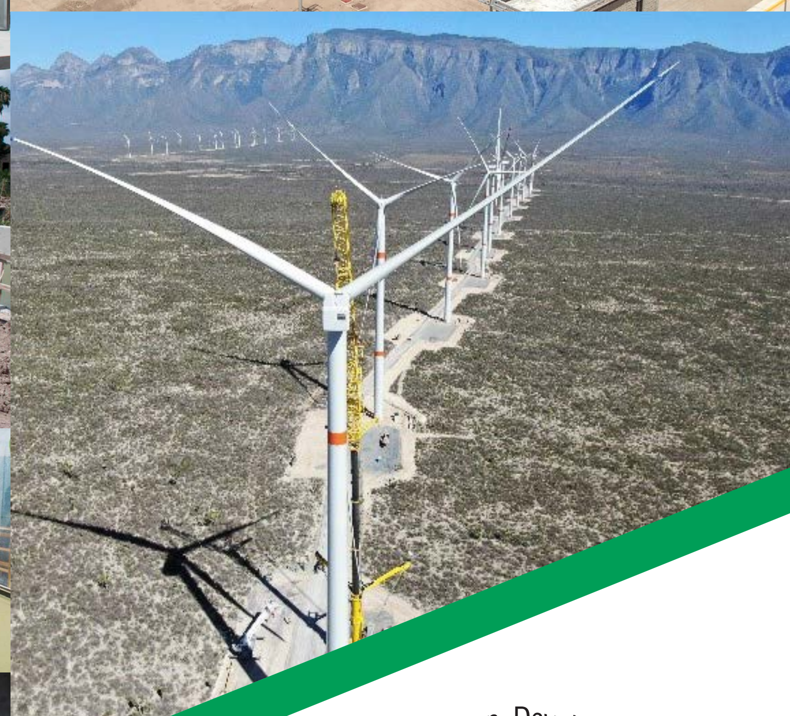
25 YEARS

of Green Investments in Communities in the U.S.-Mexico Border Region










North American Development Bank
Banco de Desarrollo de América del Norte

North American Development Bank: 25 Years of Green Investments in Communities in the U.S.-Mexico Border Region

This report documents the achievements of NADB and the Border Environment Cooperation Commission (BECC), which operated as sister institutions until their merger in November 2017.

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Abbreviations & Acronyms

$\mu g/m^3$	Micrograms per cubic meter
µm	Micrometers
BOD_5	Biochemical oxygen demand at 5 days
CO	Carbon monoxide
CO_2e	Carbon dioxide equivalent
GHG	Greenhouse gases
GWh	Gigawatt-hour
hm^3	Hectometer, equivalent to one million cubic meters
lps	Liters per second
mg/l	Milligrams per liter
mgd	Million gallons a day
MW	Megawatts
$MX\$/m^3$	Mexican pesos per cubic meter
NO_2	Nitrogen dioxide
NOx	Nitrogen oxides
O_3	Ozone
PM_{10}	Particles with an aerodynamic diameter of less than 10 µm
$PM_{2.5}$	Particles with an aerodynamic diameter of 2.5 µm or less
ppm	Parts per million
SO_2	Sulfur dioxide
ton	Metric tons
$US\$/m^3$	U.S. dollars per cubic meter

ADEQ	Arizona Department of Environmental Quality
APTA	American Public Transportation Association
B2012	U.S.-Mexico Border 2012 Environmental Program
B2020	U.S.-Mexico Border 2020 Environmental Program
BEA	Bureau of Economic Analysis
BECC	Border Environment Cooperation Commission
BEIF	Border Environment Infrastructure Fund
BLS	U.S. Bureau of Labor Statistics
CalRecycle	California Department of Resources Recycling and Recovery
CAP	Community Assistance Program
CCS	Center for Climate Strategies
CEL	Certificados de Energías Limpias [Clean Energy Certifcates]
CENAPRED	Centro Nacional de Prevención de Desastres [National Center for the Prevention of Disasters]
CINPRO	Consultoría en Ingeniería de Proyectos, S. de R. L.
COFEPRIS	Comisión Federal para la Protección contra Riesgos Sanitario [Commission for Protection against Health Risks]
CONAGUA	Comisión Nacional del Agua [National Water Commission]
CONAPO	Consejo Nacional de Población [National Population Council]
CONEVAL	Consejo Nacional de Evaluación de la Política de Desarrollo Social [National Council for the Evaluation of Social Development Policy]
CRE	Comisión Reguladora de Energía [Energy Regulatory Commission]
DENUE	Directorio Estadístico Nacional de Unidades Económicas [National Statistical Directory of Economic Units]
DOF	*Diario Oficial de la Federación*, official federal gazette of Mexico
EIA	U.S. Energy Information Administration
ENIGH	Encuesta Nacional de Ingresos y Gastos de los Hogares [National Survey of Household Income and Expenses]

ENOE	Encuesta Nacional de Ocupación y Empleo [National Ocupation and Employment Survey]
EPA	U.S. Environmental Protection Agency
FHWA	Federal Highway Administration
FONDEN	Fondo de Desastres Naturales [Natural Disaster Fund]
HEI	Health Effects Institute
IBWA	International Bottled Water Association
IBWC	International Boundary and Water Commission
IDB	Inter-American Development Bank
IMTA	Instituto Mexicano de Tecnología del Agua [Mexican Institute of Water Technology]
INECC	Instituto Nacional de Ecología y Cambio Climático [National Institute of Ecology and Climate Change]
INEGI	Instituto Nacional de Estadística y Geografía [National Institute of Statistics and Geography]
INEM	Inventario Nacional de Emisiones [National Emissions Inventory]
INPC	Índice Nacional de Precios al Consumidor [National consumer price index]
LMOP	Landfill Methane Outreach Program
NADB	North American Development Bank
NAFTA	North American Free Trade Agreement
NCHS	National Center for Health Statistics
NCDP	National Center for Disaster Preparedness
NMED	New Mexico Environment Department
NOAA	National Oceanic and Atmospheric Administration
OECD	Organisation for Economic Co-operation and Development
PDAP	Project Development Assistance Program
PIBE	PIB de Entidades Federativas [GDP by state]
PIGOO	Programa de Indicadores de Gestión de Organismos Operadores [Priority Utility Management Indicator Program]
PRODESEN	Programa de Desarrollo del Sistema Eléctrico Nacional [National Power System Development Program]
RNC	Red Nacional de Caminos [National Road Network]
SAT	Servicio de Administración Tributario [Tax Administration Service]
SEDATU	Secretaría de Desarrollo Agrario, Territorial y Urbano [Ministry of Agrarian, Terriotrial and Urban Development]
SEGOB	Secretaría de Gobernación [Ministry of the Interior]
SEMARNAT	Secretaría de Medio Ambiente y Recursos Naturales [Ministry of Environment and Natural Resources]
SENER	Secretaría de Energía [Ministry of Energy]
SINA	Sistema Nacional de Información del Agua [National Water Information System]
SNIARN	Sistema Nacional de Información Ambiental y de Recursos Naturales [National Environmental and Natural Resource Information System]
SRE	Secretaría de Relaciones Exteriores [Ministry of Foreign Relations]
SSA	Secretaría de Salud [Ministry of Health]
SSPC	Secretaría de Seguridad y Protección Ciudadana [Ministry of Security and Civilian Protection]
SWEP	Solid Waste Environmental Program
TCEQ	Texas Commission on Environmental Quality
TWDB	Texas Water Development Board
UMI	Utility Management Institute
UN	United Nations
UNPD	United Nations Development Programme
USGS	United States Geological Survey
USMCA	United States-Mexico-Canada Agreement
WCIF	Water Conservation Investment Fund
WHO	World Health Organization

Message from Management

Since its creation in 1994, the North American Development Bank (NADB) has helped preserve, protect and enhance the environment and public health of the U.S.-Mexico border region, home to more than 25 million residents. Working closely with communities, water utilities, local and federal governments, private sector sponsors, non-governmental organizations and academic institutions, NADB has played a key role in the progress achieved in improving various indicators in the region related to the provision of basic services, environmental quality and public health. In addition, it has become a benchmark for binational coordination on various environmental issues.

True to its vision, mission and values, in its 25-year history, NADB has approved 268 environmental infrastructure projects for financing, 236 of which were in operation at the close of 2019. The completed projects represent a total investment of US$9.53 billion, with US$2.99 billion financed through loans and grants from the Bank. At the same time, NADB has supported institutional strengthening at the local level, closing historical gaps in operational efficiencies.

As documented in this performance evaluation, great strides have been made in advancing the mission of the Bank. As a palpable example, between 1995 and 2015 wastewater treatment coverage in the border region of Mexico rose from 21% to 91%, with NADB participating in most of the public treatment plants that were built and went into operation during that period. Even more importantly, the homes of thousands of families on both sides of the border have been connected to reliable water distribution and sewer systems, providing first-time access to these basic services that many people take for granted.

Clean and renewable energy is another area that has seen significant growth in the past decade. NADB has played an essential role in the emerging renewable energy market in the border region of both countries, supporting the construction of 32 wind farms and solar parks with a combined installed capacity of 2,861 MW, which is equivalent to the annual consumption of 916,540 homes and the displacement of carbon dioxide emissions from 910,747 cars.

These and other achievements have been made possible thanks to the guidance and ongoing support of the NADB Board of Directors, the dedication of Bank staff and the collaboration of many border stakeholders, in particular municipal and state governments in both countries.

Although significant progress has been made, challenges remain. While coverage of water and wastewater services has increased substantially, there are still needs in terms of service reliability, water quality and aging

Calixto Mateos-Hanel
Managing Director

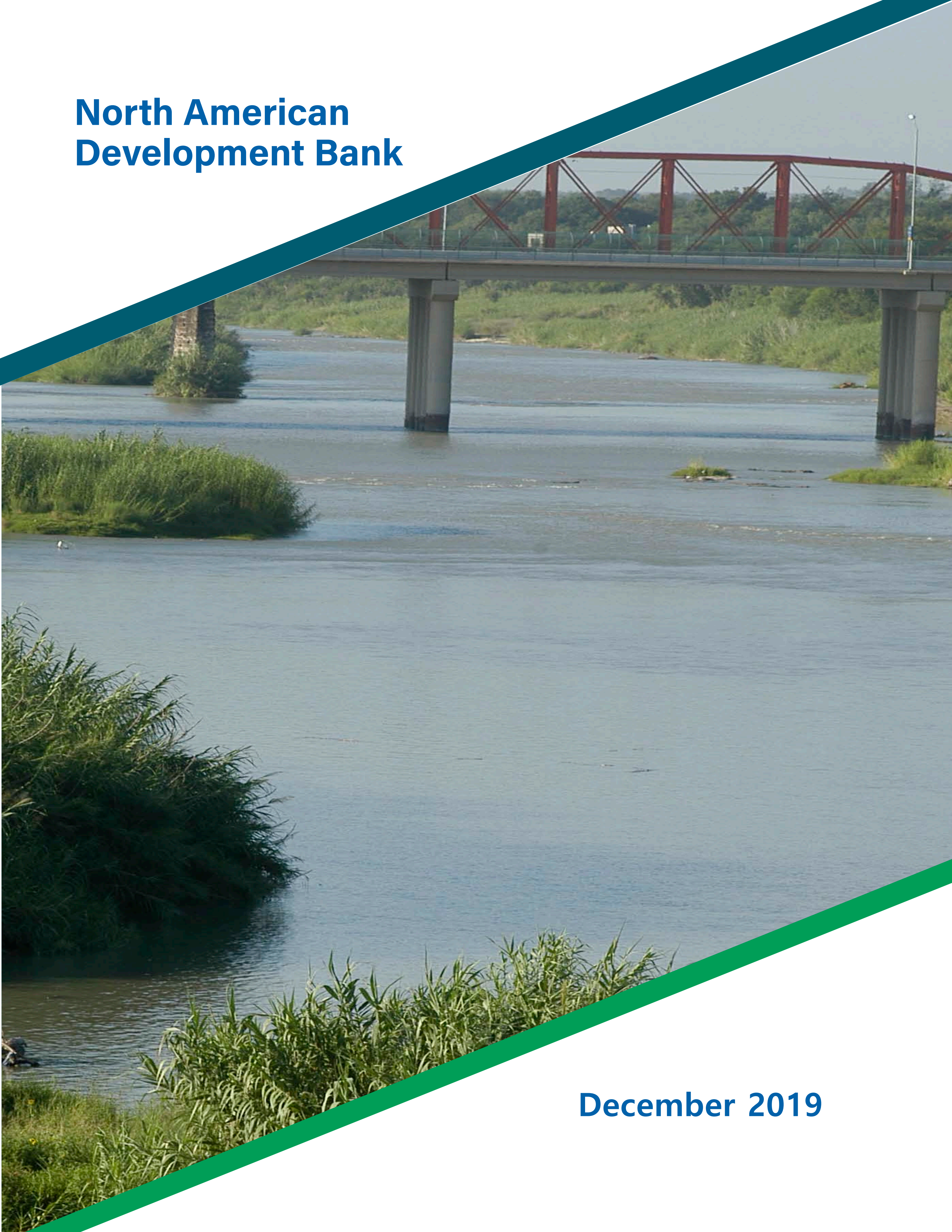
Salvador López-Córdova
Chief Environmental Officer

infrastructure, as well as issues related to water availability and storm water management. Likewise, some indicators for air quality have been deteriorating as our cities grow and people rely more on private vehicles, prompting the need for effective solutions for mobility and urban development.

For 25 years, NADB has participated in the development of the region, promoting a vision of binational governance and cooperation in pursuit of a better shared destiny. Looking towards the future, NADB is firmly established as one of the first green banks in the world and is well positioned as a self-sustaining and competitive institution to continue promoting the sustainability and development of the U.S.-Mexico border region.

Calixto Mateos-Hanel Managing Director	Salvador López-Córdova Chief Environmental Officer

North American Development Bank



December 2019

25 YEARS

Section 1

Institutional Profile

Board of Directors

UNITED STATES

- Secretary of the Treasury
- Secretary of State
- Administrator of the Environmental Protection Agency (EPA)
- U.S. border state representative
- U.S. border resident representative

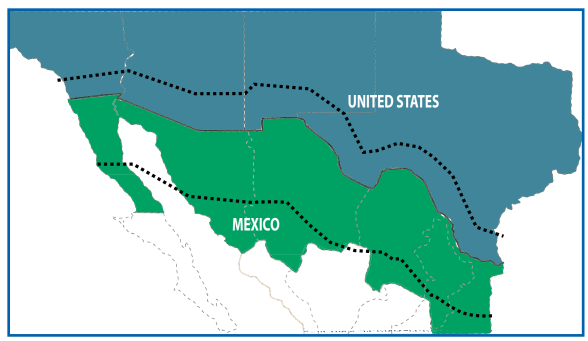
MEXICO

- Secretary of Finance and Public Credit (SHCP)
- Secretary of Foreign Relations (SRE)
- Secretary of Environment and Natural Resources (SEMARNAT)
- Mexican border state representative
- Mexican border resident representative

NADB is a binational financial institution established and capitalized equally by the Governments of the United States (U.S.) and Mexico for the purpose of financing infrastructure projects that preserve, protect or enhance the environment in order to advance the well-being of border communities, as well as providing technical and other assistance to support the development of such projects.

In November 1994, NADB began operations in accordance with an agreement between the two governments (the Charter), which also created the Border Environment Cooperation Commission (BECC), its sister institution charged with supporting the development and certification of projects seeking financing from NADB. In November 2017, NADB and BECC merged into a single entity to streamline their processes and maximize their services for border communities.

Its ten-member Board of Directors is made up of five representatives from each country, and the chairmanship alternates between the U.S. and Mexican representatives every year. NADB is headquartered in San Antonio, Texas, and has an office in Ciudad Juarez, Chihuahua.



NADB's area of operation comprises the region within 100 kilometers (62 miles) north of the U.S.-Mexico international boundary in the U.S. states of Texas, New Mexico, Arizona and California and within 300 kilometers (186 miles) south of the border in the Mexican states of Tamaulipas, Nuevo Leon, Coahuila, Chihuahua, Sonora and Baja California.

Projects that qualify as eligible infrastructure are those that will prevent, control or reduce environmental pollutants, improve the drinking water supply or protect flora and fauna; provided that such projects also improve human health, promote sustainable development or contribute to a higher quality of life. In its early years, NADB was exclusively dedicated to financing projects related to the drinking water supply, wastewater treatment and municipal solid waste management, and they continue to be its main priority. In 2000, the eligible sectors were expanded to include water conservation, storm water management and projects that improve air quality, such as street paving, public transportation, clean energy generation from renewable sources and energy efficiency.

NADB provides infrastructure financing in the form of loans and grants through various programs. The grant programs consist of the Border Environment Infrastructure Fund (BEIF), which is financed by the U.S. Environmental Protection Agency (EPA) and administered by NADB, as well as several programs funded from its retained earnings, including the Water Conservation Investment Fund (WCIF), the Solid Waste Environmental Program (SWEP) and the Community Assistance Program (CAP) for public projects in low-income communities.

During its first 25 years of operation, NADB has approved a total of 268 environmental infrastructure projects in both countries for financing, 236 of which were in operation at the close of 2019, benefitting close to 17.5 million border residents. The projects in operation represent a total investment of US$9.53 billion, of which NADB has financed US$2.99 billion through its loan and grant programs, as well as channeled US$626 million in EPA-funded BEIF grants to water and wastewater projects.

In addition to financing infrastructure, NADB also plays a key role in the development phase of projects and in strengthening the institutional capacities of border communities through its technical assistance programs and the EPA-funded Project Development Assistance Program (PDAP). To date, NADB has invested a total US$69 million in technical assistance through those programs to finance 548 project development and institutional strengthening initiatives, benefiting more than 160 border communities. Likewise, NADB has supported EPA and the Mexican Ministry of Environment and Natural Resources (SEMARNAT) in administering and channeling more than US$16 million in grants through the U.S.-Mexico Border 2012/2020 Programs for the development and implementation of 351 environmental initiatives.

Its binational nature has allowed NADB to bring together and work with local authorities, state agencies and other entities from both sides of the border to create synergies that foster the development of environmentally sustainable and resilient border communities. With the strong support of its partners in both countries, significant progress is being made towards improving the quality of life for millions of residents in the region.

NADB Sectors

WATER

- Water treatment and distribution
- Wastewater collection, treatment and reuse
- Water conservation
- Storm drainage
- Flood controls

AIR QUALITY

- Street paving and other roadway improvements
- Public transportation
- Ports of entry
- Industrial emissions
- Biogas/methane capture
- Renewable energy: Wind, solar, geothermal, hydroelectric
- Biofuels
- Energy efficiency: Public lighting, building retrofits, equipment replacement

SOLID WASTE

- Sanitary landfills
- Waste collection & disposal equipment
- Dumpsite closure
- Recycling/waste reduction
- Site remediation
- Toxic waste disposal

Section 2

U.S.-Mexico Border Region

The U.S.-Mexico border extends almost 2,000 miles, with the Rio Grande marking 64% of the international boundary. For NADB, the border region constitutes its geographic jurisdiction and is defined as the area extending 100 kilometers (62 miles) north and 300 kilometers (186 miles) south of the international boundary. In Mexico, the region comprises portions of six states and 220 municipalities, while in the U.S. it covers part of four states and 41 counties.[1] Its population in 2015, the last year for which census data is available, was 24.3 million residents: 17.6 million in Mexico and 6.7 million in the United States.[2]

Over the last few decades, the region has experienced accelerated population growth, although in more recent years the rate has declined to 1.9% for Mexican municipalities and to 1.2% for U.S. counties (2010-2015).[3] Even so, these rates are higher than the national growth rate of their respective countries (1.4% in Mexico and 0.9% in the U.S.).

This demographic growth partly stems from the extremely dynamic economy in the region, as well as the better standard of living in the Mexican border municipalities as compared to the interior of the country. However, it has also generated several challenges in providing basic infrastructure and services, as well as led to a deterioration of some environmental indicators.

There are 14 pairs of sister cities along the border that had a combined population of around 9 million in 2018.[4] Border communities are connected by 53 active border crossings consisting of 19 land crossings and 34 bridges over the Rio Grande. In 2019, 73 million automobiles and 49 million pedestrians crossed the border.[5]

The ten border states account for an increasingly larger share of the gross domestic product of their respective countries and represented almost a fourth of the national total (22% in Mexico and 24% in the U.S. in 2012).[6] In August 2019, Mexico had 5,190 export manufacturing industries, known as "*maquiladoras*," providing direct jobs to 2.73 million people, 60% of whom were living in the U.S. border states.[7]

[1] A municipality in Mexico is comparable to a county in the United States.
[2] Sources: For Mexico, Consejo Nacional de Población (CONAPO), Proyecciones de la Población de los Municipios de México 2015-2030; for the United States, U.S. Census Bureau, 2018 National and State Population Estimates.
[3] Sources: Ibid.
[4] Sources: Ibid.
[5] Source: U.S. Department of Transportation, Bureau of Transportation Statistics, 2019.
[6] Source: FOA Consultores and Texas A&M Transportation Institute, *Analysis of International Border Crossing Projects on the U.S.-Mexico Border*, May 2017.
[7] Source: Instituto Nacional de Estadística y Geografía (INEGI), Estadística Manufacturera y Maquiladora de Exportación 2019.

Goods traded between Mexico and the U.S. came to US$614 billion in 2019, with 67% of the them transported by land through their shared border.[8] In 2019, 6.51 million cargo trucks crossed the border.[9]

Some key socioeconomic indicators for the region are presented below.

2.1 Gross Domestic Product

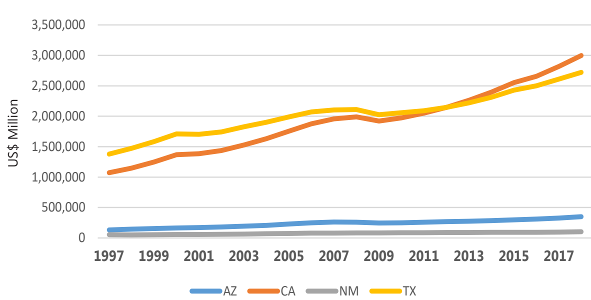
According to data from the Mexican National Institute of Statistics and Geography (INEGI), in nominal terms, the GDP of the Mexican border states grew moderately, though consistently, between 1991 and 2017.[10] Baja California, Coahuila, Chihuahua, Sonora and Tamaulipas followed a similar trend, while Nuevo Leon saw accelerated growth, well above the rest of the Mexican border states in terms of regional GDP.

Among the U.S. border states, as reported by the U.S. Bureau of Economic Analysis (BEA), California and Texas stand out with similar patterns of high growth.[11] During the period 1997-2011, Texas had the largest economy in the region; however, in 2012, California took the lead and has maintained it ever since.

The following graphs show the historical GDP figures for the border states.

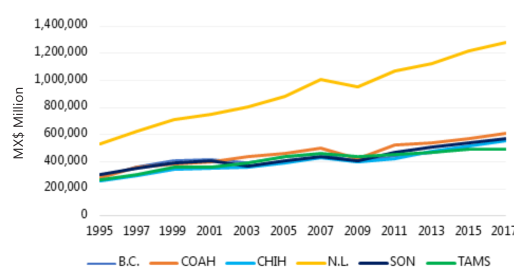
Figure 2.1: Gross Domestic Product

U.S.



Developed by NADB with data from BEA

Mexico



Developed by NADB with data from INEGI

[8] Source: U.S. Census Bureau, Trade in Goods with Mexico, 2019.
[9] Source: U.S. Department of Transportation, Bureau of Transportation Statistics, 2019.
[10] Source: INEGI, PIB por Entidad Federativa (PIBE), Base 2013.
[11] Source: Bureau of Economic Analysis (BEA), GDP by County, Metro, and Other Areas (2012 base year).

