

IPM: Integrated Planning Model CAIR vs. CAIR Plus

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Outline

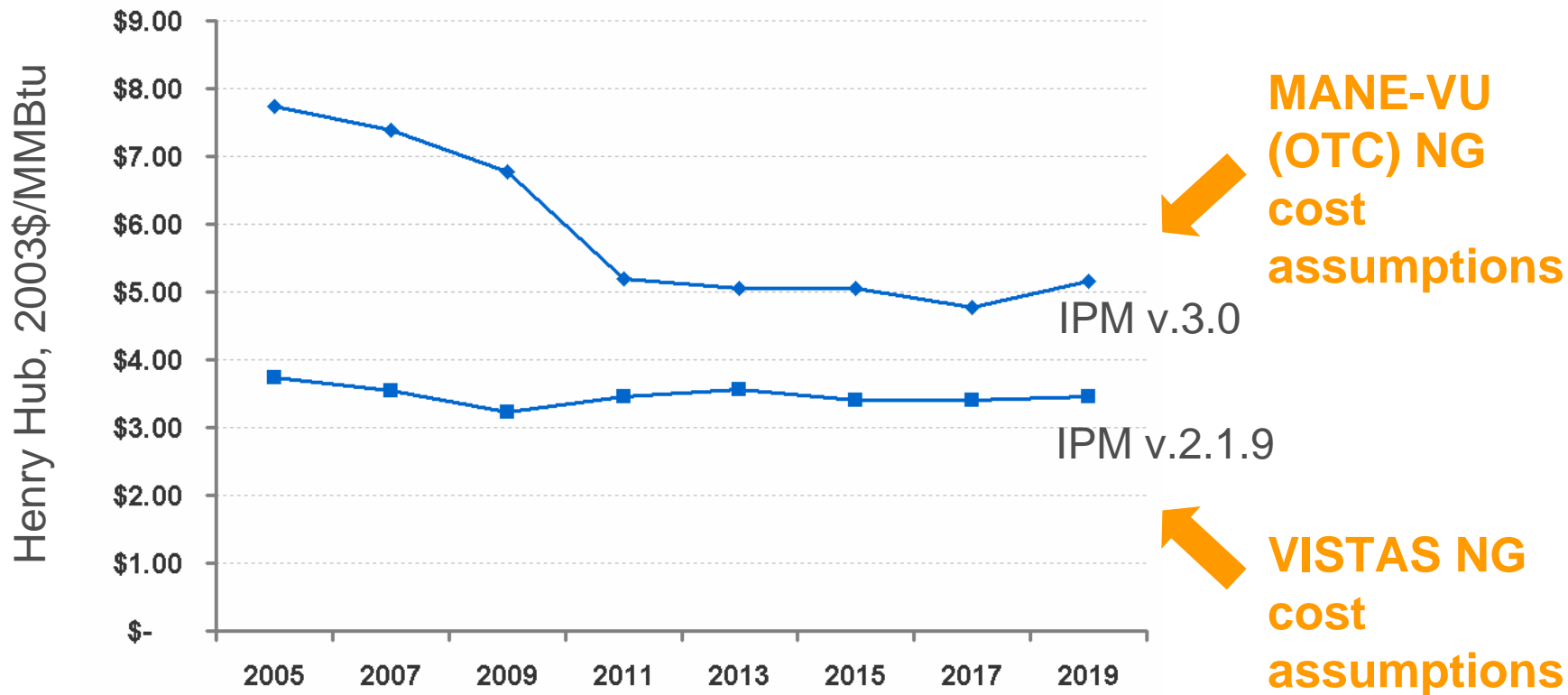
- Summary of Key IPM Assumptions
- Policy Scenarios -
CAIR Base Case vs. CAIR Plus
 - Seasonal NO_x
 - Annual NO_x
 - Annual SO₂
- Comparative Analysis

Key IPM Modeling Assumptions

- **Cost and Performance of New Generating Capacity**
- **Cost and Performance of Pollution Control Technologies**
- **Pollution Control Feasibility Constraints (FGD and SCR)**
- **Capital Charge Rates and Other Financial Assumptions**
- **Fuel Prices** (natural gas, oil, coal)
- **Fuel Transportation Costs**
- **Etc.**

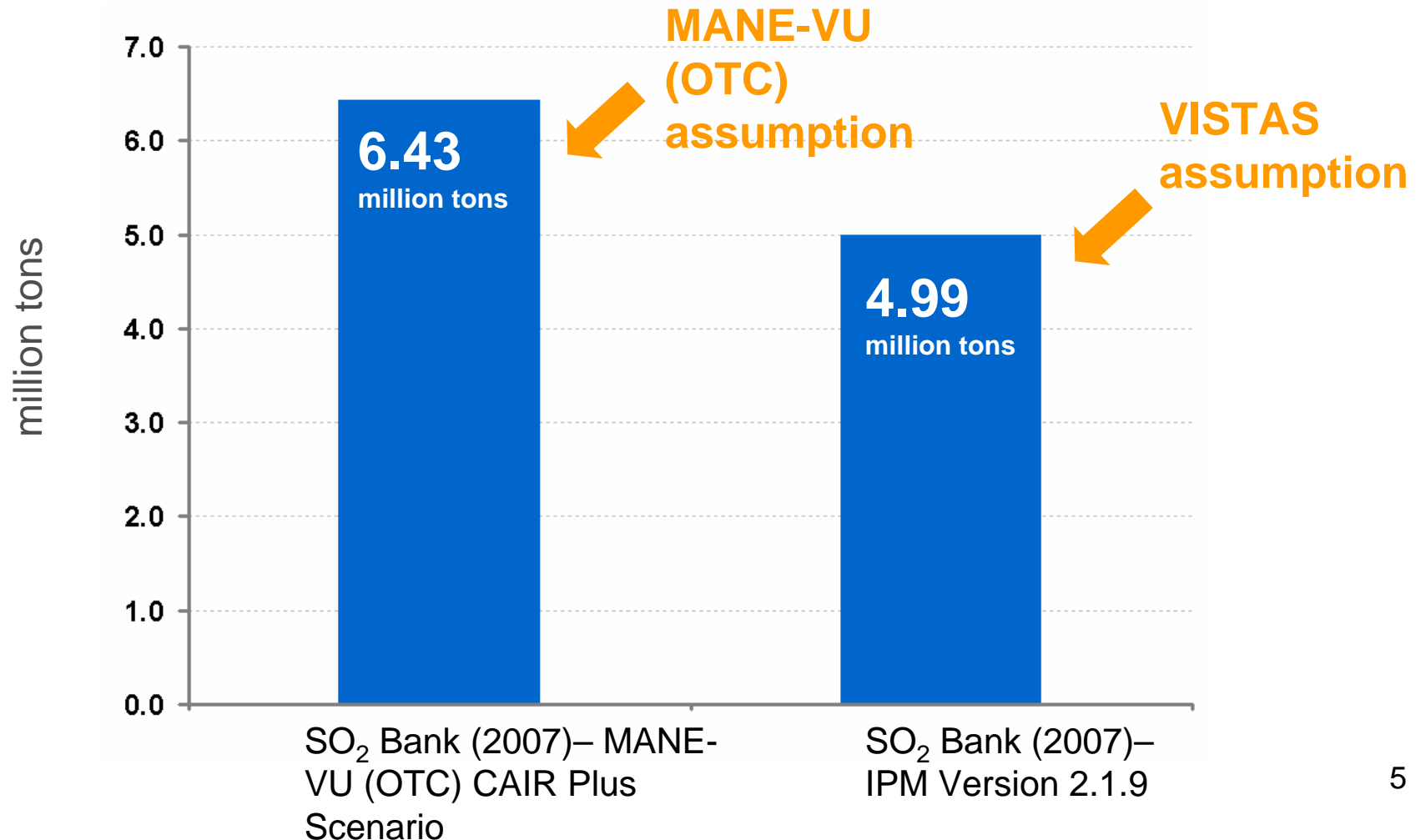
Assumptions (Continued)

MANE-VU used updated natural gas prices consistent



Assumptions (Continued)

MANE-VU updated the size of the SO₂ allowance bank.



Assumptions (Continued)

Updated constraints on pollution control equipment installations

**MANE-VU
(OTC)
constraint
assumptions***



| Year | FGD (GW) | SCR (GW) |
|------|----------|----------|
| 2008 | 133 | 98 |
| 2009 | 153 | 104 |
| 2010 | 172 | No limit |

