



# State of Sonora State Climate Action Plan

## Phase 1 – Identification of priority options for mitigating greenhouse gas emissions August 2011

### ***Introduction and Background***

The Government of the State of Sonora, through the Commission for Ecology and Sustainable Development (*Comisión de Ecología y Desarrollo Sustentable*, CEDES) and with the participation of a broad sector of the community and federal government agencies, is developing the State Climate Action Plan (SCAP). The purpose of the SCAP is to outline a statewide strategy to mitigate (reduce) greenhouse gas (GHG) emissions that contribute to climate change throughout the state and to implement measures to adapt to climate change effects expected in Sonora.

The SCAP complements the strategies and measures identified by the Special Climate Change Program (*Programa Especial de Cambio Climático*, PECC) at the federal level. It focuses primarily on actions that Sonora can and should implement at the state level, in some cases in coordination with federal agencies. The SCAP is being developed in coordination with the National Institute of Ecology (*Instituto Nacional de Ecología*, INE) in order to comply with requirements established by the agency for state plans.

The SCAP's development process can be summarized in four main steps:

- GHG emissions inventory and projections
- GHG emissions mitigation measures
- Climate change adaptation measures
- Development of the SCAP document

To date, the State of Sonora has completed the development of the GHG emissions inventory and projections, and is in the process of evaluating and selecting GHG emissions mitigation policies. This document is a report of the first phase of this last activity. The evaluation of mitigation measures, which represents the second phase, has been proposed for the second half of 2011, contingent upon the availability of the required funding.

Furthermore, the state expects to continue identifying and assessing adaptation measures in the future.

The development of this phase of the SCAP received the support of the Border Environment Cooperation Commission (BECC) through technical assistance funding provided under the Border 2012 Program. BECC is a binational organization created by the governments of the United States and Mexico to preserve, protect, and improve the environmental and human health conditions of the U.S.-Mexico border region. In regard to climate change, BECC has supported the development of SCAPs in Mexican border states by establishing coordination and training activities and providing technical assistance funding. In the particular case of Sonora, BECC provided technical assistance for the development of the emissions inventory and projections, and for the first phase of the evaluation and selection of mitigation measures presented in this report.

## **Objectives**

The process for evaluating and selecting emission mitigation measures can be summarized in two phases:

Phase 1 – Identification of priority policy options for mitigating greenhouse gases.

Phase 2 – Design and quantification of costs, benefits, and macroeconomic impacts of priority policy options, and final recommendations

The purpose of this document is to present the methodology used and the results of Phase 1 of this process.

An important achievement in this phase, in addition to the prioritization of mitigation options, was the establishment of an Advisory Group (AG) and five (5) Technical Work Groups that will guide and participate throughout the development of the SCAP beyond this first phase. These groups include a wide range of representatives from the government, private, academic, and social sectors.

## **Advisory Group and Technical Work Groups**

The SCAP Advisory Group (AG) was summoned by the State Governor from the existing State Council for Sustainable Development (*Consejo Estatal para el Desarrollo Sustentable*), and was supplemented with additional members in order to broaden the participation of other sectors of the Sonoran society. As shown in the table below, the AG contributes a wide range of perspectives and interests to the process, including those of federal, state, and local government agencies, the private sector, academia, and non-governmental organizations.

The role of the AG in the development of the SCAP is critical, since the AG is responsible for recommending feasible and detailed actions to be implemented by the relevant government entities, the industrial and commercial sectors, and the community at large. These actions must be economically viable and strategically sensible. Additionally, the organizational level and experience of the members of this group will give the SCAP the required credibility and support.

The criteria for the establishment of the AG include having broad participation of organizations and government entities, gender diversity and varied experience, as well as the participants' personal characteristics with regards to leadership, influence in their respective areas, and ability to work well in collaborative processes.

**Table 1. Members of the Advisory Group**

NAME	INSTITUTION
Rogelio Alcaraz Flores	Unión Ganadera Regional de Sonora
José Trinidad Borbón Soto	Ayuntamiento de Navojoa
Gerardo Carrión Arroyo	Naturalia A.C.
José Coronado Celaya	Comisión de Ecología y Desarrollo Sustentable de Sonora (CEDES)
Juan Jaime De la Torre	Ayuntamiento de Nogales
Cuauhtémoc González Ruelas	Comisión Federal de Electricidad – Generación
Érika Gussen Sánchez	Procuraduría Federal de Protección al Ambiente (PROFEPA)
Gloria Juvera Moreno	Secretaría de Infraestructura y Desarrollo Urbano (SIDUR)
Fernando Landgrave	Secretaría de Infraestructura y Desarrollo Urbano (SIDUR)
Eduardo López Saavedra	Biodiversidad y Desarrollo Armónico
Víctor Manríquez	Secretaría de Economía
Joaquín Marruffo Ruiz	Comisión de Ecología y Desarrollo Sustentable de Sonora (CEDES)
Oswaldo Mendoza García	Ayuntamiento de Puerto Peñasco
Héctor Tecumshe Mojica Zárate	Universidad de la Sierra
Jesús Roberto Molina Acedo	Comisión Estatal del Agua
Yolanda Núñez Hernández	Secretaría de Salud Pública
María Alejandra Olivares Ceceña	Secretaría de Educación y Cultura
Carmen Isela Ortega Rosas	Centro de Estudios Superiores del Estado de Sonora (CESUES)
Ramón Pacheco Aguilar	Centro de Investigación en Alimentación y Desarrollo (CIAD A.C.)
Rigoberto Palafox Rivas	Comisión Nacional Forestal
Rafaela Paredes Aguilar	Comisión Nacional de Areas Naturales Protegidas (CONANP)
Antonio Paz M.	SAGARHPA
Carlos Enrique Peña Limón	Universidad de Sonora (UNISON – DICTUS)
Alberto Platt	Universidad de Sonora (UNISON)
Jorge R. Preciado Peralta	TECMED
Leoncio Rodríguez Valdez	Ayuntamiento de Huatabampo
Juan Carlos Rojo Ibarra	Asociación de Profesionales en Seguridad Ambiental
Alberto Rojo	Ayuntamiento de Álamos

Humberto Ruiz Molina	Secretaría de Medio Ambiente y Recursos Naturales (SEMARNAT)
Elia Serrano	PROMAESA
Juan Antonio Serrano Sainz	Unidad Estatal de Protección Civil
Martín Tapia	Ayuntamiento de Caborca
Oscar Téllez Leyva	Comisión de Ecología y Desarrollo Sustentable de Sonora (CEDES)
Rafael Valdez Portillo	Comisión Estatal del Agua
Luis Carlos Valdez	Instituto Tecnológico de Sonora (ITSON)
Luis Velázquez Contreras	Universidad de Sonora (UNISON)
Julio Abdón Zamorano Santacruz	Comisión de Energía del Estado de Sonora
Joel Alonso Zepeda Ibarra	Ayuntamiento de Hermosillo
Martín Valencia Moreno	Universidad Nacional Autónoma de México (UNAM) – Geología

The AG is responsible for making final recommendations to the Governor regarding policy options to be included in the SCAP.

Additionally, five Technical Work Groups (TWG) were established, composed of a diverse range of representatives of the Sonoran community, including the government, academic, private, and social sectors. Exhibit I presents a list of the members of each TWG.

TWGs represent a forum for the conceptualization, analysis, and design of specific recommendations for each sector. Therefore, their members must reflect the same diversity of the AG within each sector. TWGs are composed of highly specialized professionals and technicians who have been recognized in their fields and are capable of working well in teams. This group includes policymaking officials and members with a deep understanding of the social aspects related to their sectors.

The function of the TWGs is to review an initial catalog of policy options, add other options to the catalog, and issue recommendations to the AG; however, the TWGs do not have decision-making authority. The five TWGs created were:

***Energy Supply (generation)*** – power and heat generation, with a primary focus, in the case of Sonora, on the generation and distribution of electricity and hydrocarbon transportation.

***Residential, Commercial, and Industrial (energy use)*** – energy efficiency in the residential, commercial, and industrial sectors, including government offices; and the release of GHGs from non-fuel industrial processes.

***Transportation and Urban Development*** – vehicle efficiency, alternative fuels, mass transit, and fuel demand reduction programs, including planning and urban development strategies.

