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Summary of Preliminary IPM Results State Collaborative / "CAIR Plus" Test Run

Ozone Transport Commission Fall Meeting

November 15, 2006

Richmond, Virginia

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IPM Modeling Work to inform State Collaborative/ “CAIR Plus” effort

- Assumptions
- Policy Scenario & Base Case
- Comparative Results

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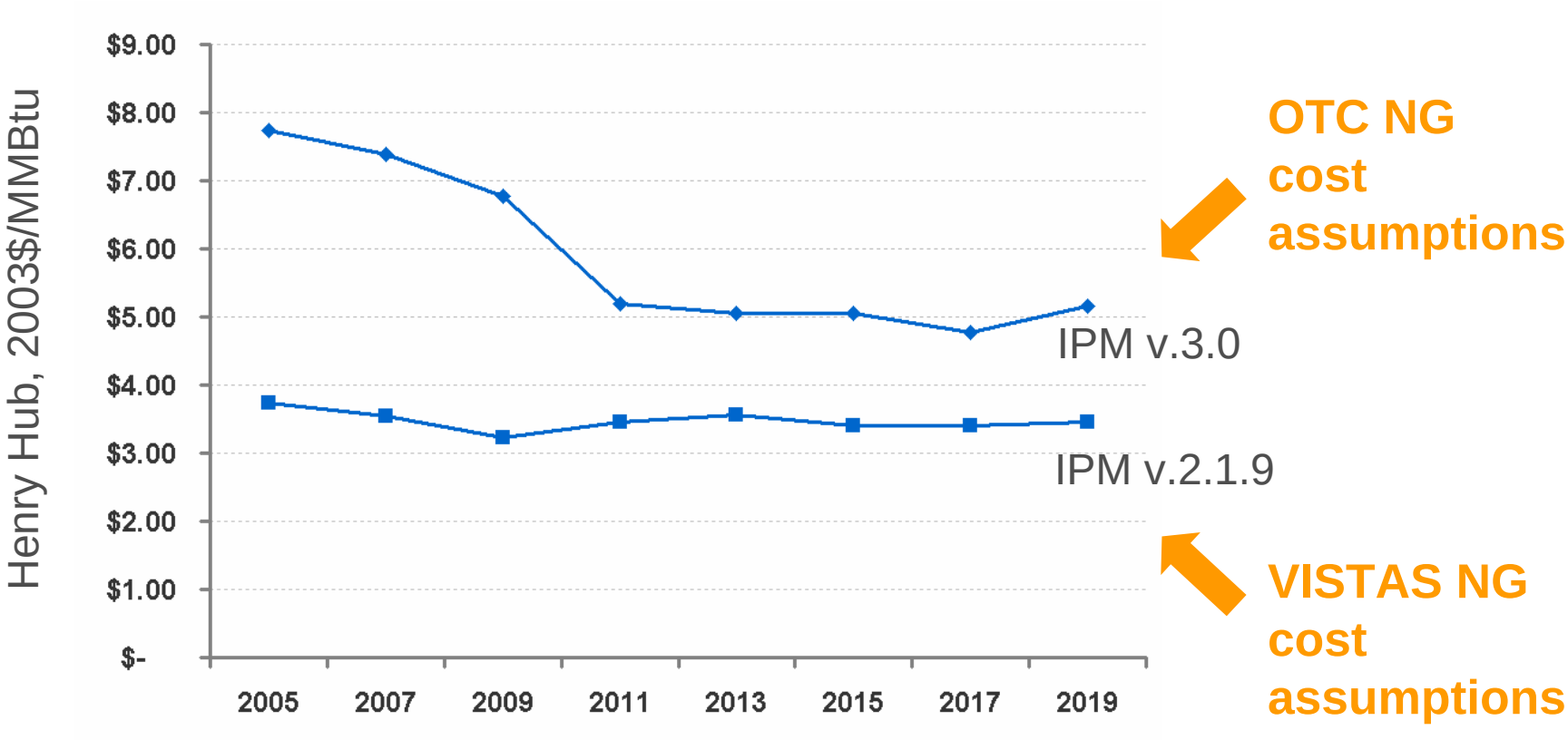
Assumptions Overview

- The OTC based its CAIR-plus analysis on IPM Version 2.1.9 with (1) updated natural gas prices, (2) updated oil prices, (3) a larger SO_2 bank in 2007, and (4) additional constraints on FGD and SCR installations in the first few years of the program.
- Ideally, a Base Case would be modeled with the same set of assumptions used in the OTC CAIR-plus analysis.
  - This is being done now
- For now the CAIR-plus analysis will be compared with a VISTAS's CAIR run and EPA CAIR run based on IPM Version 2.1.9.
- On November 9, 2006, EPA released IPM Version 3.0 with major revisions to the model.
  - Alternative Run: EPA/OTC Run "CAIR Plus" Policy Run with new base case.

The OTC used updated natural gas prices in its modeling consistent with IPM v.3.0.



