Development of Mexico National Emissions Inventory Projections for 2008, 2012, and 2030

Presentation to the
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Project Support

- **Western Governors' Association (WGA)**
- **National Renewable Energy Laboratory (NREL)**
- **Instituto Nacional de Ecología (INE)**

Presentation Outline

- **Scope**
- **New Municipalities**
- **Methodology**
- **Control Scenarios**

Scope of Projections

- **Based on 1999 Mexico National Emissions Inventory (Mexico NEI)**
- **Projection years of 2008, 2012, and 2030**
- **Source types**
  - Point Sources
  - Area Sources (including aircraft, railroads, and commercial marine; excluding paved/unpaved road dust)
  - On-road Motor Vehicles
  - Nonroad Mobile Sources
  - Natural sources (biogenic/geogenic) are excluded

Scope – continued

- **Pollutants (NO_x, SO_2, VOC, CO, PM_{10}, $PM_{2.5}$, and NH_3)**
- **Municipality-level (county equivalent)**
- **Emissions reported in megagrams (Mg) per year**
- **Results provided in:**
  - Spreadsheets
  - Database
  - U.S. EPA Emissions Inventory Format (NIF 3.0)
  - SMOKE/IDA files (modeling format)
- **Greenhouse gas harmonization**

New Municipalities

- **2000 Census – 2,443 municipalities**
- **2005 Intracensus Estimates – 2,454 municipalities**
- **11 new municipalities**
  - Guerrero (5)
  - México (3)
  - Veracruz (2)
  - Zacatecas (1)

Methodology – Point Sources

- **Point sources divided into 6 groups based on 3-digit NAICS codes**
  - Electricity generating units (EGUs)
  - Refineries and other petroleum-related sources
  - Primary metals
  - Manufacturing industries
  - Miscellaneous industries
  - Services industries