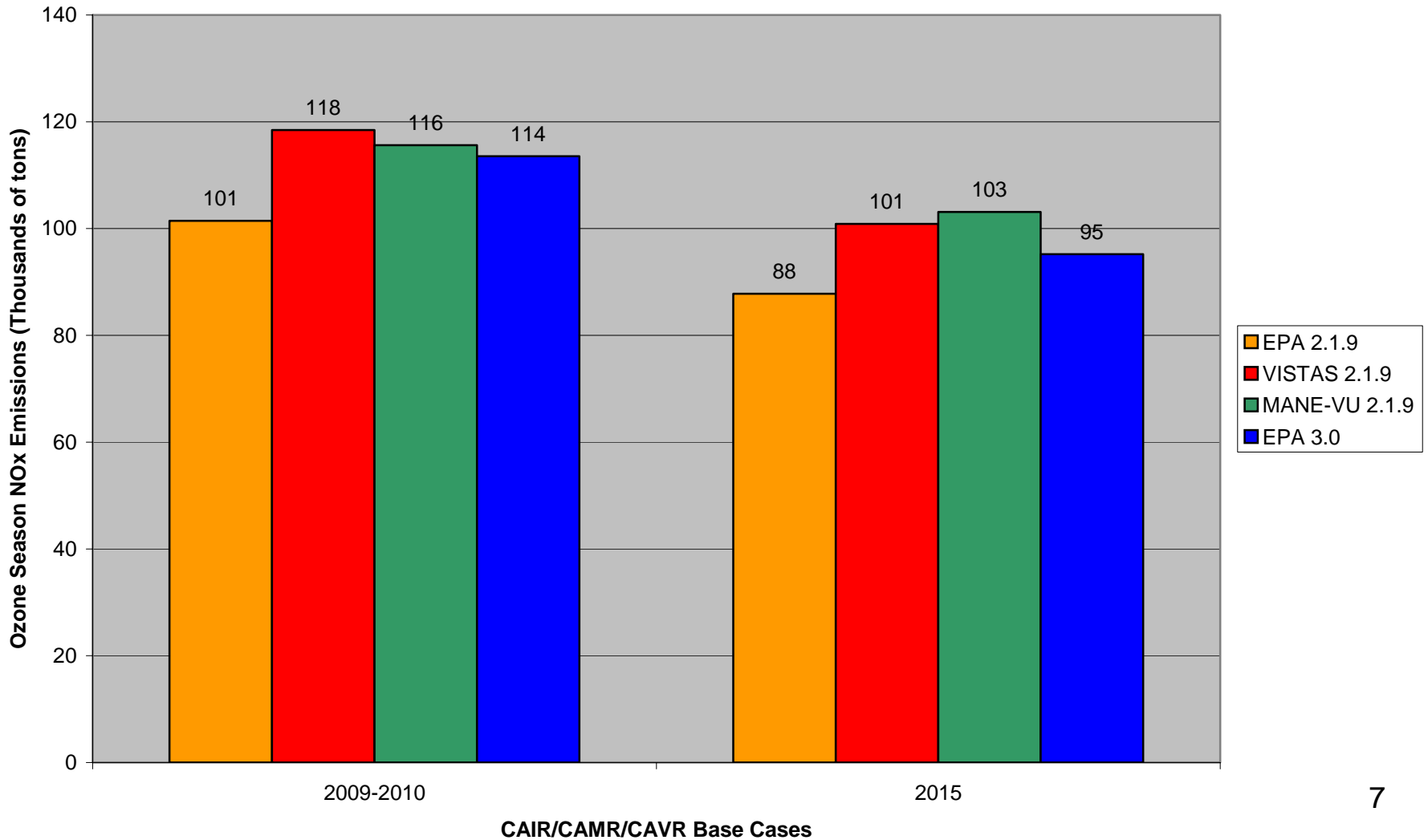
**VISTAS
constraint
assumptions**



| Year | FGD (GW) | SCR (GW) |
|------|----------|----------|
| 2007 | 80 | No limit |

*MANE- VU (OTC) constraints based on recommendations by ICF Consulting.

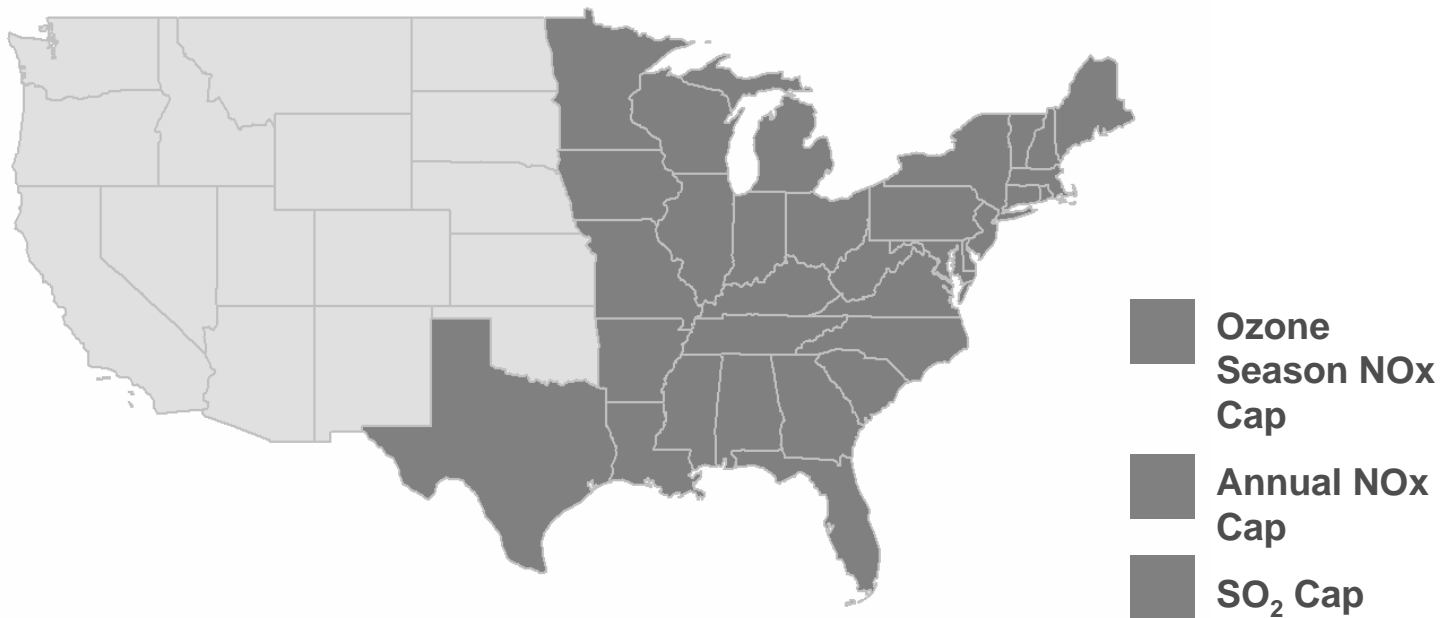
MANE-VU Total IPM Ozone Season NOx Emissions Comparison



POLICY SCENARIOS

CAIR Base Case vs. CAIR Plus

CAIR Plus Policy Modeling Domain



SO₂ Allowance Retirement Ratios

OTC CAIR Plus Scenario

SO₂ Retirement Ratios

- **2009** - 1.0
- **2010** - 2.50 (60% reduction)
- **2012** - 2.94 (66% reduction)
- **2015** - 3.57 (72% reduction)
- **2018** - 4.16 (76% reduction)

CAIR Base Case Scenario

SO₂ Retirement Ratios

- **2009** - 1.0
- **2010** - 2.0 (50% reduction)
- **2012** - 2.0 (50% reduction)
- **2015** - 2.86 (50% reduction)
- **2018** - 2.86 (65% reduction)

The SO₂ allowance retirement ratio is the number of Title IV SO₂ allowances that need to be surrendered for each tons of SO₂ emissions in the CAIR/CAIR Plus region.

Basis for Annual and Ozone Season NO_x Caps

OTC CAIR Plus Scenario

- **2009-2011** = 0.12 lbs/MMBtu
- **2012-2014** = 0.08 lbs/MMBtu
- **2015 and beyond** = 0.07 lbs/MMBtu

X

Current Heat Input*

*Heat input was increased by 5% in calculating the cap in 2015 and beyond to account for growth

CAIR Base Case Scenario

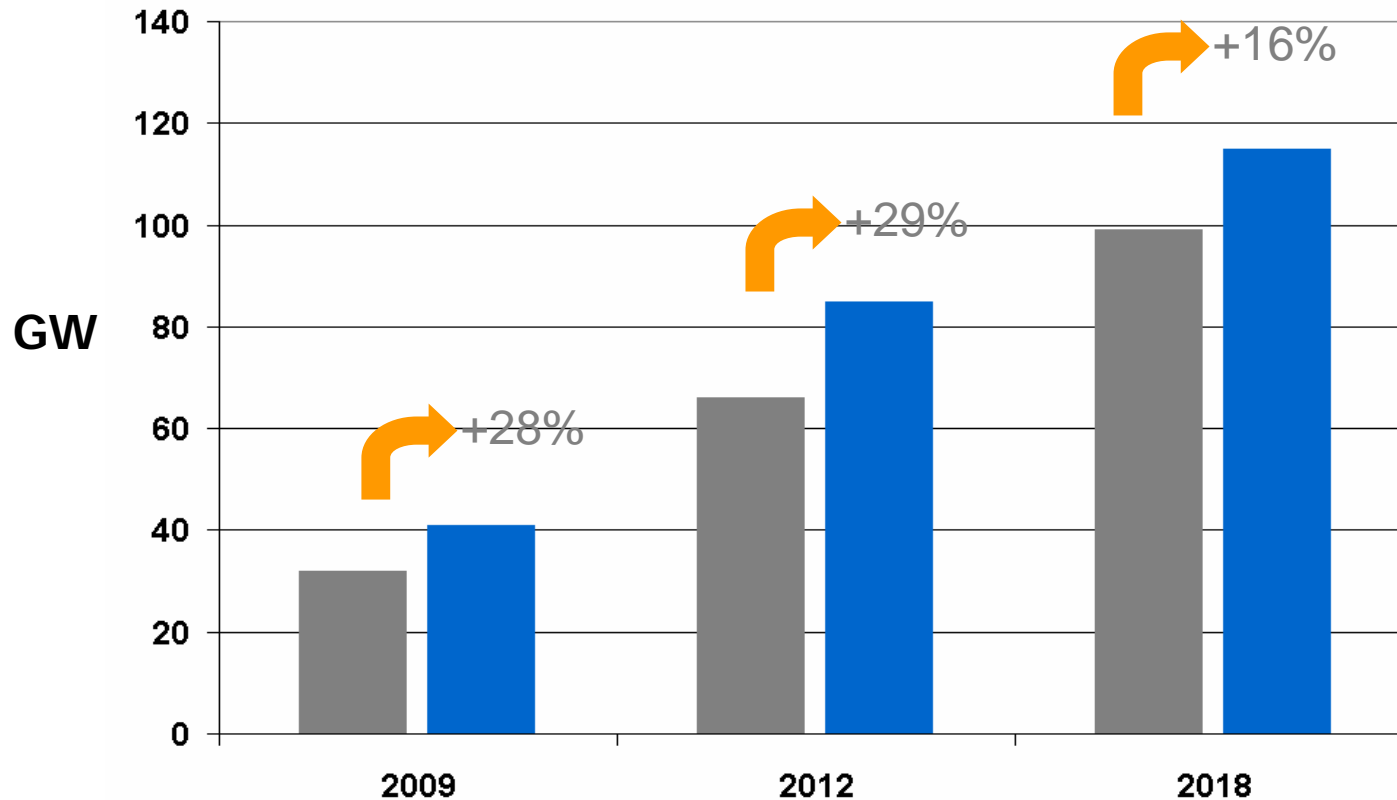
- **2010** = 0.15 lbs/MMBtu
- **2015 and beyond** = 0.125 lbs/MMBtu