Source: Technical Background Paper on the Development of Natural Gas Supply Curves for EPA Base Case 2006, v.3.0 & Appendix 8-2. Technical Background Paper on the Development of Natural Gas Supply Curves for EPA Base Case 2004, v.2.1.9

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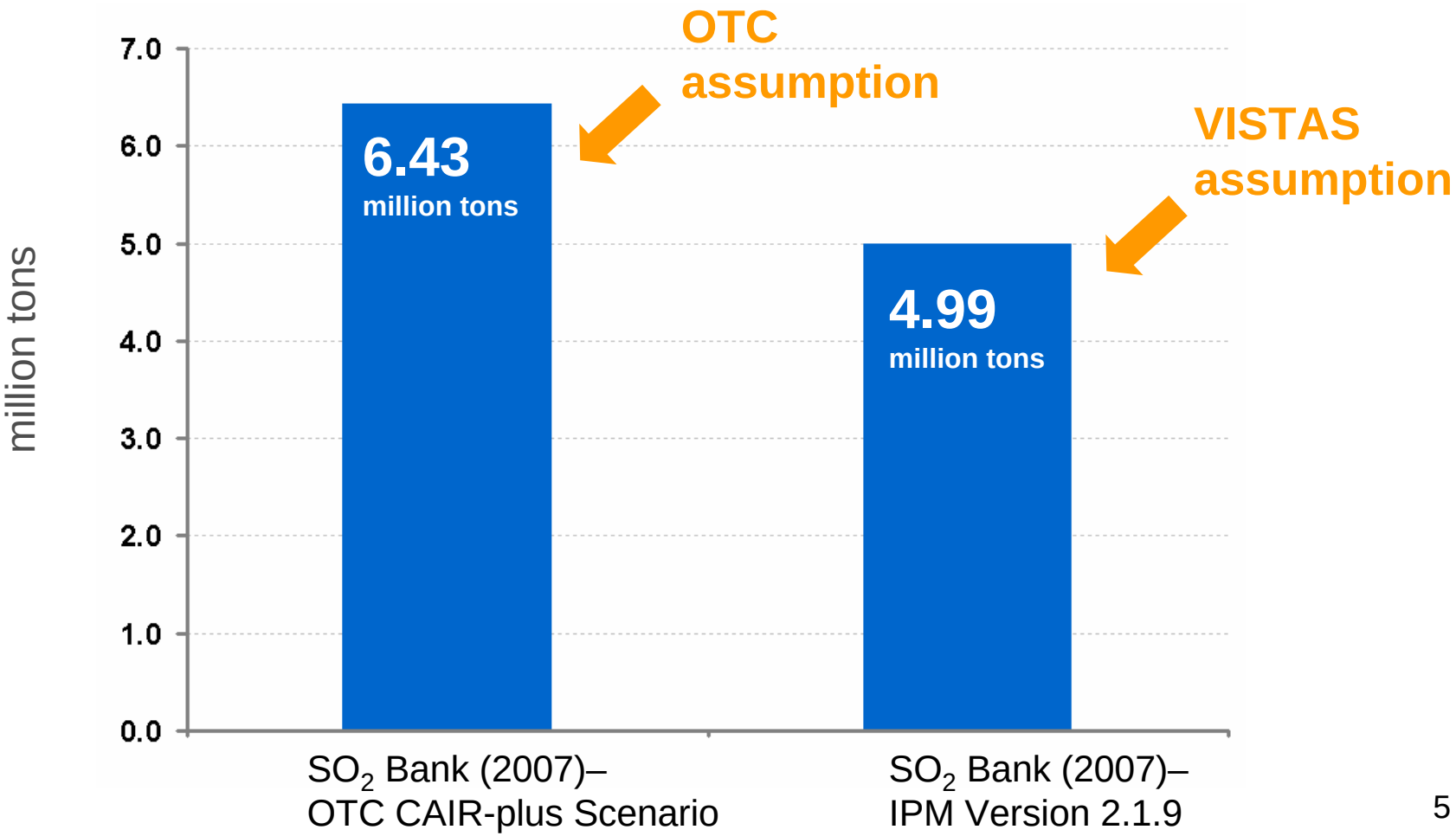
The OTC used updated information regarding the size of the SO_2 allowance bank.



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Constraints on pollution control equipment installations

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

*OTC constraints based on recommendations by ICF Consulting.

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IPM Version 2.1.9 has been used to model various environmental policies:

- The Clean Power Act (Jeffords, S.150 in 109th)
- The Clean Air Planning Act (Carper, S.843 in 108th)
- The Clear Skies Act of 2005 (Inhofe, S.131 in 109th)
- The Clear Skies Act of 2003 (Inhofe, S.485 in 108th)
- The Clear Skies Act of 2005 (Manager's Mark of S.131 in 109th)
- The Clean Air Interstate Rule, The Clear Air Mercury Rule, and The Clean Air Visibility Rule (EPA promulgated rules, 2005)

Note: EPA released IPM Version 3.0 on November 9, 2006, including substantial revisions to the models underlying assumptions.