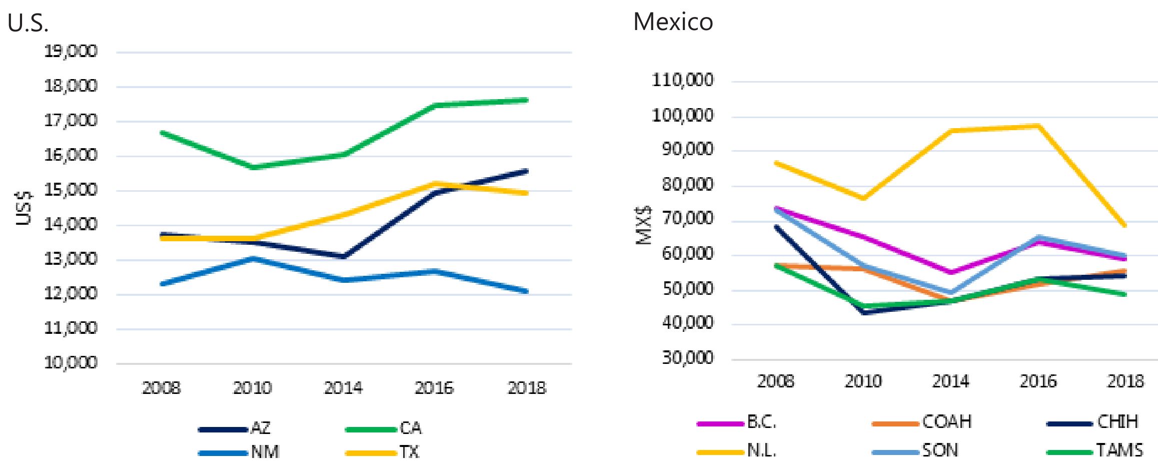
2.2 Income

In the Mexican border region, income registered an overall decline in real terms over the last decade.[12] Income growth from 2014 to 2016 was cancelled out in 2017 by an increase in the value-added tax (VAT) (a circumstance foreseen years earlier)[13] and by inflation, which reached 6.77% nationally that same year (the highest level in 17 years).[14]

In the U.S. border states, income generally observed an upward trend in real terms between 2008 and 2018, except in New Mexico. Income levels in Arizona, California and Texas increased by 14%, 6% and 10%, respectively.[15]

Figure 2.2: Average Quarterly Household Income

(2018 Constant Prices)



Developed by NADB with data from the U.S. Census Bureau

Developed by NADB with data from INEGI and the U.S. Bureau of Labor Statistics (BLS)

2.3 Unemployment Rate

Unemployment in U.S. counties and Mexican border municipalities has followed similar tendencies. As trade partners, economic activity on both sides of the border declined during the U.S. mortgage crisis in 2008, and unemployment rates rose in both countries.[16] The highest historical rates were recorded in Coahuila, where unemployment reached 7.9% in 2010, and in California with a 12.2% unemployment rate the same year.[17]

In recent years, both countries have seen a significant drop in unemployment rates. For example, Chihuahua reported a rate of 3.2% in 2014, and Texas had a rate of 3.4% in 2018.[18]

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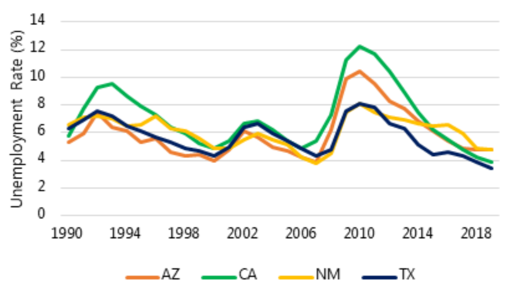
[12] Real income in Mexico was estimated using the methodology of the U.S. Bureau of Labor Statistics (BLS), 2019.
[13] Source: Mexican Senate, Comisión de Asuntos Fronterizos Norte, *Gaceta Frontera Norte*, No. 3, 2014.
[14] Source: INEGI, Índice nacional de precios al consumidor (INPC), 2020.
[15] Source: BEA, National Income and Product Accounts, 2019.
[16] This indicator measures the unemployment level of the economically active population and is defined as the percentage of that population who are of working age and are able and willing to work, but do not have a job.
[17] Sources: For Mexico, INEGI, Encuesta Nacional de Ocupación y Empleo (ENOE), 2019; and for the United States, U.S. Census Bureau, Employment Status, 2019.
[18] Sources: Ibid.

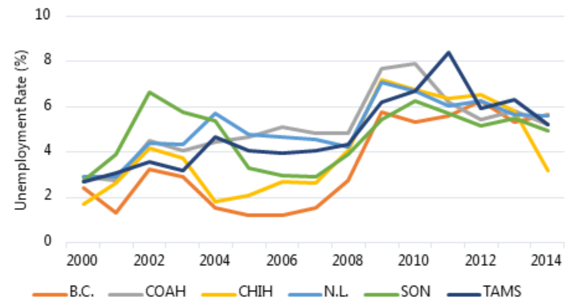
Figure 2.3: Unemployment Rate

U.S.



Developed by NADB with data from the U.S. Census Bureau

Mexico



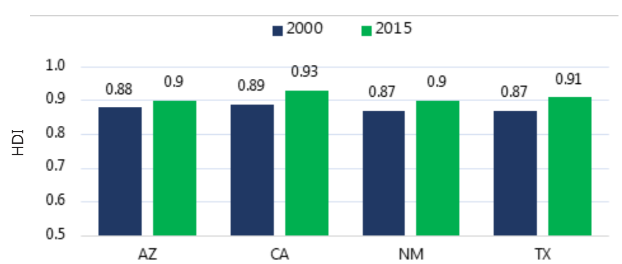
Developed by NADB with data from INEGI

2.4 Human Development Index

The Human Development Index (HDI) measures the success of a society in terms of its economy, opportunities and the education level of its people. The HDI for Mexico increased from 0.70 in 2000 to 0.75 in 2012.[19] However, the HDI for the Mexican border states decreased from 0.82 to 0.77, on average, which is still a high level and above the national average.[20] The HDI for U.S. border states rose slightly from 0.89 to 0.92 between 2000 and 2015, placing all the states at a very high level of human development.[21]

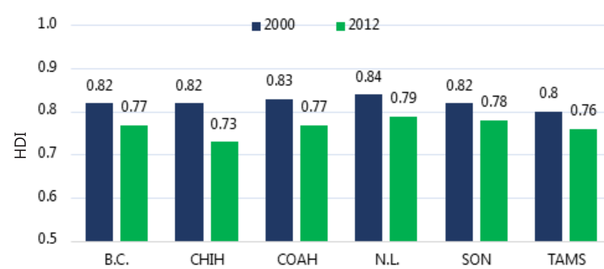
Figure 2.4: Human Development Index (HDI)

U.S.



Developed by NADB with data from countryeconomy.com

Mexico



Developed by NADB with data from UNDP

For 25 years, NADB has been part of this regional evolution, boosting communities in both countries through technical assistance and environmental infrastructure projects, not just in terms of quantitative goals, but also by forging a new way of engaging border communities and residents, from a perspective of binational cooperation and governance, which is also helping shape a greater shared future.

[19] Source: United Nations Development Programme (UNDP), *Índice de Desarrollo Humano para las entidades federativas de México*, 2015.
[20] Source: Ibid.
[21] Source: countryeconomy.com, Human Development Index of the U.S., 2019.

Section 3

Impact of NADB

Since its inception, NADB has helped border communities preserve, protect and improve the environment by financing environmental infrastructure works, providing technical assistance for project development, building institutional capacities and facilitating international cooperation to address shared problems.

The NADB Board of Directors has approved a total of 268 environmental infrastructure projects for financing in both countries. Of those projects, 236 were in operation at the close of 2019, directly benefitting 17.5 million border residents.

Figure 3.1: Cumulative Results as of December 2019

WATER

Access to Clean and Sustainable Water

25 water treatment plants

160 mgd of installed capacity

291 miles of new waterlines

13,258 new user connections

Water Conservation

1,033 miles of irrigation canals rehabilitated

Adequate Wastewater Management

61 wastewater treatment plants

442 mgd of installed capacity

1,309 miles of new sewer lines

387,645 new sewer connections

Adequate Storm Water Management

21.7 miles of storm water canals

AIR QUALITY

Clean Energy

2,091 MW of generation capacity in 14 wind farms

770 MW of generation capacity in 18 solar parks

3.2 MW of generation capacity in 3 bioenergy facilties

4.3 million metric tons/year of CO_2 emissions avoided

Street Paving

18 paving projects covering 14,110,404 m^2 of streets

4,540 metric tons/year of PM_{10} emissions avoided

Public Transportation

722 new buses with cleaner technologies in circulation

2,554 metric tons/year of CO_2 equivalent emissions avoided

SOLID WASTE

Disposal

17 sanitary landfills built or expanded

72 pieces of landfill operation equipment

5.95 million m^3 of new disposal capacity

13 open-air dumpsites closed

Collection

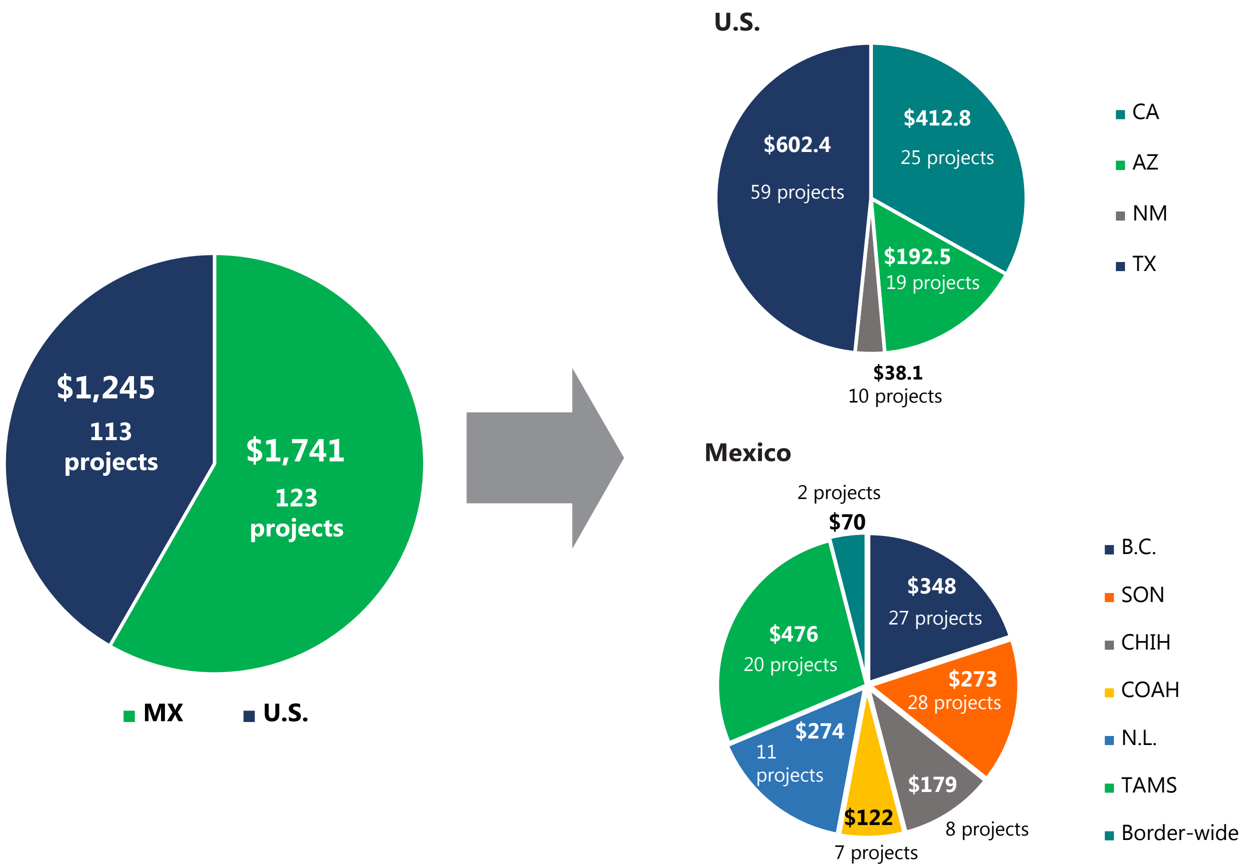
7 new or improved transfer stations

81 new garbage collection trucks

3,263 metric tons/day of new waste management capacity

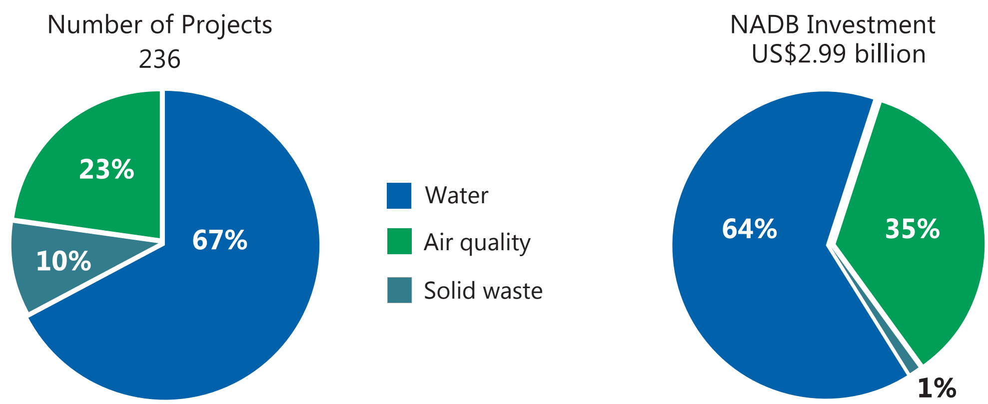
The projects in operation represent a total investment of US$9.53 billion, of which NADB financed US$2.99 billion through its loan and grant programs. These figures denote a direct leverage ratio of close to 3:1. In other words, for every dollar financed by NADB, two additional dollars have been mobilized from other sources. The investment distribution by country is relatively balanced with 57% in Mexico and 43% in the United States.

Figure 3.2: Geographic Breakdown of NADB Financing (1994-2019)
(US$ Million)



As a result of the priority given to water and wastewater issues, 67% of the projects financed have been in that sector, followed by 23% in the air quality sector. NADB participation in air quality projects has increased significantly over the past decade due to the growing demand for renewable energy projects, fueled by clean energy goals in the U.S. border states and by the Mexican federal government, as well as the rapid decrease in the costs of wind and solar technologies, which has made them more competitive against conventional sources. While the largest number of projects financed has been in the water sector, the largest amounts invested have been in the air quality sector (64%), which on average require a larger investment per project.

Figure 3.3: Sector Breakdown of NADB Financing and Projects (1994-2019)



In addition to financing infrastructure and helping leverage investments from other sources, NADB has played an important role in project development by using a portion of its retained earnings to provide technical assistance aimed at supporting project planning and design, building institutional capacity and generating knowledge. In this context, as of December 2019, more than US$35 million had been invested in studies and other support activities benefitting more than 160 border communities.[22] As a part of these efforts, NADB established the Utility Management Institute (UMI), which since its inception has provided training for just over 2,000 water utility managers and personnel: 68% in Mexico and 32% in the United States.

Likewise, NADB administers the Project Development Assistance Program (PDAP) funded by EPA to support the development of water and wastewater projects on both sides of the border that have been prioritized to receive a BEIF construction grant. Since its creation, PDAP has financed studies and other development activities totaling more than US$34 million.

Finally, NADB has supported EPA and the Mexican Ministry of Environment and Natural Resources (SEMARNAT) in implementing the Border 2012 and Border 2020 programs, which have focused on the strategic goals of reducing air pollution; improving access to safe drinking water; promoting comprehensive management of waste, hazardous materials and site remediation; enhancing joint emergency preparedness; and promoting regulatory compliance and environmental stewardship in the border region. Since 2005, more than US$16.0 million has been channeled through these programs to support 351 initiatives.

The following sections of this report provide detailed information on the projects financed and their impact on water resources, air quality and waste management in the border region, as well as on the quality of life of border residents.

[22] This figure includes US$12.1 million in BECC technical assistance invested prior to the merger of the two institutions in November 2017.

Section 4

Water Sector

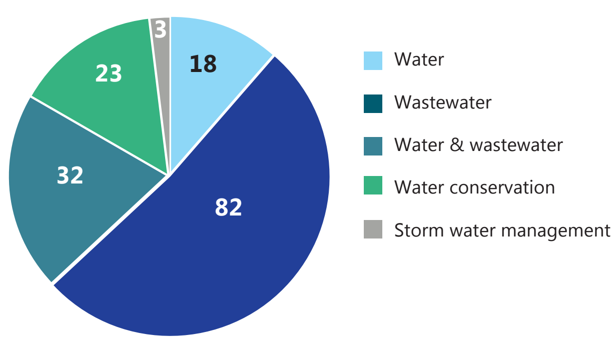
Access to adequate quantities of good quality water is essential for sustainable growth, including economic development and quality of life, food and energy production, healthy ecosystems and the very survival of human life. The U.S.-Mexico border region, where NADB is recognized as one of the leading institutions in the advancement of water and wastewater infrastructure, has become an international benchmark for binational water governance. The activities of NADB are specifically linked to four fundamental objectives: (i) access to safe and sustainable drinking water, (ii) proper wastewater management, (iii) institutional capacity-building of water utilities and (iv) storm water management and use.

Over the past 25 years, NADB has invested US$1.05 billion in water-related infrastructure projects, which combined with funding from other sources, represent a total investment of US$2.61 billion or a leverage ratio of 1 to 2.5.[23] In addition, NADB has provided support to strengthen the administrative and technical capacities of water utilities, as well as their legal framework, monitoring systems and information sharing. But above all, NADB has provided support mechanisms for communities with the greatest wastewater treatment needs.

Water sector investments supported by NADB have been achieved through a combination of financing sources, including NADB loans and grants, funding from EPA through the Border Environment Infrastructure Fund (BEIF), private capital through public-private partnerships and contributions from the Mexican federal government, as well as state and local governments on both sides of the border.

In the water sector, NADB has worked on the development and financing of 158 projects that are divided into the following categories: drinking water, wastewater, a combination of water and wastewater components, water conservation and storm water management.

Figure 4.1: Water Sector Projects



[23] Source: NADB, 2019.

Figure 4.2: Total Investment in the Water Sector by Country
(US$2,605 Million)

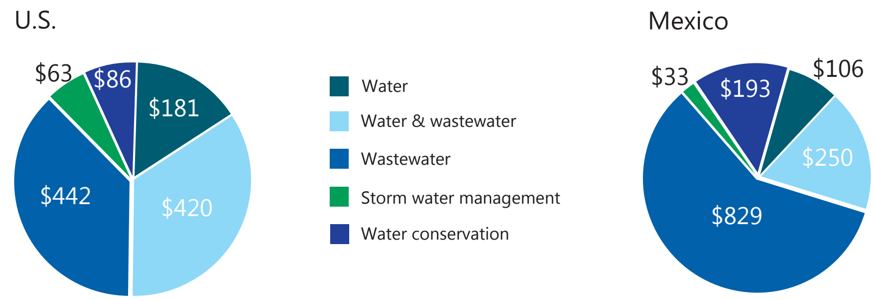


Figure 4.3: Breakdown of NADB-funded Water Projects

	No. of Projects	NADB Funding (US$ Million)	Total Investment (US$ Million)
Water	18	113	287
Wastewater	82	536	1,271
Water & wastewater	32	237	670
Water conservation	23	84	279
Storm water management	3	76	96
Total	**158**	**1,048**	**2,605**

Figure 4.4: Water Sector Outcomes

WATER

Access to Clean and Sustainable Water

25 water treatment plants built

160 mgd of installed capacity

291 miles of new waterlines

13,258 new user connections

Water Conservation

1,033 miles of irrigation canals rehabilitated

Adequate Wastewater Management

61 wastewater treatment plants

442 mgd of installed capacity

1,309 miles of new sewer lines

387,645 new sewer connections

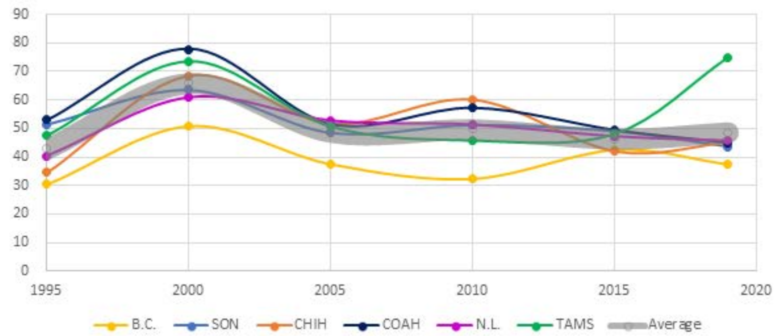
Adequate Storm Water Management

21.7 miles of storm water canals

4.1 Water and Public Health

Access to safe drinking water is a key factor for public health, especially in the prevention of gastrointestinal diseases. According to data from the Mexican Ministry of Health (SSA), the rate of gastrointestinal infections in the Mexican border states rose between 1995 and 2000, but has been on a slight decline since then.[24]

Figure 4.5: Rate of Intestinal Infections
(Cases per 1,000 Residents)



Developed by NADB with data from SSA

The morbidity rates of intestinal diseases are not readily available in the United States, but in general are not very significant. However, these diseases can be a problem in areas where basic utility services are deficient, such as in the so-called "*colonias*," some of which have received support from NADB.[25] For example, the incidence of hepatitis A in the Lower Valley of El Paso, Texas, fell from 60.8 to 0.2 cases per 100,000 residents between 1995 and 2015, in part as a result of the improvements to the water and wastewater infrastructure in the communities of San Elizario and Socorro, Texas.[26] Likewise, in Nogales, Arizona, only three cases of Hepatitis A were detected in 2017, a substantial decrease from the 89 identified in 2001, due at least in part to the increase in wastewater collection coverage in its sister city of Nogales, Sonora between 2010 and 2015, which significantly reduced transboundary flows of untreated wastewater.

4.2 Access to Safe and Sustainable Drinking Water

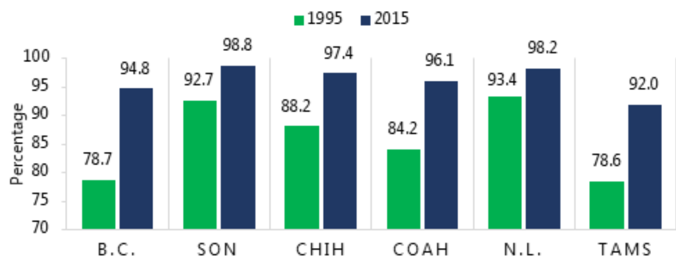
4.2.1 Water Distribution Service

Improving water distribution infrastructure and providing adequate wastewater management have been the primary focus of NADB since its creation 25 years ago. During that period, water service coverage increased 10 percentage points in Mexico and almost 14 percentage points in the United States.[27] Water service coverage

[24] Source: Secretaría de Salud (SSA), Dirección General de Epidemiología: Anuario de Morbilidad 1984 -2019.
[25] In the U.S., the term "*colonia*" refers to residential developments along the border that generally lack basic living necessities, such as running water, sewer systems, electricity and paved roads.
[26] Hargrove, W.L. and Del Rio, M., *Water Matters: A Retrospective Health Impact Assessment (HIA) of Water and Sanitation Infrastructure in Socorro and San Elizario, TX*. Center for Environmental Resource Management (CERM) at the University of Texas at El Paso (UTEP), March 2017.
[27] Sources: For Mexico, INEGI, Conteo de Población y Vivienda, 1995 and Encuesta Intercensal 2015; for the U.S., United States Geological Survey (USGS), Water-Quality Annual Statistics for the Nation, 2019.

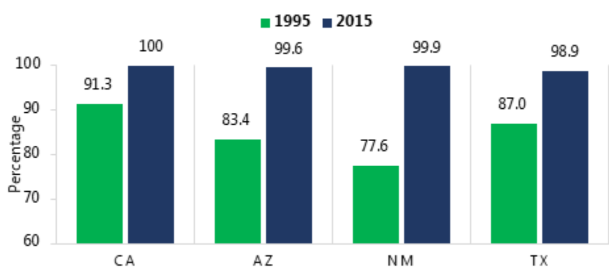
in the Mexican border region currently averages around 96%, while in the U.S. it is practically universal. The following charts show this evolution with the official data available.

Figure 4.6: Border Population with Access to a Proper Water Distribution System in Mexico



Developed by NADB with data from INEGI

Figure 4.7 Border Population with Access to a Proper Water Distribution System in the U.S.