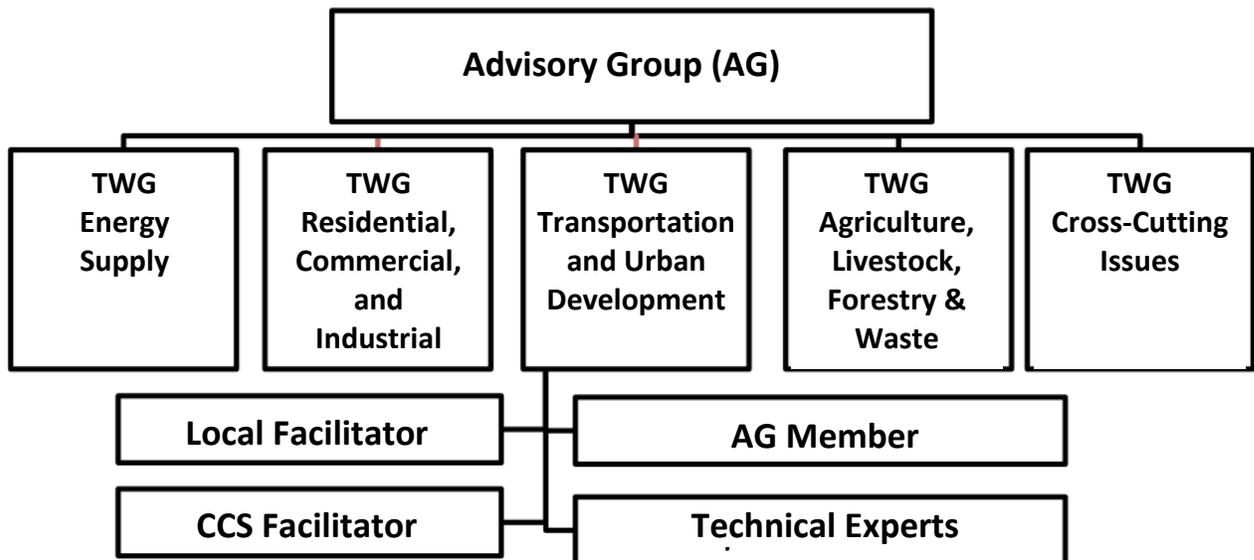
***Agriculture, Livestock, Forestry, and Waste***– soil protection, energy conservation and energy efficiency in agriculture and livestock farming, reforestation, sustainable forestry, bioenergy, sustainable wood products, waste reduction and recycling.

***Cross-Cutting Policy Issues*** – emissions reporting and registries, public education, state goals, state government "leading by example," social and gender equity in climate change policies.

The first four TWGs represent sectors of the economy, while the Cross-Cutting Issues TWG, as its name implies, covers issues that are relevant to all sectors.

Each TWG incorporated at least one member of the AG, and one of the members was appointed as group facilitator. Facilitators were selected not only based on their technical ability and willingness to take on additional responsibilities, but also based on their recognition as experts in their field and their organizational and leadership skills to convene and lead the rest of the group –which has varied perspectives and viewpoints– through the analytical process required to review, evaluate, and recommend climate change policies to the AG.

Additionally, each TWG received the assistance of a facilitator from the Center for Climate Strategies (CCS). The figure below shows the relationship between the AG and the TWGs.



## **Methodology**

### **Process for identification, prioritization, and selection of options**

The process for evaluating and selecting priority options was led by CEDES, and included the active participation of 71 representatives from all sectors of the community who sat on the Advisory Group (39 representatives) and the Technical Work Groups (32

representatives, in addition to the AG). CCS provided technical support and facilitated the process.

The process consists of a total of 10 steps. The first 4 steps are reflected in Phase 1 herein, while the six remaining steps will be implemented in Phase 2. Below is a summary of these steps.

### ***Organization and Establishment of the Advisory Group and Technical Work Groups***

As described in the previous section, the Advisory Group was comprised of 39 members who represent the diversity of sectors in the state. The AG was established on the basis of the State's Sustainable Development Advisory Council. The AG is responsible for guiding the process for the selection of alternatives and issuing a series of final recommendations to the State Governor to be incorporated to the SCAP.

This first step also included the review of a base catalog of mitigation options to be considered during the process. The base catalog was provided by CCS and represents a compilation of about 350 policy options that have resulted from the implementation of this process in many state plans throughout the United States. Each of these policies included a description and a preliminary qualitative estimation of their mitigation potential and cost.

#### ***1. Review of the GHG Emissions Inventory and Projections***

The GHG emissions inventory and projections were developed in 2009 by CEES and CCS in collaboration with the University of Sonora (*Universidad de Sonora*, UNISON) and multiple federal government agencies. This step of the process allowed the AG and the TWG to become familiar with the catalog and provided them a tool for prioritizing mitigation measures based on their emission reduction potential, cost, and other considerations or externalities (i.e. co-benefits, related ongoing actions, and feasibility considerations).

#### ***2. Expansion of the Policy Options Base Catalog***

As stated above, the base catalog is a compendium of about 350 policy options; it provides a preliminary qualitative estimation of each of the options' mitigation potential and cost per ton. The base catalog was reviewed by the AG and in detail by the TWGs in May, with the purpose of discussing the feasibility and relevance of these options for Sonora; identifying additional potential options that should be included in the catalog, based on the group's knowledge of the particular features of Sonora; and making comments and annotations about the mitigation potential, cost per ton, externalities, feasibility considerations, and related actions throughout the state. These actions resulted in a revised catalog for Sonora, from which options for the state will be prioritized.

The following table presents the number of options included for each sector in the final catalog, which may be found at [www.socambioclimatico.mx](http://www.socambioclimatico.mx).

**Table 2. Policy Options included in the catalog for each sector**

Sector	Number of catalog options
Energy Supply (generation)	49
Residential, Commercial, and Industrial (energy use)	72
Transportation and Urban Development	112
Agriculture, Livestock, Forestry, and Waste	67
Cross-Cutting Policy Issues	37
<b>TOTAL</b>	<b>337</b>

### 3. *Priority Options for Future Review*

Once the catalog of options was reviewed, the group proceeded to prioritize the options that each TWG considered most important for their sectors, based on their potential to mitigate GHG emissions, implementation feasibility, cost-benefit ratio, and related actions throughout the state. After an extensive dialogue on the merits of each option, members of the TWG were asked to individually select by ballot the 10 catalog options they considered priorities for their sector. The votes of TWG members were compiled and options were grouped in three prioritization levels based on the number of votes received:

- **Level 1:** Proposals that have substantial support from the TWG and are recommended to the AG for a more detailed analysis in Phase 2
- **Level 2:** Proposals that have less support from the TWG than Level 1 options, but nevertheless may be of interest to the AG and may be promoted to Level 1 or combined with Level 1 options
- **Level 3:** Proposals that have little or no support from the TWG and are not recommended for further consideration during the review phase (Phase 2)

The individual voting results were discussed within each TWG to make clarifications and identify options that could be combined. Note that the numerical result of the vote was taken only as a guide for decision-making purposes, and not necessarily as the final result. Based on the group discussions, some options were combined and even reassigned from one level to another.

Prioritization results were presented to the AG for review and comment during a working session, at the end of which a final list of prioritized options was obtained. These options are described in more detail in the next section.

The next six steps in the mitigation measures process will be carried out during Phase 2, and will consist of:

***Preliminary design of options*** – including goals, implementation time, stakeholders involved in the implementation, and establishing quantification parameters

**First quantification round** – quantification of potential GHG emissions, costs, and savings generated by priority options. Additionally, externalities (co-benefits or indirect costs) are included

**Options matrix** – design of policies and potential methods for their implementation; definition of related policies; identification of obstacles for AG consensus and for implementation

**Identifying solutions to overcome obstacles and achieve AG consensus** – Clarifications, additions, or modifications to the policy designs

**Comprehensive policy review and comparison with goals** – Integrating all the options, avoiding overlapping and duplicity, and assessing impacts globally

**Preparing Final Report**

**Workflow and AG/TWG Meetings**

The workflow revolved around a considerable number of AG working sessions, with the participation of TWGs, and separate TWG-only meetings. During AG meetings, progress was reviewed and decisions were taken, while the TWG meetings focused on the review and evaluation of policy options. In total, Phase 1 included three AG meetings, and between each of them, at least two independent meetings of each of the TWG were held, for a total of at least four TWG meetings (the Energy Supply, ALFW, and Cross-Cutting Issues TWGs met five times). A total of 26 meetings were held.