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POLICY SCENARIO & BASE CASE

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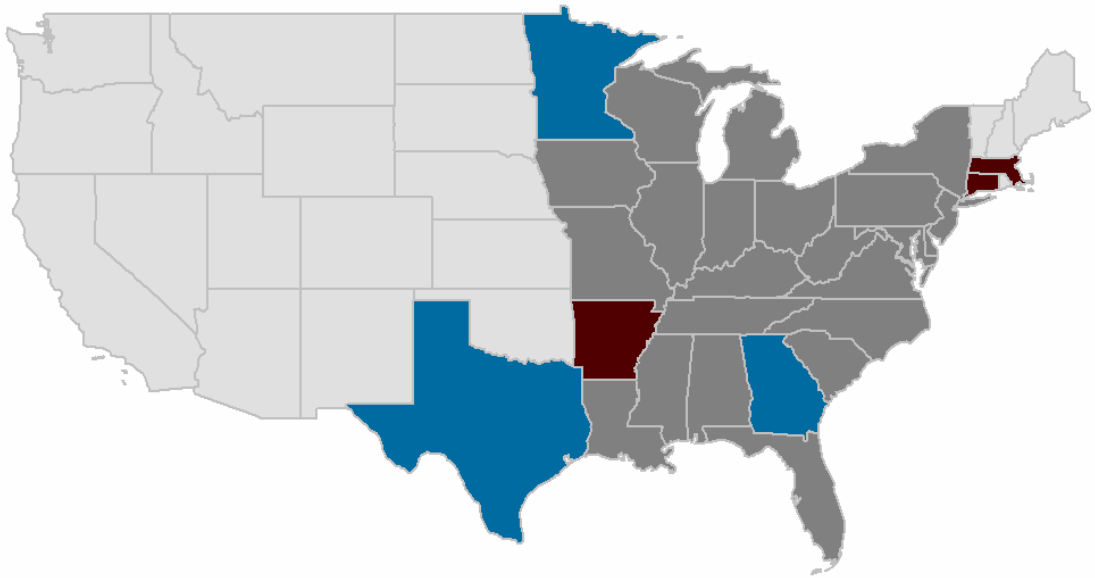
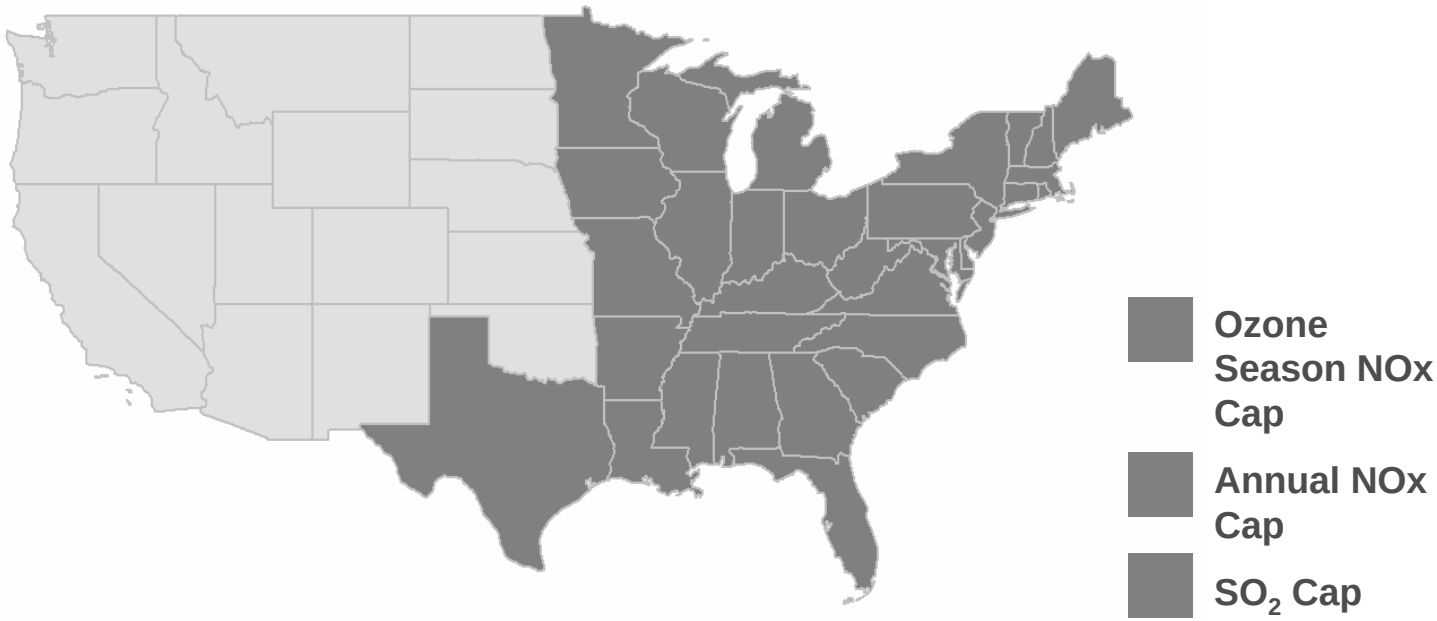
CAIR Modeling Domain