X

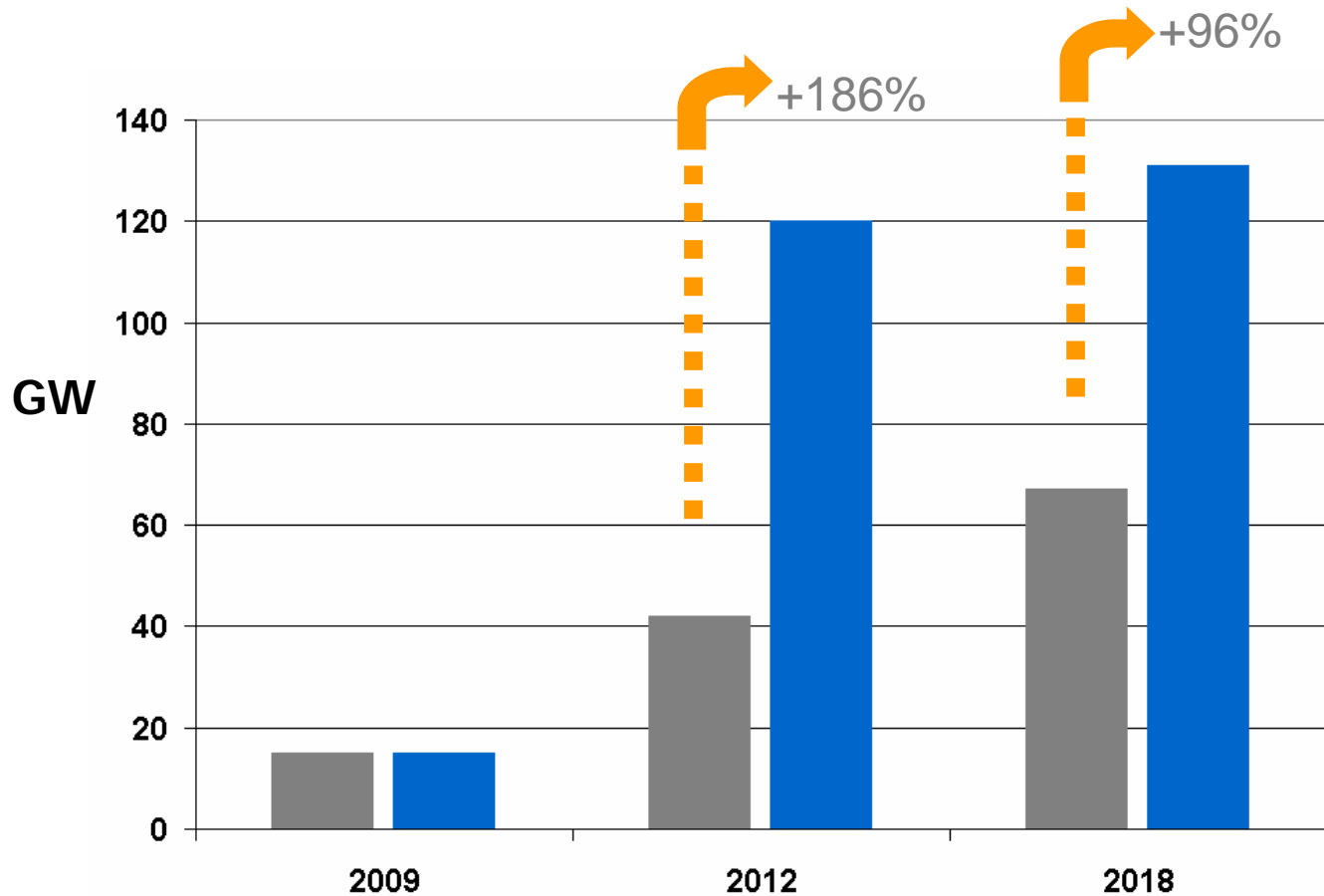
Current Heat Input

Comparative Analysis

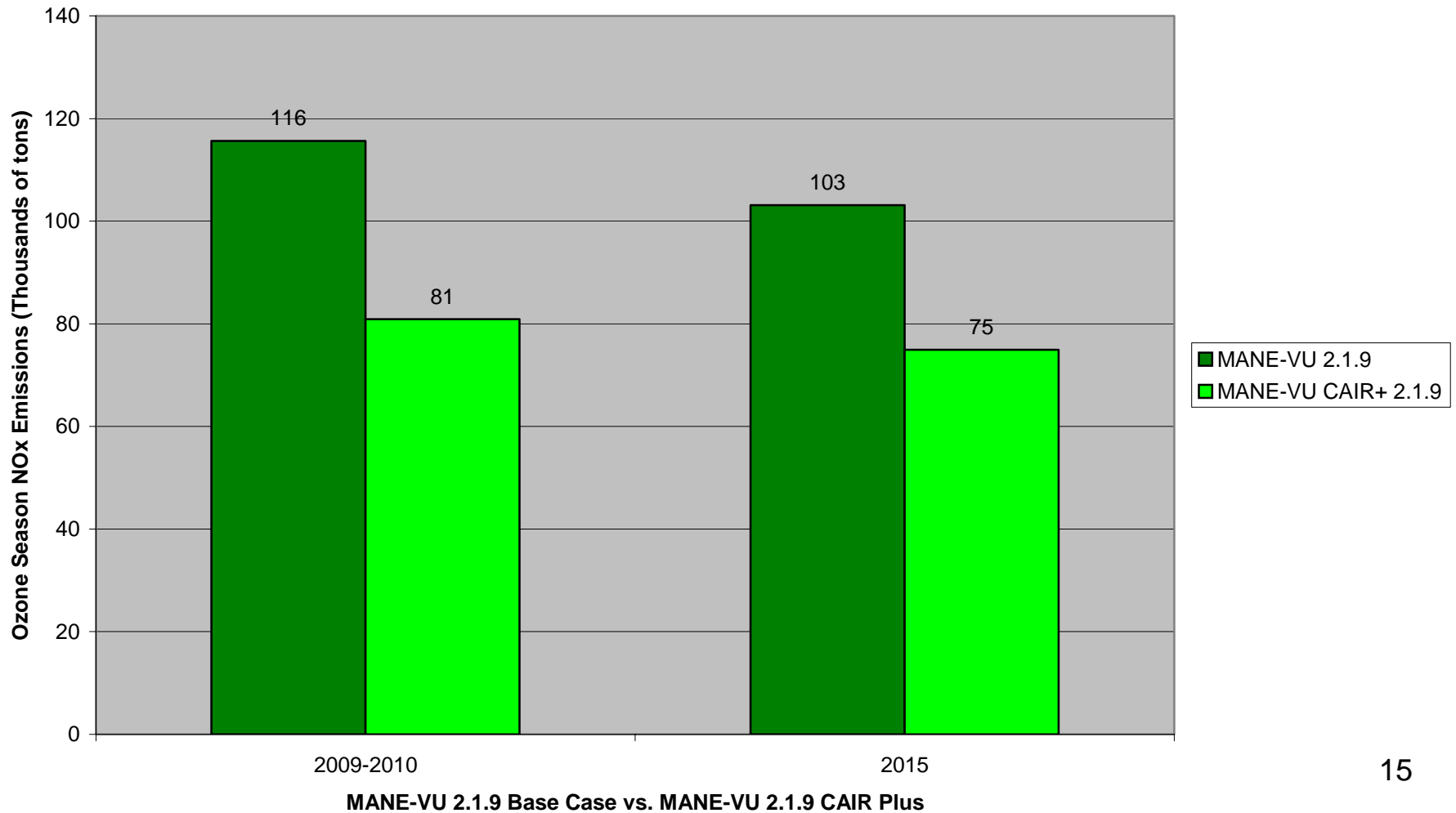
Additional coal capacity retrofits -SO₂ scrubbers:
CAIR Base Case vs. CAIR Plus