The objectives and topics covered in each meeting were:

**Table 3. Objectives and topics addressed in working meetings**

Meeting	Objectives and Topics Addressed
First AG Meeting	Process summary Begin consultation about draft catalog of potential actions Establish Technical Work Groups
First TWG Meeting	Review catalog of potential actions and clarifications Identify potential options for Sonora that should be included in the catalog
Second TWG Meeting	Final review of expanded catalog Finalize the catalog for AG consideration
Second AG Meeting	Review and finalize the catalog of potential actions Review of the prioritization process
Third TWG Meeting	Review the process for prioritizing catalog options Discuss the merits of each option
Individual voting of TWG members	Select the 10 options considered as priorities for each sector individually by each member of the TWGs
Fourth TWG Meeting	Collect individual ballots and rank them by priority levels Discussion of results Adjustments to the prioritization as a result of discussions Finalize the list of priority options to be submitted to the AG for consideration
Third AG Meeting	Review and comment on priority options recommended by the TWGs Adjustments to the prioritization as a result of discussions

Selection of priority action policies for review during the Second Phase

\* Each TWG met individually; some TWGs decided to have more meetings to discuss options in more detail.

A similar methodology will be followed during Phase 2. The next phase will begin with two TWG meetings, followed by three AG meetings. At least two meetings of each of the TWGs will be held between AG meetings.

### Priority Policy Options

This section presents policy options for each of the five sectors. In addition to the priority options characterized as Level 1, options considered as Level 2 are presented for reference. These are not intended to be designed and quantified during Phase 2, but nevertheless, they could be considered as important issues in the design and quantification of priority policies. The description of Level 2 options may be found in the full catalog of options published in the SCAP website ([www.socambioclimatico.mx](http://www.socambioclimatico.mx)). Additionally, the catalog includes options related to Level 1 options that may be considered during the design of priority options during the next phase.

### Energy Supply

Priority options for the energy supply sector, as well as related actions that should be considered during the design of policies in Phase 2 are presented in Table 4. These 10 options are grouped into four sub-sectors:

- Emissions policies and general issues: 1.1
- Renewable energy and energy efficiency: 2.2, 2.4, 2.8, 2.12, 2.13, and 2.16
- Fossil fuels: 3.2
- Other energy supply options: 6.1 and 6.4

**Table 4. Priority Energy Supply Policies – Level 1**

Option	Related Options
1.1 – GHG emissions trading	
2.2 – Incentives and/or removal of barriers to renewable energy generation for delivery to the power grid	
2.4 – Incentives and/or removal of barriers to combined heat and power generation	
2.8 – Demand-side energy efficiency (focus on Residential, Commercial, and Industrial)	
2.12 – Incentives and/or removal of barriers to consumers for energy efficiency	
2.13 – Research and development of renewable energy technologies	1.5, 2.9
2.16 – Promote renewable energy generation for self-consumption in Sonora (all sectors)	
3.2 – Efficiency improvements and repowering of existing plants	
6.1 – Upgrades to the hydrocarbon transportation and power transmission system	4.2

6.4 – Environmental and emissions disclosure	
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**Table 5. Energy Supply Policies – Level 2**

2.9 – Technology-focused initiatives (biomass, energy storage, etc.) (Grouped in Level 1 with option 2.13)
1.5 – Technology research and development (Grouped in Level 1 with option 2.13)

Following is a brief description of the options recommended for further review:

***1.1 GHG Emissions Trading***

An emissions trading system is a market mechanism by which GHG emissions are limited or capped to a predetermined level, and those involved in the system require a permit for each unit of emissions. Through trading, participants with lower compliance costs may release emissions below their limit (i.e. "over-compliance") and sell their surplus rights to participants for whom compliance costs are higher. Thus, the total compliance costs for the community could be lower, while complying with the limit established for total emissions.

The initial distribution of allowances is a critical policy decision. Original allowances may be auctioned (and the proceeds of the auction may be used to benefit consumers who may be affected by higher costs as a result of the policy), allocated to existing emission sources, or a combination of both.

The level of participation ranges from a specific group of emitters in a particular sector, to all sectors of the economy. As with carbon taxes, the obligation to comply may be imposed "upstream" (at fuel extraction or importation points) or "downstream" (at fuel consumption points).

Important considerations regarding the emissions trading program include the sources and sectors to which the program applies; emission rights level, times, and duration; how allowances would be distributed (i.e. based on load or based on generation, how new participating markets are accommodated, how leaks are approached, etc.). Other issues to consider include: what gases will be included in the system; availability of loans; early emissions reduction credits; opportunities to include incentives; the use that will be given to the revenues obtained from auctioning allowances; and provisions to encourage energy efficiency.

***2.2 – Incentives and/or removal of barriers to renewable energy generation for delivery to the power grid***

This priority option includes financial incentives to encourage investments in renewable energy resources such as wind and solar energy. Examples include: (1) direct subsidies for the purchase and sale of renewable energy technologies; (2) tax credits or exemptions for the purchase of renewable technologies; (3) feed-in tariffs that provide direct payments to renewable energy generators for each kilowatt-hour (kWh) of electricity generated by a qualified facility; (4) tax credits for each kWh generated by a qualified facility; (5) regulations that result in incentives and/or the assurance of cost recovery for utilities that

invest in renewable energy systems. In addition, this policy would make it a priority for the relevant state agencies to identify and remove barriers to the development of renewable resources in the state.

Considerations for this option may include net metering, interconnection standards, and production-based incentives.

#### ***2.4 – Incentives and/or removal of barriers to combined heat and power generation***

Combined heat and power (CHP) can reduce GHG emissions and increase the overall efficiency of fuel use. However, there are numerous barriers to CHP, including inadequate information, institutional barriers, high transaction costs due to the small scale of projects, high financing costs because of lender unfamiliarity and perceived risk, "split incentives" between building owners and tenants, and utility related policies like interconnection requirements, high standby rates, exit fees, etc.

Additionally, the lack of offer or long term contracts, payment at avoided cost levels, and the lack of recognition for emissions reduction value provided also create obstacles.

Policies to remove these barriers may include improved interconnection policies; improved rates and fees policies; streamlined permits; recognition of the emission reduction value provided by CHP and distributed generation; financing packages; power procurement policies, and education and outreach, among others.

Financial incentives for CHP could include: (1) direct subsidies for the purchase and sale of CHP systems given to the buyer or seller; (2) tax credits or exemptions for the purchase and sale of CHP systems issued to the buyer or seller; (3) tax credits or exemptions for operating CHP systems; (4) feed-in tariff as a direct payment to CHP owners for each kWh of electricity or BTU (British Thermal Unit) of heat generated by a qualifying CHP system.

#### ***2.8 – Demand-side energy efficiency (focus on Residential, Commercial, and Industrial)***

Encourage energy efficiency in the consumer sector and smart metering that allows the consumer to interact and manage energy use. See the Residential, Commercial, and Industrial (RCI) sector section.

#### ***2.12 – Incentives and/or removal of barriers to consumers for energy efficiency***

This policy option includes financial incentives for consumers to encourage investment in energy efficiency and conservation technologies.

Considerations for this option could include corporate tax incentives; tax credits and incentives for sustainable or green building; green building standards for state facilities; energy efficiency bond programs; personal tax incentives; sales tax incentives; lease-to-purchase programs; grant programs; and loan programs.

#### ***2.13 – Research and development of renewable energy technologies***

Policies may be developed to help overcome barriers for the development of renewable energy technologies. Institutional and market barriers include price distortions, failure of the market to value the public benefits of renewable energies, and the social cost of fossil

fuel technologies, inadequate information, institutional barriers to grid interconnection, high transaction costs due to the small scale of projects, high financing costs because of lender unfamiliarity and perceived risk. These barriers may be overcome through a set of financial and regulatory redresses, as well as through information and public education campaigns.

Financial obstacles can be addressed through property tax exemptions; personal income tax credits or deductions to cover the expense of purchasing and installing renewable energy equipment; loan programs to aid in financing the purchase of renewable energy equipment; and grant programs designed for technology research and development or to help a project achieve commercialization.

Regulatory policies can include easements or access rights for wind or solar projects; development of guidelines at the local level to enhance renewable energy generation (e.g., requiring proper street orientation); and requirements that utilities provide information on renewable energy production to customers in remote regions.