Note: VISTAS excluded NJ and DE from its CAIR run

- **Ozone Season NOx cap, Annual NOx Cap, SO_2 Cap**
- **Ozone Season NOx cap only**
- **SO_2 Cap and Annual NOx Cap only**

OTC CAIR-plus Modeling Domain



Basis for Annual and Ozone Season NOx Caps

OTC CAIR-plus Policy 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

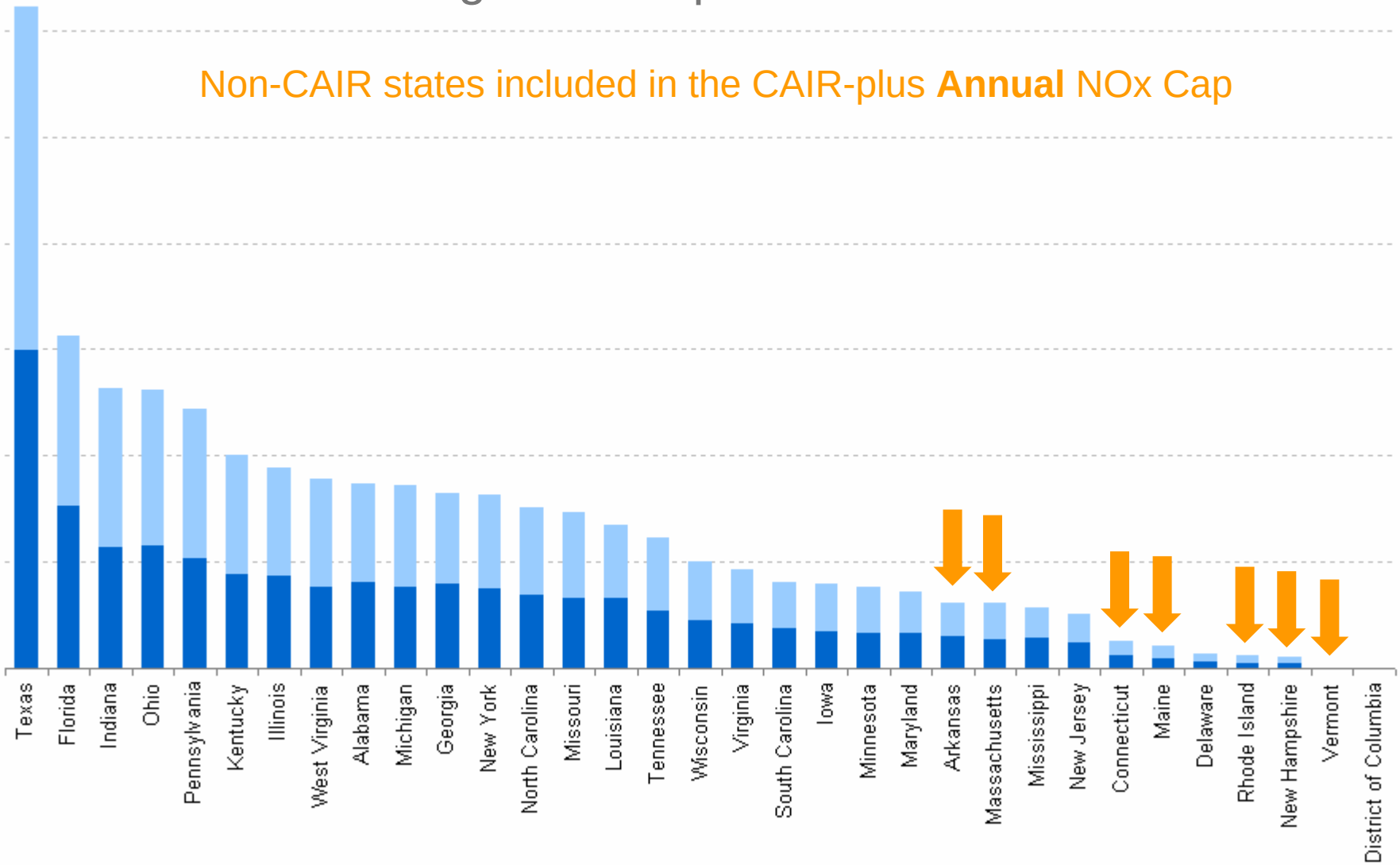
- **2010** = 0.15 lbs/MMBtu
- **2015 and beyond** = 0.125 lbs/MMBtu