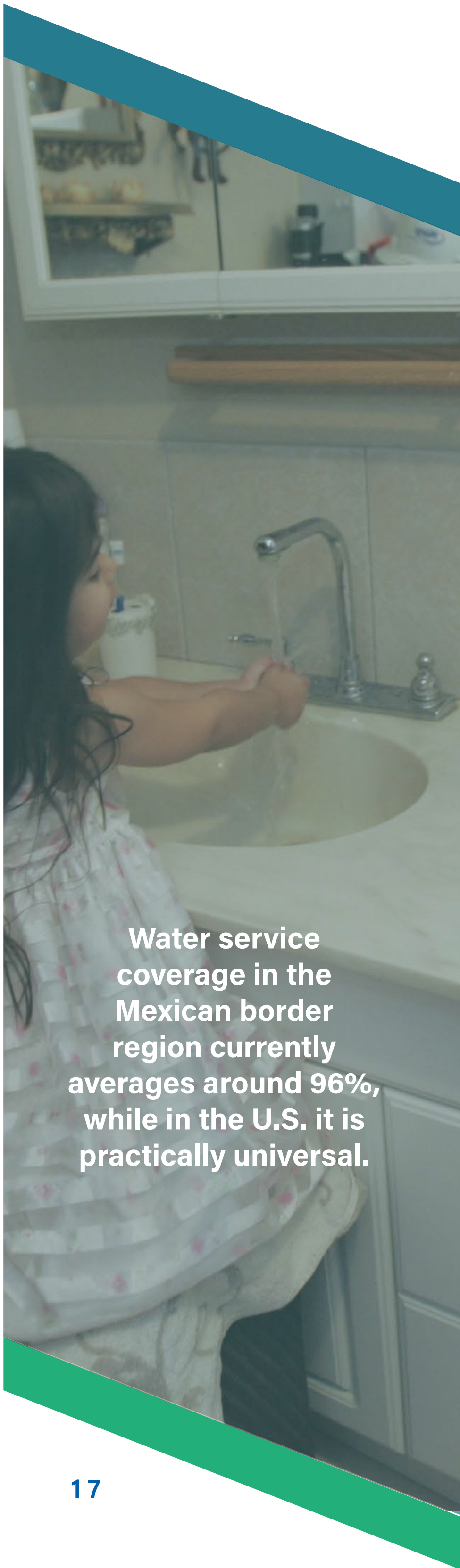
Developed by NADB with data from United States Geological Survey (USGS)

Despite the increase in water service coverage, needs still exist in both countries. In the case of Mexico, the coverage gap needs to be closed in the more remote municipalities and areas. In the U.S., there are still small and underdeveloped *colonias* with gaps in service coverage and quality.

Although the physical coverage of distribution systems has increased substantially, there are still needs in terms of reliability (e.g. intermittent distribution), water quality, service quality (e.g. low pressure), leak prevention and the reduction of commercial losses, both in centralized systems in Mexico and in private or on-site systems in the United States primarily.

4.2.2. Drinking Water Quality

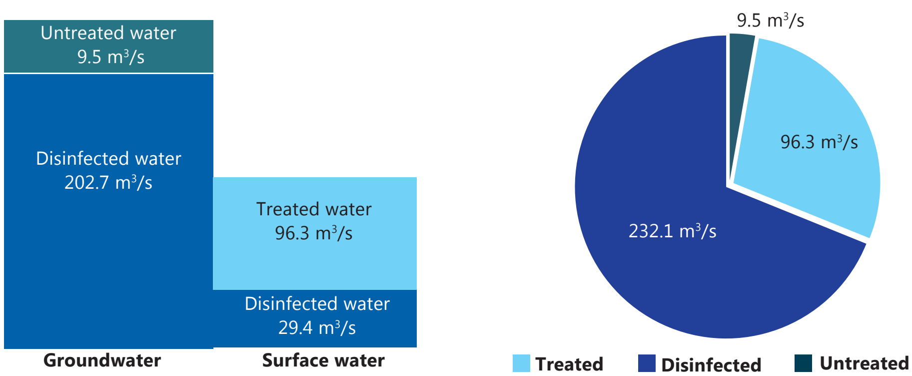
Public distribution systems must meet minimum quality standards to ensure that the water is suitable for human consumption. In the U.S., the quality of drinking water falls within the jurisdiction of the states, while in Mexico it falls within federal jurisdiction.



In the U.S., the quality of water in distribution systems tends to be good and consistent, with some exceptions in small and underdeveloped communities, where water sources are scarce or poor quality and treatment is inadequate or nonexistent. In Mexico, on the other hand, many cities have problems supplying drinking water to residents 24 hours a day, largely due to the deterioration of existing infrastructure and leaks, as well as scarce supply sources. The practice of shutting down the distribution system for scheduled periods on a regular basis, known as the "*tandeo*" in Mexico, depressurizes the lines, converting them into a potential source of contamination, regardless of the quality of the water supply. Moreover, because of this intermittent distribution practice, many residents store water in cisterns, water tanks or other types of containers, which do not always comply with the necessary hygiene standards.

According to the Mexican National Water Commission (CONAGUA), in 2015, nationwide, only 28% of the water supply was treated, 69% was disinfected, and 3% was supplied directly from the source with no treatment.[28] It should be noted that disinfection is sufficient in many cases, mainly for groundwater. Although there is no specific data available for the border states, their situation is similar to that of the rest of the country, since only surface water is treated, and most of the water supply comes from wells, which just have disinfection systems.

Figure 4.8: Drinking Water Sources and Treatment Processes in Mexico



CONAGUA graphs reproduced by NADB

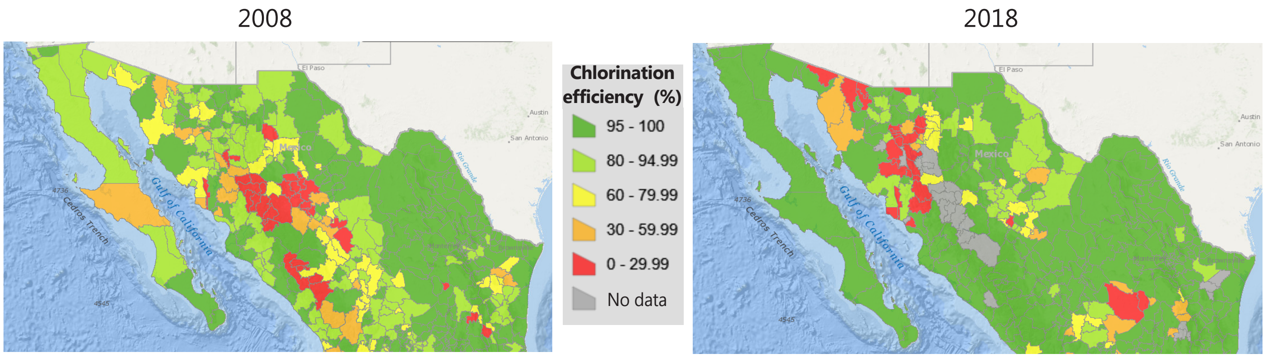
According to data from CONAGUA, between 2008 and 2018, disinfection efficiency—the percentage of water disinfected prior to distribution—increased in Baja California and Tamaulipas but decreased in some areas of the Chihuahua and Sonora.[29]

In the U.S., compliance with water quality standards is enforced by the states. In general, the quality of the water in the distribution systems is acceptable, with certain exceptions in low-income communities and areas without access to a centralized system, such as *colonias*, which have received assistance through NADB projects.

Due in part to a lack of confidence in the quality of the water in the distribution system, the rate of consumption of bottled water in the border region is high. According to the data available, bottled water consumption in the Mexican border states increased from 28 to 67 gallons/year/person between 1997 and 2017.[30] In the U.S.

[28] Source: Comisión Nacional del Agua (CONAGUA), *Situación del Subsector de Agua Potable, Drenaje y Saneamiento*, 2015 edition.
[29] Source: CONAGUA, Sistema Nacional de Información del Agua (SINA), Agua y Salud: Eficiencia de cloración por municipio, 2018.
[30] Estimate based on statistics from the International Bottled Water Association (IBWA), 2019; and from CONAPO, Proyecciones de la Población de los Municipios de México 2015-2030.

Figure 4.9: Water Chlorination by Municipality in Mexico



Source: CONAGUA, National Water Information System (SINA)

during the same period, bottled water consumption increased from 14 to 41 gallons/year/person.[31] The high rate of bottled water consumption creates environmental problems related to the use of energy and other resources for bottling and marketing, as well as the disposal of the empty containers.

4.2.3. Water Consumption per Capita

Economic development, quality of life and human health require sufficient water resources, while avoiding their waste or inefficient use. The United Nations, for example, recommends a minimum of 13 gallons per resident per day to cover basic food and hygiene needs and 26 gallons for general needs. In Mexico, the average water consumption rate is 97 gallons/person/day, while in the U.S. it is 152 gallons/person/day—the highest per capita consumption in the world.[32]

In the Mexican border states, average water consumption was 106 gallons/person/day in 2009 and dropped to 87 gallons in 2017. This decline is largely due to water conservation campaigns and efficiency improvements undertaken by the local water utilities. However, despite this progress, average consumption is still higher than the 50-53 gallons/person/day recommended by CONAGUA.[33]

In the U.S. border states, per-capita water consumption has gone down as a result of conservation efforts and the reclamation of treated wastewater for non-potable uses.[34] According to United States Geological Survey, between 1985 and 2015, consumption in the U.S. border states decreased from 180 to 132 gallons/person/day, on average.[35]

While the results in both countries are trending in the right direction, they seem to be falling short of the mark, given the increasing pressure on surface water bodies, the accelerated depletion of major aquifers and projected demographic and economic growth.

[31] Estimate based on statistics from IBWA, 2019; and population data from the U.S. Census Bureau.
[32] Source: Fortuño, M., La economía del agua: El futuro se avecina complicado, World Economic Forum, 2017.
[33] Source: CONAGUA, *Manual de Agua Potable, Alcantarillado y Saneamiento*, sección 2.2.1.3. Estudios sobre el consumo, p. 10. These figures reflect average residential water consumption estimated for dry, hot subhumid and hot humid climates, and do not include industrial consumption, physical losses in the systems and other inefficiencies.
[34] Source: EPA, WaterSense, How We Use Water, 2018.
[35] Estimate calculated with data from the USGS, Water Use Data for the Nation, 2015.

4.3 Water Availability

The border region is arid, and water resources are stressed. If water management continues under the current model, this situation will only worsen as the population and economy grow, especially in the light of climate change.

Aquifers are the main source of water in the region, especially in urban areas. However, the Colorado River is the primary supply source for urban use in the major cities of Baja California and California, while the Rio Grande serves as a supply source for cities such as El Paso and the Rio Grande Valley. These bodies of water, along with other sources such as the Conchos River in Chihuahua, also supply significant amounts of water for agricultural use. It is common knowledge that these rivers are susceptible to droughts, which are expected to increase because of climate change, as well as to disputes over resource allocation among different users.

The availability of groundwater for the Mexican border states is estimated by CONAGUA every three years based on rainfall and recharge rates. In the last decade, water availability remained relatively constant at 11,641 cubic hectometers (hm^3)/year (9.44 million acre-feet) in 2012 and 12,249 hm^3/year (9.93 million acre-feet) in 2019.[36] However, the border population grew approximately 13% during the same period, so availability per capita is actually declining, making a more sustainable approach to water resource management essential.

There is little information regarding groundwater depletion, given that extraction and recharge conditions are not monitored. Based on available data on the border region, the number of over-pumped aquifers in Mexico remained relatively constant, dropping from 44 in 2003 to 43 in 2017.[37] It is well known that aquifers such as the Bolson Hueco—which supplies a significant percentage of the water consumed in El Paso, Texas, and Ciudad Juarez, Chihuahua—are shrinking, which also affects the quality of the groundwater in terms of higher salinity.

In the United States, the information is classified into 41 aquifer systems, subareas and categories. According to the USGS, between 1900 and 2008, groundwater in the U.S. was being depleted at an average rate of 9,200 hm^3 (7.46 million acre-feet) per year, but between 2000 and 2008 the rate jumped to 25,000 hm^3 (20.67 million acre-feet) per year.[38] The border state with the highest rate of groundwater depletion is Texas, with the Pecos River basin at 21,000 hm^3 (17.02 million acre-feet) and the Hueco Bolson Aquifer at 5,700 hm^3 (4.62 million acre-feet).[39]

Given these trends, it is vitally important to step up efforts to achieve a more efficient use of water resources, such as eliminating leaks in urban and agricultural systems and reusing treated wastewater. Moreover, diversifying water sources is essential for cities like Tijuana or Ciudad Juarez that rely heavily on a single supply source.

4.4 Adequate Wastewater Management

Proper wastewater management, just like access to a safe and sustainable water supply, has been a priority for NADB since its inception. NADB has provided loans and grants to finance 114 projects with wastewater collection and treatment components, as well as administered EPA-funded grants through its BEIF program, which has played a critical role in addressing the transboundary flows of polluted water.

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[36] Source: CONAGUA. Acuerdo por el que se actualiza la disponibilidad media anual de agua subterránea de los 653 acuíferos de los Estados Unidos Mexicanos, *Diario Oficial de la Federación*, January 4, 2018.

[37] Source: CONAGUA, *Estadísticas del agua en México*, 2003 and 2017 editions.

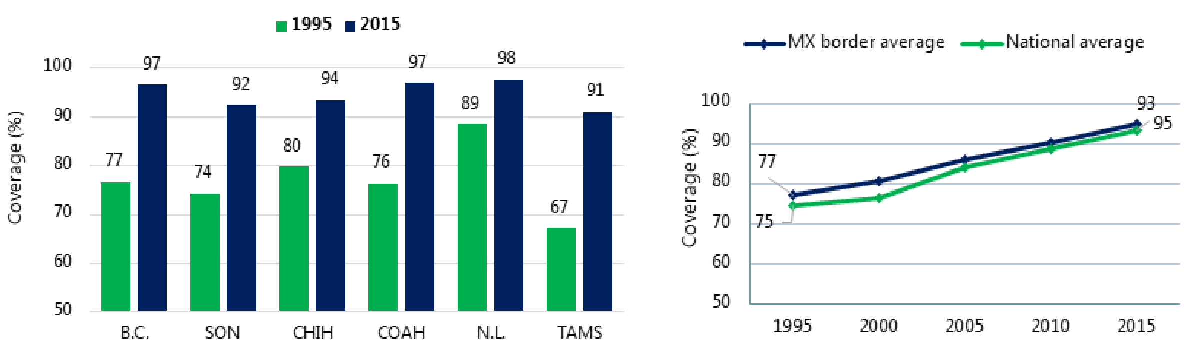
[38] Source: USGS, *Groundwater Depletion in the United States (1900-2008)*, published in 2013.

[39] Source: Ibid.

4.4.1 Access to a Wastewater Collection System

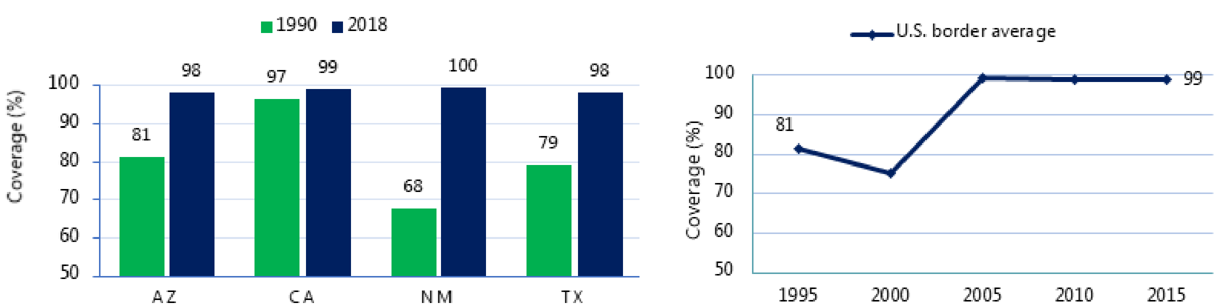
As shown in the following graphs, wastewater collection coverage in the border region has increased substantially over the past 25 years, in part because of projects supported by NADB. In Mexico, wastewater collection coverage climbed from 77% in 1995 to 95% in 2015.[40] Similarly, coverage in the U.S. rose from 76% to 99%.[41]

Figure 4.10: Border Population with Access to Wastewater Collection Systems in Mexico



Developed by NADB with data from INEGI

Figure 4.11: Border Population with Access to Wastewater Collection Systems in U.S.



Developed by NADB with data from the U.S. Census Bureau

Despite major advances in wastewater collection coverage, there are still significant infrastructure needs, such as expanding sewer service to 100% of the population and rehabilitating infrastructure that has reached the end of its useful life or not been properly maintained. In Mexican communities, it is common to find clogged or collapsed sewer lines and pump stations that are out of service.

In the United States, the provision of acceptable wastewater collection services is almost universal, although there are still some underdeveloped areas (*colonias*) with inadequate service or with individual on-site systems, such as septic tanks, that may not comply with regulatory quality standards.

[40] Source: INEGI, Conteo de Población y Vivienda 1995 and Encuesta Intercensal 2015.
[41] Source: U.S. Census Bureau, Housing, 2019.

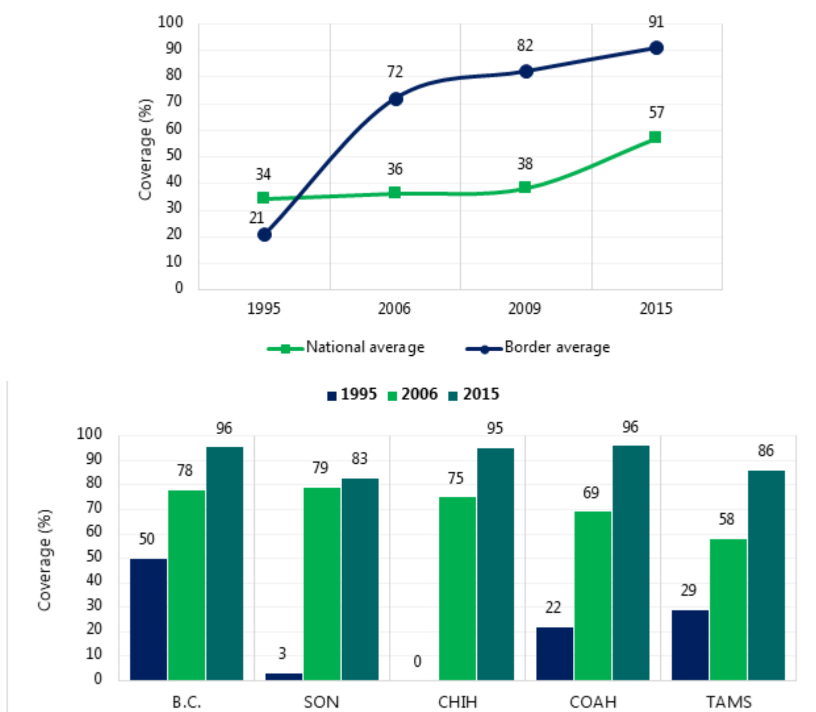
Wastewater collection coverage in the border region has increased substantially over the past 25 years, in part because of projects supported by NADB.

In Mexico, wastewater collection coverage climbed from 77% in 1995 to 95% in 2015. Similarly, coverage in the U.S. rose from 76% to 99%.

4.4.2 Wastewater Treatment

Major improvements have also been made in wastewater treatment capacity over the past 25 years. NADB has played a significant role in the development and construction of 61 wastewater treatment plants in the region, with a combined capacity of 442 million gallons a day. In Mexico, NADB has participated in projects equivalent to 33% of the total treatment capacity currently installed in the six border states. The improvements are particularly notable in the 100-kilometer region on the Mexican side of the border, where average treatment coverage climbed from 21% in 1995 to 91% in 2015, well above the national average of 57%.[42] As a result of this expanded coverage, in 2015, an estimated 8.5 million Mexican border residents were receiving wastewater treatment services compared to 1.5 million in 1995.

Figure 4.12: Wastewater Treatment in the 100-km Border Region of Mexico



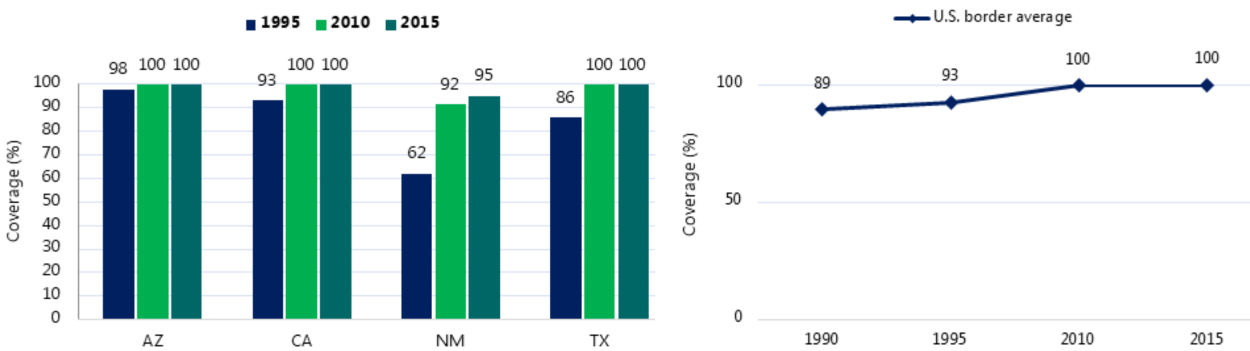
Note: No communities in the state of Nuevo Leon are located within the 100-km border region.

Developed by NADB with data from BECC

The same indicator for the United States shows that treatment coverage has gone up in all four border states, increasing from an average of 89% in 1990 to 100% as of 2010.[43]

[42] Estimate developed by BECC, 2015.
[43] Source: U.S. Census Bureau, Housing, 2019.

Figure 4.13: Wastewater Treatment in the 100-km Border Region of the U.S.



Developed by NADB with data from the U.S. Census Bureau

Notwithstanding the progress achieved, there are still major challenges, primarily in Mexico, related to obsolete infrastructure that has exceeded its useful life, the failure to invest adequately in the operation and maintenance of facilities, non-compliance with discharge standards and management of the sludge generated in the treatment process, among other issues. Moreover, despite the semi-arid climate of the region and the low availability of water, wastewater reuse is very limited. Likewise, even though the sludge generated in the treatment process has value as a fertilizer or source of energy, its proper disposal has become a problem.

In the context of the border region, deficiencies in wastewater collection and treatment systems can result in polluted water flowing across the border. As part of its ongoing efforts, NADB is helping address this problem by developing projects and coordinating with stakeholders from both countries.

4.4.3 Aging Infrastructure

Aging and obsolete water and wastewater infrastructure is a recurring problem in both countries. A large portion of the water and sewer lines currently in service have exceeded their useful life, but because of limited capital resources, investments in their replacement and rehabilitation does not occur with sufficient frequency to ensure quality service. The more sophisticated utilities maintain information on the status of their infrastructure, but most communities do not have this type of data.

In Mexico, CONAGUA provides an annual report on the national inventory of wastewater treatment plants, which includes the construction and commissioning dates of each plant. According to those reports, the average age of wastewater treatment infrastructure in the border states was eight years in 1990. The average age rose to 17 years in 2004 and dropped back down to 13 years in 2006 due to the start-up of new facilities. By 2016, the average age had increased once again to 18 years. The level of maintenance of each of the plants is unknown considering their age and operational status, but it is well known that several of them need to be replaced or rehabilitated.

Given that 15 projects for the construction of wastewater treatment plants in Mexico were certified and financed between 1997 and 2006, the decrease in the average age of the plants in 2006 can in part be attributed to the work of NADB.

4.5 Quality of Regional Water Bodies

Information regarding the quality of regional surface water bodies—such as rivers, lakes and streams—is not consistent nor easy to interpret. Water quality information for groundwater is even more difficult to obtain than for surface water. However, there is specific data, which together with the field experience of NADB, indicates that significant challenges exist, including with binational water bodies.

