

## USING NATURAL RESOURCES IN AN OPTIMAL WAY

### EXECUTIVE SUMMARY

**Message 1.** In a country where forests play a very strategic environmental and social role, high forest degradation is a cause for concern. Policy options to reverse this trend include shifting funds from reforestation to community forestry and paying for environmental services; strengthening advisory and monitoring systems; fostering sustainable and competitive community enterprises; developing approaches for forests with high biodiversity values but relatively low commercial value; and promoting cross-sector coordination and public participation in policymaking.

**Message 2.** Per capita water availability has decreased by a factor of four in the last 50 years. This situation is compounded by an inefficient use of resources in agriculture as well as in urban water services; service quality is below OECD standards. Recent projections show the situation will worsen if no action is taken. The new administration should therefore give priority to establishing a set of policies and incentives to promote a more efficient allocation and usage of water resources, and improve the quality of service.

**Message 3.** The possibility of Mexico turning into a net oil importer poses the challenges of radically transforming the country's energy matrix composition and also reducing its competitiveness. A key option to promote green growth, enhance energy security, and reduce vulnerability lies in further exploiting the use of renewable energy sources; involving the private sector in financing investments in renewable energy; and exploring the potential to expand solar and wind power.

### OBJECTIVES

To ensure sustainable and optimal use of its common property natural resources, Mexico will need to strengthen its focus on enhancing stewardship in three key sectors—forests, water, and energy resources. The key objectives include the following:

- Identifying options that would contribute to Mexico's climate agenda and build social resilience through forest management
- Ensuring economically efficient and environmentally and socially sustainable water management to promote “green” growth in the context of water scarcity and climate uncertainty
- Assessing the impacts of declining oil and gas reserves and the role of renewable energy as an alternative and cleaner source

### KEY CHALLENGES

#### *Forest management*

**While forests contribute a modest 1 percent of GDP,<sup>1</sup> they represent an essential source of employment, income, and livelihood for some 12 million people.<sup>2</sup>** Almost nine thousand agrarian communities and *ejidos*<sup>3</sup> own around 70 percent of the country's forests under a legally recognized collective land ownership system—a situation unique in the world. In 2008, 57 percent of the poorest quintile of rural households obtained almost one-quarter of their income from natural resource extraction, most of which was forest-related.<sup>4</sup> In many cases, managing forests collectively strengthens social capital within communities, enabling the pursuit of other

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development activities. In some instances, collective management of forests increases social cohesion and reduces conflict.

**Forests can play an important role in mitigating and adapting to climate change.** Reducing Emissions from Deforestation and Forest Degradation (REDD+) and other forest-related activities could account for almost 20 percent of reductions in greenhouse gas emissions that Mexico could achieve by 2030. If agriculture and livestock activities are included, then the entire land use, land use change, and forest sector has a mitigation potential of 30 percent (15.3 million tonnes of carbon dioxide a year).<sup>5</sup> Forests also play an important role in adapting to climate change. By reducing erosion, regulating hydrological cycles, and protecting watersheds, forests lessen the physical impacts of floods, droughts, and other climate-related disasters that inflict loss of life and other significant damage. In addition, social capital built through collective forest management may strengthen community resilience to climate-related disasters and economic downturns.

**Although much remains to be done, Mexico has become a global leader in forest management.** Mexico's approach, which combines community forestry, the enhancement of environmental services such as water and biodiversity, and REDD+ is increasingly recognized as a reference worldwide for its innovativeness, scale, and results. As many as four thousand communities have participated in the demand-driven programs operated by the National Forestry Commission (CONAFOR) since 2001. An estimated 2,380 communities use forest management, and about 50 are independently certified. Furthermore, Mexico led the initial global agreement on REDD+ at the UNFCCC Conference of Parties in Cancun in 2010, where it also presented its own REDD+ Vision focusing on cross-sector integration at the landscape level. Promising REDD+ efforts are underway in selected Early Action Areas, with a learning potential of global relevance. Continued high-profile efforts and innovative thinking for REDD+ could further strengthen Mexico's position as a leader in global negotiations and attract green investors.

**Allocation of resources among the various programs is not optimal.** Reforestation efforts have obtained modest results despite receiving 38 percent of Mexico's forest investments in 2011 (US\$486 million). Of the area that was reforested nationwide, only half was in good or excellent condition one year later, and no systematic monitoring occurs beyond the first year.<sup>6</sup> Meanwhile only 12 percent of forest investments went to managing natural forests.<sup>7</sup> There seems to be room for a better balancing of the budget among the various programs based on their performance.