X

Current Heat Input

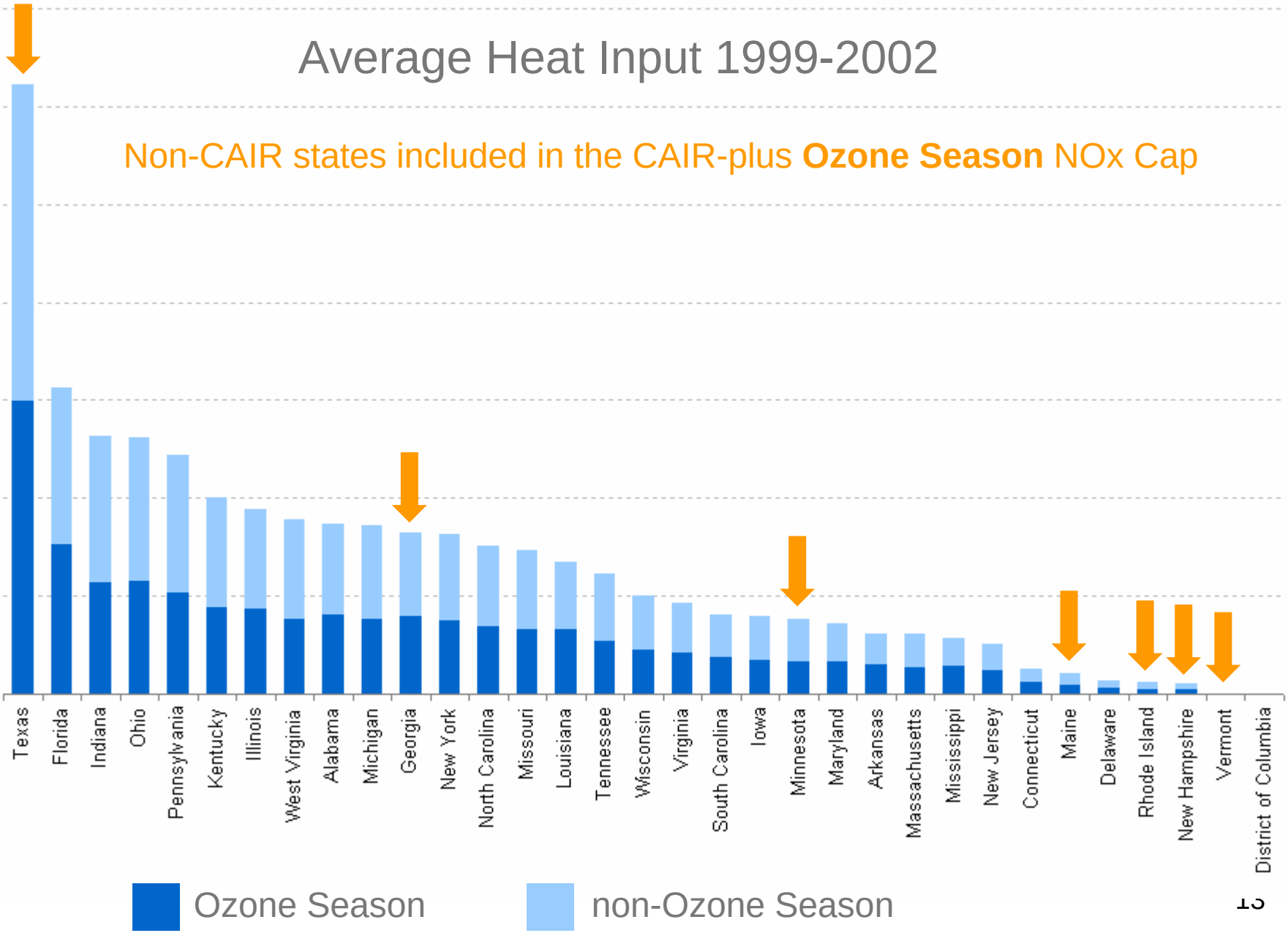
Average Heat Input 1999-2002

Non-CAIR states included in the CAIR-plus **Annual** NOx Cap



Average Heat Input 1999-2002

Non-CAIR states included in the CAIR-plus **Ozone Season** NOx Cap



SO_2 Caps

OTC CAIR-plus Policy Scenario

SO_2 Retirement Ratios

- **2010** - 2.5 (60% reduction)
- **2012** – 2.94 (66% reduction)
- **2015** – 3.57 (72% reduction)
- **2018** – 4.16 (76% reduction)