Routine monitoring of the Rio Grande shows critical impairment of the water quality in 14 segments of the river, mainly due to bacteria (E. coli), low dissolved oxygen and salinity (mainly from chlorides and sulfates).[44] The impairment of these segments—including in the vicinity of the Amistad, International, Riverside and Red Bluff reservoirs—is associated with discharges of treated and raw sewage from urban areas located along both banks of the river. Alarming conditions have also been identified in another 11 segments—among them the area around the Juarez Valley and the El Paso Lower Valley, the confluence with the Conchos River, Big Bend and the Lower Rio Grande Valley in Texas—due to high levels of chlorophyll, ammonia nitrogen, nitrates and phosphates, as well as dissolved oxygen depletion, which are associated with irrigated areas and agricultural runoff. Moreover, two serious problems have been observed along the entire course of the river: the indiscriminate discharge of agricultural and municipal solid waste into the river and the proliferation of exotic and invasive species of flora and fauna.

In 2010, the Tijuana, Baja California/San Diego, California area experienced problems with heavily contaminated water, a situation that worsened around 2014 and had improved somewhat in 2018, but it is still unacceptable. This improvement is probably due to the investments made to replace wastewater collection infrastructure in Tijuana, which has reduced fugitive discharges, but improving treatment quality in one of its plants and stopping transboundary wastewater flows is still pending. The quality of ambient water in the Mexicali, Baja California area has also deteriorated in the last decade, resulting in contaminated transboundary flows.[45]

These trends clearly demonstrate the need to step up efforts to improve wastewater collection and treatment infrastructure and strengthen the institutional capacities of the water utilities.

4.6 Institutional Capacity-building

In addition to financing the construction of water and wastewater infrastructure, since its inception, NADB has helped strengthen the administrative, financial and technical capacities of water utilities in the border region through various technical assistance programs. In this context, it has financed studies for the development of specific projects, as well as initiatives for planning, training and improving efficiencies. Over the past 25 years, NADB has invested more than US$35 million in technical assistance studies and other activities in benefit of more than 160 border communities.[46]

[44] Source: International Boundary and Water Commission (IBWC), U.S. Section, *Annual Update on Rio Grande Water Quality and the Clean Rivers Program*, 2019.
[45] Source: CONAGUA, SINA, Agua y Salud: Eficiencia de cloración por municipio, 2018.
[46] This figure includes US$ 12.1 million in BECC technical assistance invested prior to the merger of the two institutions in November 2017.

NADB technical assistance is geared towards three main objectives:

1. *Project development*: Basic engineering plans, final designs, financial studies, water and energy audits, etc.
2. *Institutional strengthening*: Master plans, comprehensive needs assessments, rate studies, training programs and workshops, etc.
3. *Sector studies*: Strategic plans, sector guidelines and manuals, legal frameworks, regional forums, etc.

Additionally, as part of its technical assistance program, NADB established the Utility Management Institute (UMI) for the purpose of strengthening the administrative and financial capacities of public utilities within its jurisdiction. UMI has grown significantly since its creation in 1999, expanding beyond the basic program of its early years to present specialized seminars throughout the border region. At the end of 2019, training had been provided to more than 2,000 water utility managers and personnel—68% in Mexico and 32% in the United States.

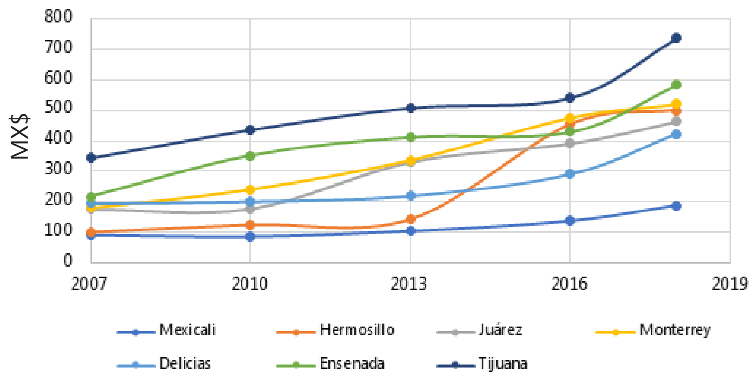
4.6.1 Water Rates

Adequate water rates and an efficient revenue collection system are essential for the proper operation and maintenance of water utilities, as well as for making the capital investments necessary to expand or rehabilitate the systems, and potentially improve the level of service. Moreover, user fees promote efficient water use and conservation. However, at times they may become burdensome or unaffordable for low-income households, so rates need to be structured appropriately.

In Mexico, water rates are set differently in each state and/or municipality, depending on local legislation. The Mexican Institute of Water Technology (IMTA), though its Utility Management Indicator Program (PIGOO), maintains statistics on the rates of some utilities, including seven communities in the border region: Mexicali, Hermosillo, Ciudad Juarez, Monterrey, Delicias, Ensenada and Tijuana.[24] In those cities, the average residential water bill for 30 m^3 a month was between $93.00 and $344.00 pesos in 2007 and had increased to between $189.00 and $738.00 pesos a month by 2018. Net increases in monthly billing ranged from 103% to 401% between 2007 and 2018, while cumulative inflation during the same period was 57%. In other words, in this sample of seven border cities, rates were adjusted in an attempt reflect the real cost of service, maintenance and infrastructure replacement. However, in many small, low-income communities, water rates are insufficient and do not even cover operating costs, which is why they are subsidized by municipal governments.

[47] Source: Instituto Mexicano de Tecnología del Agua (IMTA), Programa de Indicadores de Gestión de Organismos Operadores (PIGOO), 2019.

Figure 4.14: Monthly Water Bill in Mexico (30 m³)



Developed by NADB with data from IMTA (PIGOO)

In addition, most border communities have a low collection rate or commercial efficiency, exacerbating the financial problems of the water utilities.

In the U.S., residential rates are generally sufficient to cover operation, maintenance and infrastructure replacement costs, although in some small low-income communities, utilities still face financial difficulties. In general, the rates in the U.S. reflect an upward trend, in part to cover increased operating expenses. Higher rates may also be used as a sustainability strategy to curb consumption. In some Arizona cities, a slight reduction in rates has been observed, possibly due to improved operational, financial or administrative efficiencies.

4.6.2 Efficiency of Water Utilities

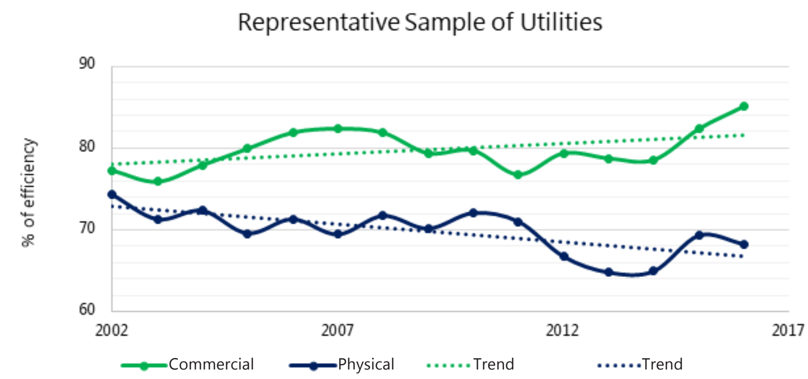
The overall or global efficiency of a utility is defined as the physical efficiency multiplied by the commercial efficiency. Physical efficiency is the ratio between the volume of water billed and the volume of water produced. The difference between those two figures represents the physical losses in the system, whether from leaks, metering errors, illegal connections or other factors. Commercial efficiency is the ratio between the volume of water paid and the volume billed.

According to the Utility Management Indicator Program, the average physical efficiency of water utilities in Mexican border municipalities was 74% in 2002 and dropped to 68% by 2016. The 32% in physical losses represents approximately 383 million gallons a day (mgd).

Commercial efficiency for the border states, on the other hand, averaged 77% in 2002 and increased to 85% in 2016.[48] The steady increase in revenue collections has offset the decline in physical efficiency.

[48] Source: IMTA, PIGOO, 2019.

Figure 4.15: Efficiency of Water Utilities in Mexico



Developed by NADB with data from IMTA (PIGOO)

Based on the foregoing physical and commercial efficiency ratios, the overall efficiency of Mexican border water utilities in 2016 was around 58%, which represents the percentage of water produced that is paid for and generates revenue for the utilities.

Data on the efficiency of U.S. water utilities could not be found for the purposes of this study, but in general, it is considered a minor issue for border water utilities.

A key component for managing the efficiency of water utilities is metering, both inflows at the supply end and the outflows to each individual connection. On average, the Mexican border states have meters in approximately 90% of the user connections.[49] In some states like Nuevo Leon, metering coverage is close to 100%, while other states have been increasing metering, such as Chihuahua, which went from 68% in 2002 to 89% in 2017, and Coahuila, which rose from 75% to 85% during the same time period.

4.7 Storm Water Management and Harvesting

The climate in the U.S.-Mexico border region is characterized by dry conditions that alternate with episodes of brief but heavy rainfall. The region has experienced severe weather events, which have caused significant human and economic impacts.[50] The intensity and frequency of severe weather events is expected to increase as a result of climate change.

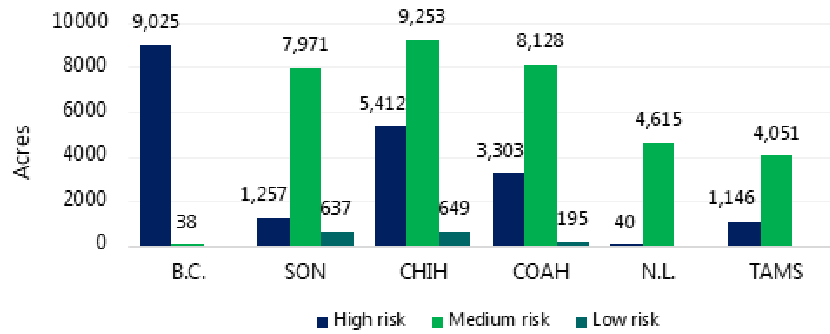
The Mexican border states that have areas with the highest risk of flooding are Baja California and Chihuahua, while the states with the largest populations vulnerable to flooding are Baja California and Nuevo Leon. Between 1994 and 2018, the population vulnerable to flooding in the Mexican border region grew by 54%, from 3.7 million to 5.7 million.

[49] Source: Ibid.

[50] Source: Giner, M.E.; Córdova, A.; Vázquez, F.; and Marruffo, J.; Promoting green infrastructure in Mexico's northern border: The Border Environment Cooperation Commission's experience and lessons learned, *Journal of Environmental Management*, Vol. 248, October 15, 2019.

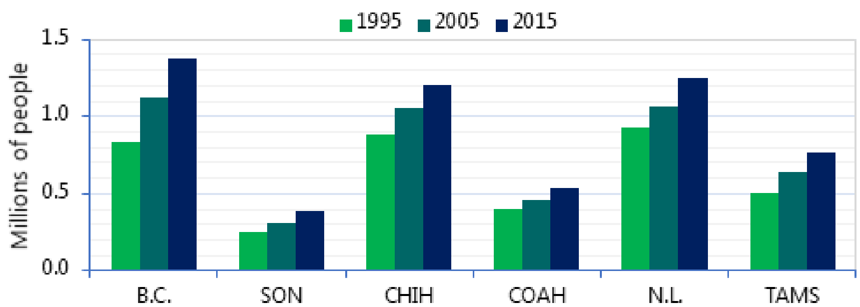
25 YEARS

Figure 4.16: Areas at Risk of Flooding in Mexico



Developed by NADB with data from SEDATU and the National Center for the Prevention of Disasters (CENAPRED)

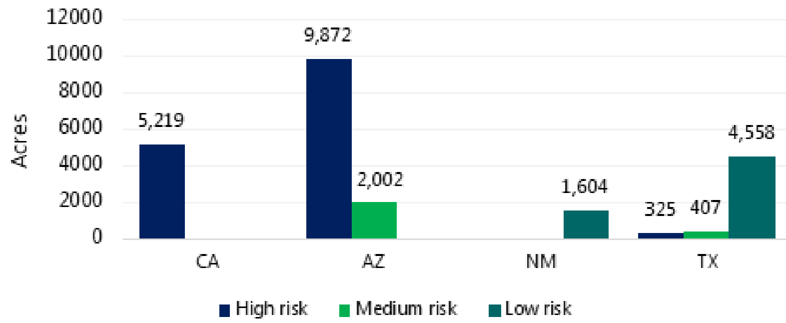
Figure 4.17: Population Vulnerable to Flooding in Mexico



Developed by NADB with data from SEDATU, CENAPRED and INEGI

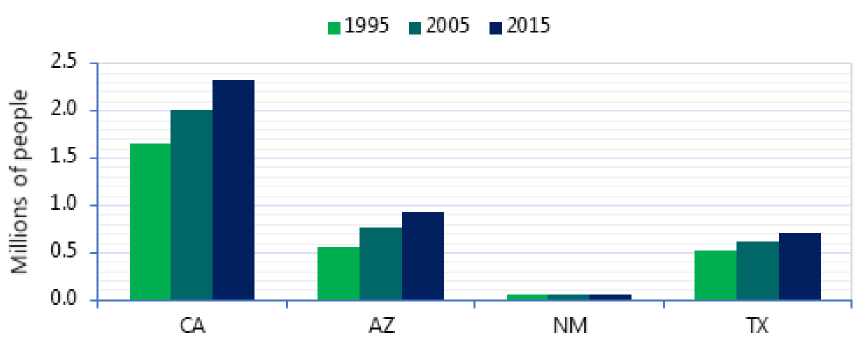
The U.S. border state that has areas with the highest risk of flooding is Arizona, while the state with the largest population vulnerable to flooding is California. Between 1994 and 2018, the population vulnerable to flooding in the U.S. border region grew by 51%, from 2.8 million to 4.2 million. Although to date NADB participation in storm water management projects has been limited, its support for improvements to the storm water system in El Paso, Texas, following the 2006 flood is noteworthy.

Figure 4.18: Areas at Risk of Flooding in U.S



Developed by NADB with data from the National Center for Disaster Preparedness (NCDP)

Figure 4.19: Population Vulnerable to Flooding in the U.S.



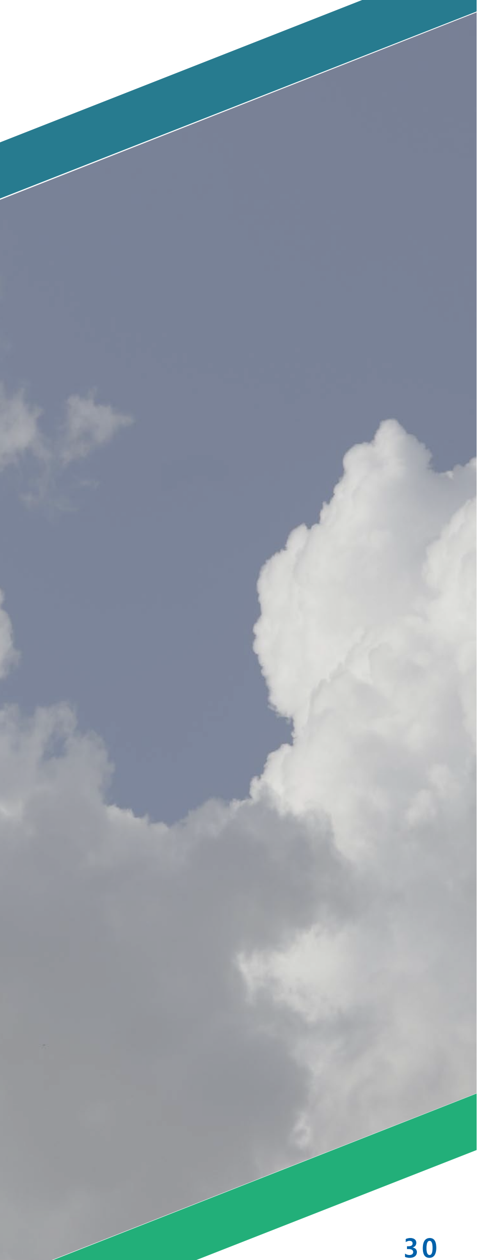
Developed by NADB with data from NCDP and the U.S. Census Bureau

Extreme weather events, in addition to threatening the safety and well-being of the population, can cause significant economic losses. For example, torrential rains in California in 2017 caused US$4.9 billion in losses, while a 17-inch deluge in Texas in 2016 resulted in US$2.9 billion in losses.[51] On the Mexican side of the border, the impact of Hurricane Alex on Nuevo Leon in 2010 was devastating, causing close to $15.44 billion pesos in losses.[52]

[51] Source: National Oceanic and Atmospheric Administration (NOAA), Billion-Dollar Weather and Climate Disasters: Events, 1990-2019.
[52] Source: Secretaría de Seguridad y Protección Ciudadana (SSPC), Fondo de Desastres Naturales (FONDEN), 2019.

Section 5

Air Quality Sector



The U.S.-Mexico border is a geographically diverse region, stretching more than 2,000 miles and encompassing numerous shared air basins. An air basin, or airshed, is a geographic area partially or totally delimited by mountain systems or other natural elements with similar meteorological and climatic features, where seasonal air quality is influenced by internal anthropogenic and natural emission sources and sometimes by pollutants transported from other airsheds.[53]

Maintaining suitable air quality is critical for public health and the quality of life of the inhabitants. According to data from the World Health Organization (WHO), in 2016, 91% of the world's population were living in places with poor air quality. Air pollution in cities and rural areas around the world causes 4.2 million premature deaths each year.[54]

There are various pollutants associated with health problems, and among those that directly impact the respiratory system are respirable particles with aerodynamic diameters of less than 10 micrometers (PM_{10}) and 2.5 micrometers ($PM_{2.5}$), ozone (O_3), carbon monoxide (CO), nitrogen dioxide (NO_2) and sulfur dioxide (SO_2).[55]

These pollutants mainly come from mobile source emissions (private, public and cargo vehicles), point source emissions (industry, power plants) and area source emissions (unpaved streets). Moreover, the use of fossil fuels, land use changes and inadequate waste management, among other activities, generate greenhouse gas (GHG) emissions that contribute to global warming.

To date, NADB has participated in projects to improve air quality and reduce exposure to pollutants in three areas: (i) clean and efficient energy, (ii) street paving and other roadway improvements, and (iii) public transportation in urban areas.

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[53] Source: Mexican Congress, Ley General del Equilibrio Ecológico y la Protección al Ambiente de México (LGEEPA). The purpose of identifying and delimiting an airshed is to preemptively and consistently manage the air quality in it without being constrained by political borders.

[54] Source: WHO, Ambient (outdoor) air pollution, 2018.

[55] Note: According to a recent Harvard study published in *medRxvi* by Xiao Wu et al., air pollution increases the risk of dying from COVID-19. The study found that U.S. counties with the highest levels of air pollution had significantly higher death rates from COVID-19 than counties with low levels.

Figure 5.1: NADB-funded Air Quality Projects by Country

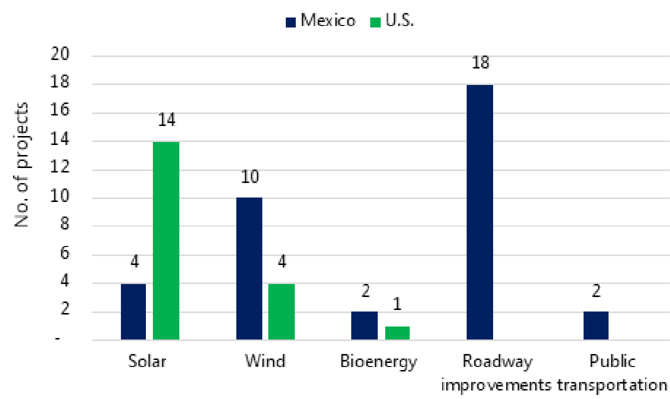
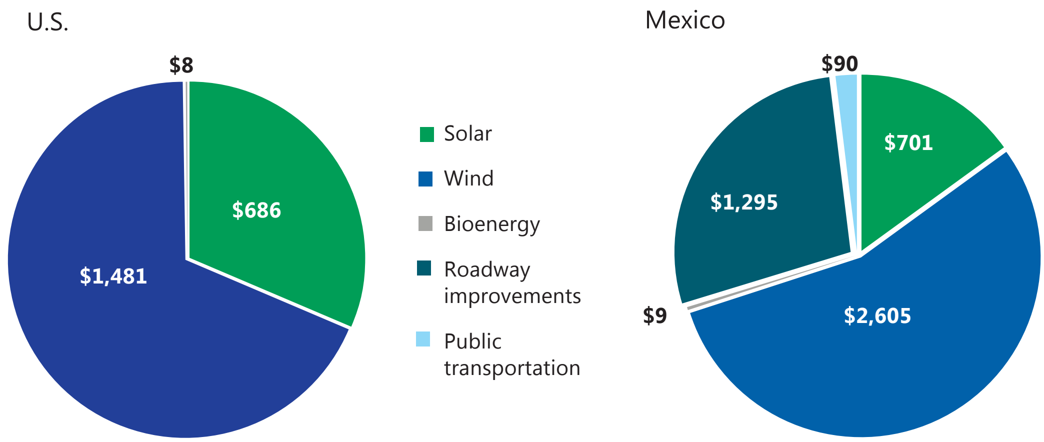


Figure 5.2: Total Investment in the Air Quality Sector by Country
(US$6,874 Million)



19 projects = $2,175

36 projects = $4,699

Figure 5.3: Breakdown of NADB-funded Air Quality Projects

	No. of projects	NADB Funding (US$ Million)	Total Investment (US$ Million)
Renewable energy:			
Solar	18	$ 560	$ 1,387
Wind	14	919	4,086
Bioenergy	3	9	17
Street paving	18	359	1,295
Public transportation	2	70	90
Total	**55**	**$ 1,917**	**$ 6,874**

Figure 5.4: Air Quality Sector Outcomes

AIR QUALITY

Clean Energy

2,091 MW of generation capacity in 14 wind farms

770 MW of generation capacity in 18 solar parks

3.2 MW of generation capacity in 3 bioenergy facilities

4.3 million metric tons/year of CO_2 emissions avoided

Street Paving

18 paving projects covering 14,110,404 m² of streets

4,540 metric tons/year of PM_{10} emissions avoided

Public Transportation

722 new buses with cleaner technologies in circulation

2,554 metric tons/year of CO_2 equivalent emissions avoided

5.1 Air Quality Monitoring

In the Mexican border region, air quality monitoring systems that measure PM_{10}, $PM_{2.5}$, O_3, NO_2 and SO_2 have generated data from 1994 to 2018, except for the state of Sonora. In the U.S., pollutant concentration data has been collected in outdoor monitors from 1980 to 2018 and is available for the four border states.

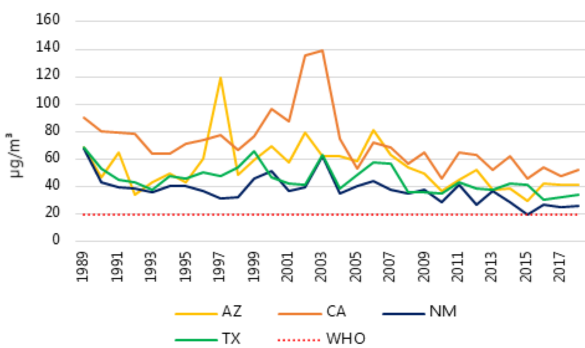
Under the U.S. Clean Air Act (1990), states may adopt strategies, measures and regional standards to comply with National Ambient Air Quality Standards (NAAQS), depending on local conditions and the likelihood of the occurrence of natural phenomena, such as dust and sandstorms. The air quality data reported for urban border areas measures their degree of compliance with their own regional standards, making it difficult for a direct comparison of the value/effect relationship on the population among these areas. Therefore, for comparison purposes in this report, internationally accepted WHO criteria are used.

The following graphs show the time series of annual average PM_{10} and O_3 data. Both pollutants are of great concern for human health, and some NADB projects have helped reduce their emission. The graphs indicate significant exceedances in relation to the quality criteria established as safe by WHO, in all jurisdictions and for practically the entire time series.[56]

[56] WHO criteria: For PM_{10}, an annual mean of 20 µg/m³ and a 24-hour mean of 50 µg/m³ (99th percentile); for O_3 an 8-hour mean of 100 µg/m³ [= 0.050 ppm], per *WHO Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulfur dioxide – Global update 2005 – Summary of risk assessment*, 2005.