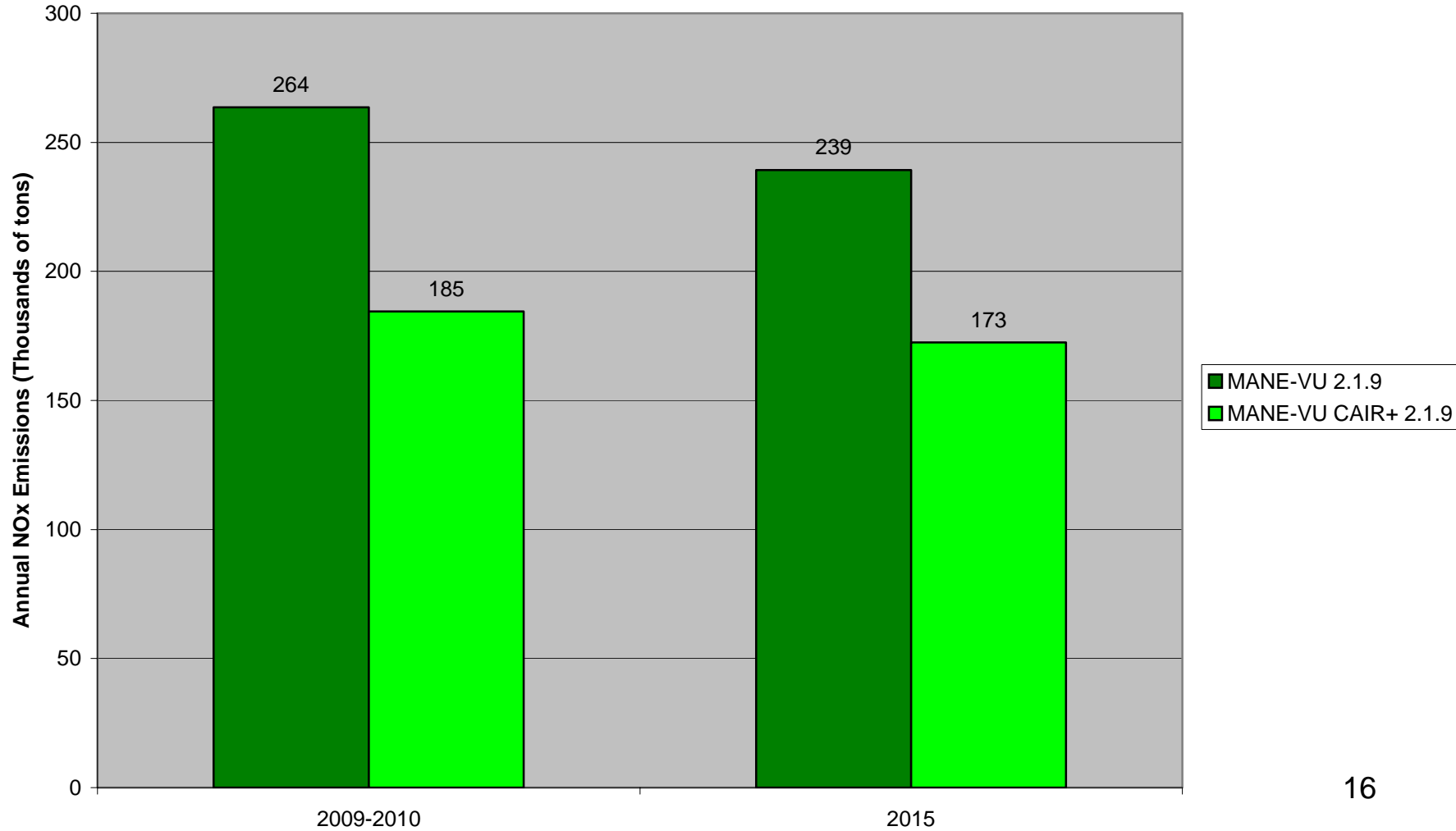
Comparative Analysis (Continued) Additional coal capacity retrofits - SCR: CAIR Base Case vs. CAIR Plus



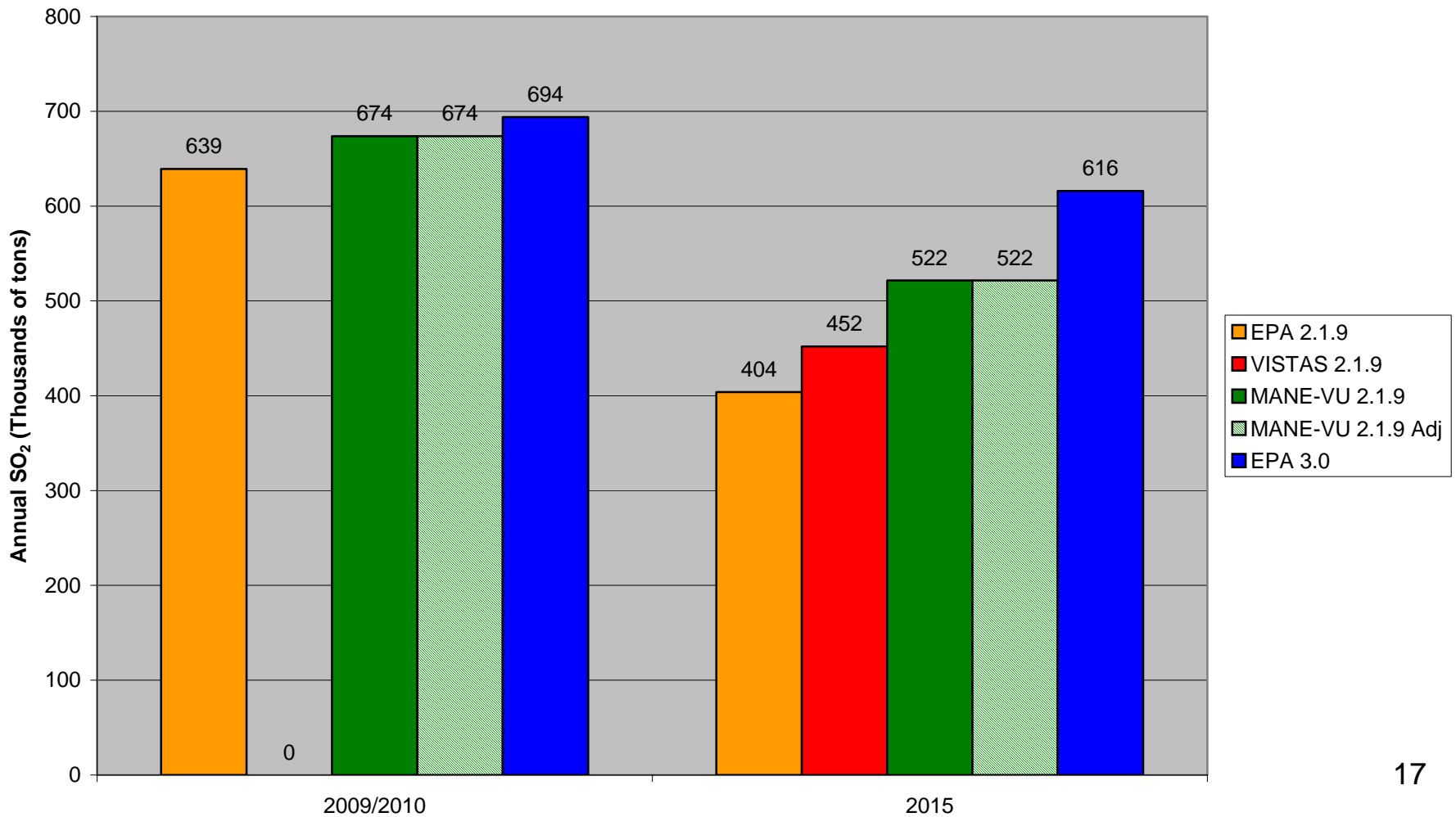
**MANE-VU Total IPM Ozone Season NOx Emissions
CAIR versus CAIR Plus Comparison**



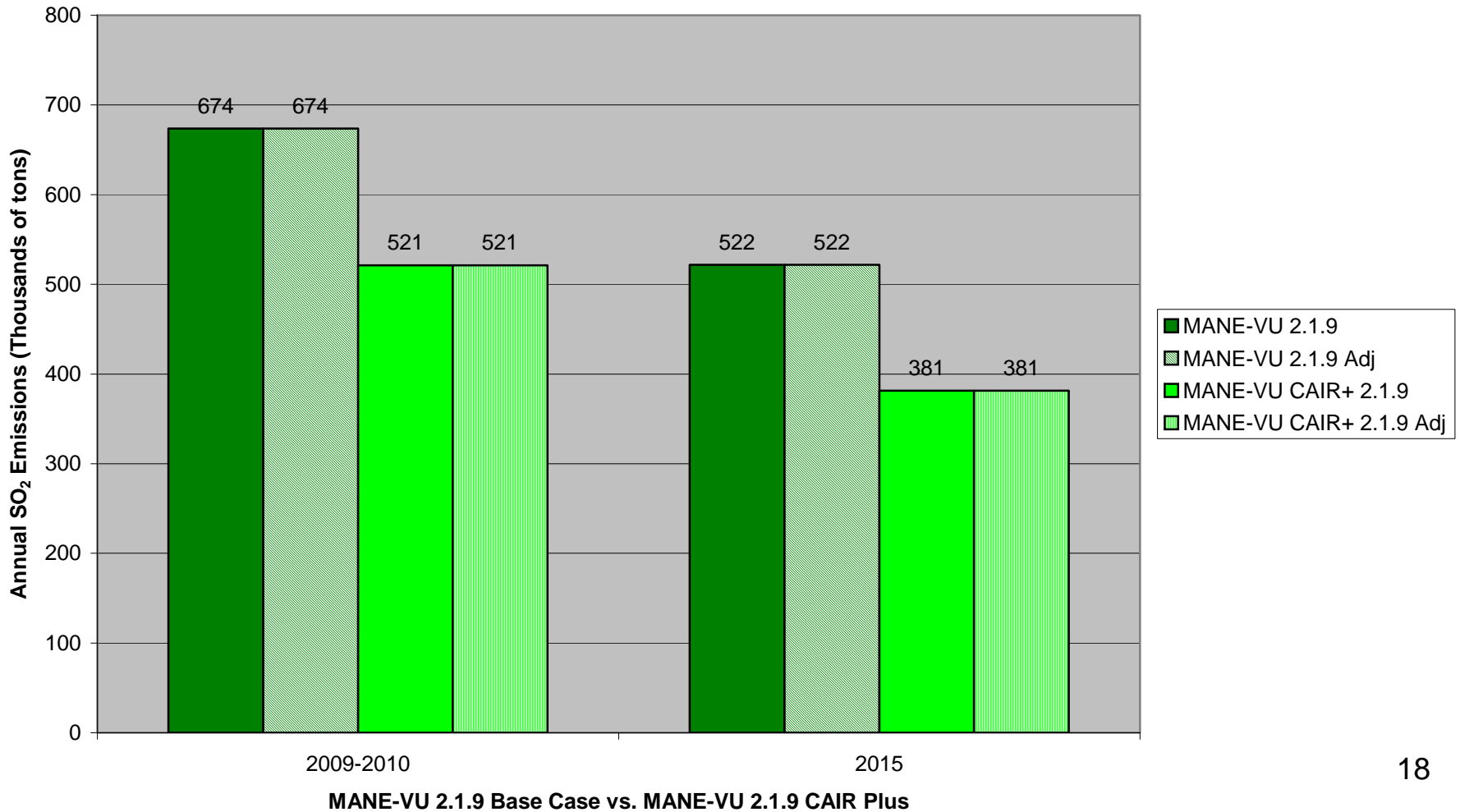
MANE-VU Total IPM Annual NO_x Emissions CAIR versus CAIR Plus Comparison