### ***2.16 – Promote renewable energy generation for self-consumption in Sonora (all sectors)***

Promote the implementation of renewable and local energy technologies in all sectors of the economy (residential, commercial, and industrial; agriculture; urban and rural sectors). The self-generation of renewable energy at the local level may increase energy independence and in many cases, reduce energy costs. Having alternative and self-controlled sources of energy can supplement conventional sources, thus reducing GHG emissions from fossil fuels and providing flexibility and a constant load during blackouts.

Incentives such as net metering –i.e. selling surplus power generated on-site with renewable technologies to the grid; technical assistance programs; training workshops, installation assistance, and other mechanisms, may facilitate the integration of renewable sources to the existing system and infrastructure. Additionally, applied research and service initiatives by University Outreach and local technical schools would be very helpful. State and local governments can lead by example by installing renewable energy systems in their buildings, which not only would reduce GHG emissions and save money on energy costs, but would also demonstrate and prove these systems for their subsequent implementation in the private sector.

### ***3.2 – Efficiency improvements and repowering of existing plants***

This policy refers to increasing generation efficiency at existing power plants through initiatives such as more efficient boilers and turbines, improved control systems, or combined cycle technology, among others. Repowering existing power plants refers to switching to lower or zero emitting fuels at existing plants or new facilities. This includes the 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 above, with adjustments for financing opportunities and emission rates of existing plants.

### ***6.1 – Upgrades to the hydrocarbon transportation and power transmission system***

This policy includes measures to improve transmission systems to reduce bottlenecks and increase specific performance to meet electricity demands in the long term, and improve operating efficiency throughout the system. Opportunities may exist to substantially increase transmission line carrying capacity through the implementation of new construction, and to upgrade the transmission line by incorporating advanced composite conductor technologies, capacitance technologies, and computerized grid management.

The installation of new transmission lines may be a difficult process, considering its cost and local impacts on the environment and property use and value. Policy measures in support of this option could provide incentives for utilities to improve the transmission systems and thus reduce barriers to the installation of new transmission lines.

### ***6.4 – Environmental and emissions disclosure***

This policy consists of establishing requirements for GHG emitters to report their emissions on a regular basis (i.e. annually). In addition to emissions, disclosure may also include an account of business risks resulting from climate change, such as assets at risk of being impacted by the climate, threats to their market share, and potential risks of future regulations.

Environmental disclosure allows investors and consumers to obtain information pertaining to GHG emissions and climate risks from companies to make more informed decisions about the purchase of stock and investments, and provides incentives for companies to reduce their risks in these areas and, among other actions, reduce their carbon footprint. In the case of energy supply, environmental disclosure provides consumers and shareholders information about carbon emissions per kWh, which would help them make informed decisions about electricity purchase and use, and assess investment risks. Disclosure is particularly effective in areas where consumers have the opportunity to choose their electricity provider.

## **Residential, Commercial, and Industrial**

Priority options for the residential, commercial, and industrial sector, as well as related actions that must be considered during the design of policies in Phase 2 are presented in Table 6. These 8 options are grouped into 4 sub-sectors:

- Energy efficiency programs: 1.5 y 1.11
- More sustainable constructions and facilities: 2.3, 2.6 y 2.8
- Education and environmental disclosure: 4.1 y 4.5
- Distributed energy and cogeneration: 6.5

As stated in the energy supply section, Level 1 options will be evaluated in more detail during Phase 2. Level 2 options are presented in Table 7 for information purposes, and will be considered during the design of priority policies.

**Table 6. Priority RCI Policies – Level 1**

Option	Related Options
1.5 – Regional market transformation through partnerships, technology development programs, and education	
1.11 – Reduce energy use by 10% or more in state-owned buildings	2.11, 9.1, 9.3
2.3 – Improved design and construction throughout all sectors, "Government leading by example"	2.1, 2.2, 2.9, 2.10, 2.12, 2.17, 9.4
2.6 – Promotion and incentives for improved design and construction (e.g. green building, LEED)	1.9, 1.13, 2.7, 6.1, 9.6
2.8 – Incentives for retrofitting existing residential, commercial, institutional, and industrial buildings	2.13, 6.1, 6.4, 9.4
4.1 – Consumer (and public) education programs	4.2
4.5 – Create a high-tech research and development center that focuses on renewable energy and energy efficiency, and promotes marketing and training	4.6
6.5 – White roofs, rooftop gardens, and landscaping (including shade tree programs)	6.7, 6.8

**Table 7. RCI Policies – Level 2**

2.11 Energy efficiency in local and state government buildings <i>(Included in Level 1 with Option 1.11)</i>
2.12 – Require new government buildings to comply with LEED Gold certification or equivalent requirements <i>(Included in Level 1 with Option 2.3)</i>
6.1 – Incentives for renewable energy systems in residential, commercial, and industrial sites <i>(Included in Level 1 with Option 2.8)</i>

Following is a brief description of options recommended for further review:

***1.5 - Regional market transformation through partnerships, technology development programs, and education***

Market transformation alliances use voluntary efforts, typically implemented by non-utility organizations, to encourage the use of cost-effective energy efficiency practices by consumers (residential, commercial, and industrial, as well as the professionals who service energy-using equipment).

A market transformation program is designed to create a situation where the bulk of the private market adopts or incorporates technologies or techniques that result in improved energy efficiency. The goal of a market transformation and technology development program is to put energy efficiency technologies and practices into a position where they are demanded by the public, chosen by builders and manufacturers, and provided by retailers and contractors. Methods of transformation can be different for each technology or technique, but often revolve around public and private review of quality and effectiveness, including partnerships between government agencies, retailers, manufacturers, and nongovernmental organizations. Market transformation programs can be statewide or regional.

Market transformation also seeks to ensure sufficient supplies of technologies and practitioners to meet the subsequent increased demand for energy efficiency.

Potential elements of a market transformation program include:

- Specific measures, such as geothermal heating, solar /photovoltaic (PV) water heaters, or other important technologies
- Support for commercialization of promising technologies
- Bulk-purchasing programs (public/private) or arrangements with retailers
- Consumer education is a significant supporting measure for market transformation programs.

### ***1.11 - Reduce energy use by 10% or more in state-owned buildings***

Recognizing that governments should “lead by example,” this option provides targets to improve energy efficiency in existing state and local government buildings, as well as for new construction and major renovations of government buildings. As certain goals are achieved, they may be raised to achieve greater reductions. This policy option includes programs to disseminate information and demonstrate technologies and techniques in order to promote their implementation in the residential, commercial, and industrial sectors as part of similar demand reduction programs.

### ***2.3 - Improved design and construction throughout all sectors, "Government leading 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. The proposed standards are 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, and in the improvement in operation of buildings and other facilities.
- Requiring energy performance audits in government buildings. Audit results could be used to target and prioritize investments in improving government building

energy efficiency. Efficiency goals could be reviewed and improved over time, and flexibility in contracting arrangements could be developed to encourage integrated energy-efficient design and construction.

- Recommending that the infrastructure for implementation (meters, bookkeeping systems, staff, etc.) be established as soon as possible.
- Requiring state bulk purchase of appliances and equipment with higher-than-standard energy efficiency for public facilities.
- Establishing “retained savings” policies, whereby government agencies can retain funds saved by reducing energy bills and apply them to further energy efficiency/renewable energy investments.

Potential supporting measures for this option include training and certification of building-sector professionals, shared savings with contractors based on performance, energy and water use audits in government buildings, energy use benchmarking, measurement, and tracking programs for municipal and state buildings.

### ***2.6 - Promotion and incentives for improved design and construction (e.g. green building, LEED)***

This policy provides incentives and targets for owners and developers of new and existing buildings to improve the efficiency of the use of energy and other resources in those 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.

Additional potential elements of this option include:

- Focusing on new, renewed, and/or existing buildings under renovation
- Set a cap on the use of energy per unit area of floor space for new buildings
- Encourage energy monitoring and benchmarking
- Provide incentives in the form of tax credits, financing incentives (such as "green mortgages") or other incentives for retrofitting existing residential and commercial buildings
- Promote the use of alternative and local building materials and practices

Potential supporting measures for this option include training and certification of building professionals, consumer and primary/secondary education, performance contracting/shared savings arrangements, and setting up an information clearinghouse, and access to software tools to calculate the impacts of energy efficiency and solar technologies for buildings.