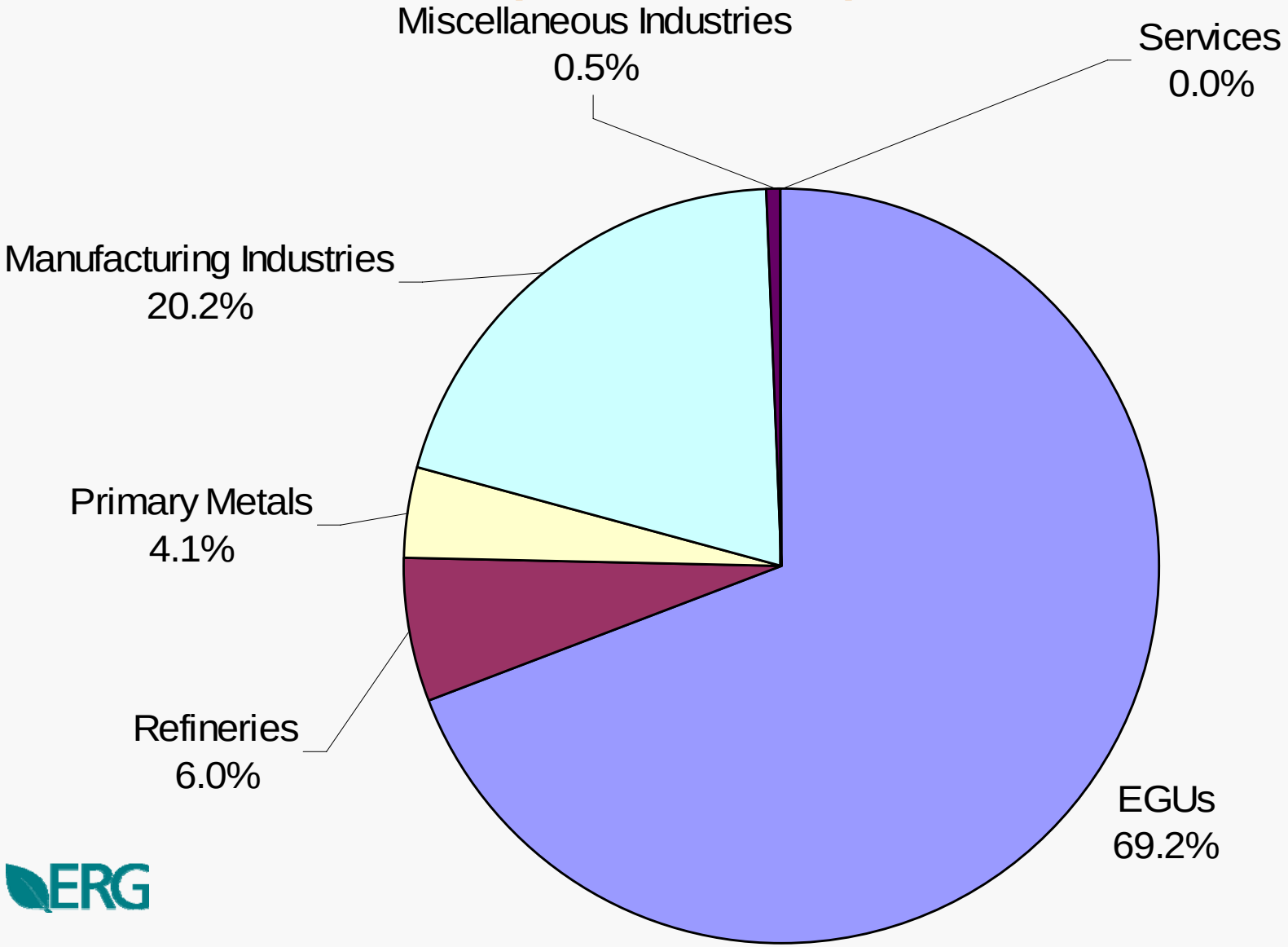
Methodology – Point Sources

- **EGUs – Projected fuel consumption (LEAP)**
- **Refineries – Projected crude oil production (OPEC)**
- **Primary metals – Historic metal production (USGS)**
- **Manufacturing industries – Annual GDP**
- **Miscellaneous industries – Annual GDP**
- **Services industries – Population (CONAPO)**

Methodology – Point Sources

- **LEAP (Long-range Energy Alternatives Planning System) – Fuel-specific consumption projections developed at UNAM (National Autonomous University of Mexico) for use in modeling for Mexico greenhouse gas studies.**
- **CONAPO (*Consejo Nacional de Población* or National Council of Population) – Municipality-level population projections available from 2005 to 2050.**

Point Source Results – 2030 NOx (% of Total)



Methodology – Area Sources

- **Population – CONAPO**
- **Fuel use – LEAP**
- **Gross domestic product (GDP)**
- **Planted acreage – SAGARPA**
- **Livestock population – SAGARPA**
- **Burned forest acreage – CONAFOR**
- **Border crossing traffic – U.S. BTS**
- **Aircraft passenger volume – OMA**
- **Annual treated wastewater – CNA**

Methodology – Area Sources

- **SAGARPA (Secretariat of Agriculture, Livestock, Rural Development, Fisheries, and Food Supply) – Historical agricultural acreage (1980-2006) and livestock populations (1996-2005)AGARPA**
- **CONAFOR (National Forest Commission) – Historical burned forest acreage (1970-2005)**
- **OMA (Airport company/consortium) – Historical airport activity (2001-2008)**
- **CNA (National Commission on Water) – Historical wastewater treatment (1999-2006) and projected treatment capacity (2008-2012)**

Area Source Results

- Decrease in SO_2 due to decrease in residual fuel combustion
- NO_x increases mainly from increases in commercial marine diesel and LPG
- VOC increases due to population and GDP categories
- PM_{10} and $PM_{2.5}$ decrease due to drop in residential wood combustion
- NH_3 decreases due to 1999 being higher than historical averages for livestock and fertilizer