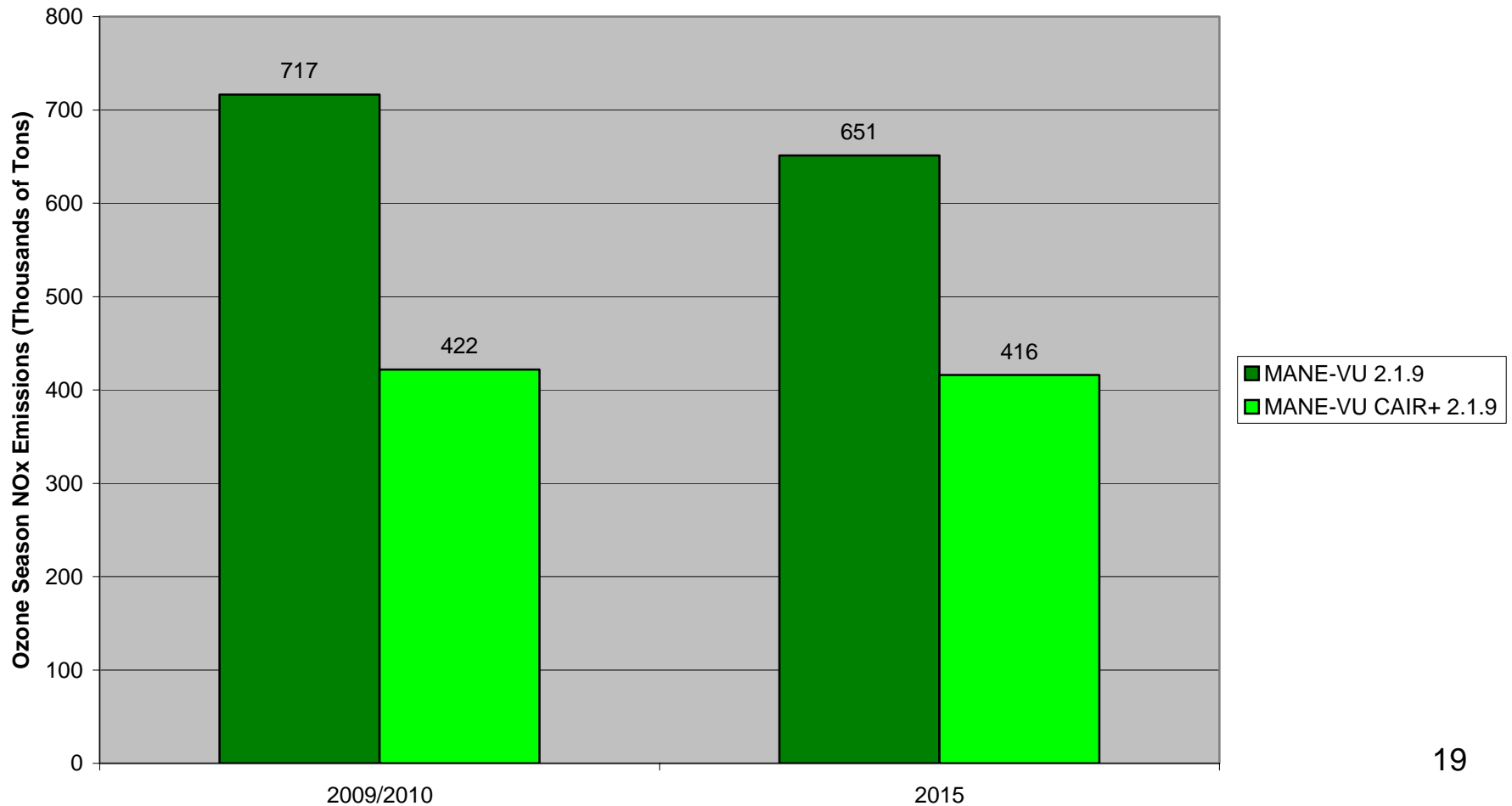
MANE-VU Total IPM Annual SO₂ Emissions Comparison