**Existing forest programs can be improved.** Although the community forestry and environmental services programs seem successful, their effectiveness falls short of potential. For example, the *Instituto Nacional de Ecología* (INE) estimates that deforestation among participants in the payment for environmental services (PES) program could have been reduced by 3.5 percent, rather than the observed 1 percent, if areas at high risk of deforestation had been targeted specifically.<sup>8</sup>

**The capacity to monitor investments is lagging compared with the scale of the programs.** During the last decade, annual public investments increased 20-fold, to US\$486 million. But CONAFOR's ability to effectively monitor results on the ground—in terms of forest cover, welfare of local communities, water services, and biodiversity—has lagged behind and needs to be strengthened. The capacity and supervision of private technical service providers also needs

improvement.<sup>9</sup> The significant achievements in policy performance assessments will need to be expanded to include strategic impact assessments to better identify potential synergies and conflicts across sectors.

**Other policies undermine the competitiveness of community forest production.** Despite the overall success of community forestry, legal timber production nationwide fell by 30 percent since 2000, and the trade deficit for forest products more than doubled.<sup>10</sup> Other policies seem to undermine public investments in the sector. These include unnecessary requirements and slow approvals of management plans by the Ministry of Environment (SEMARNAT), which make community efforts less competitive. Diverse circumstances that vary across the landscape may aggravate the problem, including difficult access to credit; land tenure issues; and insufficient infrastructure, public services, and marketing assistance, as well as weak institutional efforts to curtail illegal logging.

**Few options exist for forests with low commercial value.** To harvest forest products legally, communities must have management plans. However, many forests lack sufficient valuable timber to justify the cost and complications of getting a plan approved. In other cases the government will not approve plans due to conflicts or tenure issues. Consequently, about 85 percent of forests outside conservation areas lack management plans.<sup>11</sup> Most deforestation and degradation occurs in these forests, and informal forestry activities are widespread there. The federal attorney for the environment estimates that almost half of the industrialized timber might come from these areas. However, these forests have received limited attention, and existing regulations and programs are poorly adapted to their needs.

**Rural policies are still too fragmented, thematically and geographically.** In spite of recent progress, remaining inconsistencies among forestry, agriculture, livestock, and other regional and economic development policies reduce the impact and sustainability of public investments in rural areas. Public subsidies for forest management and protection, agriculture, ranching, mining, and urbanization often compete with each other in the same location. The lack of inter-institutional collaboration heightens the risk that public policies and subsidy programs work at cross-purposes with each other. In addition, forest and agricultural programs usually operate at the relatively small level of individual communities and parcels, hence missing economies of scale. A broader landscape approach including forests, agriculture, pastures, and other rural lands could foster synergies among various land uses and among various levels of governance.

**Public engagement in policymaking is still limited.** For almost two decades Mexico has been actively supporting consultation platforms such as the *Consejos Forestales*, *Promotorias Forestales*, and *Foros Regionales de Recursos Naturales*, and most forest investments are driven and implemented by communities themselves as owners of the forests. However, until recently there was insufficient space for civil society and community inputs into broader policymaking, especially in relation to REDD+. The creation of the national multi-stakeholder consultative committee for REDD+ (CTC REDD+) was a key step in that direction. Nevertheless, greater civil society participation, especially grassroots organizations and indigenous peoples' groups at the local level, is needed to promote successful climate change adaptation and mitigation programs in the field, including REDD+.