Methodology – On-Road Motor Vehicles

- **Two different components of growth**
  - Increased fuel use: Based upon motor vehicle fuel projections from LEAP
  - Fleet turnover: Based upon MOBILE6-Mexico fleet average emission rates

Methodology – MOBILE6-Mexico Analysis

MOBILE6-Mexico

- **Gasoline and diesel sulfur standards for Metropolitan Zone (ZM), Frontier Zone (ZF), and remainder of country (RP)**
- **New vehicle emission limits standards (U.S. – Tier 1 and 2; Europe – EURO 3 and 4)**
  - Standard A (similar to U.S. Tier 1 for VOC, CO, and NO_x)
  - Standard B and C (combination of U.S. Tier 1 and 2 for VOC, CO, and NO_x)
  - Standard A, B, and C (same as U.S. Tier 1 for PM)
  - Do not apply to heavy-duty vehicles

Modifications to MOBILE6-Mexico Input Files

- **Implementation Schedule Input File**
- **Certification Standards Input File**
- **Exhaust Emissions Standards Input File**

On-Road Motor Vehicle Results

- **Increased motor vehicle fuel use**
- **SO_2 reductions due to lower fuel sulfur content**
- **NO_x, VOC, and CO reductions due to fleet turnover (i.e., new "clean" cars replacing old "dirty" cars)**
- **Increased PM emissions due to increased fuel use without any future standards**
- **Increased NH_3 emissions due to fleet turnover (i.e., new vehicle technologies such as advanced catalytic converters reduce NO_x, but increase NH_3)**