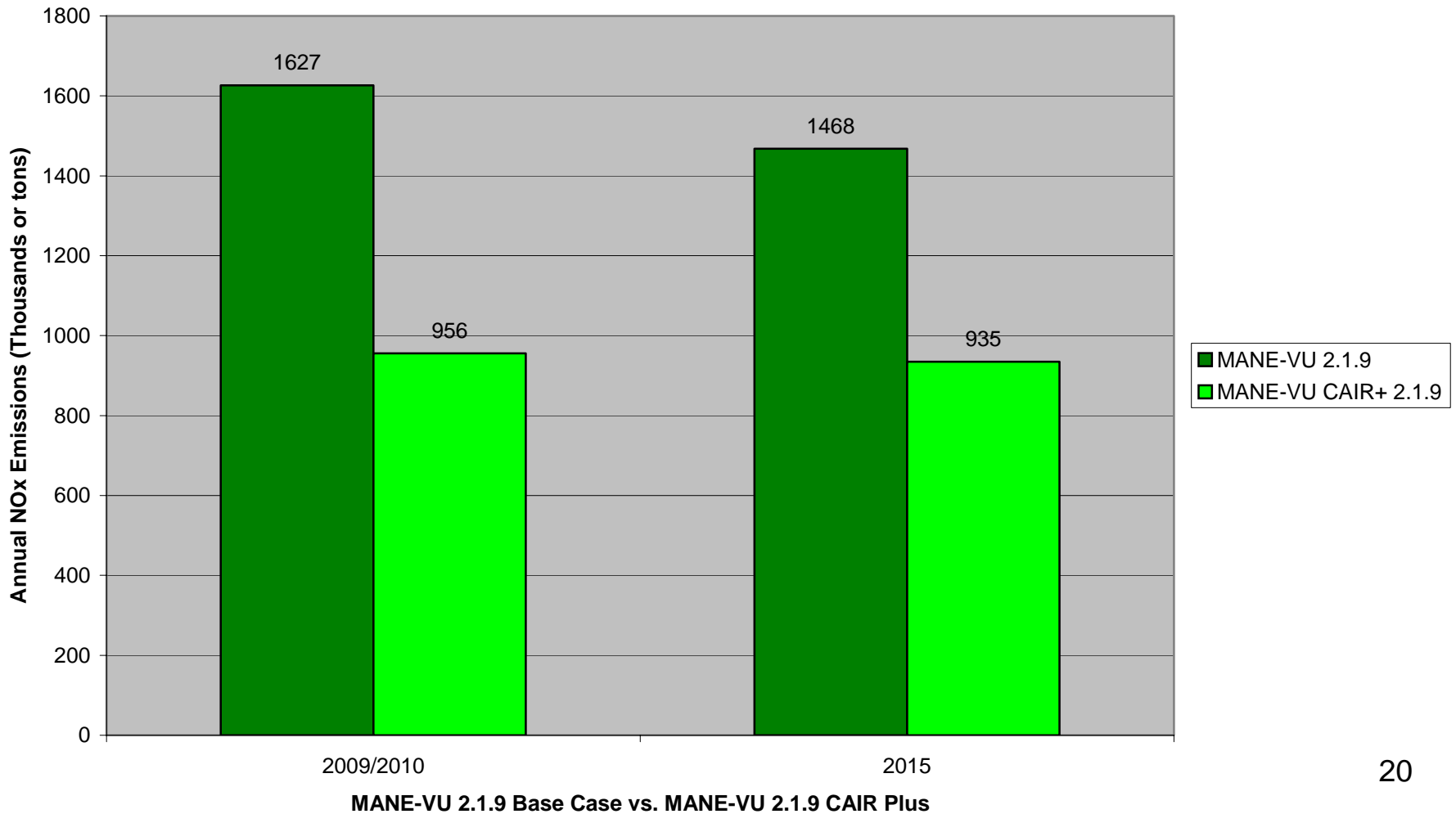
**MANE-VU Total IPM Annual SO₂ Emissions
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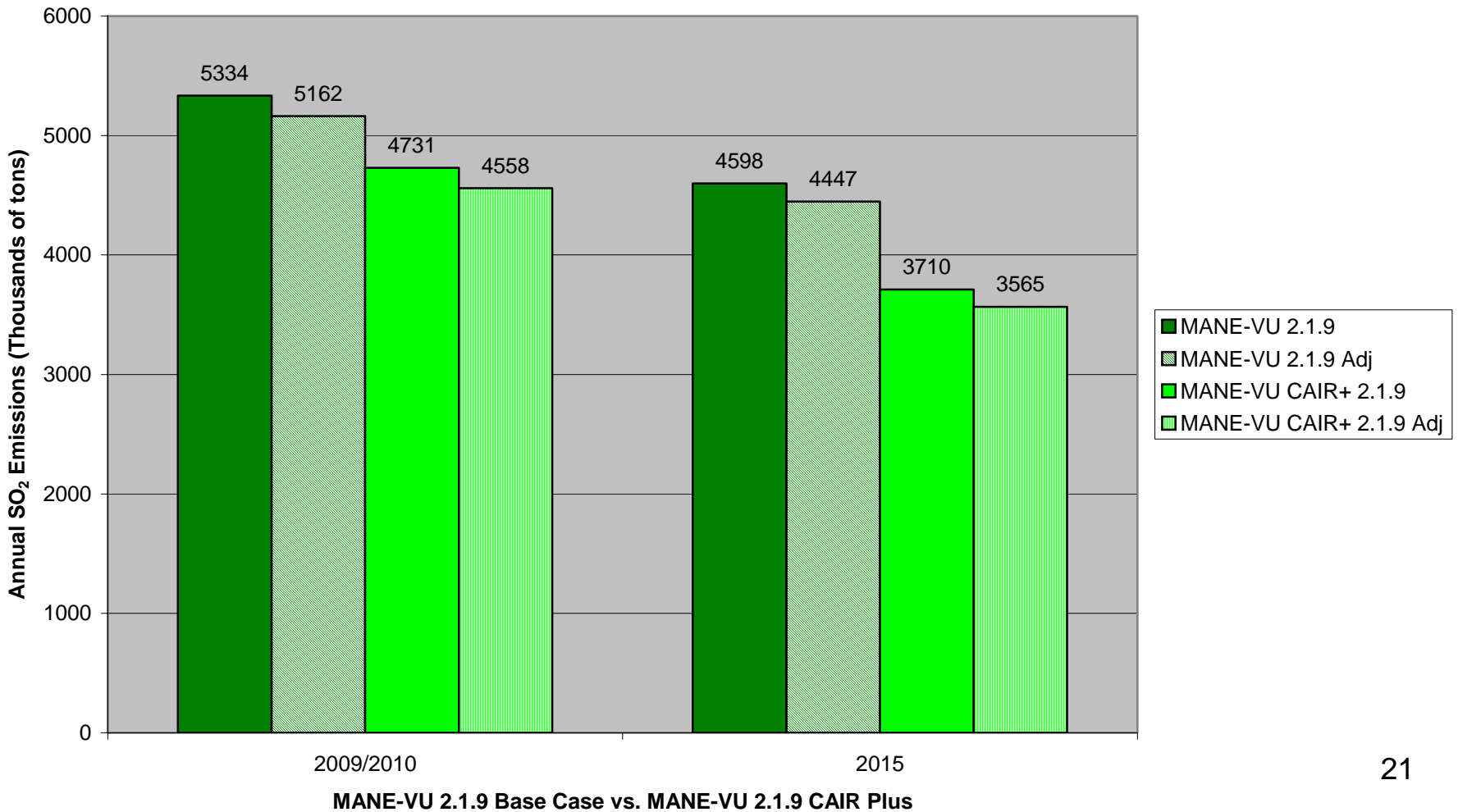
MANE-VU Modeling Domain Total IPM Ozone Season NOx Emissions CAIR versus CAIR Plus Comparison



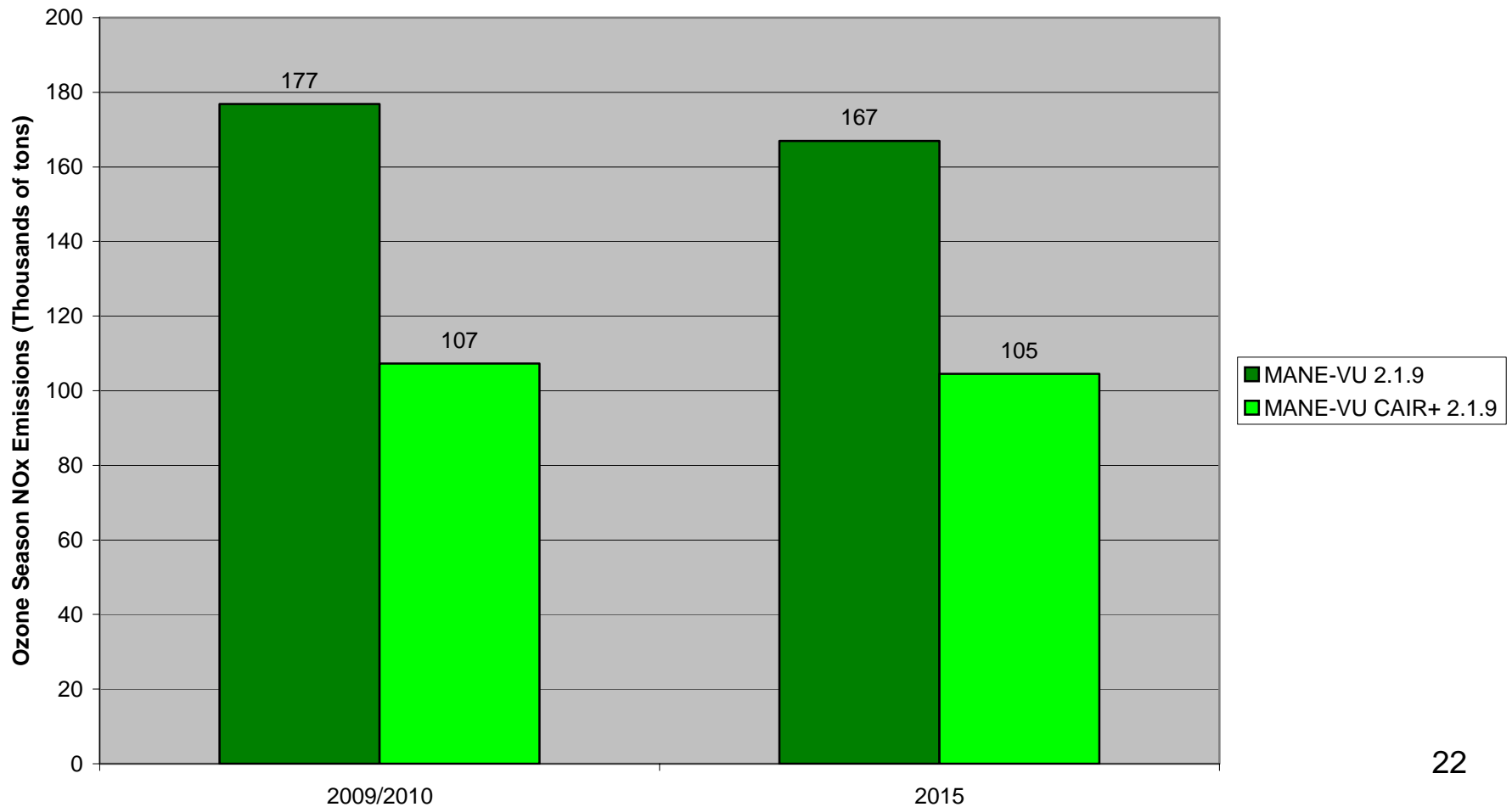
MANE-VU Modeling Domain Total IPM Annual NO_x Emissions CAIR versus CAIR Plus Comparison