### *Water management*

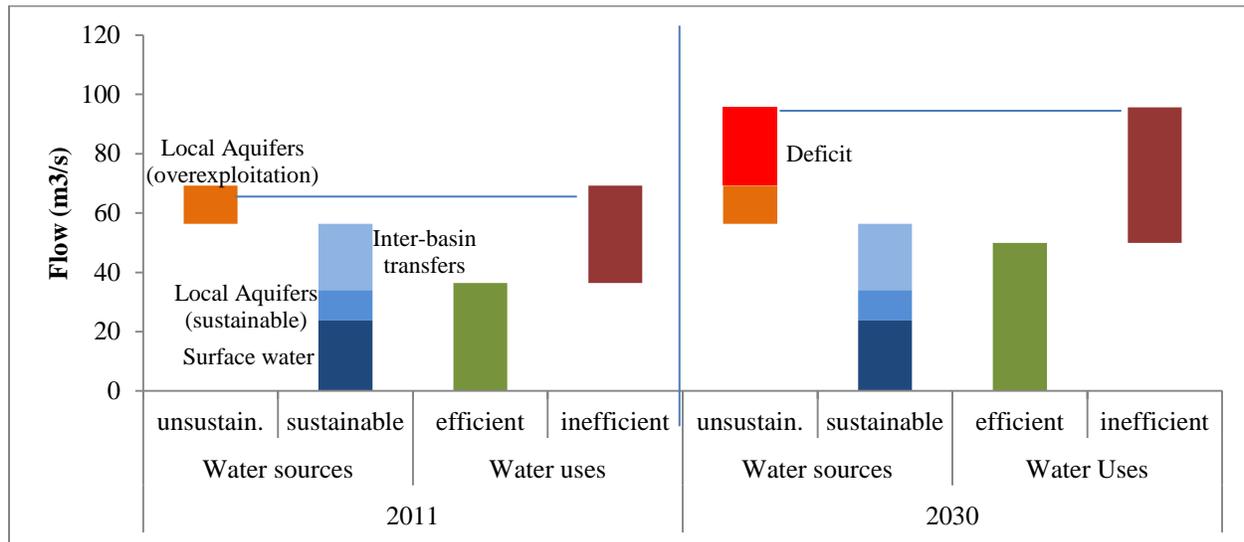
**Mexico faces increasing stress on water resources resulting from population and economic growth as well as a suboptimal management** (including inefficiency, overexploitation, and pollution). While significant regional disparities with regard to water availability exist,<sup>12</sup> Mexico is dealing with increasing water stress.<sup>13</sup> Increasing population and economic activities only partially explain the water scarcity experienced by some areas of Mexico. Water use is relatively inefficient. Irrigation techniques are generally highly water-intensive, farmers tend not to select crops with regard for changing climate conditions and water availability, and electricity tariffs for agriculture are highly subsidized. Many of the water supply and sanitation utilities also do not make efficient use of water resources,<sup>14</sup> generating significant impact, especially in predominantly urban watersheds such as the Mexico Valley.<sup>15</sup> Overexploitation of groundwater resources remains a significant problem.<sup>16</sup>

**Mexico already faces water stress, which is exacerbated by the impact of climate change.** Climate change is increasing the frequency and intensity of weather-related extreme events and changing precipitation patterns. There is a pressing need to incorporate climate change impacts into water resources management policy and to develop planning exercises to reverse the negative trends in the sector. In recent years, Mexico has strengthened its position in the field of climate change adaptation, taking the lead in the region. Nevertheless, great challenges still lay ahead, in particular in implementing the proposed policies, especially on the demand management side, and making efficiency improvements. The provision of accurate and timely weather and climate information still needs to be developed. The existing institutional framework does not easily allow the development of the inter-institutional arrangements that are often required for the development of multi-sectoral projects, which are usually required for climate change adaptation.

**Water scarcity and climate uncertainty combined with generally poor water services represent a serious threat to green growth prospects in Mexico.** World Bank projections show the situation will worsen if no action is taken. The importance of water for green growth is evident, and successive Mexican administrations have declared water to be a “strategic matter of national security.” Ample evidence is available about the economic costs associated with water problems in Mexico. In the Valley of Mexico alone, more than 30 percent of water uses are not economically efficient, and annual economic costs resulting from poor urban water management (including poor water services) is estimated at US\$2.4 billion annually, or 1 percent of the Valley’s GDP (figure 1). These costs are largely borne by lower income residents dealing with high coping costs, and could grow to US\$3.5 billion and 1.7 percent of GDP by 2030 if no action is undertaken.<sup>17</sup> Despite very significant investments in the sub-sector, only about one-third of large Mexican utilities provide continuous supply to their customers, with no significant improvement over the past 10 years,<sup>18</sup> a glaring exception in the OECD zone. The implicit electricity subsidy provided to Mexican farmers for pumping groundwater has been estimated to be about US\$700 million per year.<sup>19</sup>

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**Figure 1. Sources and uses of urban water in the Mexico Valley today and in 2030 in a business-as-usual scenario**



Source: World Bank staff calculations

**The water sector is also challenged by incomplete reforms of its institutional and legal framework.** In spite of the institutional innovation conveyed in the reform of the legal system in 1993 and 2004, the implementation of key legal and administrative instruments has not fully or efficiently taken place. For instance, the water rights, originally conceded based on self-declarations, should have been renovated every 20 years based on field surveys of actual use and water availability, but in most cases they have been extended automatically. The decentralization initiated in the nineties, transferring service provision responsibilities to municipalities, was not accompanied by the expected improvement in financial sustainability or service quality. In fact no mechanisms were put in place to ensure that service quality, sustainability, and affordability were regulated in a consistent and nonpolitical manner. Despite very significant federal investments in the sector, the *Sistema Financiero del Agua* proposed in the 2004 Water Law has not been implemented; most operators and water users associations continue to depend on unpredictable and sometimes arbitrary federal investment programs (50 percent of total investment in the sector) that, overall, tend to undermine the ownership, efficiency, and sustainability of local entities.