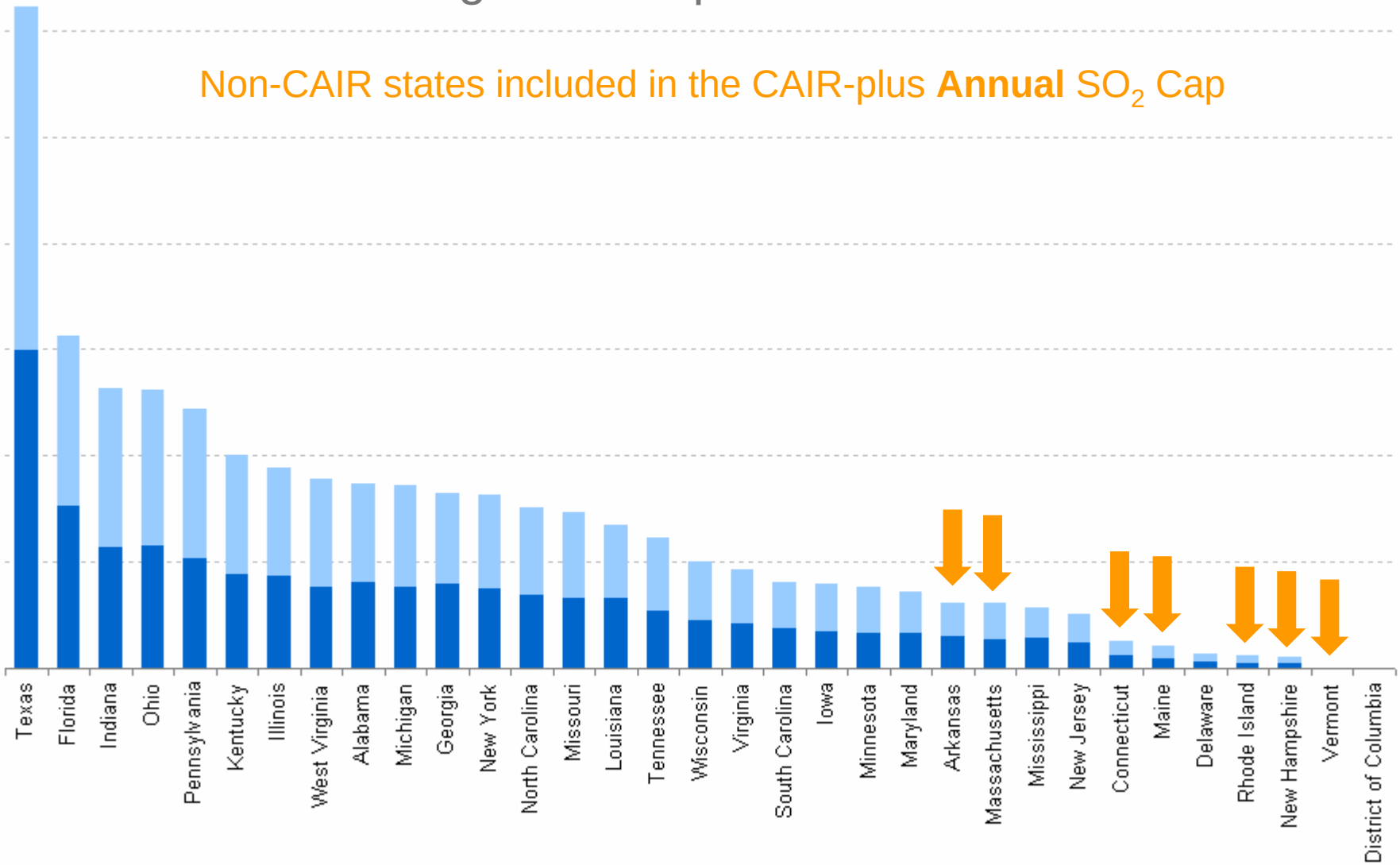
CAIR Policy Scenario

SO_2 Retirement Ratios

- **2010** - 2.0 (50% reduction)
- **2018** – 2.86 (65% reduction)