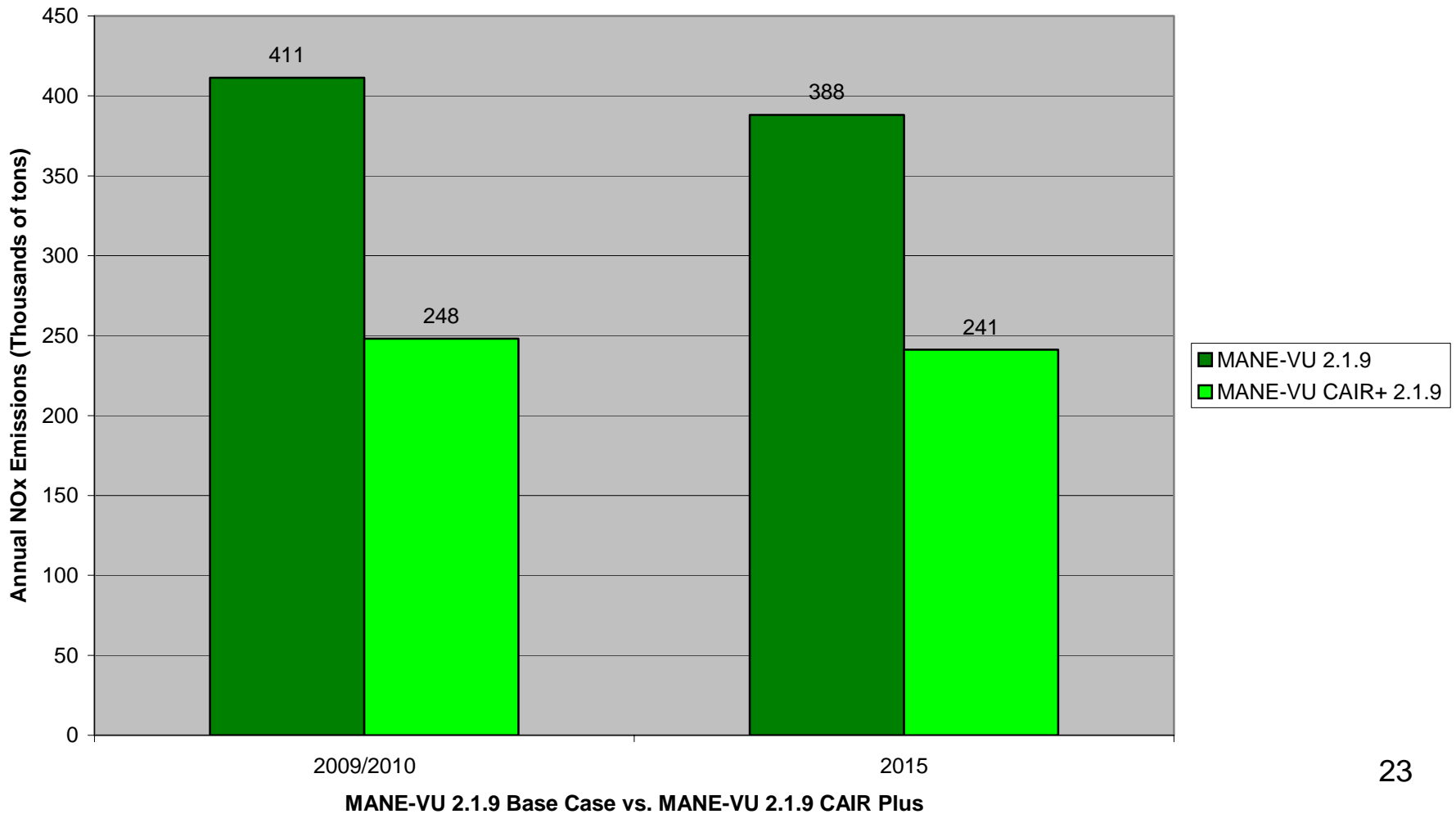
**MANE-VU Modeling Domain Total IPM Annual SO₂ Emissions
CAIR versus CAIR Plus Comparison**



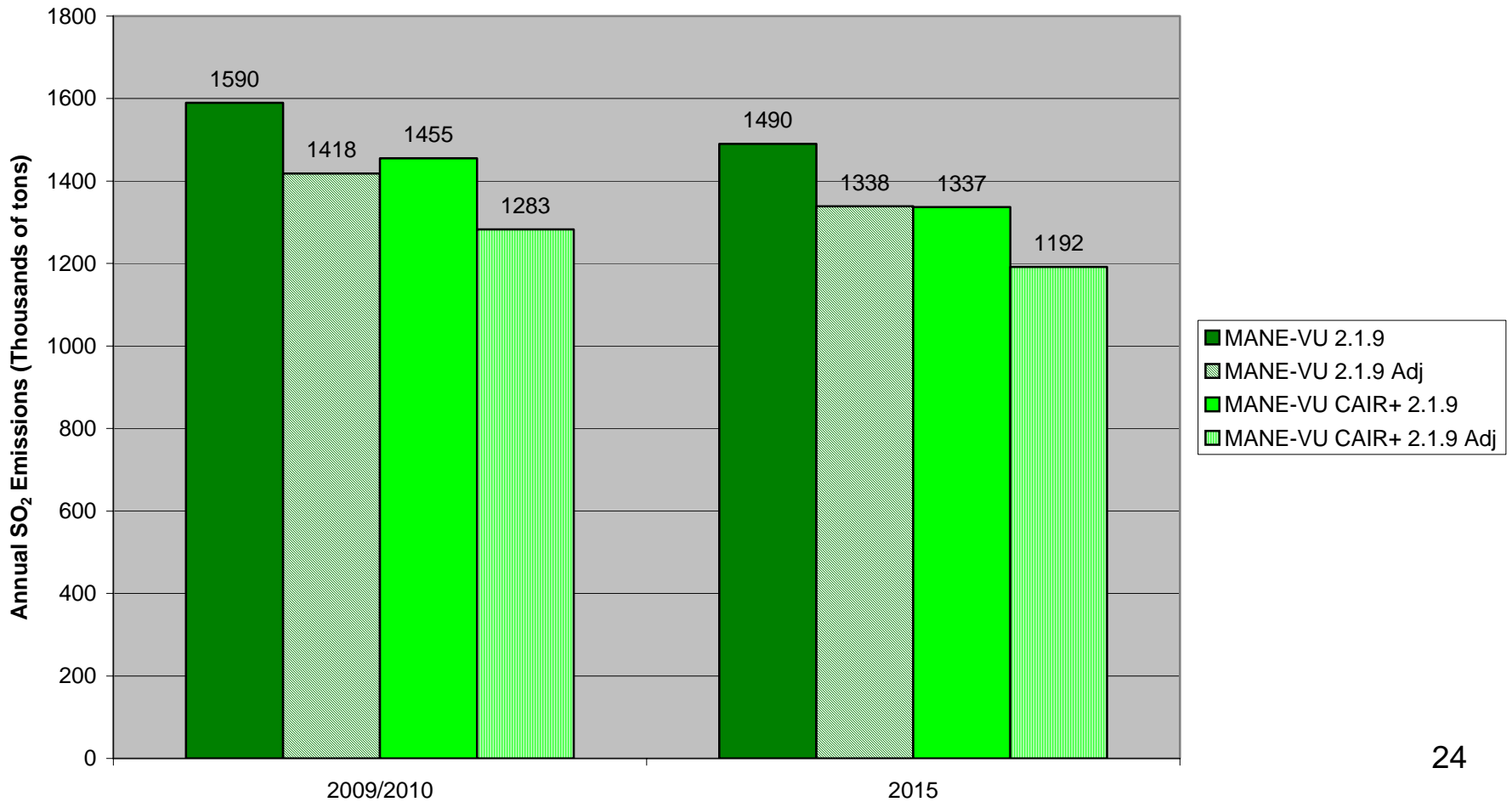
Midwest RPO IPM Ozone Season NO_x Emissions CAIR versus CAIR Plus Comparison



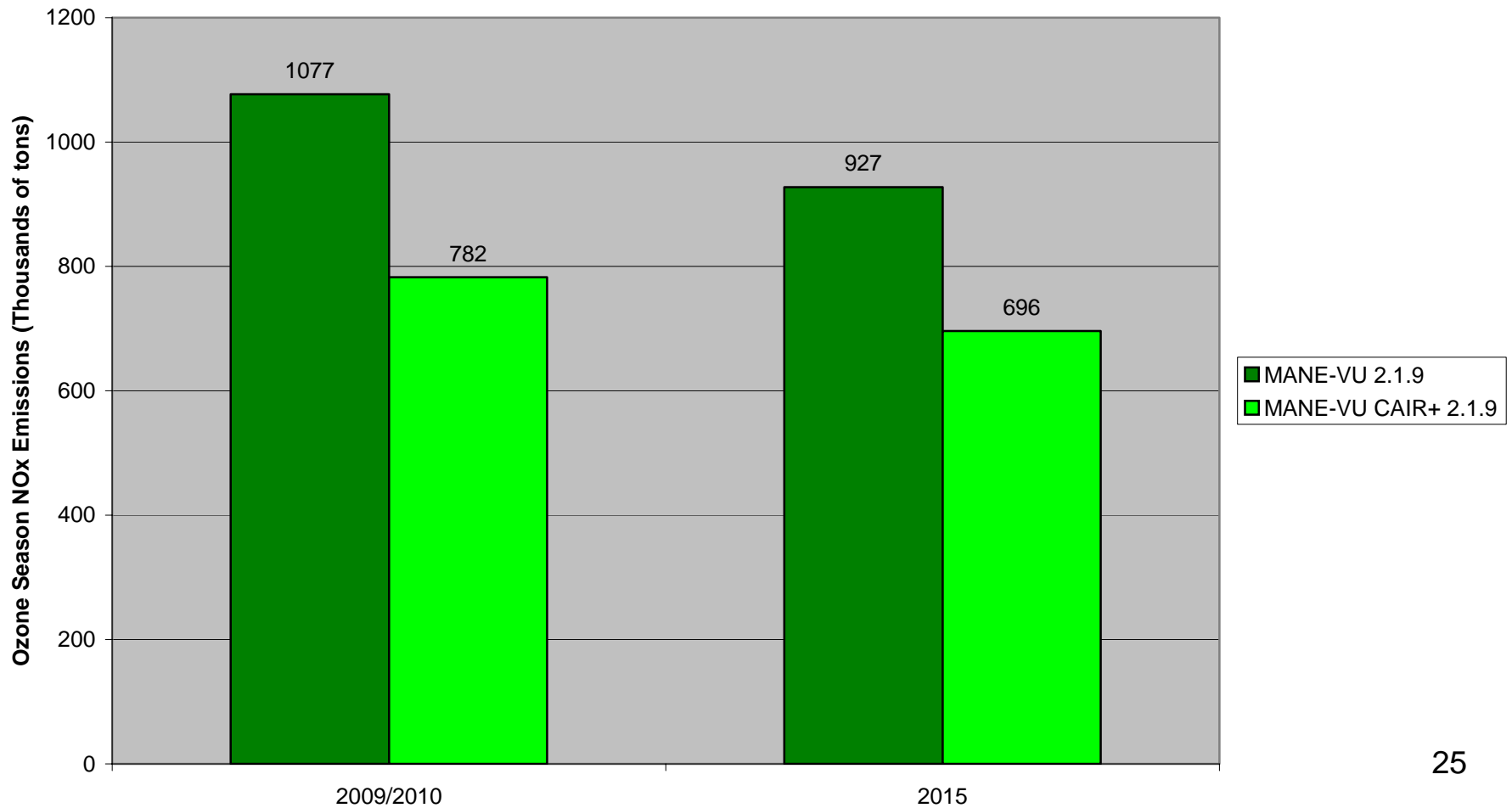
Midwest RPO IPM Annual NO_x Emissions CAIR versus CAIR Plus Comparison