### *Energy diversification*

**The heavily based hydrocarbon structure determines the configuration of the power sector.** For instance, 73 percent of Mexico's installed power generation capacity is fossil fuel-based. Through the introduction of newer technologies and regulatory changes, the power sector has become the main driver of natural gas demand in Mexico.

**Oil supplies are declining, and this affects the future performance of the energy sector.** The outlook for Mexico's supply-and-demand energy structure in the near to medium term is molded by the country's declining oilfields. The effects from the declining oil production can be felt presently, as the country's energy trade balance surplus has decreased. The sharp decrease in oil production and the country's high dependency on hydrocarbons are the two main factors

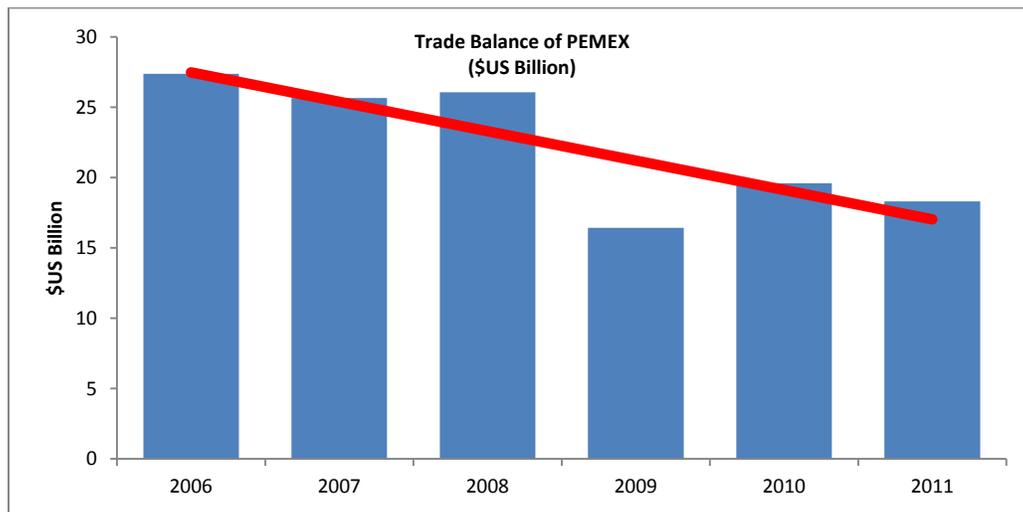
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affecting the sustainability of the energy matrix. This has important implications for the way the government should handle energy subsidies and overall energy policy.

**The possibility of Mexico turning into a net oil importer poses the challenge of radically transforming the energy matrix composition and affecting its competitiveness.** PEMEX's net trade balance has decreased since 2006. Most of that decrease is explained by the growing tendency of hydrocarbon imports to fill the gap between domestic supply and demand. If this tendency continues in the years to come and domestic hydrocarbons supply does not offset it, PEMEX's trade balance may turn negative (figure 2). Such a scenario would profoundly affect the energy sector and the fiscal balance.

**Figure 2. PEMEX trade balance**



Source: PEMEX

**Energy sector challenges have broader policy implications.** High oil dependence, an undiversified energy matrix, reduced investment in oil and gas exploration and production, declining oil production, and reduction in the hydrocarbons trade surplus are interdependent and have important implications for fiscal balance, public investment policy, and debt management. Any significant changes in the pricing or availability of primary fuels, whether in power production, transport, or other energy-intensive sectors, will affect consumers throughout the economy.

**Oil revenues are projected to fall as reserves and production decline in the years to come.** Oil revenues contribute at least one-third of the federal budget and are a major source of funds for general social spending. The burden of fiscal adjustment to oil price swings and other external shocks has therefore fallen on public expenditures. Given that current expenditures are difficult to reduce in the short term, the primary fiscal response to external shocks has been to make drastic cuts in capital expenditures. Because PEMEX and CFE investments comprise a large share of the capital budget, the investment budgets of these enterprises have borne an important share of such unanticipated cuts.

**Mexico's energy sector has found itself in a vicious circle, in which reduced budget and borrowing capacity has restricted sector investment, in turn limiting the expansion of**

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**production and government revenues.** This has made it more difficult to fund future financial needs. The government is increasingly forced to choose between the call to spend on urgent social programs now, and the need to invest in energy now to maximize value creation from oil production, meet the growing demand for energy, and accumulate funds for future public spending.

**Renewable energy provided only 14 percent of Mexico’s electricity generation in 2009 despite important endowments in wind, geothermal, and solar energy.** Since 1990 there has been a decline in the share of renewable energy sources (table 1). This is primarily due to the declining relative share of hydro; the total share of non-hydro renewable sources increased slightly. Over the past two decades the main shift in energy generation has been from oil-fired plants to natural gas and, to a lesser extent, coal.