## ***2.8 - Incentives for retrofitting existing residential, commercial, institutional, and industrial buildings***

This policy provides targets and incentives for owners of existing homes to improve the efficiency of the use of energy and other resources, along with provisions for raising targets periodically. This policy can include elements to encourage the review of energy use goals over time in existing dwellings.

### ***- Consumer and public education programs***

The ultimate effectiveness of emission reduction activities depends in many cases on providing information and education to consumers regarding energy and the implications of GHG emissions resulting from consumer choices.

Public education and outreach are vital to fostering a broad awareness of climate change issues and effects (including co-benefits, such as clean air and public health) among state residents. Such awareness is necessary to engage citizens in actions to reduce GHG emissions in their personal and professional lives. Public education and outreach efforts should integrate with and build upon existing outreach efforts involving climate change and related issues. Ultimately, public education and outreach will be the foundation for the long-term success of all of the mitigation actions proposed, as well as those that may evolve in the future.

Green-raising efforts represent a specific door-to-door education campaign approach for raising awareness of energy efficiency and money-saving opportunities among households. The development of accessible materials, videos, and other educational information can support these efforts. Support for program management and coordination activities can also help to ensure that outreach efforts are effectively planned and implemented.

## ***4.5 - Create a high-tech research and development center that focuses on renewable energy and energy efficiency, and promotes marketing and training***

Create a high-tech research and development center that focuses on renewable energy, methane recovery, energy efficiency, and industrial processes. This center would be a collaborative enterprise of state and local governments, nearby universities, and local business interests, and would offer innovative research and technical solutions to governments and businesses. Renewable energy research includes wind, geothermal, solar, biofuel, and other sources. Industrial processes should have a particular focus on industries that have GHG-intensive industrial processes, such as cement, ammonia and urea, carbon black production, nitric acid production, and substitutes for ozone-depleting substances. Methane-recovery technologies in the agricultural sector could have a significant impact on gross GHG emissions. This center could also work with state university engineering departments to create a curriculum focusing on the discipline of energy efficiency engineering. Topics could include comparative analysis of various process and equipment designs, as well as execution of performance simulations on various systems to determine the lowest operating and life-cycle costs.

**6.5 - White roofs, rooftop gardens, and landscaping (including shade tree programs)**

High summer roof temperatures increase the need for more electricity for air conditioning, as well as the production of carbon black. Incentives for the introduction of white roofs, rooftop gardens, and landscaping can lower electricity demand. Trees and other vegetation that provide shade to buildings and soil reduce heat absorption and evaporation of moisture, which reduces cooling requirements. Lower temperatures along transportation routes and parking facilities reduce the emission of volatile organic compounds from vehicles that contribute to the greenhouse effect.

**Transportation and Urban Development**

Priority options for the residential, commercial, and industrial sector, as well as related actions that should be considered during the design of policies in Phase 2 are presented in Table 8. These 10 options are grouped into six sub-sectors:

- Technologies and operations for light-duty vehicles: 1.7 and 1.9
- Incentives and disincentives for light-duty vehicles: 2.7
- Measures related to alternative fuels: 3.7
- Land use and efficiency of location: 4.1, 4.3, 4.10
- Transportation efficiency in planning and infrastructure: 5.1, 5.15

Increase transportation options for heavy-duty vehicles: 9.4

Once again, Level 1 options shown in Table 8 are those considered priorities, while Level 2 options shown in Table 9 are presented for informational purposes.

**Table 8: Priority Transportation and Urban Development Policies – Level 1**

Option	Related Options
1.7 Vehicle maintenance and driver education	1.6
1.9 Vehicle inspection program	2.5
2.7. Establish a grant program to replace vehicle fleets with high fuel efficiency and lower emission vehicles	1.4
3.7. Research and development for a broad range of renewable transportation fuels	3.6
4.1. Infill and redevelopment of brownfields	
4.3 Smart Growth planning, modeling, and tools	4.2, 4.6, 5.7
4.10. Balance economic development with agriculture, protection of natural resources, and preserving rural character (including urban green areas)	
5.1 Transportation system management	5.2, 5.3, 5.5, 6.7, 6.17

5.15 Use federal and international funding (clean development models and carbon bonds) to reduce vehicle congestion and improve air quality	
9.4 Shift freight transportation from truck to rail	

**Table 9. Transportation and Urban Development Policies – Level 2**

4.2. Transit-oriented development ( <i>Included in Level 1 along with Option 4.3</i> )
2.10. Programs restricting motor vehicle access in crowded areas of cities on certain days to promote the use of alternative means of transportation (walking, bicycles, etc.)
1.2. Efficient tires
5.2. Improve transit service ( <i>Included in Level 1 with Option 5.1</i> )
5.3. Mass transit marketing and promotion ( <i>Included in Level 1 with Option 4.3</i> )
1.6. Lower and/or enforce speed limits ( <i>Included in Level 1 with Option 1.7</i> )
4.9. Revitalization of city downtown areas
5.16. Thorough review of future infrastructure capacity
5.6. Create regional multimodal transportation centers
2.9. Support alternative travel in the advertising media, focusing on cycling and pedestrian travel.

Following is a brief description of options recommended for further review:

***1.7 Vehicle maintenance and driver education***

Improved consumer information and education can lead to a gain in fuel efficiency. Consumer education could include the use of "best in class" vehicle guides that provide comparative fuel efficiency information about different vehicles and also provide associated vehicle GHG emissions.

Public education and training can make drivers more aware of maintenance issues that have an impact on pollution and vehicle operating costs, including tire inflation and engine lubricants. Such public education may also encourage energy-efficient driving habits (notably, slower acceleration, shifting at lower RPMs, and the use of cruise control), as well as encourage the use of lower GHG modes of transportation. Driver eco-training may also be required as part of training programs for obtaining a driver's license for the first time.

***1.9 Vehicle inspection program***

Vehicles that are obsolete or in poor condition usually have low energy efficiency, which increases fuel use and GHG emissions, in addition to creating local pollution issues.

A vehicle inspection program would ensure minimum performance standards and reduce the proliferation of polluting vehicles, which in turn would increase energy efficiency, reduce GHG emissions, and improve local air quality.

This policy may be linked with support and incentives for automobile replacement or alternative transportation methods (see Option 2.7 below).

***2.7. Establish a grant program to replace vehicle fleets with high fuel efficiency and lower emission vehicles***

The government may encourage the retirement of older fleet vehicles by creating a grant program that helps vehicle owners to purchase more fuel efficient, lower GHG emitting vehicles. This option is particularly important and effective for company or government vehicle purchase programs with an established replacement schedule.

***3.7. Research and development for a broad range of renewable transportation fuels***

Provide funding to assist in the development of low carbon fuels that are not yet commercially viable, such as cellulosic ethanol. Provide an accurate analysis and recommendations of which renewable fuels will be the best options for the state, region, or city.

***4.1. Infill and redevelopment of brownfields***

Provide economic incentives, liberalized zoning, and land-use restrictions, and permit streamlining to encourage the development of empty, underutilized, and abandoned industrial facilities in urban areas. Redeveloping brownfields in urban areas can be a key factor in urban revitalization, providing new centrally located areas for residential, commercial, or mixed-use development. Redeveloping brownfields also reduces average trip distances and can save public funds by taking advantage of existing infrastructure and public utilities.

***4.3 Smart Growth planning, modeling, and tools***

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

***4.10. Balance economic development with agriculture, protection of natural resources, and preserving rural character (including urban green areas)***

Adopt a comprehensive state plan to preserve agricultural land uses, protect natural resources, and preserve rural character, especially on the periphery of urban areas where sprawl development may otherwise occur. This option involves taking multiple land uses and policy objectives into consideration, including economic development, agriculture, the preservation of natural resources, and the preservation of the rural character of a given area, when examining future development patterns and the economic needs of an area.

***5.1 Transportation system management***

Improve the existing transportation system management by analyzing current conditions, improving traffic flow, synchronizing traffic lights, installing roundabouts, building high

occupancy vehicle lanes, designing intelligent systems, addressing interconnectivity of transportation options, etc. Improve overall system functionality through broad planning initiatives.

**5.15 Use federal and international funding (clean development models and carbon bonds) to reduce vehicle congestion and improve air quality**

Efficiently use federal funds in the sector and prioritize their use to reduce GHG emissions. Additionally, seek access to international funding sources to help increase the financial feasibility of projects.