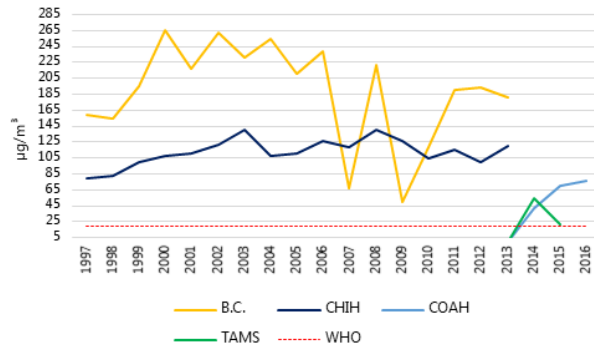
Figure 5.5: Average 24-hour PM_{10} Concentrations Compared to WHO Criteria

U.S.



Developed by CINPRO with data from EPA

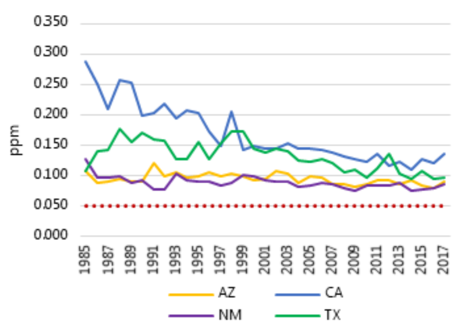
Mexico



Developed by CINPRO with data from INECC

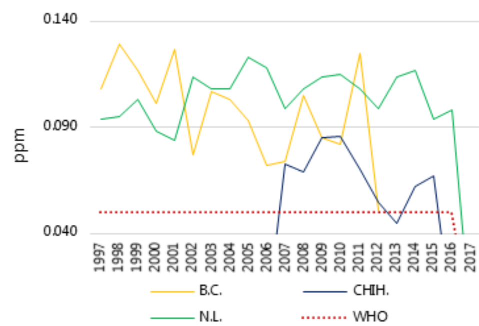
Figure 5.6: Average 8-hour Maximum Ozone Concentrations Compared to WHO criteria

U.S.



Developed by CINPRO with data from EPA

Mexico



Developed by CINPRO with data from INECC

In Mexico, air quality data is inconsistent, and monitoring has not been performed long enough to identify defined trends, but all available data indicate that pollutant levels exceed the WHO criteria. Moreover, an upward trend is observed in states such as Chihuahua and Coahuila. In the U.S., on the other hand, a downward trend in concentrations is observed over time, although pollutant levels still exceed the WHO criteria.

Even though historically air quality has been improving in the U.S. border states, there are still many cases where the annual maximum average and the annual average for acute and chronic exposure to PM_{10} and O_3 exceed the WHO criteria, most notably in San Diego and Imperial Valley, California.[57] On the Mexican side of

[57] Acute exposure generally refers to a high concentration of pollutants for a short period of time, while chronic exposure is defined as low concentrations over a prolonged period.

the border, the trends in air pollution are uncertain, basically due to gaps in data; however, concentrations have reached critical levels in Tijuana and Mexicali, Baja California; Ciudad Juarez, Chihuahua; and the metropolitan area of Monterrey, Nuevo Leon.

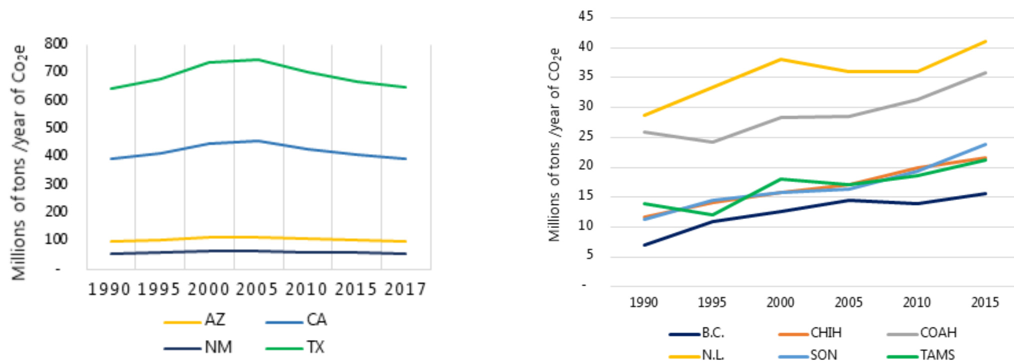
5.1.1 Greenhouse Gas Emissions

In 2010, BECC, in collaboration with the Center for Climate Strategies (CCS), developed the first greenhouse gas (GHG) emission inventories and projections for the six Mexican border states, covering the period between 1990 and 2025. These inventories helped strengthen the technical capacities of both the Mexican border state governments and the Mexican federal authorities. They also served as the basis for the development of at least five of the first State Climate Action Plans in the country.

The GHG inventories and forecasts of the Mexican border states indicate a clear upward trend over the past two decades, with the states of Nuevo Leon and Coahuila producing the highest quantities, mainly deriving from power generation.[58] In contrast, U.S. GHG emission reports show a downward trend during the same period, with the states of Texas and California generating the most emissions.[59]

Figure 5.7: Annual Emissions of CO_2 Equivalent

U.S. | Mexico

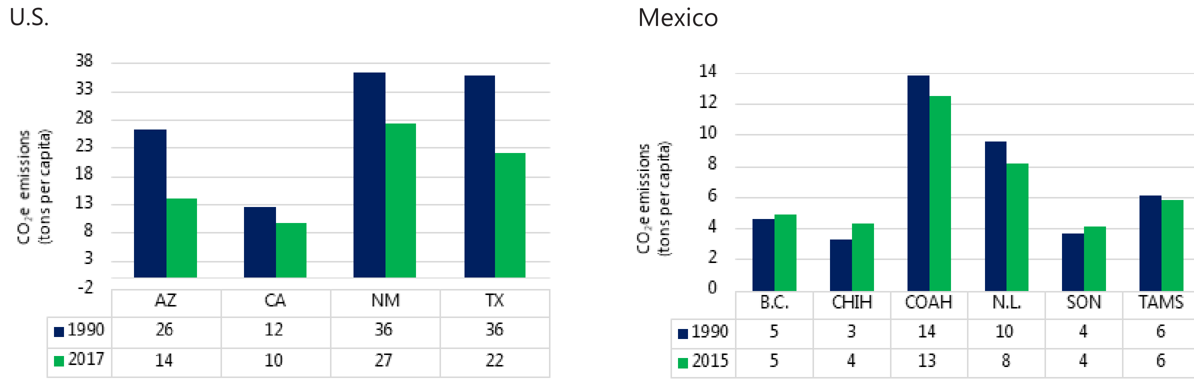


Developed by CINPRO with data from EPA | Developed by CINPRO with data from BECC and CCS

Annual per capita contributions of CO_2 equivalent reported by protocol in all GHG inventories and forecasts make it possible to compare the magnitude of the emissions from different societies based on their customs and access to public services. In the Mexican border states, average annual per capita emissions of CO_2e decreased from 7.0 tons in 1990 to 6.6 tons in 2015,[60] while in the U.S. border states, the average declined from 27.5 tons in 1990 to 18.2 tons in 2017.[61]

[58] Source: BECC and CCS, reports on "emisiones de gases de efecto invernadero y proyección de casos de referencia 1990-2025" for each Mexican border state, 2010.
[59] Source: EPA, Inventory of Greenhouse Gas Emissions and Sinks, 2018.
[60] Source: BECC and CCS, reports on "emisiones de gases de efecto invernadero y proyección de casos de referencia 1990-2025" for each Mexican border state, 2010.
[61] Source: EPA, Inventory of U.S. Greenhouse Gas Emissions and Sinks, 2018.

Figure 5.8: Annual Emissions per Capita of CO_2 Equivalent



Developed by CINPRO with data from EPA

Developed by CINPRO with data from BECC and CCS

5.2 Human Health and Air Quality

Poor air quality is the environmental condition that has the greatest impact on the health of the world population.[62] In 2015, 92% of the world's population lived in areas where air pollution exceeded the maximum criteria established by WHO,[63] and 8.4 million deaths were associated with air pollution in 2012.[64]

In the border region, emissions of criteria pollutants, such as O_3, CO, NOx, SO_2, PM_{10} and $PM_{2.5}$ are mainly produced by mobile and stationary sources, including power generation, as well as area sources, such as unpaved streets. Various studies have found that an increase of 10 millimeters/m^3 in ozone concentration is associated with a 0.3% increase in the general mortality rate and a 0.4% increase in the heart disease mortality rate.[65]

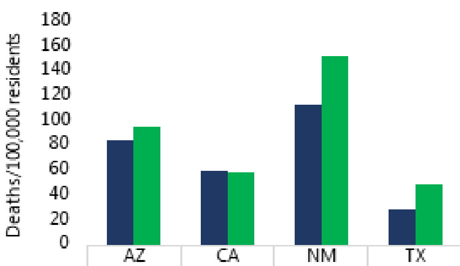
Information on mortality from respiratory diseases at the state level is scarce in Mexico due to the lack of epidemiological monitoring programs. Nevertheless, it is possible to infer some indicators from data collected by the Mexican Federal Commission for Protection against Health Risks and published by INEGI. For the U.S. border states, mortality records were obtained from the State Centers for Disease Control and Prevention and the National Center for Health Statistics.

The following charts illustrate the change in the mortality rate from respiratory illnesses in the Mexican border states between 1990 and 2017 and in the United States between 1999 and 2017. An increase in mortality was observed in three of the six Mexican states and three of the four U.S. states.

[62] WHO, Ambient (outdoor) air pollution, 2018.
[63] Source: Health Effects Institute (HEI), *State of Global Air/2017, A Special Report on Global Exposure to Air Pollution and its Disease Burden*, 2017.
[64] Source: Landrigan, P. J. and Fuller, R., Environmental pollution: An enormous and invisible burden on health systems in low- and middle-income counties, *World Hospitals and Health Services*, Vol. 50, No. 4, p. 35, January 2014.
[65] WHO, Ambient (outdoor) air pollution, 2018.

Figure 5.9: Mortality from Respiratory Illnesses

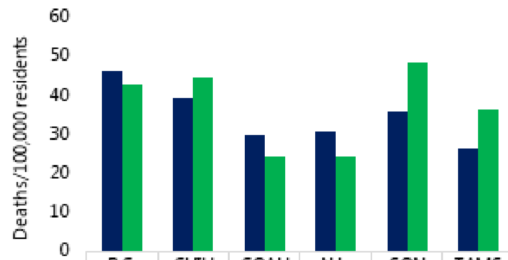
U.S.



	AZ	CA	NM	TX
1990	84	59	112	29
2017	95	58	153	49

Developed by NADB with data from the CDC and U.S. Census Bureau

Mexico



	B.C.	CHIH	COAH	N.L.	SON	TAMS
1990	47	40	30	31	36	27
2017	43	45	24	25	49	37

Developed by NADB with data from INEGI and CONAPO

5.3 Clean and Renewable Energy

In general terms, clean and renewable energy is power generation from sources that are naturally replenishing and virtually inexhaustible—such as water, wind, solar, geothermal and biomass—that do not produce polluting emissions.[66] Renewable energy has gained significant relevance and is currently a key element in the fight against GHG emissions from burning fossil fuels. It also displaces air pollution at the local level (criteria pollutants) and consumes less water resources. Moreover, renewable energy helps protect economies in terms of energy security, encourages reduced mining and drilling of non-renewable resources and increases the availability of electricity in remote communities.

Since 2011, NADB has implemented 34 renewable energy projects in the border region in both countries, with a total installed capacity of 2,864 MW and the potential to generate 8,780 gigawatt-hours (GWh)/year of electricity. These projects represent a total investment of US$5.48 billion, and their environmental benefits include displacing 4.26 million tons of CO_2e, 7,208 tons of nitrogen oxides and 1,699 tons of sulfur dioxide annually.

Implementation of renewable energy in the border region has depended on the evolution of the regulatory framework in each country, the partnerships established between the public and private sectors to make the necessary investments and a significant and steady decline in capital costs. In the U.S. border states, renewable energy generation capacity more than tripled in just 24 years, increasing from 19,868 MW in 1994 to 67,030 MW in 2018.[67] According to the Mexican National Power System Development Program (PRODESEN), during the same period, renewable energy in the Mexican border states grew 225%, from 907

[66] In the U.S., EPA defines clean energy as power generation from renewable sources and energy saved through efficiency. Mexico defines clean energy in Article 3, Section XXII, of the Mexican Power Industry Law, which in addition to renewable electricity includes: nuclear power, power generated by sugar mills that comply with the environmental requirements established by SEMARNAT, power generated by efficient cogeneration plants under the terms established by the Energy Regulatory Commission (CRE), power generated by thermal plants with geological processes for capturing and storing CO_2, and low-carbon emission technologies as defined by international standards.

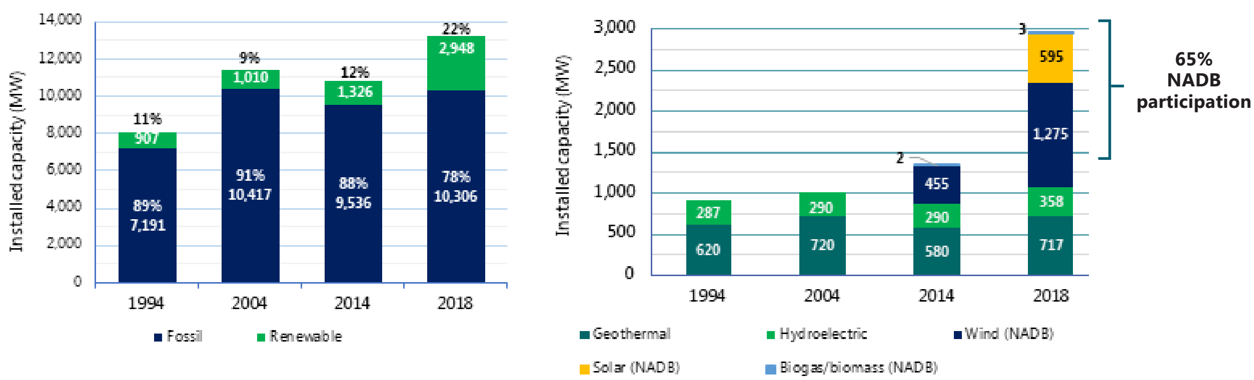
[67] Estimate calculated by NADB based on data from the U.S. Energy Information Administration (EIA), Electricity: Data, 2018.

to 2,948 MW, and accounted for 22% of installed generation capacity in the northern region of Mexico in 2018.[68]

In Mexico, NADB has participated in 16 renewable energy projects with 1,873 MW of installed capacity that generate 6,250 GWh/year of electricity and represent a total capital investment of US$3.31 billion. The renewable energy market grew significantly in Mexico as a result of the 2013 Energy Reform, which, among other changes, requires qualified suppliers and users (who consume more than 1 MWh of energy) to support achievement of the country's clean energy goals by purchasing Clean Energy Certificates (CEL).[69] Within this framework, Mexico established the goal of generating 35% of its electricity from clean energy sources by 2024, 37.7% by 2030 and 50% by 2050.[70]

NADB has participated in the implementation of 65% of the renewable energy generation capacity installed in the Mexican border region. This capacity is sufficient to supply electricity to 3.5 million homes and prevent CO_2 emissions equivalent to 524,000 vehicles.[71] The following graphs illustrate the increase in renewable energy in the northern border region of Mexico, along with the distribution by generation source.

Figure 5.10: Power Production by Energy Source in Mexico



Developed by NADB with data from INEGI and SENER (PRODESEN)

In the U.S., NADB has participated in the implementation of 18 renewable energy projects with 990 MW of installed capacity that generate 2,530 GWh/year of electricity and represent a total investment of close to US$2.17 billion. The renewable energy sector gained momentum in 2011 as a result of the implementation of state renewable portfolio standards that require electricity service providers to contribute renewable energy to the state energy portfolio. All four U.S. border states have had renewable energy policies and incentives in place since 2000.[72]

[68] Estimate calculated by CINPRO based on data from INEGI, *El sector eléctrico en México*, various editions from 1995 to 2014; and Secretaría de Energía (SENER), Programa de Desarrollo del Sistema Eléctrico Nacional (PRODESEN), 2018.
[69] Source: Secretaría de Gobernación (SEGOB), Lineamientos que establecen los criterios para el otorgamiento de Certificados de Energías Limpias y los requisitos para su adquisición. *Diario Oficial de la Federación*, October 31, 2014.
[70] Source: SENER, *Estrategia de transición para promover el uso de tecnologías y combustibles más limpios*, 2016.
[71] Estimated using the EPA Greenhouse Gas Equivalencies Calculator.
[72] Source: North Carolina Clean Energy Technology Center, Database of State Incentives for Renewables & Efficiency (DSIRE), 2019.

Figure 5.11: Installed Capacity of Solar and Wind Projects Funded by NADB

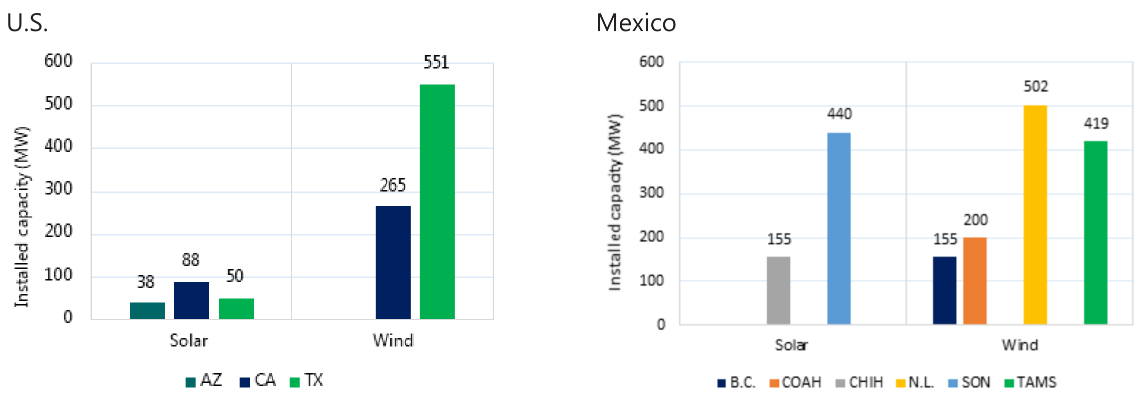
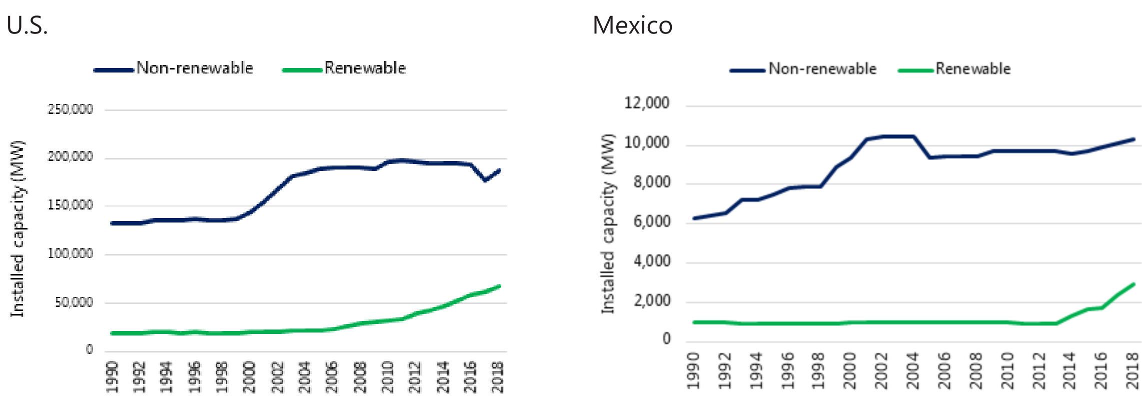


Figure 5.12: Evolution of the Installation of Renewable and Non-renewable Energy in the Border Region



Developed by NADB with data from EIA

Developed by NADB with data from INEGI

In the U.S. border states, power generation from renewable sources increased from 12% in 1990 to 26% in 2018.[73] This growth was made possible by mandatory and voluntary energy markets, state renewable portfolio standards, renewable energy certificates and market competitiveness.

In the Mexican border region, power generation from renewable sources has been increasing since 2005. Private investment has played an important role in modernizing existing energy infrastructure and the national power system. Power generation from non-renewable sources has also increased, following the implementation of a public policy that favors natural gas combined-cycle thermoelectric technology over renewable sources.

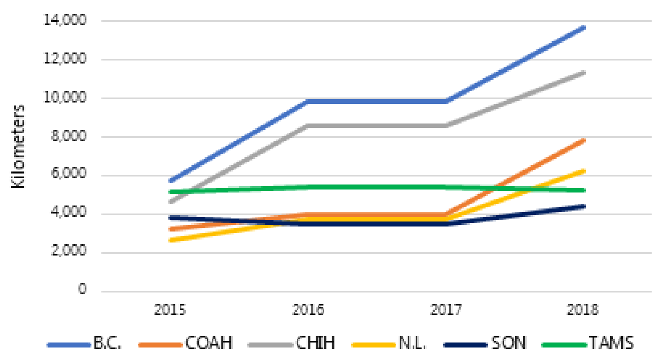
[73] Estimated by CINPRO with data from EIA, Electricity: Data, 2019.

5.4 Street Paving

One of the objectives of NADB is to reduce PM_{10} emissions generated by unpaved roadways, which are generally related to substandard residential developments built without basic infrastructure and public services. In addition to generating air pollution, unpaved streets are a travel hazard for both drivers and pedestrians, because they reduce visibility due to blowing dust, increase wear and tear on vehicles and can potentially cause accidents, especially in wet weather. They also tend to prolong travel times, delaying the delivery of goods and emergency services, and make public transportation more difficult. Consequently, street paving is a key factor in the well-being and quality of life of the population.

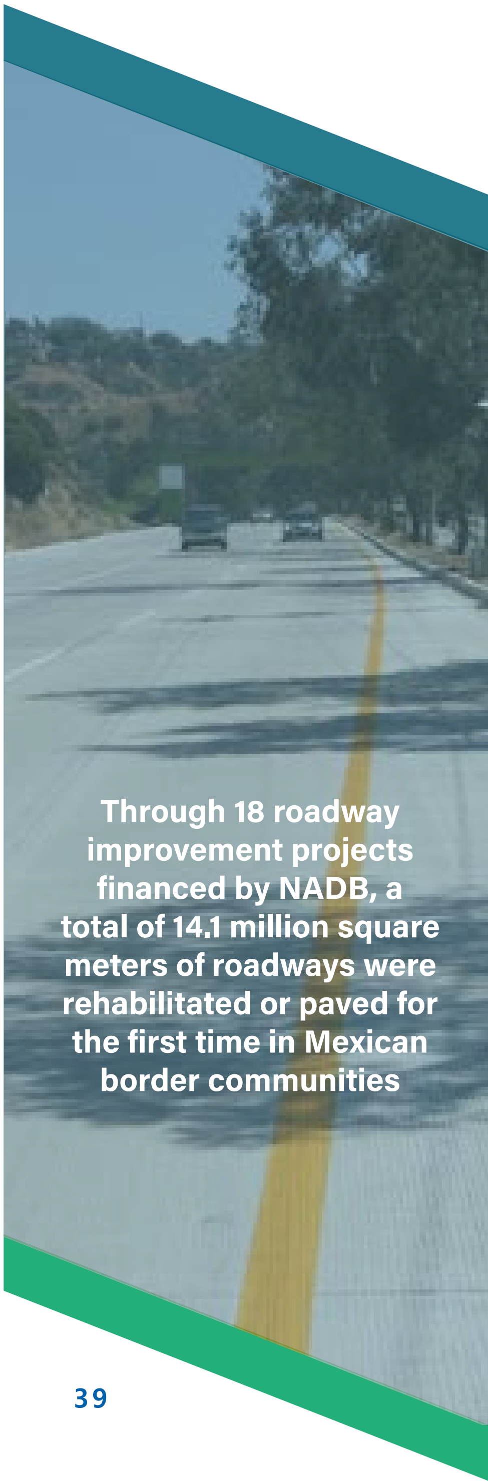
This situation is more prevalent on the Mexican side of the border. The following graph shows the unpaved roadways reported in the Mexican border states during the period 2015-2018.[74]

Figure 5.13: Unpaved Roadways in Mexican Border States



Developed by CINPRO with data from INEGI

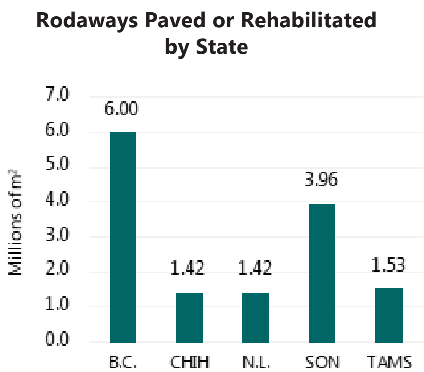
The 18 roadway improvement projects financed by NADB are all located on the Mexican side of the border and required a total investment of US$1.30 billion. Through these projects, a total of 14,110,404 square meters of roadway were rehabilitated or paved for the first time. The following graphs show the surface area paved per state and the distribution of NADB financing per state. As illustrated in the graph, Baja California is the state where the most paving works have been implemented.

