms that might be applied include regulator-verified

savings targets, public benefit charges, portfolio standards, energy trusts, integrated resource planning, performance-based incentives, decoupling of rates and revenues, and appropriate rate treatment for efficiency.

RCI-2 High performance buildings –Private sector

This policy provides incentives and targets to encourage or induce the owners and developers of new and existing buildings and facilities to improve the efficiency of their buildings, along with provisions for raising targets periodically and providing resources to building industry professionals to help achieve the desired building performance. This policy can include elements to encourage the improvement and review of energy-use goals over time, and flexibility in contracting arrangements to promote integrated energy- and resource-efficient design and construction.

RCI-2 High performance buildings--Government Lead by Example

Recognizing that governments should "lead by example," this option provides targets to improve the energy efficiency of existing state and local government buildings, existing buildings being renovated, and new buildings under construction. This option could include improved design and construction for government-owned institutional buildings, such as schools and universities. The proposed targets are typically much higher than code standards for new state-funded and other government buildings. Potential elements of this policy include: Requiring that energy efficiency be a criterion in procurement of energy-using equipment and systems; requiring improvements in the operation of buildings and other facilities; requiring audits of energy performance and operations of state and other government buildings; energy star procurement requirements; review of efficiency goals over time, and development of flexibility in contracting arrangements to encourage integrated energy-efficient design and construction.

RCI-3 Appliance standards

Appliance and electronic equipment efficiency standards reduce the market cost of energy efficiency improvements by incorporating technological advances into base appliance models, thereby creating economies of scale. Appliance and electronic equipment efficiency standards can be implemented at the state level for equipment not covered by federal standards, or where higher-than-federal standard efficiency requirements are appropriate.[2] Regional coordination for state appliance and electronic equipment standards can be used to avoid concerns that retailers or manufacturers may (1) resist supplying equipment to one state that has advanced standards, or (2) focus sales of lower-efficiency models on states with less stringent efficiency standards.

RCI-4 Building codes

Building energy codes specify minimum energy efficiency requirements for new buildings or for existing buildings undergoing a major renovation. Given the long lifetime of most buildings, amending state and/or local building codes to include minimum energy efficiency requirements

[2] In recent years, Arizona, Oregon, and Washington, among other states, adopted state standards for several appliances; this led to the inclusion of standards for these appliances in the federal Energy Policy Act of 2005 federal energy bill.

and periodically updating energy efficiency codes could provide long-term GHG savings from commercial, residential, institutional, industrial and government facilities. Implementation of building energy codes, particularly when much of the building occurs outside of urban centers, can require additional resources.

RCI-5 Combined heat and power

Combined heat and power (CHP) systems reduce fossil fuel use and GHG emissions through the improved efficiency of the CHP systems (relative to separate heat and power technologies), and by avoiding transmission and distribution losses associated with moving power from central power stations located far from where the electricity is used.

Transportation and Land Use

Vehicles

TLU-1 Vehicle purchase incentives, including pay as you drive

Federal, state and local governments can provide incentives for public and private vehicle fleets to include low-GHG vehicles. The federal "Cash for Clunkers" program is an example. The state may pass necessary legislation to allow, encourage and support the provision of pay-as-you-drive auto insurance, possibly including state support for additional pilot programs. This measure converts vehicle insurance from a relatively fixed annual amount (which varies little by mileage), to a mostly mileage-based rate.

Fuels

TLU-2 Renewable Fuel Standard (biofuels goals)

Adopt standards that require a certain amount or percentage of fuel sold within the state to be a renewable fuel (e.g., ethanol or biodiesel). This percentage can gradually increase over time. The State can help facilitate the transition to renewable fuels by regulating quality standards for fuel blends.

VMT-- travel activity

TLU-3 Smart Growth/land use

Provide state funding, information dissemination, and technical assistance to facilitate the adoption of smart growth planning processes, models and tools by local and regional jurisdictions. Smart growth planning, modeling, and tools are methods of development that reduce sprawl and maximize environmental, fiscal, and economic resources. This form of planning and modeling often incorporates other planning tools such as mixed-use, open space protection and transit-oriented development.

TLU-4 Transit

Improve existing transit service (e.g., expanded hours or coverage of bus service, higher frequency bus routes, investments in rail transit) to generate greater use of public transit and a reduction in automobile travel. Fund enhanced promotion and marketing of transit to achieve greater use of public transit. Create new public transit infrastructure (e.g., rail lines, bus rapid transit [BRT] routes); greater use of public transit and reduction in automobile travel can be achieved by expanding public transit infrastructure.