Average Heat Input 1999-2002

Non-CAIR states included in the CAIR-plus **Annual** SO_2 Cap



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COMPARATIVE RESULTS

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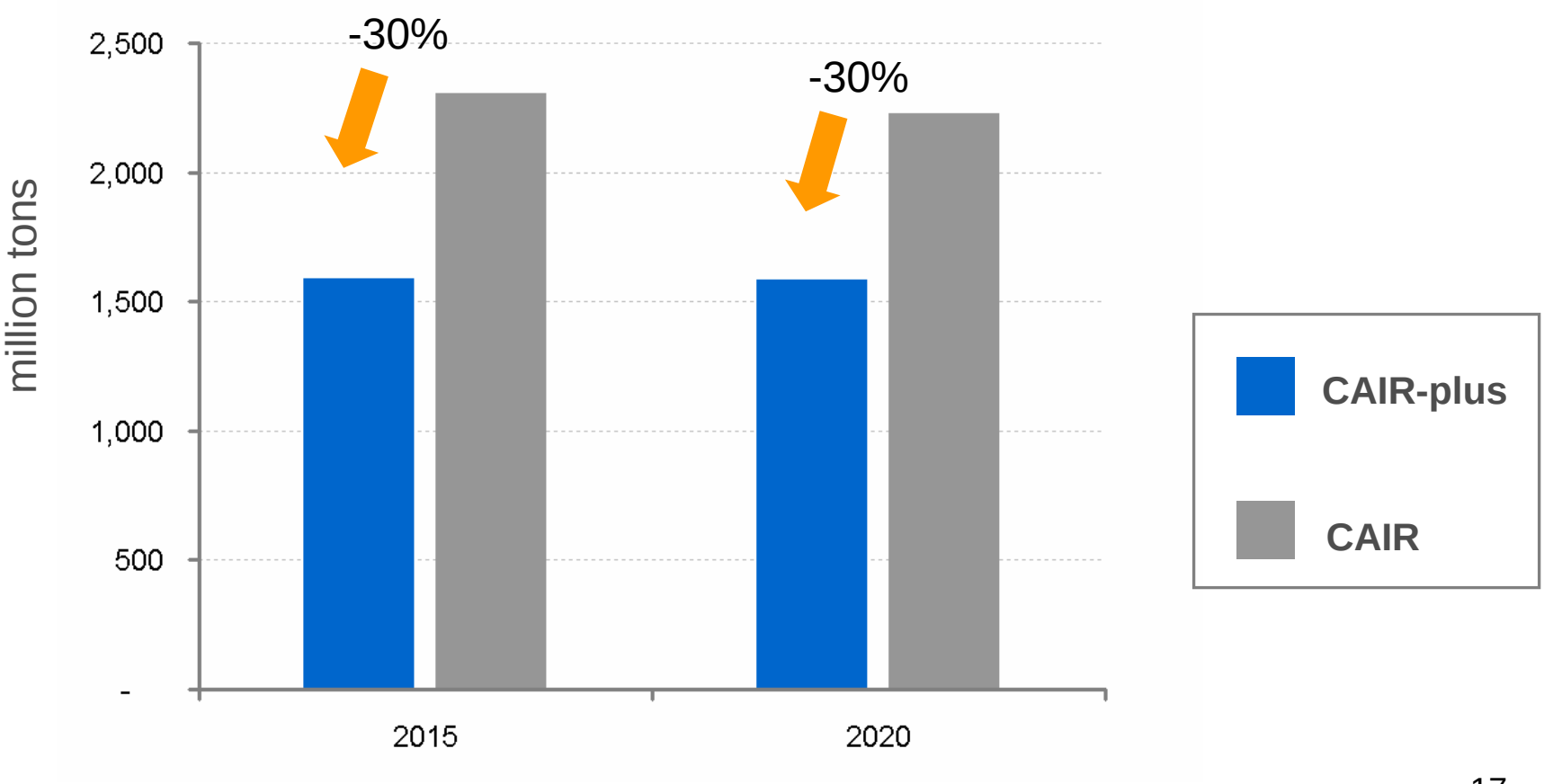
NOx Emissions: CAIR-plus versus VISTAS CAIR Scenario



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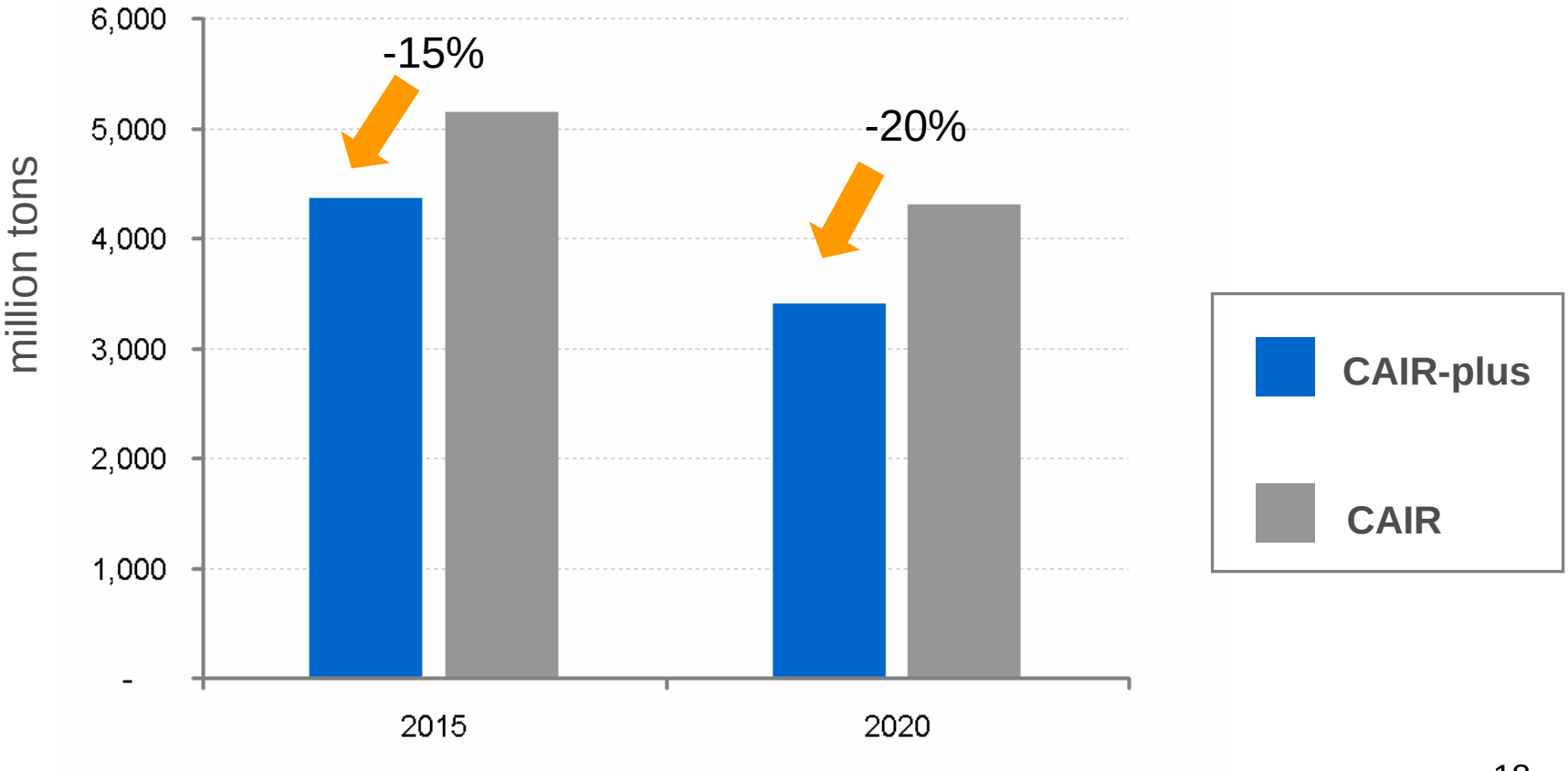
SO_2 Emissions: CAIR-plus versus VISTAS CAIR Scenario