**For the period 2009–2012, the goal of the *Programa Especial para el Aprovechamiento de Energías Renovables* has been to increase renewable capacity** (excluding hydro capacity larger than 30 MW) by up to 7.6 percent and its share in total energy generation to 4.5–6.6 percent. Almost all of the planned increase to 2012 would be from wind energy. In addition, the program has the goal of making electricity available to 2,500 rural communities by using renewable sources.

**Table 1. Evolution of share of energy sources in electricity output in Mexico, 1973–2009 (percent unless otherwise noted)**

Energy source	1973	1980	1990	2000 <sup>a</sup>	2009
<b>Total (including self-generators), (TWh)</b>	<b>37.1</b>	<b>67.0</b>	<b>115.8</b>	<b>204.2</b>	<b>261.0</b>
Oil-fired	41.1	57.9	53.6	46.2	17.5
Natural gas-fired	14.2	15.5	12.5	20.3	53.1
Coal-fired	0.6	0.0	6.7	9.5	11.3
Nuclear	0.0	0.0	2.5	4.0	4.0
Hydro	43.6	25.2	20.3	16.2	10.2
Non-hydro renewable	0.4	1.4	4.4	3.7	3.9
Biomass	0.0	0.1	0.0	0.8	1.0
Geothermal	0.4	1.3	4.4	2.9	2.6
Wind and solar	0.0	0.0	0.0	0.0	0.2

*Note a.* 2009 was a relatively dry year, which diminished hydro output by ~15 percent from the mean, equivalent to a reduction of about 2 percent in the share of total generation. The other years shown had river flows within the “typical” range (CFE, 2011).  
Source: International Energy Agency, <http://www.iea.org>, *Energy Statistics of OECD Countries*.

**More broadly, and over the longer term, the National Energy Strategy has the goal of achieving a 35 percent share of generation capacity-** through renewable energy (including large hydro), nuclear energy, and “clean fossil fuel” technologies by 2024.<sup>20</sup> Overall, the share of renewables in terms of output is expected to remain almost unchanged by the end of the period—14 percent of the projected total of 415 TWh for public service. In the next sections the projected expansion is reviewed in light of the potentials of the different renewable energy resources.

**Recently there has been increased emphasis on the development of small and micro hydro,** which is seen as having lower environmental impacts than larger hydro projects. It is estimated

that there are roughly 3.3 GW of remaining small hydro potential. The inventory of small hydro potential is quite sketchy outside of a few states. But even a rapid development of most small hydro potential would not have a large impact on the generation mix. For example, tripling the planned expansion of small hydro from 375 MW to 1,125 MW would increase output by about 2 TWh, or 0.5% of total generation in 2025.

**Development of wind generation has steadily grown but wind generating capacity in 2009 was still only 85 MW.** However, it is increasing rapidly and is projected to exceed 3,000 MW in 2014 and 5,500 MW by 2025 (SENER 2010). Assuming a capacity factor of 33 percent (average of the capacity existing in 2009), this would be equivalent to 16 TWh, less than 1 percent of total generation.

**Since 1973, Mexico has been one of the world's pioneers in exploiting geothermal energy for electricity generation.** Capacity has grown fairly slowly over the years and was 965 MW in 2009 (1.9 percent of total installed capacity). Geothermal plants are base load with high capacity factors, which have ranged between 78 percent and 88 percent since 1999. Output in 2009 was 6.7 TWh, or about 2.9 percent of total generation.

**Mexico is one of the best-endowed countries in Latin America for solar energy, but this advantage has not translated into commensurate electricity generation** because of the high cost of the associated technologies. Their use has been restricted to mostly small isolated rural systems. But the cost of photovoltaic systems fell dramatically from 2009 to 2011. While far from competing with alternatives for central station supply to the grid, this cost reduction has put PV systems close to economic viability for distributed generation among segments of consumers paying higher prices for electricity. Mexico is also developing the first concentrated solar power (CSP) plant in Latin America in Agua Prieta, Sonora.

**The potential of Mexico's shale gas development is vast, yet many challenges must be overcome to realize it.** According to the EIA estimate, potential reserves of shale gas are more than three hundred times what was consumed in 2010. Worldwide development of shale gas, especially in the United States, will be important to revolutionize technology, incentivize production in Mexico, and help to lower the market price of gas, making it a competitive alternative source against other fuels and energy sources. Some challenges lay in the future development of gas. The investments required to develop shale gas reserves in Mexico are huge and the adoption of new technologies may be difficult at the beginning. In addition, several environmental concerns will have to be settled in an appropriate manner and an underdeveloped internal gas transportation system will need to be upgraded.