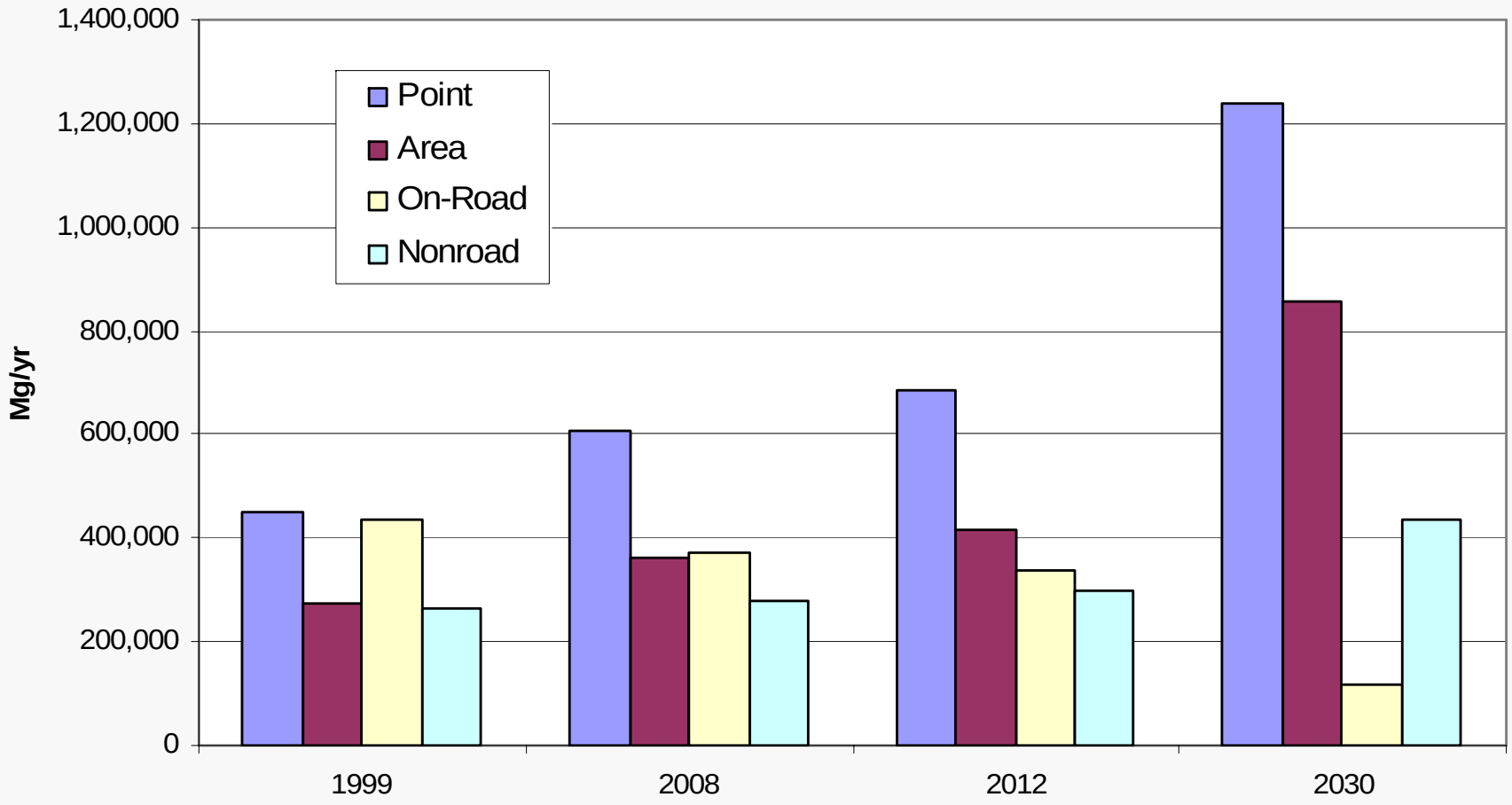
Methodology – Nonroad Mobile Sources

- **Agricultural equipment (diesel-powered)**
- **Construction equipment (diesel-powered)**
- **Source of data – LEAP**

Overall Baseline Results (Mg)

	NO_x	SO_2	VOC	CO	PM_{10}	$PM_{2.5}$	NH_3
1999							
Point	448,826	2,633,799	247,878	167,648	297,264	198,917	
Area	276,321	194,642	1,743,587	2,500,852	439,253	320,369	1,130,400
On-Road	435,665	24,453	573,042	4,671,842	20,567	18,845	7,609
Nonroad	263,768	3,486	35,169	153,604	37,240	36,123	
Total	**1,424,580**	**2,856,380**	**2,599,676**	**7,493,946**	**794,324**	**574,254**	**1,138,009**
2030							
Point	1,239,873	3,359,643	455,901	436,116	638,533	420,929	
Area	854,999	23,223	3,170,187	4,167,536	412,043	286,518	738,330
On-Road	117,883	5,366	317,164	2,731,909	71,402	64,816	36,529
Nonroad	437,465	5,777	59,058	256,756	62,449	60,576	
Total	**2,650,220**	**3,394,009**	**4,002,310**	**7,592,317**	**1,184,427**	**832,839**	**774,859**

Mexico NO_x Emissions by Source Type (Mg/yr)