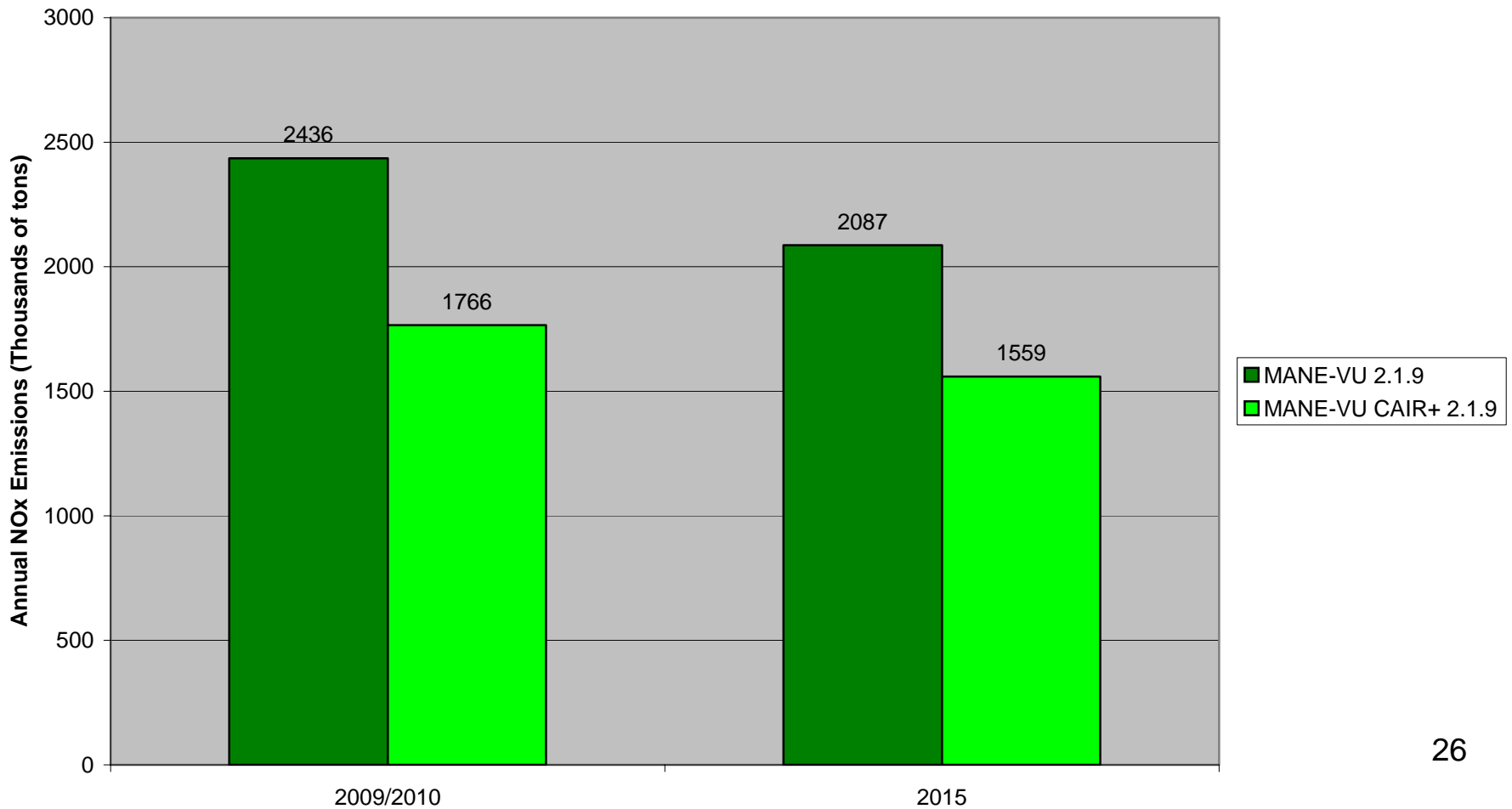
Midwest RPO IPM Annual SO₂ Emissions CAIR versus CAIR Plus Comparison



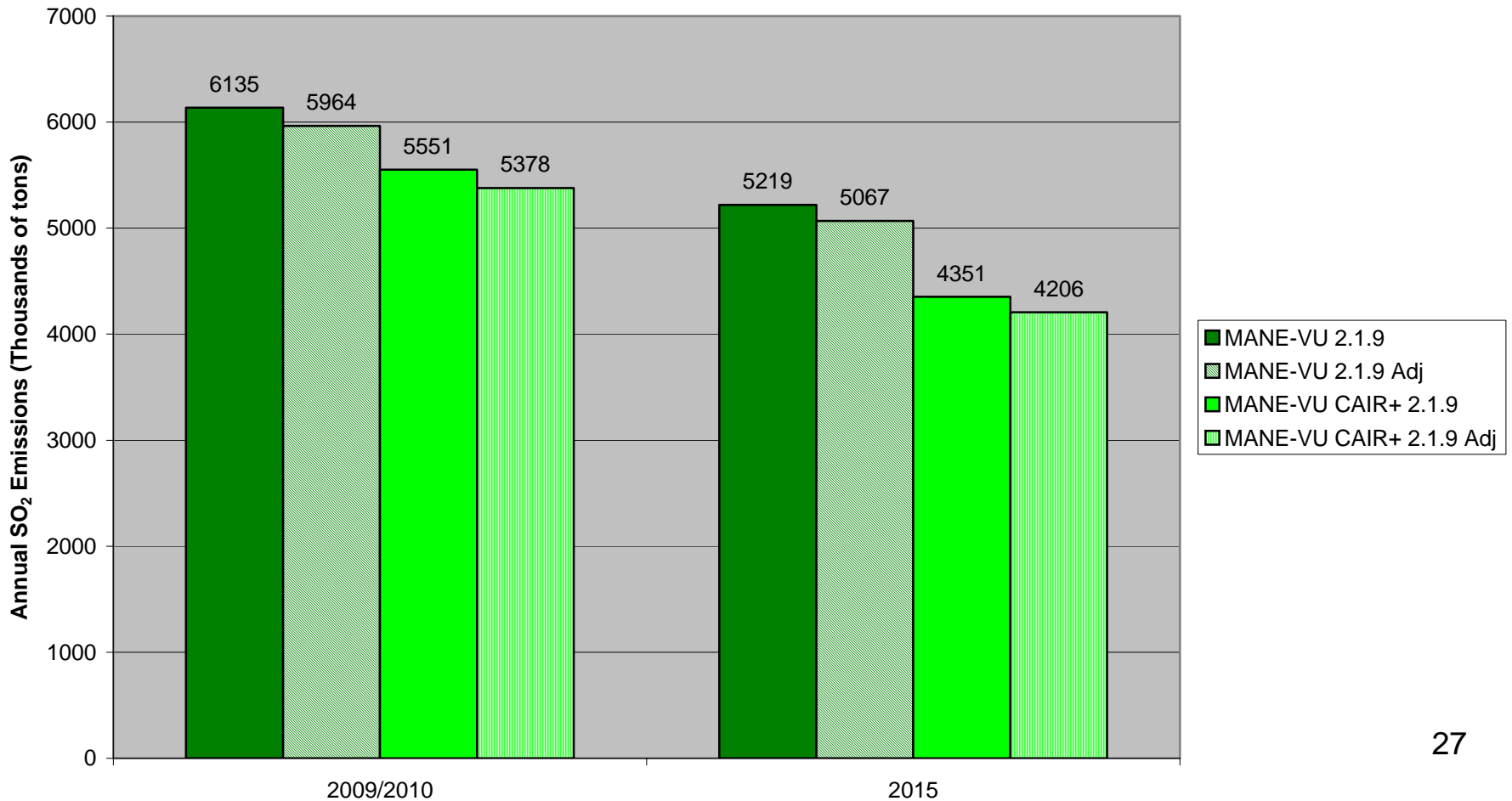
USA Total IPM Ozone Season NO_x Emissions CAIR versus CAIR Plus Comparison



USA Total IPM Annual NOx Emissions CAIR versus CAIR Plus Comparison



USA Total IPM Annual SO₂ Emissions CAIR versus CAIR Plus Comparison



Comparative Analysis Projected Costs

- In comparing the CAIR Base Case with the CAIR Plus scenario, the annual incremental costs* increase by less than 5%:
 - \$4.4 billion (+3.9%) in 2009
 - \$2.6 billion (+2.1%) in 2018
- Incremental benefits (2004 est)
 - Approximately 40% reduction throughout the Domain
 - Increase in health benefits (based on 2004 IPM Work) by about
 - \$40-60 Billion in 2010
 - \$70-100 Billion in 2018

*Costs include the capital costs of new investment decisions, fuel costs and the power plant operation and maintenance costs