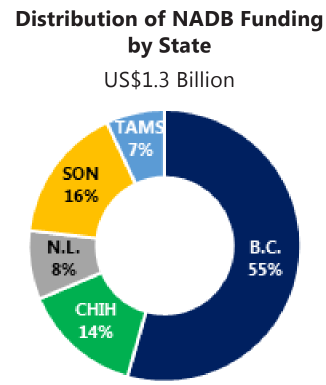


Through 18 roadway improvement projects financed by NADB, a total of 14.1 million square meters of roadways were rehabilitated or paved for the first time in Mexican border communities

[74] Source: INEGI, Red Nacional de Caminos (RNC), 2018.

Figure 5.14: NADB Roadway Improvement Projects in Mexican Border Region





Despite the ongoing proliferation of dirt roads due to the rapid growth of border cities and taking 1995 as the base year, it is estimated that these projects helped reduce the backlog of unpaved roads by 22.8%.[75] As a result, they have also helped prevent the emission of 4,540 tons of PM_{10} annually in urban areas, positively impacting air quality and the health of the population.[76]

Other positive impacts of these projects for residents include safer roadways, reduced travel times, increased property values and in general a better quality of life in their communities.

5.5 Public Transportation

The exhaust from motorized vehicles is one of the main sources of air pollution in urban areas. An efficient and modern public transportation system can help reduce the number of vehicles on the road, thereby reducing traffic congestion and the quantity of greenhouse gases and other pollutants released into the atmosphere. For that reason, NADB supports projects to modernize public transportation systems and improve urban mobility in the border region. In 2014, NADB approved the financing of a program for the acquisition of buses that use cleaner emission technologies to replace old units or to expand public transportation services in urban areas in the Mexican border region. Based on the success of the first project, a similar program was approved in 2016.

To date, 722 buses have been financed in five municipalities in the metropolitan area of Monterrey (Apodaca, García, Escobedo, Guadalupe and Monterrey) Nuevo Leon, as well as in Hermosillo, Sonora; Tijuana, Baja California; and Ciudad Juarez, Chihuahua. Of those vehicles, 42% operate with natural gas and the rest with cleaner diesel technologies, thereby avoiding the emission of 4,750 tons a year of CO_2e, 326 tons a year of NOx, 13 tons a year of hydrocarbons and 2.11 tons a year of $PM_{2.5}$.[77] The total investment in the two vehicle programs is currently US$89.6 million; however, due to the revolving nature of the lines of credit and ten-year disbursement periods, these investments are expected to continue to grow, along with the environmental benefits.

[75] Estimate calculated based on the quantity of unpaved roads reported by INEGI (RNC) in 2018 and the projects financed by NADB.
[76] PM_{10} emissions from unpaved roads were estimated using EPA AP-42 factors.
[77] Estimates calculated by NADB based on the certification and financing proposals for the border-wide low-emission vehicle acquisition programs in Mexico, 2014 and 2016.

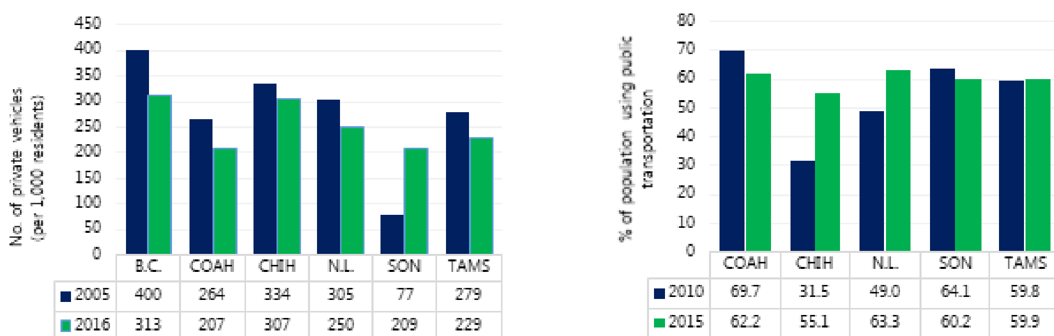
5.5.1 Historical Trends

Urban mobility is determined by the time people spend getting around town to carry out their daily activities, as well as the methods and conditions associated with those trips. When the means of transportation are inadequate, people lose a lot of time traveling even for short distances. Public transportation users make their mobility decisions based on various factors, including the availability of a private vehicle and the safety, convenience, cost and quality of available public transportation (physical condition of the vehicles and rider treatment).

To promote development in the border region in terms of mobility and sustainability, the following factors must be considered: the motorization rate (use of private vehicles), the population that uses public transportation, number of buses per capita and the technological characteristics of vehicles used for transportation (vehicle age).

The following graph shows the motorization rate and percentage of the population that uses public transportation in the Mexican border states.

Figure 5.15: Motorization Rate and Ridership in Public Transportation in the Mexican Border Region



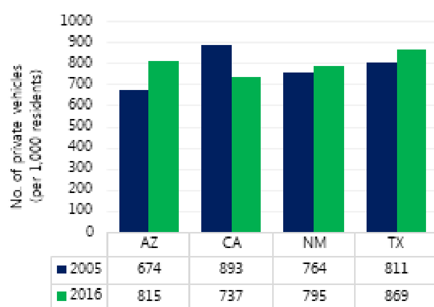
Developed by CINPRO with data from SEMARNAT, INEGI and CONAPO

In the states of Chihuahua and Nuevo Leon, the percentage of the population using public transportation increased, as the motorization rate decreased between 2010 and 2016. In these states, more efficient public transportation has been promoted through urban and semi-urban mass transit improvement plans in the cities of Ciudad Juarez and Chihuahua, the Chihuahua Public Transportation Law and the Metro and Ecovía rapid transit systems in Monterrey, Nuevo Leon.

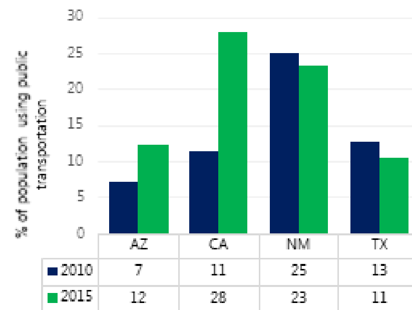
In the case of Baja California and Coahuila, both the motorization rate and the percentage of the population using public transportation have declined, which may indicate that many private vehicles are not being registered. The Mexican Tax Administration Service (SAT) estimates that 25% of all vehicles in Mexico are not registered.

The United States is and has been the country with the highest number of vehicles in the world. Nevertheless, the motorization rate in California decreased between 2005 and 2016, while the number of people using public transportation increased between 2010 and 2015.[78]

Figure 5.16: Motorization Rate and Ridership in Public Transportation in the U.S. Border Region



Developed by CINPRO with data from FHWA and the U.S. Census Bureau



Developed by CINPRO with data from APTA and the U.S. Census Bureau

Between 2005 and 2016, the motorization rate in the U.S. border region increased 2.3%, while the percentage of population using public transportation climbed from 14% to 18%.[79] In contrast, in the Mexican border region, the motorization rate decreased 8.7%, while the percentage of people using public transportation increased from 57% to 59%.[80]

Bus capacity in the border region, in millions of users per day, is higher in Mexico than in the U.S., which is consistent with their motorization rates. The motorization rate in the U.S. is double the rate in Mexico. In the U.S. border region, the number of buses per capita increased 13%, from 2.03 buses per 1,000 residents in 2013 to 2.32 in 2017. The state registering the largest increase was California, which went from 1.49 to 2.53 buses per 1,000 residents during that same period. In Mexico, the number of buses per capita increased 10% between 2008 and 2013, going from 0.97 to 1.09 buses per 1,000 residents. The state of Sonora registered the largest increase, going from 0.36 to 1.16 buses per 1,000 residents.

[78] Estimates calculated by CINPRO with data from the Federal Highway Administration (FHWA), Office of Highway Policy Information, 2019; and the American Public Transportation Association (APTA), Public Transportation Vehicle Database, 2018.
[79] Ibid.
[80] Estimates calculated by CINPRO with data from SEMARNAT, Inventarios Nacionales de Emisiones de Contaminantes Criterio, 2019.

5.2.2 Vehicle Technology and Age

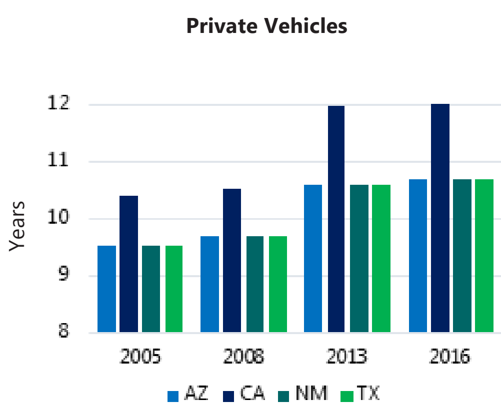
In general terms, the newer models generate less polluting emissions due to technological advances and the stricter regulations to which they are subject, than older vehicles, which in addition have also deteriorated from use. That is why it is important to know the age of the fleets in the region.

Based on data from the American Public Transportation Association (APTA) and Federal Highway Administration (FHWA), between 2002 and 2018, the average age of private vehicles in the U.S. border region was 10 to 12 years, and it has been on the rise.[81] The state with the highest average is California. The average age of public buses is just over 12 years, and Texas has the oldest vehicle fleet.[82]

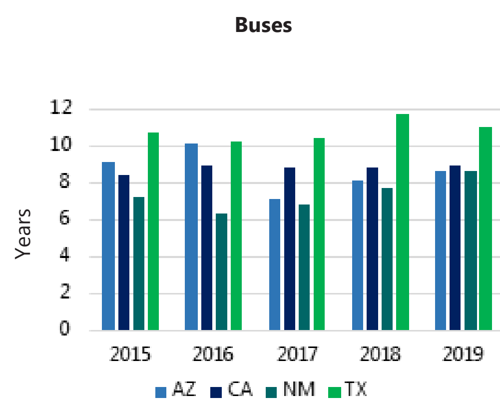
According to data from the Mexican Automotive Industry Association (AMIA), the Mexican National Association of Bus, Truck and Tractor Producers (ANPACT) and the Mexican Association of Automotive Distributors (AMDA), in 2018, the average age of private vehicles in Mexico was 15 years, mainly because of an influx of more than 8 million used vehicles from the U.S. in recent years.[83]

Most of the public transportation fleet in the Mexican border region is obsolete, which translates into higher CO_2, $PM_{2.5}$ and NOx emissions that have a negative impact on the health of residents and, thus, their quality of life. Based on data from the Mexican National Emissions Inventory (INEM), in 2016, the average age of buses in the region was 19 years and, between 2005 and 2018, Nuevo Leon had the oldest vehicle fleet, with an average age of 26 years.[84] In the U.S., even though the percentage of people using public transportation is low, buses were replaced more frequently than in Mexico between 2010 and 2015. In general, buses on the Mexican side of the border are twice as old those on the U.S. side.

Figure 5.17: Average Age of Private Vehicles and Buses in the U.S. Border Region



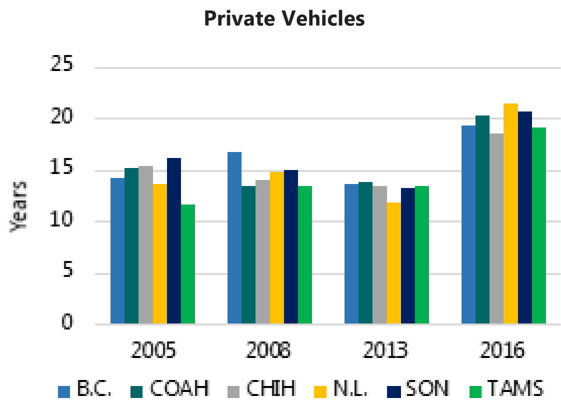
Developed by CINPRO with data from FHWA

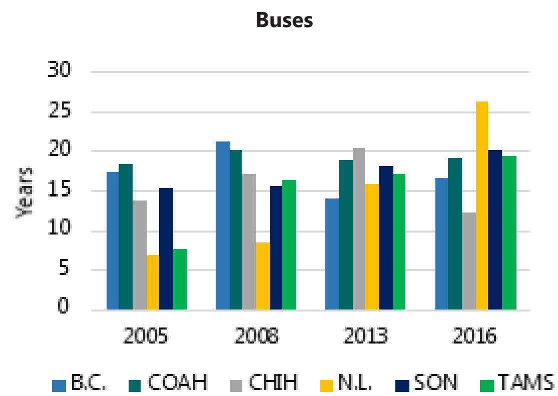


Developed by CINPRO with data from APTA

[81] Estimates calculated by CINPRO with data from FHWA, Office of Highway Policy Information, 2019; and IHS Markit, Vehicles Getting Older: Average Age of Light Cars and Trucks in U.S. Rises Again in 2016 to 11.6 Years, IHS Markit Says, November 22, 2016.
[82] Estimates calculated by CINPRO with data from APTA, Public Transportation Vehicle Database, 2018.
[83] Estimates calculated by CINPRO with data from SEMARNAT, Inventarios Nacionales de Emisiones de Contaminantes Criterio, 2019.
[84] Ibid.

Figure 5.18: Average Age of Private Vehicles and Buses in the Mexican Border Region

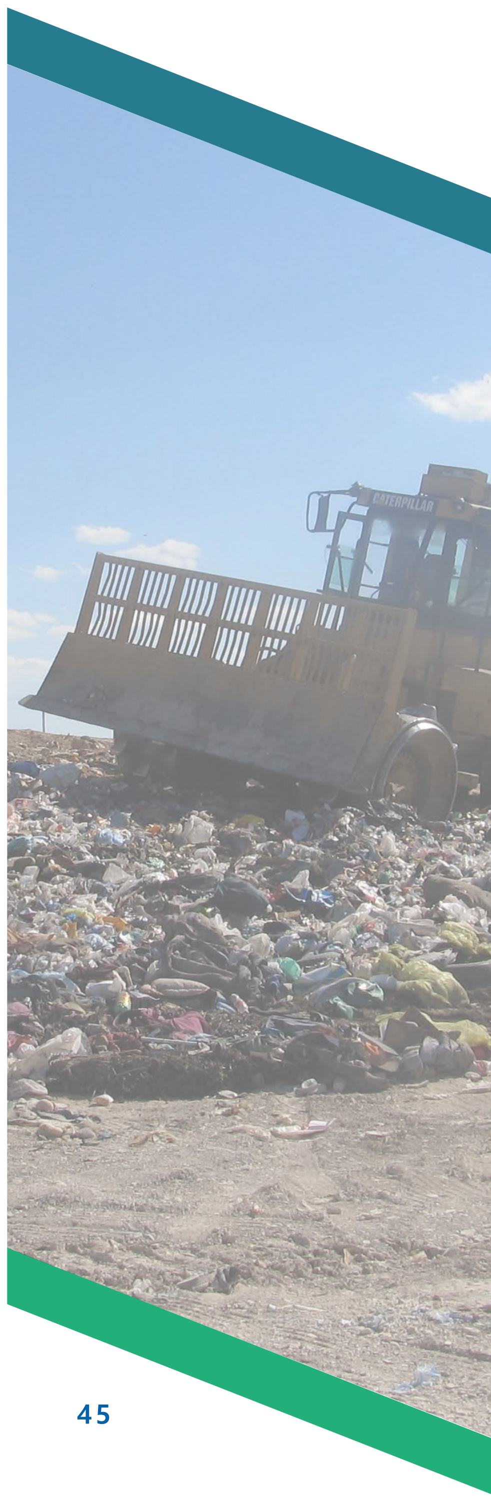




Developed by CINPRO with data from SEMARNAT

Section 6

Solid Waste Sector

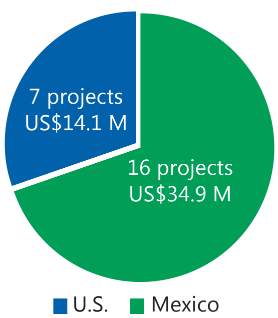


In the United States, municipal solid waste is handled expeditiously, at least with respect to its collection and final disposal; however, there are opportunities to reduce waste generation and increase recycling and waste valorization. In the case of Mexico, many people still do not have access to waste collection and disposal services, which is why they adopt inappropriate practices, such as depositing their waste in illegal dumps or burning it outdoors, which impacts air quality.

Recognizing that municipal solid waste can cause significant health and pollution problems if not managed properly, NADB has financed the implementation of 23 projects in this sector with loans and grants totaling US$21.4 million. The total investment in these projects is just over US$49 million, which means that for every dollar provided by NADB, US$2.29 in complementary funding was provided from other sources, mainly state and municipal contributions.

Figure 6.1: Breakdown of NADB-funded Solid Waste Projects

Total investment by Country



Communities Benefitted by State

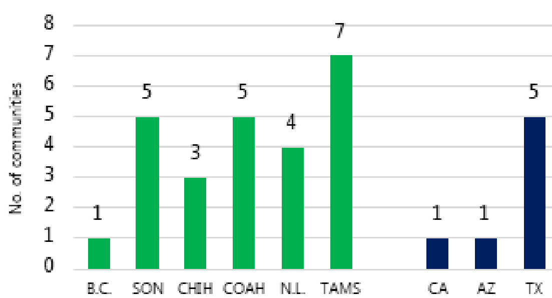


Figure 6.2: Solid Waste Sector Outcomes

SOLID WASTE




Disposal

17 sanitary landfills built or expanded

72 pieces of landfill operation equipment

5.95 million m³ of new disposal capacity

13 open-air dumpsites closed

Collection

7 new or improved transfer stations

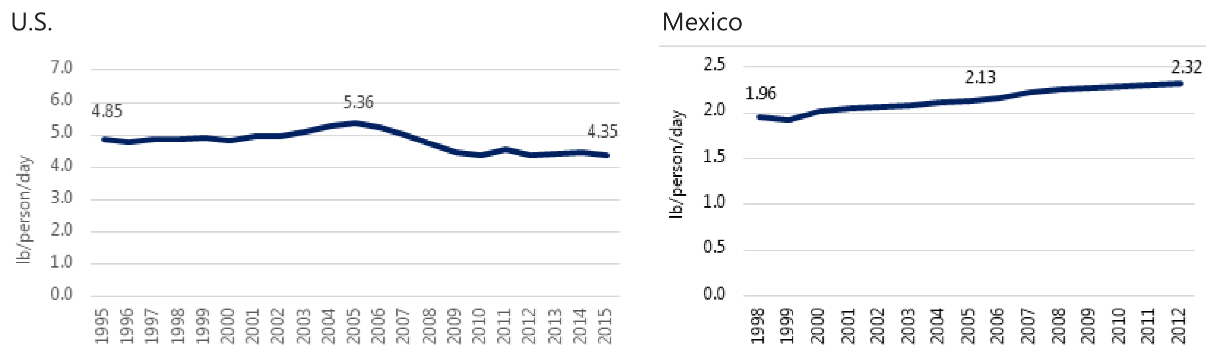
81 new garbage collection trucks

3,263 metric tons/day of new waste management capacity

6.1 Waste Generation per Capita

This indicator is one of the most important for designing municipal solid waste management policies and programs in a community. Waste generation per capita in Mexican border states in 2012 averaged around 2.20 pounds per person a day,[85] which was very similar to the national average of 2.22 pounds per person a day reported in 2015.[86] In the U.S., waste generation per capita reached its highest average at 5.35 pounds per person a day between 2004 and 2006 and then gradually decreased to 4.36 pounds in 2015.[87] The state with the highest waste generation was California, with 8.81 pounds per person a day in 2005 and 5.73 pounds per person a day in 2015.[88]

Figure 6.3: Average Solid Waste Generation per Capita in the Border States



Developed by CINPRO with data from ADEQ, CalRecycle, NMED, TCEQ and the U.S. Census Bureau

Developed by CINPRO with data from SEMARNAT and INEGI

In addition to having adequate collection and disposal systems, it is important to establish programs aimed at reducing waste generation, especially with the increased purchasing power of the population.

6.2 Population with Access to Solid Waste Collection Services

In the United States, the population with access to solid waste collection services has remained constant, with coverage at practically 100% over the past 20 years, while in Mexico service coverage increased from 86% in 1998 to 92% in 2015.

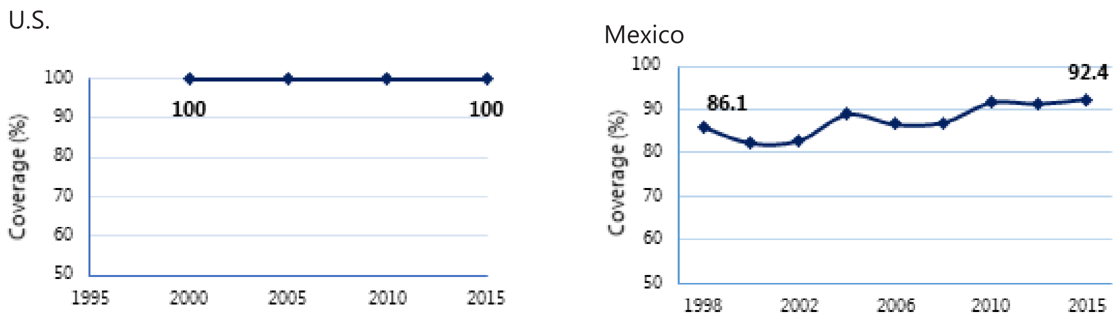
[85] Calculated by CINPRO with data from SEMARNAT, Sistema Nacional de Información Ambiental y Recursos Naturales (SNIARN), 2012; and from INEGI, Conteos y Censo de Población y Vivienda 1995, 2000 y 2005.

[86] Source: INECC and SEMARNAT, Capítulo 4: Residuos sólidos urbanos, Cuadro 4.1 Proyección de la generación per cápita y total de RSU (2004-2020).

[87] Calculated by CINPRO with waste generation data from: (i) Arizona Commission on Environmental Quality (ADEQ), Solid Waste Program, 2019; (ii) California Department of Resources Recycling and Recovery (CalRecycle), Countywide Disposal Destination, 2019; (iii) New Mexico Environment Department (NMED), Solid Waste Bureau: Recycling, Composting, and Diversion, 2019; and (iv) Texas Commission on Environmental Quality (TCEQ), Annual Summary of Municipal Solid Waste Management in Texas, 2018; and population data from the U.S Census Bureau, 2018 National and State Population Estimates.

[88] Calculated by CINPRO with data from CalRecycle, Countywide Disposal Destination, 2019.