Freight/Goods Movement related measures

TLU-5 Anti-Idling technologies and practices

Vehicle idling can be reduced by enforcing anti-idling ordinances and/or encouraging the use of alternatives to idling. Many states and local governments have adopted idling regulations for trucks and buses. Alternatives to long-term truck idling include the use of technologies such as automatic engine shut-down/start-up system controls, direct-fired heaters, auxiliary power units, and truck stop electrification.

TLU-6 Mode Shift from Truck to Rail

This option focuses on strategies to encourage more use of rail freight, for example through improvements to railroad infrastructure and railyards. In many cases, carrying freight by rail rather than trucks can reduce emissions and fuel consumption, while also reducing congestion on major roadways. Shifting freight from trucks to rail also decreases impacts on highway infrastructure, and may reduce truck-related idling and emissions of particulate matter.

Agriculture, Forestry and Waste Management

Agriculture

AFW-1 Crop Production Practices--Soil Carbon Management

The amount of carbon stored in the soil can be increased by the adoption of such practices as conservation, no-till cultivation, and crop rotation. Reducing summer fallow and increasing winter cover crops are complementary practices that reduce the need for conventional tillage. In addition, the application of biochar (i.e., charcoal) may also increase soil carbon content and stabilize soil carbon. By reducing mechanical soil disturbance, these practices reduce the oxidation of soil carbon compounds and allow more stable aggregates to form. Other benefits include reduced wind and water erosion, reduced fuel consumption, and improved wildlife habitat.

AFW-1 Crop Production Practices--Nutrient Management

Improve the efficiency of fertilizer use and other nitrogen-based soil amendments through implementation of management practices and Generally Accepted Agriculture Management Practices (GAAMP). Excess nitrogen not metabolized by plants can leach into groundwater and/or be emitted to the atmosphere as N_2O. Better nutrient utilization can lead to lower N_2O emissions from runoff.

AFW-2 Livestock Manure - Anaerobic Digestion and Methane Utilization

Reduce the amount of methane emissions from livestock manure by installing manure digesters on livestock operations. Energy from the manure digesters is used to create heat or power, which offsets fossil fuel–based energy production and the associated greenhouse gas (GHG) emissions. Farmers may consider new technologies as well, such as plasma arc technology. The joint U.S. Department of Agriculture/U.S. Environmental Protection Agency AgSTAR program maintains extensive information on manure management technologies, including anaerobic digestion. More information may be found at: http://www.epa.gov/agstar/.

Forestry

AFW-3 Forest Retention

Reduce the rate at which existing forests are cleared and converted to developed uses. Much of the carbon stored in forest biomass and soils can be lost as a result of such a land-use conversion. Easements can be used toward this end, as well as conservation programs.

AFW-4 Reforestation/Afforestation

Establish forests on land that has not historically been forested (e.g., agricultural land; "afforestation"). Promote forest cover and associated carbon stocks by regenerating or establishing forests in areas with little or no present forest cover ("reforestation"). In addition, implement such practices as soil preparation, erosion control, and stand stocking to ensure conditions that support forest growth.

AFW-5 Urban Forestry

Maintain and improve the health and longevity of trees in urban and residential areas to protect and enhance the carbon stored in tree biomass. Indirect emission reductions may also occur by reducing heating and cooling needs as a result of planting shade trees. Promote use of software programs that can be used by cities and communities to track urban forestry. The policy design needs to be sensitive to greenbelt taxing issues.

Waste Management

AFW-6 MSW Source Reduction

Reduce the volume of waste from residential, commercial, and government sectors through programs that reduce the generation of wastes. Reducing generation at the source reduces both landfill emissions and upstream production emissions.

AFW-7 Enhanced Recycling of Municipal Solid Waste

Increase recycling and reduce waste generation in order to limit GHG emissions associated with landfill methane generation and with the production of raw materials. Increase recycling programs, create new recycling programs, provide incentives for the recycling of construction

materials, develop markets for recycled materials, and increase average participation and recovery rates for all existing recycling programs.

AFW-8 MSW Landfill Gas Management

Use the renewable energy created at landfills by anaerobic digestion (methane) to make electric power, space heat, or liquefied natural gas. Encourage smaller landfills that do not fall under environmental protection regulations (i.e., new-source performance standards [NSPS]) to capture and flare methane gas. Flares are used to safely combust toxic and volatile gases from landfills, and they convert methane gas, which has a relatively high global warming potential, to CO_2.