**9.4 Shift freight transportation from truck to rail**

Economic assistance and regulatory streamlining may improve intermodal rail yards and relieve rail freight bottlenecks. Rail freight is much more fuel efficient than truck transportation. Moving freight from highways to rail would also relieve congestion on highways, improving the fuel economy of remaining vehicles.

**Agriculture, Livestock, Forestry, and Waste**

This sector includes a wide spectrum of subsectors with a broad range of policy options. Table 10 presents Level 1 priority options, while Table 11 shows Level 2 options for informational purposes.

**Table 10: Priority Agriculture, Livestock, Forestry, and Waste Policies – Level 1**

Option	Related Options
2.1 Manure management and use 2.1.1 – Methane capture 2.1.2 – Use of biofilters in concentrated animal feeding operations	2.2
3.2 Nutrient and water management	
4.1 Recover marginal soils (agricultural, rangelands, mines, etc.)	
5.1 Increase crop production and energy efficiency	5.2, 5.4, 5.5, 5.6
6.1 Improved rangeland management practices	6.2, 6.3, 6.4, 6.5
7.1 Forest protection, reduced clearing, and conversion to non-forest cover (i.e. prevent the loss of forest biomass)	7.3, 7.4
9.1 Waste recycling	9.4, 9.5
9.7 Prevent landfilling of organic material	
11.2 Wastewater management (treatment, energy efficiency, methane capture)	

**Table 11: Agriculture, Livestock, Forestry, and Waste Policies – Level 2**

1.4 Improved commercialization of biomass conversion technologies
3.1 Management of organic content in agricultural soils
6.3 Restore degraded rangelands <i>(Included in Level 1 with Option 6.1)</i>
11.1 Energy efficiency improvements (in wastewater treatment management)

Level 1 options are described below.

***2.1 Manure management and use***

Implement manure management practices that reduce GHG emissions. Potential practices include but are not limited to manure composting (to reduce methane emissions), addition of additives to decrease the amount of nutrients lost, and improved methods for application to fields (for reduced nitrous oxide [N<sub>2</sub>O] emissions). Application improvements include incorporation into soil instead of surface spraying or spreading.

***2.1.1 Methane capture***

Implement digesters and energy recovery projects at concentrated animal feeding operations, both to reduce methane emissions and to utilize the energy to displace fossil fuels. (To date, most of these projects have been implemented at dairies and swine operations).

***2.1.2 Use of biofilters in concentrated animal feeding operations***

The utilization of collection and control equipment such as biofilters at concentrated animal feeding operations can reduce methane emissions.

***3.2 Nutrient and water management***

Improve the efficiency of fertilizer use and other nitrogen-based soil amendments through implementation of management practices and generally accepted agriculture management practices). Excess nitrogen not metabolized by plants can leach into groundwater and/or be emitted to the atmosphere as N<sub>2</sub>O. Better nutrient utilization can lead to lower nitrous oxide emissions from runoff. Maintaining high levels of soil nutrients by reducing leaching and runoff increases plant growth.

Improve the efficiency of water use through implementation of best management practices and generally accepted agricultural and management practices. Excess water can lead to nitrogen runoff with subsequent emission to the atmosphere as N<sub>2</sub>O. By managing and improving water consumption and nutrients spread on crops, there will be a minimal loss of carbon from the soil. Reduced water consumption can result in lower energy use for water pumping.

### ***3.2.1 Drainage management***

This option consists of improving drainage on agricultural lands to prevent ponding, which could lead to anaerobic soils and GHG emissions (methane). Ponding reduces the ability of soils to sequester carbon and grow plants. Conversely, draining of hydric soils, organic soils, and peat lands has been shown to reduce soil carbon, which in some instances could be offset by increased production. Consequently, this option is limited to reducing ponding.

#### ***4.1 Recover marginal soils (agricultural, rangelands, mines, etc.)***

There are several ways to enhance carbon sequestration in marginal lands: (1) reclaim these lands with native vegetation appropriate to the habitat type; (2) convert marginal agricultural land used for annual crops to permanent cover—such as grassland/rangeland or forest; (3) implement conservation reserve programs, (4) promote the development of biomass-oriented production system such as planting with switchgrass, miscanthus, mixed grass species, etc.

#### ***5.1 Increase crop production and energy efficiency***

Renewable energy can be produced and used on-site at agriculture operations. Examples include installation of solar or wind power; use of hydro-powered generators for irrigation (mini-power plants); converting diesel farm equipment to liquefied natural gas, compressed natural gas, or hybrid technology; increase on-farm use of biofuels and other renewables; expanding farm energy audit programs; upgrading machinery, equipment, and engines to reduce carbon dioxide emissions by displacing the use of fossil-based fuels.

#### ***6.1 Improved rangeland management practices***

The greatest source of anthropogenic losses of soil carbon on rangelands is poor grazing management. Excessive harvest of plant biomass by livestock and wildlife can lead to diminished productivity. Chronic overgrazing can lead to loss of cover and accelerated erosion, increasing carbon losses and decreasing potential for future storage. The most important aspect of grazing management is proper stocking rate, followed by proper distribution in space and time. Controlling harvest/consumption insures that the optimum amount of photosynthetically active plant tissue is available to fix atmospheric carbon. The use of wildlife from the same rangelands must be included into rangeland management systems.

Allowing livestock and wildlife to disperse over larger areas and/or keeping them from concentrating in prime vegetation zones such as lowlands and riparian areas is key to ensuring healthy range conditions and thriving plant populations. Appropriate herding, location of watering sources, distribution of salt and mineral supplements, seasonal timing of grazing and assessment of range readiness may help increase carbon sequestration in plants and soils and improve overall range health.

#### ***7.1 Forest protection, reduced clearing, and conversion to non-forest cover (i.e. prevent the loss of forest biomass)***

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. Likewise, reducing road-building in forested environments increases

effectiveness of habitat, allowing for dispersal of wildlife on greater acreage and maintains overall forest cover and health. Easements and roads can be used to protect forest cover as well as conservation programs and rangeland protection designations.

**9.1 Waste recycling**

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.

**9.7 Prevent landfilling of organic material**

Reduce methane emissions associated with landfilling by reducing the biodegradable fraction of waste emplaced. Recently, an area of focus in the solid waste industry has been in increasing recycling of organic wastes (e.g., lawn and garden waste, food waste, wood, paper, and bio-based plastics) using different conversion technologies, including composting, anaerobic digestion, or hybrids of these technologies.

**11.2 Wastewater management (treatment, energy efficiency, methane capture)**

Develop and implement best practices for lowering water consumption and lowering waste production in the industrial, commercial, and residential sectors. Encourage and create incentives for research and development on methods or technologies to reduce water consumption and waste production. Provide education to reduce water consumption and waste production. Lowering water consumption and waste production leads to lower GHG emissions.

**Cross-Cutting Issues**

This item includes policy options that cut across multiple sectors and cannot be assigned to one single area. Cross-cutting issues include broad policies such as setting emission reduction goals, reporting/registry systems, and public education, among others. Although these actions are not necessarily quantifiable, they will be, just as Level 1 policies, selected for other sectors, described in more detail, and designed in Phase 2 of the SCAP process.