Figure 6.4: Average Waste Collection Coverage in the Border States

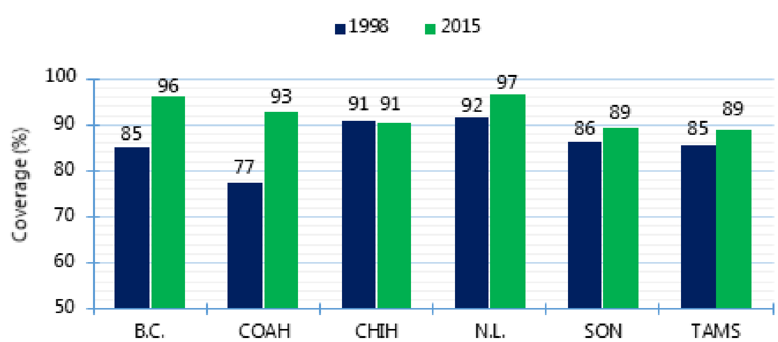


Developed by CINPRO with data from ADEQ, CalRecycle, NMED y TCEQ

Developed by CINPRO with data from INEGI

NADB projects in Mexico have helped improve the management of 3,263 metric tons a day of solid waste. Waste collection coverage rates in the states of Baja California, Chihuahua and Nuevo Leon are above 90%. According to the Mexican National Institute of Ecology and Climate Change (INECC), the collection coverage for municipalities with a population of 100,000 or more averages 86%, while coverage for municipalities with less than 10,000 residents is only 23%, mainly because of the scattered nature of those populated areas and difficult access to urban centers.[89]

Figure 6.5: Percentage of Population with Waste Collection Services in the Mexican Border Region

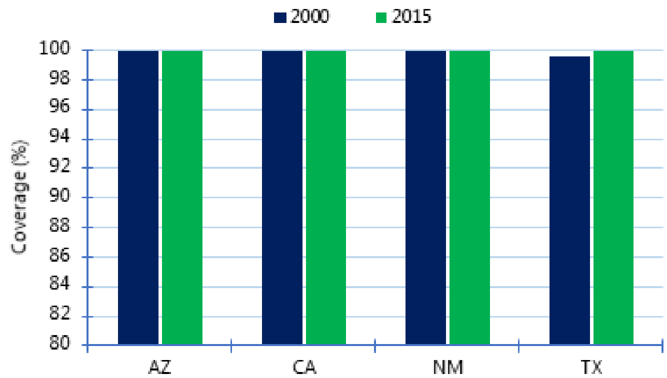


Developed by CINPRO with data from INEGI

In the U.S., the private sector has played an important role in the management of municipal solid waste services, fostering the existence of solid infrastructure and efficient operations. Based on available state data in the U.S., practically 100% of the population has access to solid waste collection services,[90] except in Texas where approximately 1% of the population does not have coverage.[91]

[89] Source: INECC and SEMARNAT, *2012: Diagnóstico básico para la gestión integral de los residuos*, p. 27.
[90] Calculated by CINPRO with data from: : (i) ADEQ, Solid Waste Program, 2019; (ii) CalRecycle, Countywide Disposal Destination, 2019; (iii) NMED, Solid Waste Bureau: Recycling, Composting, and Diversion, 2019; and (iv) TCEQ, Annual Summary of Municipal Solid Waste Management in Texas, 2018.
[91] Source: TCEQ, *Municipal Solid Waste in Texas: A Year in Review, FY2015 Data Summary and Analysis*.

Figure 6.6: Percentage of Population with Waste Collection Services in the U.S. Border Region

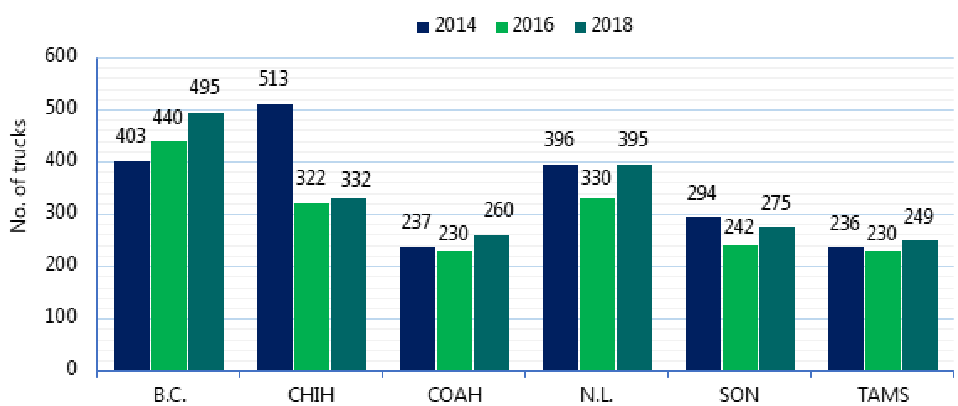


Developed by CINPRO with data from ADEQ, CalRecycle, NMED y TCEQ

Since waste collection services in the U.S. are usually performed by private companies, either under government contract or operating independently, their information is not readily available to the public. Although in Mexico there are also a few private companies with a government concession to provide waste collection services, in most communities these services are carried out by the municipal government.

Between 2014 and 2018, the average age of collection trucks in the Mexican border region remained constant at around 12 years, while the average number of collection trucks decreased slightly from 2,079 in 2014 to 2,006 in 2018.[92] Although there were no significant variations in four of the six border states, the number of vehicles increased in Baja California and decreased from 513 in 2014 to 332 in 2018 in Chihuahua.[93]

Figure 6.7: Garbage Collection Trucks in the Mexican Border Region



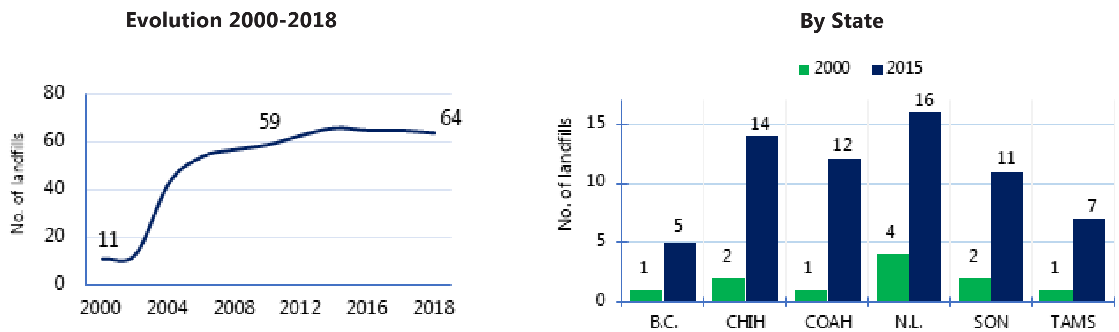
Developed by CINPRO with data from INEGI

[92] Calculated by CINPRO with data from INEGI, Censo Nacional de Gobiernos Municipales y Demarcaciones Territoriales de la Ciudad de México 2019: Residuos sólidos urbanos (2018).
[93] Ibid.

6.3 Solid Waste Disposal

In the Mexican border states, the number of sanitary landfills in operation has registered substantial growth over the past 20 years, increasing from 11 in 2000 to 64 in 2018.[94] Although efforts at the regional level have been significant, there are disparities between the states, with the greatest underdevelopment seen in Baja California and Tamaulipas.

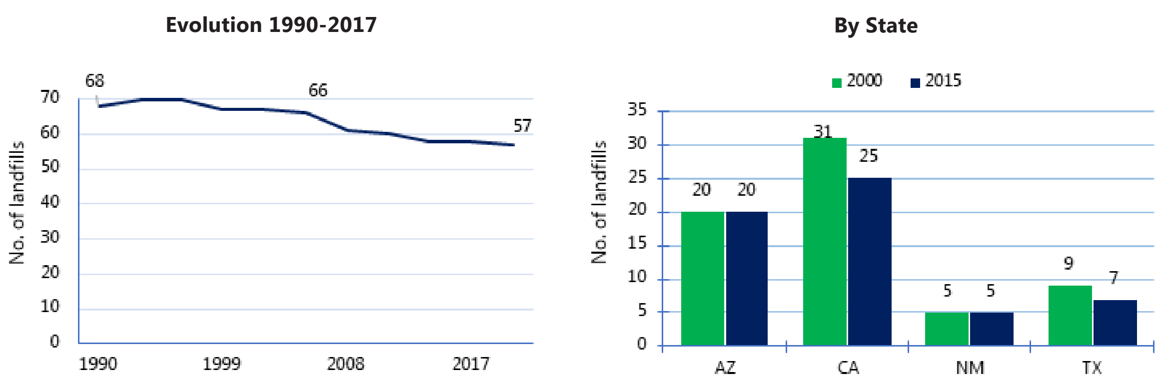
Figure 6.8: Sanitary Landfills in the Mexican Border Region



Developed by CINPRO with data from SEMARNAT

On the U.S. side of the border, the number of landfills declined from 68 in 1990 to 57 in 2019, with California having closed the most sites during that period, dropping from 37 to 25 active landfills.[95] This decrease may be due in part to incentives for waste reuse in recent years, as well as the consolidation of active sites, and does not necessarily indicate a decline in disposal capacity.

Figure 6.9: Sanitary Landfills in the U.S. Border Region



Developed by CINPRO with data from EPA

[94] Calculated by CINPRO with data from SEMARNAT, Prevención y gestión integral de los residuos, 2018.
[95] Source: EPA, Landfill Methane Outreach Program (LMOP), 2019.

NADB has helped curb the growth of open-air dumps in Mexico through the construction of 12 sanitary landfills: two in Chihuahua, three in Nuevo Leon, four in Sonora and two in Tamaulipas. In the United States, NADB has participated in the expansion of five landfills: three in Texas, one in New Mexico and one in Arizona. With respect to open-air dumps, NADB has supported the closure and remediation of 13 sites in the two countries.

6.4 Waste Recycling and Valorization

According to the Mexican National Statistical Directory of Economic Units (DENUE) developed and maintained by INEGI, recycling facilities in the Mexican border region increased from 73 in 2010 to 197 in 2019, with the largest number (49) located in Nuevo Leon.[96] The directory classifies these facilities as business support, waste management, and remediation services, but does not provide a breakdown of the types of waste recycled.

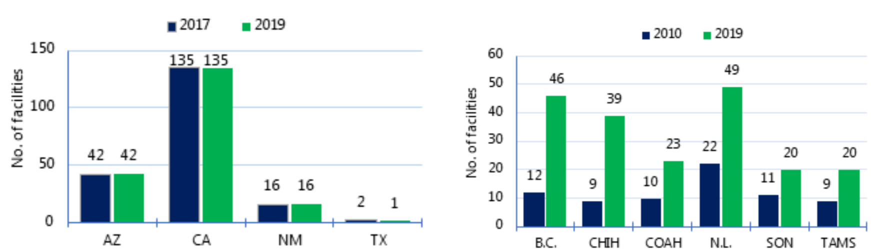
The U.S. border states reported 1,413 recycling centers in operation in 2018, while the border counties reported 195 (14% of the total) that same year.[97] California had the largest number of facilities with 135 (70% of the total) and Texas stands out for having only one facility in 2019.[98]

Waste reuse and valorization have been identified as an area of opportunity for NADB.


NADB has helped curb the growth of open-air dumps in Mexico through the construction of 12 sanitary landfills.

Figure 6.10: Recycling Facilities in the Border Region

U.S. | Mexico



Developed by CINPRO with data from ADEQ, CalRecycle, NMED and TCEQ

Developed by CINPRO with data INEGI (DENUE)

[96] Calculated by CINPRO with data from INEGI, Directorio Estadístico Nacional de Unidades Económicas (DENUE), Servicios de apoyo a los negocios y manejo de desechos y servicios de remediación, 2019.
[97] Calculated by CINPRO with data from (i) ADEQ, Solid Waste Program, 2019; (ii) CalRecycle, Countywide Disposal Destination, 2019; (iii) NMED, Solid Waste Bureau: Recycling, Composting, and Diversion, 2019; and (iv) TCEQ, Annual Summary of Municipal Solid Waste Management in Texas, 2018.
[98] Ibid.

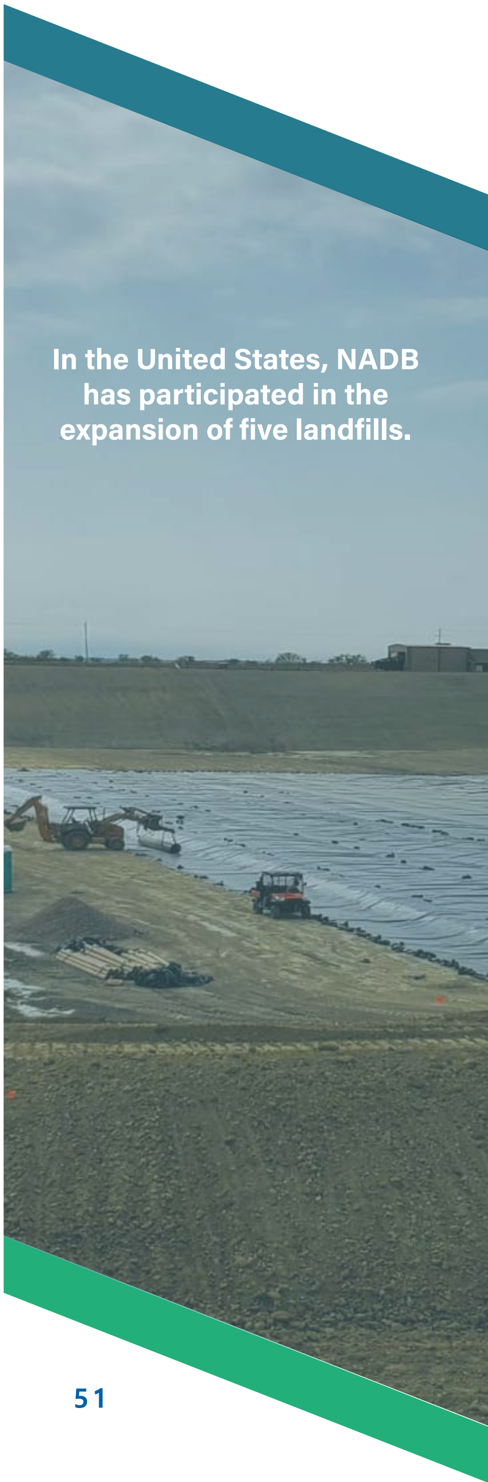
The volume of materials recycled in Mexico is very low, representing about 9.6% of the total volume of waste generated in 2012.[99] In the U.S., available information indicates the amount of waste recycled increased from 1,352 to 1,506 metric tons a day between 2013 and 2018.[100]

More than 12 million scrap tires were recovered from landfills and collection centers for use in cement kilns and other applications, through the Border 2012 Program.[101] This effort continued with the Border 2020 Program, and at the end of 2019, more than 20 million scrap tires had been recovered and recycled.[102] In support of the objectives of these programs, BECC developed a strategy and public policy proposal for the comprehensive management of used tires in the border region, which served as a guideline for the development scrap tire management plans in Baja California, Coahuila and Sonora. At the municipal level, a project for the management and final disposal of scrap tires was carried out in Ciudad Juarez, Chihuahua, and a Scrap Tire Management Plan was developed in Nogales, Sonora.

6.4.1 Electronic Waste Recycling

Electronic waste, commonly referred to as e-waste, has become more relevant in recent years due to the constant replacement of electronic device technology. The inadequate treatment of this type of waste causes serious impacts to the environment and puts human health at risk due to the hazardous materials it contains.

The information available in Mexico is very limited and varied, so the amount of electronic waste recycled annually in the border states is only an estimate, which went from 2,854 metric tons a year in 2000 to 7,604 metric tons a year in 2015.[103] On the other hand, in the U.S., the amount of electronic waste recycled increased from 33,907 metric tons a year in 2000 to 179,185 metric tons a year in 2015.[104]



[99] Source: SEMARNAT, *Informe de la Situación del Medio Ambiente en México*, p. 443, 2015.

[100] Calculated by CINPRO with data from (i) ADEQ, Solid Waste Program, 2019; (ii) CalRecycle, Countywide Disposal Destination, 2019; (iii) NMED, Solid Waste Bureau: Recycling, Composting, and Diversion, 2019; and (iv) TCEQ, Annual Summary of Municipal Solid Waste Management in Texas, 2018.

[101] Source: EPA and SEMARNAT, *Border 2012, Accomplishments Report (2010-2012), U.S.-Mexico Environmental Program*, p. 3.

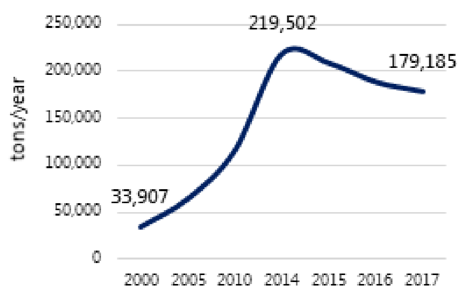
[102] Source: SEMARNAT, Reunión de Líderes del Programa Ambiental México-EU Frontera 2020, November 7, 2019.

[103] Estimates calculated by CINPRO considering the number of televisions, radios, telephones (landline and cell), computers (desk and laptop) reported to INEGI in the national censuses; the average life of the equipment; the average weight of the equipment; and the percentage recycled as reported by INECC, 2008.

[104] Estimates calculated by CINPRO with data from (i) TCEQ, Electronics Recycling, 2017; and (ii) EPA, *Electronic Products Generation and Recycling in the United States, 2016*.

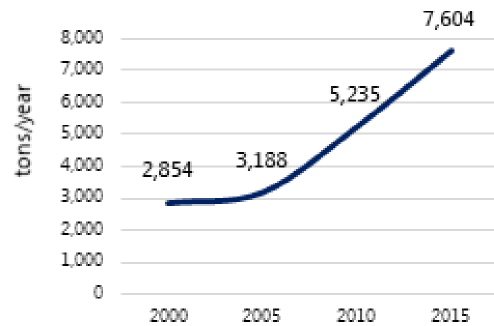
Figure 6.11: Recycled Electronic Waste

U.S.



Developed by CINPRO with data from EPA and TCEQ

Mexico



Developed by CINPRO with data from INECC and INEGI

Section 7

NADB Financial Highlights

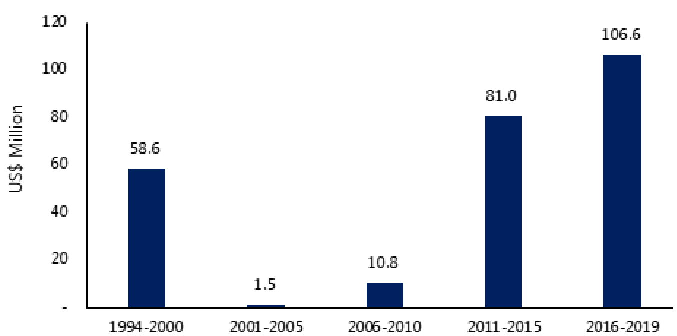
7.1. Capital Stewardship

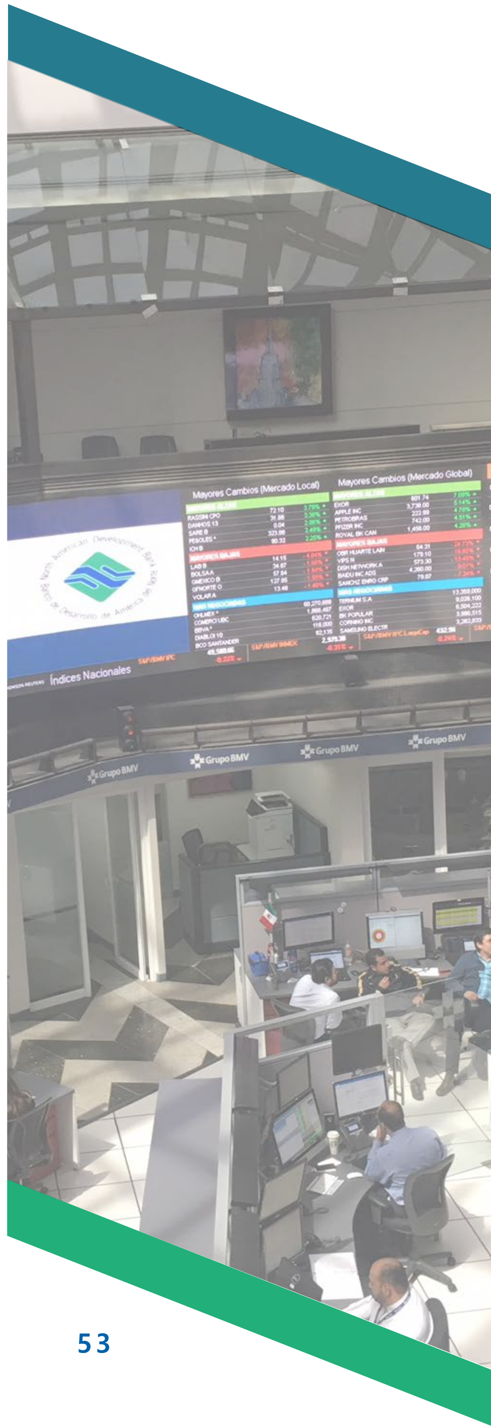
Capital stewardship is one of many ways in which NADB measures the value generated by the different projects and actions it undertakes. The Bank is focused on utilizing its capital in the best possible manner to preserve, protect and enhance the environment in order to advance the well-being of the people of the United States and Mexico. Responsible capital stewardship means NADB pursues sustainable finance while improving its governance, operational efficiency and asset utilization. Capital is invested with a long-term focus. After 25 years, this approach has resulted in NADB generating US$259 million in retained earnings since its creation.

NADB was formed in 1994 with initial capital commitments from both the United States and Mexican governments of US$1,275 million in callable capital and US$225 million in paid-in capital each, to be provided installments. The final installments of these contributions were received in 2009.

In 2015, each government agreed to subscribe an additional US$1.5 billion in capital, subject to the necessary legislation and availability of appropriations. The additional capital consisted of US$450 million in paid-in capital and US$2.55 billion in callable capital. In September 2016, Mexico made an initial contribution of US$10 million in paid-in capital, along with US$56.67 million in callable capital. In April of 2020, the United States contributed US$10 million in paid-in capital, along with US$56.67 million in callable capital.

Figure 7.1: Retained Earnings Generation





In addition to its environmental mandate, under the Charter, the two governments allocated 10% of the initial NADB capital subscription (US$22.5 million per country) to finance community adjustment and investment projects throughout the U.S. and Mexico in support of the purposes of the North American Free Trade Agreement (NAFTA). A separate program was established in each country. In the case of the Mexican domestic program, the funds were transferred in full to the Mexican government, while at the request of the U.S. government, NADB continued to hold and administer the funds of the U.S. domestic program. For more than 20 years, the Community Adjustment and Investment Program (USCAIP) provided financial assistance to communities and businesses in economically depressed areas by supporting projects designed to stimulate private-sector employment and growth. The impact of this program, which was closed at the end of 2018, is documented in a report available on the NADB website.[105]

7.2 Market Access

NADB has steadily built its market access capabilities over the last 25 years, becoming a well-known player in green finance and a recurring participant in international markets with well-received, long-term bond issues.

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In 2010, NADB carried out its first bond issue and received its first credit ratings from outside credit agencies. The bond issuance for US$250 million was placed in the United States, with a maturity of 10 years. Moody's Investors Service rated NADB as Aaa, while Standard & Poor's rated it Aa+. The credit ratings reflected the Bank's strong capitalization, high level of liquidity and the quality of its loan book and policies. The bond issue allowed the Bank to grow its lending activities.

In 2012, to further promote and finance water and wastewater projects in Mexico, NADB contracted a US$50-million loan with Kreditanstalt für Wiederaufbau (KfW), a German development bank. The loan has a maturity of 12 years. A grant was also awarded for €$1 million to support project development along the border. During the same year, NADB issued two bullet notes for a combined total of US$480 million, with maturities of 10 and 18 years.

In 2013, Fitch Ratings assigned NADB a credit rating of AA with a stable outlook and Moody's affirmed its rating.

In 2015, NADB expanded its market participation by issuing debt in Europe, increasing the options available to finance its lending operations. For its first international debt issue, NADB selected the Swiss franc market—a stable

[105] NADB, *U.S. Community Adjustment and Investment Program Impact Report*, 2018.

and long-term-oriented capital market—and issued a ten-year non-amortizing note for CHF 125 million. Building on the experience in Switzerland, in 2018, NADB placed its first bond denominated in Norwegian kroner, issuing a non-amortizing note of NOK 1,445 million with a 15-year maturity.

In keeping with its environmental mandate, in 2018, NADB issued its first green bond in the Swiss market for CHF 125 million with a maturity of ten years. The proceeds were used to finance or refinance eligible projects that support the NADB mission. To enable its green bond issue, the Bank developed a Green Bond Framework aligned with the Green Bond Principles of the International Capital Market Association (ICMA). This framework was reviewed and certified by an independent third party.