### POLICY OPTIONS

#### *Forest management*

**Rethinking the balance and packaging among programs would seem relevant at this time.** In particular, it would be useful to provide communities with more integrated support, combining multiple programs and seeking optimal policy mixes at the local level. Shifting funds from plain reforestation to a combination of community management of standing forests, restoration of degraded lands, and payment for environmental services would be a logical step considering the

positive social, economic, and environmental outcomes these programs have generated so far. Reforestation efforts can be improved, but this will require major changes in approach and will take time. There are often cheaper alternatives for promoting forest regrowth than reforestation, and where economically justified, reforestation efforts could be more integrated, selective, and geographically focused. In addition to rebalancing funds among programs, it is important to provide flexibility for communities to mix programs in ways that better recognize the complexity of rural landscapes.

**Strengthening CONAFOR's advisory and monitoring systems** is essential for the success of forest programs in the field. Priority could be given to the staffing and training of regional offices, and to the development of cutting-edge remote sensing and geographical information systems. The training and accreditation of private experts who advise communities is also critical. This effort will be all the more important because monitoring, reporting, and verification (MRV) will be a key element for a future REDD+ system.

**Fostering the ability of community enterprises to compete with other suppliers would greatly contribute to environmental sustainability and socioeconomic development.** Simplifying the requirements for community management plans and reducing the time required to approve them, particularly for forests with low timber volumes and for non-timber products, could allow large additional areas to be legally managed for production. New mechanisms that recognize long-standing informal forestry activities could enable them to get help to become more sustainable. Communities with forests certified by recognized third-party auditors could be exempted from many regulatory requirements. Efforts should be made to resolve unclear tenure situations and allow communities to manage forests legally, especially where no opposing claims to those forests are present. New loan guarantees and collateral instruments could facilitate communities' access to private credit for forestry activities. Given limited resources, forest law enforcement efforts would be more effective if they were concentrated on critical areas. Mexico's Congress approved a bill for climate change that mandates the use of economic, market, fiscal, and financial instruments to promote the principle that those who conserve also shall receive the benefits. Since many communities actually bear the cost of public services and infrastructure, fiscal incentives should be considered to recognize their contributions to the population and the environment.

**Developing approaches for forests with lower commercial value is an integral part of the solution.** A combination of reducing regulatory burdens, providing small payments for managing forests with low timber volumes and for protecting forests from fires and grazing, and improving technical support services, could make it possible to greatly improve forests' condition and livelihoods in forest areas outside the main timber production regions. This approach, facilitated by greater integration between the different forest programs, could increase carbon stock in approximately 20 million forest hectares nationally. For example, payments for environmental services could be expanded from strict protection and used to complement sustainable management in less profitable areas, or in high-biodiversity areas at risk of degradation.

**Promoting cross-sector coordination and a landscape approach would enhance comprehensiveness.** CONAFOR and the Ministry of Agriculture (SAGARPA) are developing joint databases and making efforts to align policies, ensure consistency among subsidy programs, and develop new incentives for climate-smart management of land and forests at the landscape

level. A series of inter-municipal collaborations are also emerging, following the model of the *Junta Municipal del Río Ayuquila* (JIRA), with the aim of improving integration of public policies at the territorial landscape level, fully engaging local actors, and leveraging additional resources. Pursuing these nascent efforts and promoting the scaling up of successful pilots will be essential to using forests as a platform for sustainable development and a buffer against climate change impacts in rural areas.

**Fostering public participation in policymaking can bring positive effects.** Efforts are already underway to foster greater public participation in policymaking, especially in the innovative REDD+ area. These include the creation of local consultative committees for REDD+, direct engagement with grassroots organizations in designing and implementing pilot programs, a new collaboration with the *Comisión Nacional para el Desarrollo de los Pueblos Indígenas* (CDI) and the *Instituto Nacional de las Mujeres* (INMUJERES), the development of a consultation protocol for REDD+ jointly with civil society organizations, and a comprehensive communication strategy. Moving forward, it will be essential to intensify and expand these partnerships.

### *Water management*

**Implementing an effective Water Financing System will set the incentives for a more optimal use of water resources.** The 2004 Water Law states that the creation of a Water Financing System is critical to supporting the integrated and sustainable management of the nation's water resources. The Water Financing System should determine the financial needs of the sector; identify current revenue levels and all sources of funding being channeled to the sector (ODA, federal, state and local transfers, the private sector, tariffs, and other financing instruments); define key principles governing sector financing; identify potential sources of revenue generation for the sector; monitor and evaluate the impact of financing; propose measures to increase and diversify the funding base; and improve the optimal use of financial resources. Additionally, federal investment programs should be reformed to link the decisions of resource allocation with actual performance in improving efficiency and quality of service, ensure that activities financed are consistent with the overall SFA and do not generate perverse incentives, and improve the predictability and transparency of resource allocation. Finally, requirements to account for climate variability in future investments should be embedded in all federal programs.