**Table 12: Priority Cross-Cutting Issues Policies – Level 1**

Option	Related Options
1.1 – Establish a GHG inventory and forecasting function	1.2
4.8 – Promote research on climate change and potential solutions in academic institutions	5.2 11.2
4.11 – Climate change education, training, and awareness in the public, private, social, and education sectors	4.1, 4.2, 4.3, 4.5, 4.6, 4.10

5.1 – Develop a state climate change adaptation plan	5.2, 7.3
6.1 – Establish statewide GHG reduction goals or targets	2.1, 3.1, 7.1, 7.4
7.2 – Create a multi-agency body to oversee ongoing state climate efforts	7.1, 7.5, 7.6, 7.7, 7.8, 7.10, 8.1, 8.2
7.11 – Establish an entity to coordinate state efforts to address climate change and SCAP monitoring	7.1, 7.2, 7.4, 7.6, 7.9, 8.1, 8.2
9.1 – Develop funding mechanisms for climate strategies	8.3, 10.1
11.1 – Identify resources for climate data collection and analysis	11.2, 11.3

**Table 13: Cross-Cutting Issues Policies – Level 2**

3.1 – Establish or participate in a GHG reduction registry <i>(Grouped in Level 1 with Option 6.1)</i>
4.1 – Efforts targeting state employees and state government activities <i>(Grouped in Level 1 with Option 4.11)</i>
4.2 – Efforts targeting policy makers (e.g. legislators, executive branch, agencies) <i>(Grouped in Level 1 with Option 4.11)</i>
5.2 – Assess the state's vulnerability to climate change <i>(Grouped in Level 1 with Option 4.8)</i>
1.2 – Establish an emissions forecasting function <i>(Grouped in Level 1 with Option 1.1.)</i>
2.1 – Establish or adopt a GHG emissions reporting program <i>(Grouped in Level 1 with Option 6.1)</i>
7.3 (7.2 bis) – Include in state regulations guidelines to address the impacts of climate change on urban watersheds <i>(Grouped in Level 1 with Option 5.1)</i>
10.1 – Encourage the creation of a business-oriented entity to promote climate protection in the private sector <i>(Grouped in Level 1 with Option 9.1)</i>
11.2 – Invest in water resource availability and modeling studies <i>(Grouped in Level 1 with Option 4.8)</i>
11.3 – Invest in the development of local databases to facilitate future research and increase access to existing databases <i>(Grouped in Level 1 with Option 11.1)</i>

***1.1 – Establish a GHG inventory and forecasting function***

Greenhouse gas (GHG) emission inventories and forecasts are essential for understanding the magnitude of all emission sources and sinks (both anthropogenic and natural), the relative contribution of various types of emission sources and sinks to total emissions, and the factors that affect trends over time. Inventories and forecasts help inform state leaders

and the public on statewide trends and opportunities for mitigating emissions or enhancing sinks; they are also useful for verifying GHG reductions associated with the implementation of action plan initiatives. The responsibility for preparing GHG inventories and sinks often resides with the environmental agency, which typically has the expertise needed to systematically compile information on GHG sources and sinks using established methods and data sources. Inventory and forecast efforts should be ongoing over time, reflecting improvements to the accuracy and completeness of data collected.

***4.8 – Promote research on climate change and potential solutions in academic institutions; and***

***4.11 – Climate change education, training, and awareness in the public, private, social, and education sectors***

Education and outreach can support GHG emission reduction programs, policies, and goals at many levels and among different audiences:

- Conducting outreach to government employees is an effective way to lead climate actions by example, and could include actively educating government employees through targeted events or outreach coordinators, or recognizing climate action within the government with special acknowledgment.
- Education and outreach to policymakers, including legislators, regulators, the executive branch, and agencies, is an important way to support implementation of climate actions. Regularly educating policymakers on the science of climate change, and progress toward state goals is important for promoting acceptance and implementation of proposed policies.
- Public education and outreach is vital to fostering a broad awareness of climate change issues and effects among a state's citizens (e.g., co-benefits, such as clean air and public health). Similarly, public education and outreach is the foundation for the long-term success of all policy initiatives.
- Promoting continuous action on the issue of climate change and supporting the GHG emissions reduction programs, policies, and goals require educating future generations of citizens. Conducting outreach to these future generations involves integrating climate change into educational curricula, post-secondary degree programs, and professional licensing programs.
- Providing education and outreach to community leaders and community-based organizations, such as leaders of institutions and municipalities, service clubs, social and affinity groups, and nongovernmental organizations, can help support GHG emission reduction programs, policies, and goals by expanding involvement and participation within civic society. Education and outreach to this audience may involve identifying and leveraging climate-related organizations, engaging with specific associations, or acknowledging individual community leaders who are acting effectively on climate change issues.
- Targeting specific industry sectors with education and outreach materials can help support the GHG emissions reductions policies, programs and goals that emerge from the MAC process. Having an awareness of climate change impacts, state

climate goals, and emerging science and technology options could help with the support and implementation of specific programs and policies.

***5.1 – Develop a state climate change adaptation plan***

States will experience the effects of climate change for years to come, even if immediate action is taken to reduce future GHG emissions, because of the build-up in the atmosphere of long-lived GHGs that already has occurred. As such, it is essential that the state develop a strategy to manage and adapt to the projected impacts of ongoing climate change, particularly where the state is most vulnerable.

***6.1 – Establish statewide GHG reduction goals or targets***

Some states have established GHG reduction goals or targets; in these cases, the comprehensive, stakeholder-based climate action planning process typically serves to identify and quantify policies and measures by which these goals can be achieved. In states that have not specified goals or targets prior to the planning process, the establishment of goals or targets is often considered in concert with the State after the initial quantification results for other policy options become available.

***7.2 – Create a multi-agency body to oversee ongoing state climate efforts; and***

***7.11 – Establish an entity to coordinate state efforts to address climate change and SCAP monitoring***

In terms of GHG emissions, states are not only political jurisdictions that can provide incentives to, or impose regulatory requirements on, sources and citizens in order to reduce pollution. They are also significant emitters, by virtue of state-owned buildings, fleets, and various emitting activities. States can reinforce the importance of reducing GHGs, promote others to act in this direction, and often demonstrate the economic upside of doing so by applying and implementing the policies within state agencies. For example, states can purchase low-emission vehicles for their fleets, utilize biofuels in their vehicles, construct and/or retrofit their buildings to be more energy efficient, purchase green or renewable electricity, or apply pollution prevention principles to GHG emission reductions.

States can also commit to initiatives or actions focused on GHG reductions, such as climate registries and carbon bond markets. Some states have also elected to require recipients of state-funded projects to reduce the carbon footprint of their projects through “climate-neutral bonding” requirements (meaning that there is no net increase in GHG emissions within the bond-issuing agency’s geographical jurisdiction after the project becomes operational). Some states have also included the requirement to address GHG emissions and climate change adaptation issues in environmental impact statements..

The relationship between local government jurisdictions and the state government is in many ways similar to the relationship between states and the federal government. It may therefore be appropriate to enable, assist, and otherwise encourage local governments to pursue comprehensive, multi-sector climate action plans within their jurisdictions. Similar to the state effort, local climate planning initiatives could involve local stakeholders, identify and address local mitigation opportunities, establish local emission inventories

and/or forecasts, set local GHG reduction goals or targets, consider local climate impacts and possible adaptation responses, develop long-term sustainability plans, etc. The state should encourage local governments in such efforts and contribute technical and other assistance to the extent possible.

### *9.1 – Develop funding mechanisms for climate strategies*

A number of financial policy options could be considered for design and implementation in order to stimulate a market around reducing GHG emissions.

**Tax and cap policies** (typically considered as carbon taxes and cap-and-trade programs, respectively) can be among the most economically effective means to reduce GHG emissions. By internalizing costs that are currently not assessed (i.e., are “externalized”), such policies create financial incentives for entities to reduce their emissions, since reducing emissions reduces costs.

- A carbon tax would be relatively simple to implement and would apply to all sectors. Utilities would pay the tax on the basis of their emissions and would pass the cost to consumers in their monthly electric bill. Similarly, individuals would pay the tax when they fill up their cars with gasoline. A carbon tax would also encourage efficiency improvement in all sectors. A carbon tax does not necessarily mean a net increase in the cost of living, because revenues could be “recycled” to lower other currently assessed taxes.
- Cap-and-trade programs typically establish an upper limit on emissions, usually lower than current emissions, which creates the drive for reductions. Also established under these programs are allowances or rights to emit, which are allocated or auctioned to participating sources. Sources need to match their emissions to the amount of allowances that they hold, but can trade allowances freely among themselves. The result is that sources that find it least expensive to reduce emissions can sell surplus allowances to sources for which making reductions would be more expensive. This dynamic encourages sources to pioneer innovative ways to make reductions, so they will need fewer allowances and may even be able to profit by selling allowances. The broader the universe of sources (e.g., types of sources covered, geographical region covered), the more likely it is that cost differences will be found, thereby reducing the overall cost of the program.

**Carbon credit** systems can encourage the development of carbon markets. The state could purchase carbon credits associated with its own activities, function as a purveyor of credits to others, act as a certification entity for others’ carbon exchanges, or participate in a regional credit system. The Cross-Cutting Issues TWG may want to recommend that a “Market Advisory Group” of experts be formed to provide guidance to the state on the design of market-based programs. For example, California formed a Market Advisory Committee to help develop a GHG cap-and-trade system in the state, which has formulated a set of guiding principles and has developed an initial set of recommendations for a California cap-and-trade program.