7.3 Leadership in Financial Innovation

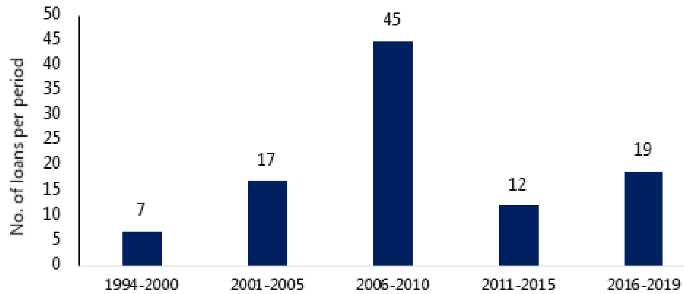
In addition to its commitment to green finance, which NADB began well before the term was in common use, the Bank has been an innovator in project finance and infrastructure financing. The first milestone was developing a process to certify a project as environmental infrastructure, defined as preventing environmental pollutants, improving the drinking water supply or protecting flora and fauna, subject to also improving quality of life or promoting sustainable development. The Bank measures its projects on their environmental merits, as well as financial metrics.

The first loan committed and funded for the sum of US$972,329 was extended to the City of Brawley, California, for the construction of a water treatment plant in January 1997. The first loan committed and funded in Mexico for the sum of US$4.58 million was to a private concessionaire in December 1998 for the construction of the first two wastewater treatment plants in Ciudad Juarez, Chihuahua. To facilitate its lending operations with Mexican states and municipalities in the border region, that same year NADB established a subsidiary, Corporación Financiera de América del Norte, S.A. de C.V. SOFOL (COFIDAN), and contracted its first loans through COFIDAN in early 1999.

To make loans more affordable for border communities and boost its lending for public projects in the water and solid waste sectors, the Low Interest Rate Lending Facility (LIRF) was created in 2001 and eventually funded with up to US$100 million of paid-in-capital, of which US$76.2 million was used to make 19 loans between 2002 and 2007. However, with the decline of market rates at the end of that decade, this program was discontinued in 2013.

In 2008, NADB entered the clean energy sector by certifying and approving financing for a biodiesel production plant in El Paso, Texas. Renewable energy gained momentum during the following decade, with the Bank certifying and approving financing for its first solar energy project in 2011—a US$86.3 million loan for the Sunpeak Solar Park in Niland, California. The Bank continued its leadership in renewable energy in 2012 with the approval of its first wind energy project—a US$51 million loan for the El Porvenir Wind Farm in Reynosa, Tamaulipas. By the end of the decade NADB had approved and funded 36 clean and renewable energy projects with loans totaling US$1.62 billion.

Figure 7.2: Loan Commitments



The most recent milestone in financial innovation and leadership came in late 2018, when NADB helped launch FFBANCK, a $4-billion-peso Mexican capital development certificate known as a CKD.[106] The purpose of FFBANCK is to co-finance loans that support the implementation of sustainable infrastructure projects in Mexico. NADB worked with Mexican pension fund management firms and the private equity management firm Fondos de fondos to help structure the CKD and is providing advisory services in the origination of projects, leveraging its experience in the structuring and financing of projects. This co-financing vehicle will facilitate the flow of significant available resources from the private sector into projects that comply with NADB requirements, thereby providing more options for making projects financially viable, while providing the Bank greater flexibility in managing its capital resources. The first transaction with the CKD occurred in 2019 with the allocation of US$35 million from a wind project loan to FFBANCK.

7.4 Grant Financing

Through sound financial management, NADB has established a solid financial structure that has allowed it to preserve and grow its capital, while creating and managing several grant and technical assistance programs to help fulfill its mission.

Through sound financial management, NADB has established a solid financial structure that has allowed it to preserve and grow its capital, while creating and managing several grant and technical assistance programs to help fulfill its mission. In addition to using part of its retained earnings to fund programs, NADB has also pursued partnerships with other agencies to identify additional support for project development and implementation.

[106] A CKD is an investment vehicle listed on the Mexican stock exchange and used by institutional investors, typically pension funds, to invest in infrastructure, real estate, mining, technology development and other private capital projects.

One of its most long-standing and successful partnerships has been with EPA. In 1997, EPA signed a cooperative agreement with NADB establishing the BEIF program with an initial contribution of $170 million for the implementation of water and wastewater facilities within 100 kilometers of both sides of the border. At the same time, EPA awarded BECC an initial US$10-million grant to create the PDAP program to support the development of projects targeted to receive a BEIF grant. These two programs have proven to be highly effective in expanding and improving water and wastewater services throughout the border region.

Building on the success of the BEIF program, in 1999, NADB used a limited portion of the its retained earnings to establish the Solid Waste Environmental Program (SWEP) to help compensate for the lack of government funding available in the solid waste sector. Then, in 2002, drought conditions in the Rio Grande watershed prompted the creation of the Water Conservation Investment Fund (WCIF), which was allocated US$80 million in retained earnings to support infrastructure improvements in irrigation districts in both countries that have produced significant water savings on an annual basis.

In 2011, NADB expanded its efforts to serve small, low-income communities with little or no debt capacity by creating the Community Assistance Program (CAP), which offers grants for public sector projects in all environmental sectors eligible for NADB financing. All the Bank's grant financing activity funded from its retained earnings was eventually consolidated under the new program, resulting in the termination of the SWEP and WCIF programs. Altogether, NADB has provided US$95.8 million in grant financing for the implementation of 60 infrastructure projects in the water and solid waste sectors.

With respect to technical assistance, the Bank established its first program in 1996 with a focus on institutional capacity-building measures aimed at helping utilities improve their operational and financial efficiency, thereby enhancing their creditworthiness and long-term sustainability. At the same time, BECC began providing limited technical assistance from its operating budget for project planning and development activities aimed at increasing project readiness for certification and financing.

Over the years, NADB expanded its technical assistance activities to address emerging needs. In 1999, NADB launched the Utility Management Institute (UMI), which provides seminars on financial administration and planning for water utilities, and in 2001 created a separate program to support project planning and development activities, initially for solid waste projects and later for all types of environmental infrastructure. In 2009, the technical assistance programs were merged to streamline their administration. To date, more than US$35 million had been invested in studies, capacity-building measures and other support activities benefitting more than 160 border communities.[107] This type of support has proven to be fundamental for the successful development and long-term sustainability of infrastructure projects.

[107] This figure includes US$ 12.1 million in BECC technical assistance invested prior to the merger of the two institutions in November 2017.

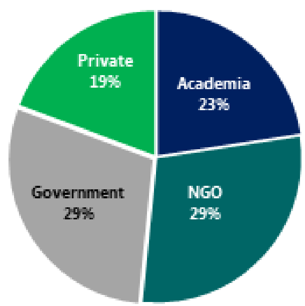
Section 8

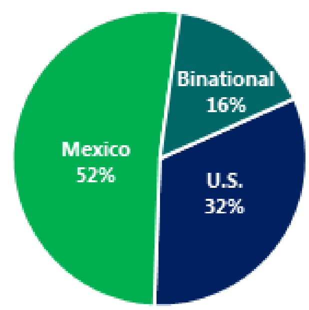
Public Perceptions

This section documents how various stakeholders from both countries perceive the state of the environment and public services in the border region, as well the performance of NADB throughout its 25-year history.

To that end, from February through March 2020, the consulting firm Consultoría en Ingeniería de Proyectos, S. de R. L., interviewed 31 people with extensive knowledge and experience in environmental issues and infrastructure development in the U.S.-Mexico border region and from diverse backgrounds, including the public, private and academic sectors, as well as non-governmental organizations (NGOs). Likewise, an open online survey was conducted with 100 participants to document public opinion about the value of NADB projects and its role throughout the border.[108]

Figure 8.1: Interviews by Stakeholder Category and Country





8.1. NADB Operations

In general terms, academic, government and NGO stakeholders recognized NADB's leadership as a binational institution, its contribution to public policy strategies on both sides of the border, and support at all three levels of government. Likewise, the private sector considers NADB a leader in financing environmental infrastructure in the border region.

As areas of opportunity for the institution, border stakeholders indicated that NADB should continue to align itself with federal programs, such as national plans associated with sustainable development goals.

> "The creation of NADB was a response of the two governments, innovative and really designed to address the realities of a border region with a great need for environmental infrastructure development."
>
> – Academic from a university in California

[108] The online survey was developed by CINPRO with input from NADB and was applied during the months of February and March 2020 by CINPRO through an open invitation posted on the web pages of NADB and SEMARNAT and through NADBankNet (University of Arizona).

MAIN INTERVIEW RESULTS

Academia

- NADB's work in infrastructure development has had an impact on improving the quality of life border residents.
- NADB has achieved much with little capital.

Public Sector

- NADB marks a turning point in border wastewater treatment systems.
- NADB specializes in finding sources of fundings.
- NADB offers assistance from the beginning to the end of a project.

Non-governmental organizations

- NADB infrastructure projects are influencing the quality of life in the border region.
- NADB technical assistance is this great machine that can get things done.
- The current challenge for NADB lies in preserving natural resources, rather than mitigating environmental pollution.

Private Sector

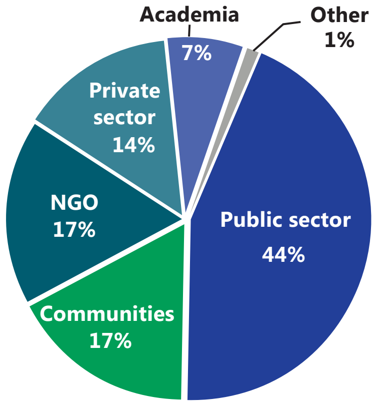
- NADB is a binational mediator.
- NADB specializes in technical and financial issues.
- ENADB is a leader in financing and project management at the national level.

In the online survey, 44% of the participants believe that NADB has a close relationship with federal and local governments, confirming its ties with government structures in the area of infrastructure. NADB was also recognized as an institution focused on partnering with communities by 17% of respondents, with non-governmental organizations by 17%, and with the private sector by 14%.

> "NADB is a unique and exemplary mechanism for attracting other international sources of funding, as it instills confidence."
>
> – Federal official from an environmental agency in México

> "They are very familiar with the processes, mechanisms, regulations of public entities, and that is very useful for bringing projects to fruition."
>
> – Private wastewater treatment plant operator in Mexico

Figure 8.2: Perception of NADB´s Closeness to Key Stakeholders



The main actions associated with NADB are project loans, technical assistance and grant funding. Technical assistance was a topic widely commented on during the interviews and was also identified in the survey as one of the main attributes of NADB.

8.2 Performance of Public Institutions

Interviewees were asked how they rate the performance of public institutions in the border region, including NADB, with respect to the development of environmental infrastructure. The general consensus was that climate change should be considered their main challenge for the implementation of public policies and infrastructure that preserve and improve the environment. Interviewees also acknowledged that the Border 2020 Program has facilitated the integration of regional groups and has promoted social consensus.

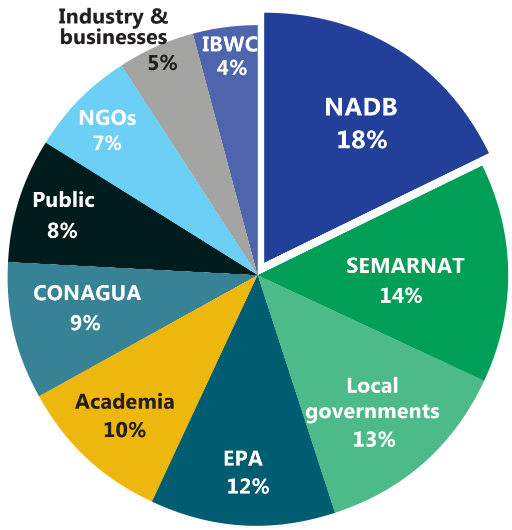
In the online survey, participants noted that NADB is key in mediating binational policies, in ongoing dialogue among the three levels of government, in technical assistance and in financing projects to improve the environment.

As for the agencies that have contributed the most to protecting the environment in their respective community, NADB was mentioned by 18% of respondents, SEMARNAT by 14%, the local government by 13% and EPA by 12%.

“NADB is considered a key institution in solving structural problems in the border region.”

– Academic at an independent research forum in the U.S.

Figure 8.3: Agencies that Have Contributed the Most to Environmental Protection



8.3 Border Environment

In the opinion of those interviewed, the state of the border environment is not optimal, although there is now greater social awareness of environmental issues. Interviewees also recognized that the improvements in infrastructure and environmental conditions are outweighed by the dynamic growth of the region in terms of population and trade, resulting in greater environmental impacts.

Water stress in the region was of particular concern for the interviewees. In the public sector, binational agreements are considered to have very limited scope, and significant socioeconomic differences were perceived between border communities and the rest of the country, in both the United States and Mexico.

To a lesser extent, interviewees also mentioned biodiversity, deforestation, mobility, urban planning and the use of renewable energy in the region. The main results of the survey regarding the water, air quality and solid waste sectors are presented below.

8.3.1 Water

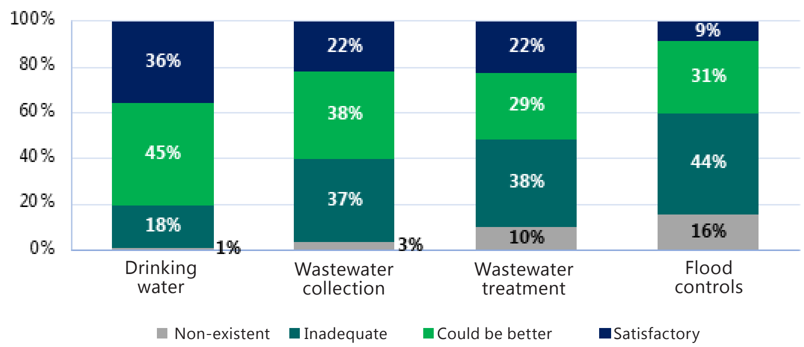
With respect to drinking water, 36% of survey respondents rated the service satisfactory, while 45% thought it could be better. In the case of wastewater collection, 22% were satisfied with the service and 33% thought it could be improved.

With respect to wastewater treatment, 48% of the respondents believed it was non-existent or inadequate. This response is significant because, although NADB has strongly promoted wastewater treatment, the perception remains that more infrastructure is needed.

One of the main concerns of the binational border community is protection against torrential storms and floods, since 60% of survey respondents rated current measures as non-existent or inadequate.

> "The significant progress made in wastewater treatment coverage in the Mexican border region, well above that of the rest of the country, was due to grants provided by the federal governments of both countries, combined with NADB´s administration and loans."
>
> – Mexican official from an international commission

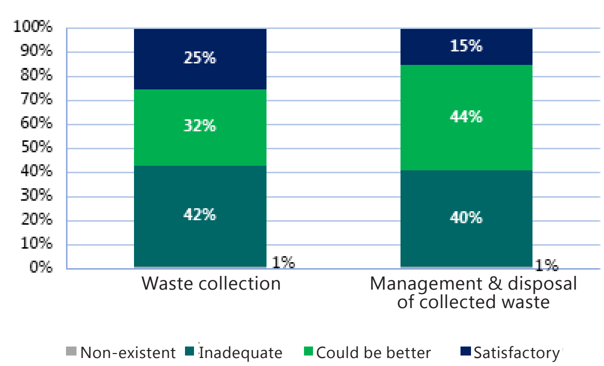
Figure 8.4: Water Services



8.3.2 Solid Waste

In general, the U.S. and Mexican border communities are not satisfied with current solid waste management. Of those surveyed, 74% thought garbage collection was inadequate or could be improved, while 84% believe that the management and disposal of collected garbage is inadequate or could be better.

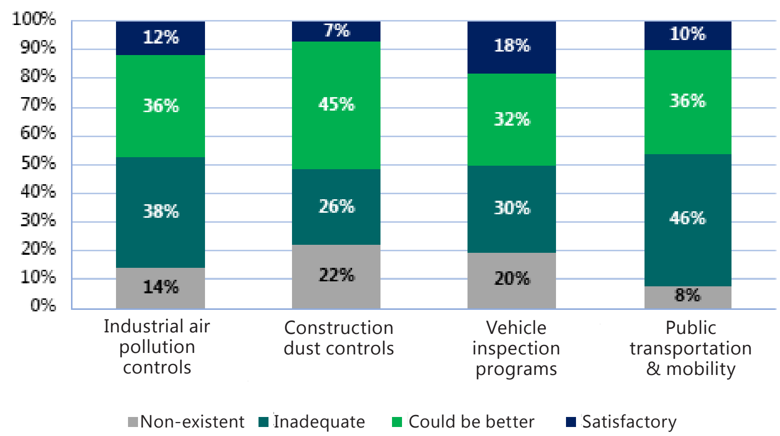
Figure 8.5: Waste Management Services



8.3.3 Air Quality

In terms of air quality management, the need for monitoring systems on both sides of the border was a consistent theme, since concrete actions cannot be taken without reliable data. In the areas of industrial emission controls, construction dust controls, vehicle inspection programs and public transportation and mobility, border communities are dissatisfied with the current results, with 51% of respondents rating air quality control actions as nonexistent or inadequate.

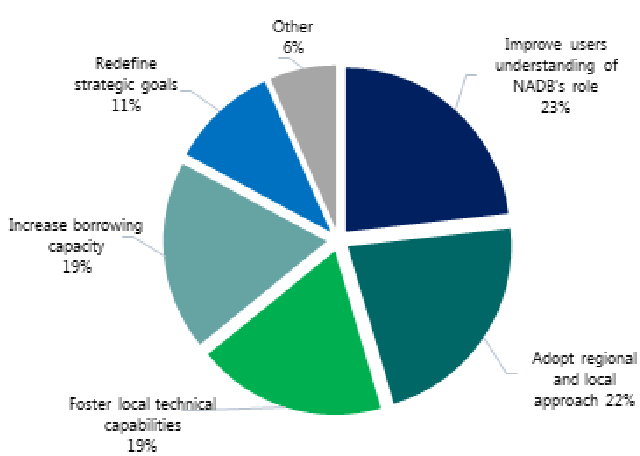
Figure 8.6: Air Quality Management



8.4 Opportunities and Challenges

In the online survey, the main challenges identified for NADB were improving its understanding of the needs of the border region (23%) and adopting a local and regional approach in its programs (22%).

Figure 8.7: Opportunities and Challenges for NADB



SHORT AND MEDIUM-TERM OPPORTUNITIES FOR NADB

Academia

- Promote paving and mobility projects, primarily public transportation.
- Create comprehensive municipal solid waste management projects.
- Consider needs on a community, rather than a regional, basis.

Public Sector

- Promote the reuse of treated wastewater.
- Link strategic planning with government programs or goals.

Non-governmental Organizations

- Become a benchmark for financing as the “green bank” of the border.
- Assess the impact of projects continually.

Private Sector

- Eliminate the geographic restriction for NADB financing, expanding its scope to encompass the entire country.
- Promote renewable energy as a matter of energy security.

Section 9

Conclusions

The purpose of the general performance evaluation of NADB for the years 1994-2019 was to document, analyze and assess the performance of this binational financial institution during its first 25 years of operation, underpinned by its mission of providing technical support and financing for the development and implementation of infrastructure projects that help preserve, protect and improve the environment, as well as the health and well-being of the residents of the U.S.-Mexico border region. NADB is celebrating its 25th anniversary with 236 projects implemented in the border region.

The performance evaluation was undertaken from two perspectives: (i) a quantitative approach based on relevant indicators in the environmental and infrastructure sectors that NADB serves within its jurisdiction and (ii) a qualitative approach that helped document how NADB and its activities are perceived by border residents and key border stakeholders.

NADB invested US$2.99 billion in the 236 completed projects, which together with funding from other sources, resulted in a total investment of US$9.53 billion. Leveraging funding from other sources has proven to be one of NADB's main strengths, demonstrating its ability to mobilize government funding, both grants and loans, from both countries, in benefit of public and private project sponsors, achieving a leverage ratio of up to US$3.20 from other sources for every dollar financed by NADB.

Advances in the water sector in the 100-km region along both sides of the border marked a clear watershed between 1995 and 2015. Wastewater treatment coverage increased by 70 percentage points in Mexico, with NADB participating in most of the public treatment plants that were built and went into operation during that period. Likewise, thanks to the EPA-funded BEIF and PDAP programs, NADB loans and the synergies created by working with other institutions, water service coverage also increased to practically 100% in U.S. communities and to close 96% in Mexican communities. Despite these advances, there are still unmet needs in this sector, especially in small, remote and vulnerable communities. In addition, there is a need to replace infrastructure that is reaching the end of its useful life, and NADB is an important option for tackling this challenge.

Efforts in comprehensive waste management have mainly concentrated on urban areas and large population centers on both sides of the border. Because of rapid population growth in the border region, along with related consumption patterns and economic activities, the quantity and quality of the infrastructure must be constantly reviewed for optimal waste management. Waste generation per capita in the U.S. border (4.4 lbs. per capita per day) is double that of the Mexican border region (2.2 lbs. per capita per day), which is consistent with the economic asymmetry between the two sides of the border. The percentage of the population receiving garbage collection service has remained constant for U.S. residents, at practically 100% coverage. In the Mexican border states, on the other hand, collection coverage has grown a modest six percentage points, increasing from 86% in 1998 to 92% in 2015, while the number of sanitary landfills increased almost six-fold, from 11 to 64, between 2000 and 2018. Regulations and technology have led to a higher level of waste reuse and recovery, but more in-depth studies are required to better understand the status of waste management in the border region, including studies on waste generation, disposal, recycling and valorization, as well as infrastructure needs assessments. NADB can provide financial support and share its technical expertise in developing suitable solutions tailored to the needs of the region.

Air quality along the border between the U.S. and Mexico has been impaired by high levels of pollution associated, in large part, with its dynamic economy. International trade and commerce activities are carried out through 14 pairs of sister cities that share the same air basins. Air quality in most of the border region does not meet the PM_{10}, and ozone parameters established by the World Health Organization. In Mexico, the lack of air monitoring data generated along the border is troubling. While street paving has been a key factor in reducing PM_{10} emissions, the demand for paving continues to grow in border cities.

The drive for renewable energy has become increasingly relevant worldwide in the fight against greenhouse gas emissions, short-lived compounds and criteria pollutants related to burning fuels. NADB has supported the implementation of 65% of the renewable energy generation capacity installed in the Mexican border region, which is equivalent to the annual consumption of 3.5 million homes and the displacement of CO_2 emissions from 524,000 cars. Similarly, NADB-supported projects in the U.S. border region have a combined capacity of 990 MW, sufficient to supply 900,000 households.

The transportation sector is one of largest sources of GHG emissions and criteria pollutants. Over the past 10 years, the rate of motorization in the U.S. border region increased 2.3%, while ridership in public transportation grew from 14% to 18%. In contrast, in Mexico, the motorization rate decreased 8.7%, and number of people using public transportation increased from 57% to 59%. NADB has certified two projects to improve public transportation with new vehicles that use cleaner emission technologies in the Mexican border region. Through these projects, 722 buses have been financed to expand services or replace obsolete vehicles.

The feedback and opinions of its clients, both public and private, as well as its institutional partners, is of the utmost importance in adjusting, redirecting and, if applicable, endorsing the activities, products and policies that NADB promotes in the border region under its mandate. Based on stakeholder interviews and survey results, since its inception, NADB has spearheaded major advances in the border region through its programs and projects. Nevertheless, border communities are now facing challenges that require new programs and financial products so that they can be preempted.

Federal, state and local governments, private stakeholders and the public in general on both sides of the border find NADB to be a trustworthy, professional, capable and credible institution. They acknowledge the challenges of increasing water, wastewater and waste collection coverage and helping states, counties and municipalities bolster their capacity to manage natural resources and environmental infrastructure in a sustainable and resilient manner. They see a big opportunity for the Bank to promote more green projects, mainly in the areas of waste, energy and transportation.

The performance evaluation will foster institutional improvements in NADB, while also clearly demonstrating that its work has had a positive impact on the border region. The next step is to internalize the lessons learned from this exercise—both from the indicators and from the recommendations deriving from how the Bank is perceived—and to continue working to support the sustainable development of the region.

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Figure Bibliography

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Section 2: U.S.-Mexico Border Region

Figure 2.1

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Figure 2.4

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Section 4: Water Sector

Figure 4.5

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Cover (2nd & 3rd photos bottom left)
Pages 3, 10 (bottom right), 17 & 66

Cubico Sustainable Investments: Cover (bottom right)

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NADB: All other photos

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