**Consolidating the information base for climate, water management, and water services will improve policy and decisionmaking.** Critical steps have been taken to ensure the modernization of the *Servicio Meteorológico Nacional*; however, the task is far from complete, and there is a need to continue strengthening the information base ranging from climate predictions to water management, water rights allocation, aquifer behaviors, and the quality and efficiency of water services. For this to happen, a culture of openness, accountability, and transparency should be promoted throughout the sector, starting with CONAGUA making its sector data available more easily and systematically. Efforts should also be made to extend climate data as well as aquifer monitoring. Groundwater extractions should be measured whenever possible, and water balances should be made on real extractions, not unmonitored extraction rights. The quality of service provided by water utilities, as well as the efficiency with which they provide that service, should be reported and made publicly available for benchmarking purposes.

**Improving and strengthening enforcement of water rights will help to cope with competing uses and climate variability.** The water rights registry in Mexico covers 95 percent of all water users and represents an impressive accomplishment. But the amount of water rights greatly exceeds sustainable levels in water-scarce areas, the errors in the records remain relatively high, and effective enforcement needs to be substantially strengthened. Climate change further threatens current allocations. Making the system work fully will require cleaning up records, implementing a complete administrative system to measure and control water usage, and setting up transparent enforcement mechanisms. The system of water rights should be used to address the issue of water over-allocation and the need for an optimal use of water resources in the most water-scarce areas—in particular, in extreme events—by letting the market rather than government fees push up the perceived marginal value and allowing water users to capture the capital value of their water allocation through the establishment of tradable water rights in critical watersheds.

**Improving the efficiency of water services in the agriculture sector will have large payoffs.** Agriculture is the primary user of water, as it accounts for about 80 percent of total water withdrawals. The efficiency of agricultural water services is therefore instrumental to achieve an optimal use of water resources. The new administration should consider modifying the electricity tariff subsidy policies, generalizing volumetric water pricing, and continuing the modernization of irrigation techniques. Capacity building among producers will be needed to move to irrigation of higher value crops in water-scarce areas.

**Bringing efficiency and quality of urban water services up to regional OECD standards is necessary to sustain green growth in dense urban areas.** However, dramatic improvements are difficult to achieve in the absence of a change of approach in the promotion of service quality and efficiency. The new administration should consider establishing and enforcing a comprehensive policy addressing the shortcomings of the urban water sector, in close coordination with states and municipalities. This policy should focus on establishing effective service quality and economic regulation; developing more sustainable and self-financed utilities; improving technical capacity of their staff; reforming the existing sub-sector financing approach; and promoting long-term planning in the face of climate change and other constraints. The recent Public Policy drafted by CONAGUA should serve as a guiding policy.<sup>21</sup> The recent adoption of a constitutional right to access affordable water in sufficient quantity and quality, together with the mandate to pass a new Water Law within a year, offers an opening to address the challenges mentioned at the legal level, creating effective regulatory and accountability mechanisms for the sector.

### *Energy diversification*

**Energy diversification is essential to use natural resources in an optimal way.** The possibility of Mexico turning into a net oil importer calls for radically transforming the energy matrix composition as well as the energy subsidies policy. Mexico should focus subsidies on the poorest consumers, while using some of the freed-up resources to boost renewable energy. Such measures are key to avoid a difficult financial situation if the government decides to keep its current subsidies policy without having compensation through fiscal reform.

**As for renewables, their projected share in Mexico's electricity supply is expected to be about the same in 2025 as in 2009—roughly 14 percent.** In the short term (2009–2014), the

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share of renewables in new output is higher, roughly 21 percent, but then it falls. The existing plan is more ambitious in the short term than in the long term. This is much preferable to the inverse: little action in the short term, with ambitious long-term targets. The short-term actions can bring experience and conditions to build on. If the share of new output added by renewables in 2009–2014 were maintained over the subsequent decade, the additional output required after 2014 would be about 13 TWh. In that case, the share of renewables in the country’s electricity output in 2025 would increase to 17 percent.

**The private sector has considerable room to finance investments in renewable energy.** The recent law to promote renewable energy represents a positive step attracting investments from the private sector. This law (as well as the Power for Public Service Law) now considers externalities but needs to be strengthened. The Independent Power Producer model could be improved and extended to promote investments in renewable energy generation. Banks could also have a role in promoting renewable energy in Mexico. Households could create a strong market for solar technologies, which (depending on the region) could be integrated into mortgages and other long-term financing mechanisms. In partnership with the private sector, Mexico could also pursue the creation of Nationally Appropriate Mitigation Actions (NAMAs) in the renewable energy sector.