**Allocation of resources** under existing state programs and initiatives can be targeted to achieving state climate goals. However, it is likely that additional resources may also be needed to implement new recommendations. Therefore, the state and others will need to consider seeking and stimulating additional funding and investment in climate solutions identified in the state plan.

**Regional market approaches** can offer broader and more streamlined market opportunities to reduce GHG emissions in collaboration with partner states or other organizations. Regional and multi-state organizations have formed in several parts of the United States. Examples of regional market approaches include the Northeast States Regional Greenhouse Gas Initiative (RGGI) (<http://www.rggi.org/>), Midwestern Regional Greenhouse Gas Reduction Accord (<http://www.midwesterngovernors.org/govenergynov.htm>), and Western Climate Initiative (<http://www.westernclimateinitiative.org/Index.cfm>).

### *11.1 – Identify resources for climate data collection and analysis*

In order to ensure cost-effective investment of resources, it is essential to have accurate and current data and information about GHG emissions and impacts, and computer modeling capabilities. High-quality data and accurate predictive capabilities are key elements in being able to plan strategically and track progress over time in reducing GHG emissions. It is also important to integrate the efforts of multiple entities gathering GHG data so that monitoring and data collection resources are effectively utilized. One example might be formation of a state climate data and analysis center that could maintain a database, develop objective climate data and analysis, assess options and directions, identify trends, develop or improve computer modeling, and provide other climate-related information to government, business, and the public.

## **Recommendations and subsequent activities**

The Federal Government has undertaken significant climate change planning activities and has established a series of actions for implementation at the federal, state, and local levels (see Exhibit 2). Additionally, Mexican border states, including Sonora, are developing their own State Climate Action Plans. In the United States, Arizona and New Mexico have conducted similar planning processes, while California is undertaking the same effort. It is expected that soon all the border states on both sides of the border will have plans with broad community participation. The three levels of government in both countries must participate and work together to achieve the greatest and more lasting impact.

Having consistency in the methodologies used is significant, as demonstrated by the development of GHG Emission Inventories and Projections, which used similar processes and metrics. When this happens, consistent measures are established for monitoring and measuring progress, lessons and best practices are transferred, and opportunities for innovation are created. Furthermore, national and international organizations can clearly understand the process and facilitate the procedure to obtain of assistance for the implementation of these plans.

To date, the State of Sonora has made considerable progress in the development of a State Climate Action Plan (SCAP), including the development of a GHG inventory and

projections, the identification of 46 priority policies for enhanced conformance, and the creation of an Advisory Group and five Technical Work Groups responsible for monitoring the development of the SCAP and issuing recommendations to the State Governor on the steps to take.

The next steps in the development of the SCAP will be to design and quantify emissions and priority policies costs and savings; and to identify and quantify policy options for climate change adaptation.

In addition to the benefits of the SCAP for the State of Sonora, it is important to emphasize its relevance for the border region and the experiences that the process of preparing this plan can offer to other Mexican states, primarily in regard to the active and transparent participation of a large number of stakeholders from all sectors of the state's economy.

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## EXHIBITS

### Exhibit I – Members of the Technical Work Groups

#### Energy Supply

<i>LAST NAME</i>	<i>NAME</i>	<i>INSTITUTION</i>
Fernández Ruiz	María Luisa	SEMARNAT
Wennberg	Jeff	Center for Climate Strategies
López Córdova	Salvador	Center for Climate Strategies
Zamorano Santacruz	Julio Abdón	Comisión de Energía del Estado de Sonora
Platt	Alberto	UNISON
Rojo Ibarra	Juancarlos	APSA
Vera Marquez	Victor	PEMEX - Gas y Petroquímica
Mendivil Valdez	Alicia	Comisión Federal de Electricidad – Distribución
Calmus	Thiery	UNAM – Geología
Orona Silva	Fausto	CFE – Generación

#### Residential, Commercial, and Industrial

<i>LAST NAME</i>	<i>NAME</i>	<i>INSTITUTION</i>
Marruffo Ruiz	Guillermo	Suma Corporativo
Ken	Colburn	Center for Climate Strategies
López Córdova	Salvador	Center for Climate Strategies
Maldonado	Juan	Center for Climate Strategies
Paredes Aguilar	Rafaela	CONANP
De la Torre	Juan Jaime	Ayuntamiento de Nogales
Serrano Q.	Elia	PROMAESA
Flores F.	J. Francisco	Comisión Estatal del Agua
Guzmán Bravo	Francisco	Suma Corporativo Nogales
Manríquez	Victor	Secretaría de Economía
Mojica Zárate	Hector Tecumshe	Universidad de la Sierra
Castillo	Claudia	Comisión de Energía del Estado de Sonora
Figueroa	Elliot	Programa ASI

### Transportation and Urban Development

<i>LAST NAME</i>	<i>NAME</i>	<i>INSTITUTION</i>
Peralta Zúñiga	Bárbara	Unidad Estatal de Protección Civil
Díaz López	Evangelina	CONANP
Matos	Patrick	Center for Climate Strategies
Velázquez Contreras	Luis	UNISON
Zepeda Ibarra	Joel Alonso	Ayuntamiento de Hermosillo
Castro Valencia	Alejandra	SIDUR
Méndez Peralta	Dulce María	Secretaría de Economía
Ocobachi Romero	Daniel	Subsecretaría de Desarrollo Urbano - SIDUR
García Román	Omar	SIDUR - Dirección General de Transporte
Ibarra Hurtado	Raul	Municipio de Hermosillo - IMPLAN
Manríquez	Victor	Secretaría de Economía

### Agriculture, Livestock, Forestry, and Waste

<i>LAST NAME</i>	<i>NAME</i>	<i>INSTITUTION</i>
Villarruel Sahagún	Leopoldo	CESUES
Maldonado	Juan	Center for Climate Strategies
Valdez T.	Luis Carlos	ITSON
Paz M.	Antonio	SAGARHPA
Tapia	Martín	Ayuntamiento de Caborca
Carrión Arroyo	Gerardo	Naturalia A.C.
Mendoza García	Oswaldo	Ayuntamiento de Puerto Peñasco
Rodríguez Valdez	Leoncio	Ayuntamiento de Huatabampo
Borbón Soto	José Trinidad	Ayuntamiento de Navojoa
Gussen Sánchez	Érika	PROFEPA
Núñez Hernández	Yolanda	Secretaría de Salud Pública
Palafox Rivas	Rigoberto	CONAFOR
Rodríguez M.	Manuel O.	UGRS - PROBIEN
Beltran L.	María del Rosario	ITSON
Rodríguez Casas	Julio	UNISON
Alcaraz Flores	Rogelio	UGRS
Rojero	Elvira	CONANP
Gómez López	Alfonso	CESUES
Martínez P.	Claudia María	CEDES - Conservación
Valenzuela Renteria	Manuel	Consejo Estatal de Minería - CESUES
Castro Valencia	Romero	Secretaría de Salud Pública

**Cross-Cutting Issues**

<i>LAST NAME</i>	<i>NAME</i>	<i>INSTITUTION</i>
Gutiérrez Rodríguez	Alejandro	UNISON
Flora	Gloria	Center for Climate Strategies
López Córdova	Salvador	Center for Climate Strategies
Serrano Sainz	Juan Antonio	Unidad Estatal de Protección Civil
Olivares Ceceña	María Alejandra	Secretaría de Educación
Ruiz Molina	Humberto	SEMARNAT
Ortega Rosas	Carmen Isela	CESUES
Juvera Moreno	Gloria	SIDUR
Álvarez Chávez	Clara Rosalía	UNISON
G. Bravo	Juan Carlos	Naturalia A.C.
Villa Terán	Alberto Eduardo	Protección Civil del Estado de Sonora
Aguiar Hernández	Carlos Gabriel	Comisión de Energía del Estado de Sonora

**Exhibit II – Relationship between the Catalog of Policy Options considered and the PECC**

The following table shows the relationship between policy options included in the base CCS catalog and the initiatives included in the 2009-2012 Special Climate Change Program (*Programa Especial de Cambio Climático*, PECC) prepared by the Federal Government. It must be noted that the vast majority of the PECC initiatives have been considered in one or more of the catalog options, although the level of detail between the two documents.

[SIC]

[END OF TRANSLATION]