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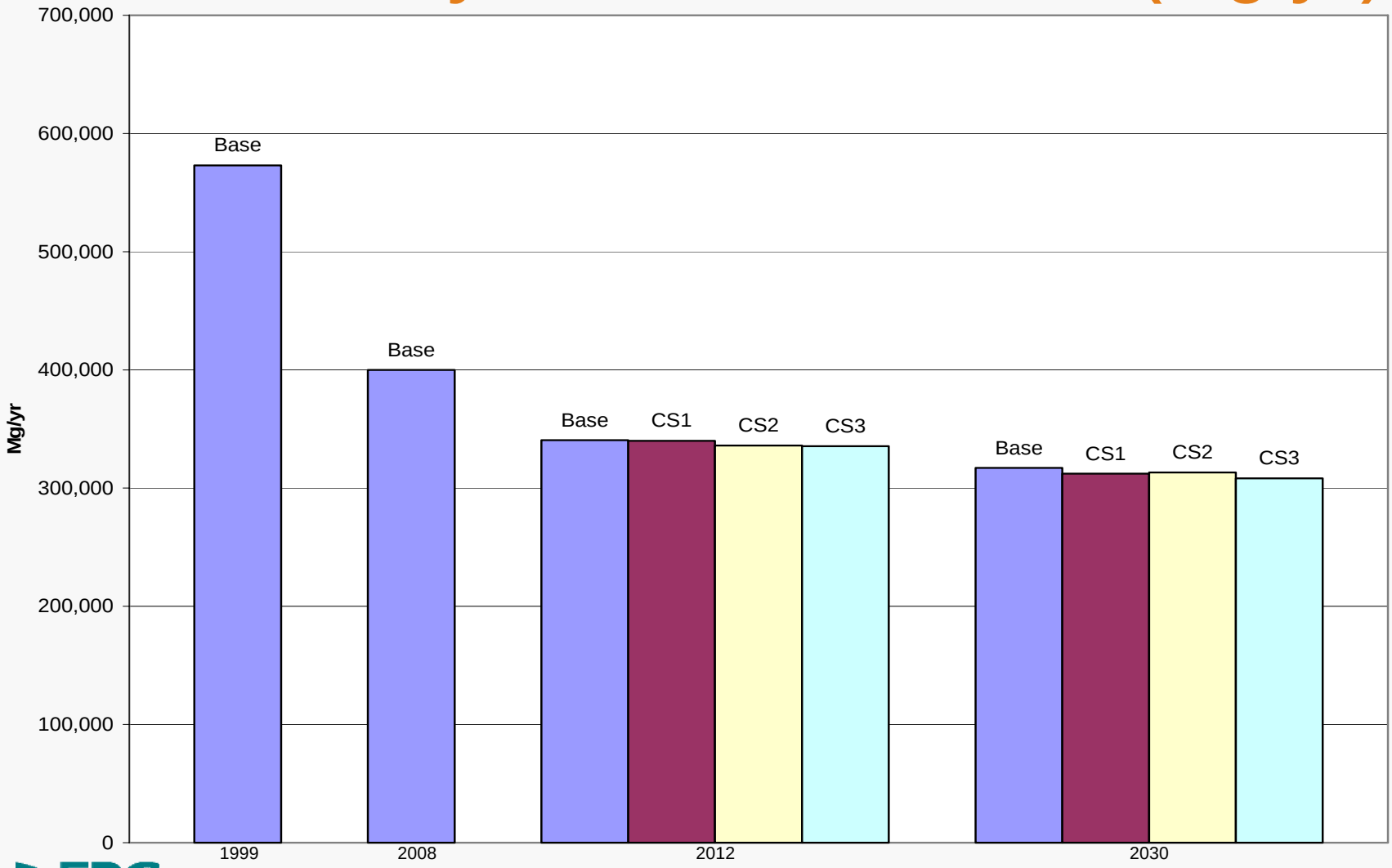
Overall Baseline Results

- **Point, area, and nonroad mobile sources**
  - General increases due to population, GDP, and fuel use growth
  - Some specialized decreases (e.g., commercial residual combustion and residential wood combustion)
- **On-road motor vehicle sources**
  - SO_2 reductions due to new fuel standards
  - NO_x, VOC, and CO reductions due to fleet turnover and new vehicle standards
  - PM_{10}, $PM_{2.5}$, and NH_3 increases due to no new vehicle standards

Control Scenarios

- **Three control scenarios applied to baseline inventory**
  - Control Scenario 1 – Increased Fuel Economy
  - Control Scenario 2 – Use of Ethanol in Oxygenated Fuel
  - Control Scenario 3 – Combination of Control Scenario 1 and 2

Mexico On-road Motor Vehicle VOC Emissions by Control Scenario (Mg/yr)



For More Information

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