### Matrix of short- and medium-term policy reform options\*

Reform area	Short-term options (1 year)	Medium-term options (2–3 years)
Forest management	<ul style="list-style-type: none"> <li>• Provide more integrated support to communities by combining programs at local level, and balancing reforestation and community forestry, restoration, and payment for environmental services funds. (AR)</li> <li>• Start addressing bottlenecks and foster competitiveness of community enterprises. (AR&amp;LR)</li> </ul>	<ul style="list-style-type: none"> <li>• Strengthen advisory and monitoring systems. (AR)</li> <li>• Develop approaches for forests with lower commercial value. (AR&amp;LR)</li> <li>• Promote cross-sector coordination and landscape approach, especially with agriculture and livestock land uses. (AR&amp;LR)</li> <li>• Promote greater public participation in policymaking with explicit focus on REDD+. (AR)</li> </ul>
Water management	<ul style="list-style-type: none"> <li>• Conduct a review of all federal programs to improve their targeting, alignment, and predictability. (AR)</li> <li>• Prepare a new water law to address key challenges signaled in the policy note, in particular with regard to water rights management and water and sanitation service provision. (LR)</li> <li>• Consider replacing the electricity subsidy for</li> </ul>	<ul style="list-style-type: none"> <li>• Develop and implement the Water Financing System to promote a vision of sustainable and efficient sector financing. (AR&amp; LR)</li> <li>• Implement the new law and related urban water service quality and efficiency policy. (AR)</li> <li>• Continue improving the information basis on sector data, and require nonfederal actors to report on their performance and service quality as a condition for federal transfers. (AR)</li> <li>• Improve and strengthen the</li> </ul>

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Reform area	Short-term options (1 year)	Medium-term options (2–3 years)
	agriculture with targeted subsidies. (AR& LR)	enforcement of the system of water rights to cope with competing uses, in particular in the most critical basins. (AR&LR)
Renewable energy	<ul style="list-style-type: none"> <li>• Continue promoting renewable energy. (AR)</li> <li>• Involve the private sector in financing investments in renewable energy. (AR)</li> <li>• Explore potential to expand solar and wind power. (AR)</li> </ul>	

\* LR= Legal Reforms; AR=Administrative Reforms, Preliminary Classification

### NOTES

<sup>1</sup> Centro de Estudios de Competitividad 2010.

<sup>2</sup> CONAFOR 2010.

<sup>3</sup> Communities and *ejidos* are landholdings with either indigenous or non-indigenous members with rights, stipulated by law, to communal resources under which an individual family has a right to an individual plot of land allocated formally by the community as well as access to communally owned lands (often forest lands, pastures, and waterways).

<sup>4</sup> Lopez Feldman 2011.

<sup>5</sup> Johnson and others 2009.

<sup>6</sup> Universidad Autónoma de Chapingo 2010.

<sup>7</sup> Consejo Civil Mexicano de Silvicultura Sostenible 2010.

<sup>8</sup> Muñoz Piña 2011.

<sup>9</sup> Universidad Autónoma de Chapingo 2009.

<sup>10</sup> CONAFOR 2008.

<sup>11</sup> About 7 million of Mexico's 65 million hectares of forest have management plans, 8 million hectares are in national protected areas, and 2 million hectares are in Payment for Environmental Service schemes (Merino. 2011).

<sup>12</sup> The semiarid and arid northern and central regions account for 79 percent of GDP and contain 77 percent of total population, but they receive only 31 percent of the total runoff (CONAGUA 2011a).

<sup>13</sup> In 1955, water availability in Mexico was 11,500 m<sup>3</sup> per person per year. By 2005 this amount had decreased to 4,288 m<sup>3</sup> (CONAGUA 2010).

<sup>14</sup> The weighted average rate of Non-Revenue Water for a selection of water utilities in communities with a population of more than 50,000 inhabitants is estimated at 40 percent according to the CONAGUA (2011c); another source reports it at 49 percent, considering all larger utilities of the country (Consejo Consultivo del Agua 2011).

<sup>15</sup> In 2009 the availability of renewable water in the Mexico Valley was only 164 m<sup>3</sup>/hab/year, well below international standards for acute water scarcity established at 1000 m<sup>3</sup>/cap/year (CONAGUA 2011b).

<sup>16</sup> Of the 256 aquifers that supply more than 90 percent of total groundwater demands, 102 are currently considered overexploited.

<sup>17</sup> World Bank 2012 (forthcoming).

<sup>18</sup> Extrapolated from Consejo Consultivo del Agua 2011.

<sup>19</sup> Guevara-Sangines 2006.

<sup>20</sup> SENER 2010.

<sup>21</sup> World Bank and CONAGUA 2012 (forthcoming).

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