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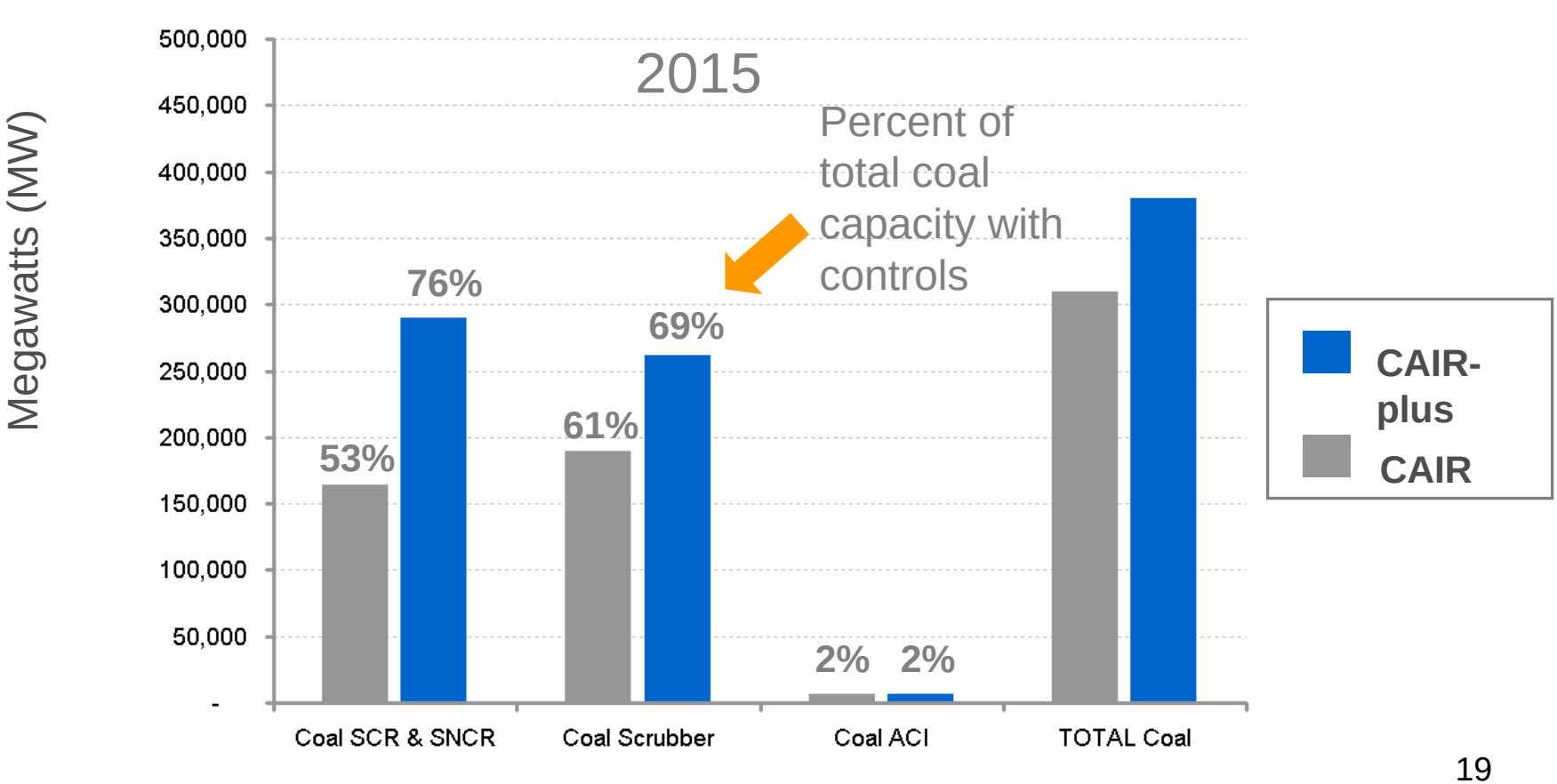
2015 Pollution Control Equipment: CAIR-plus versus VISTAS CAIR Scenario



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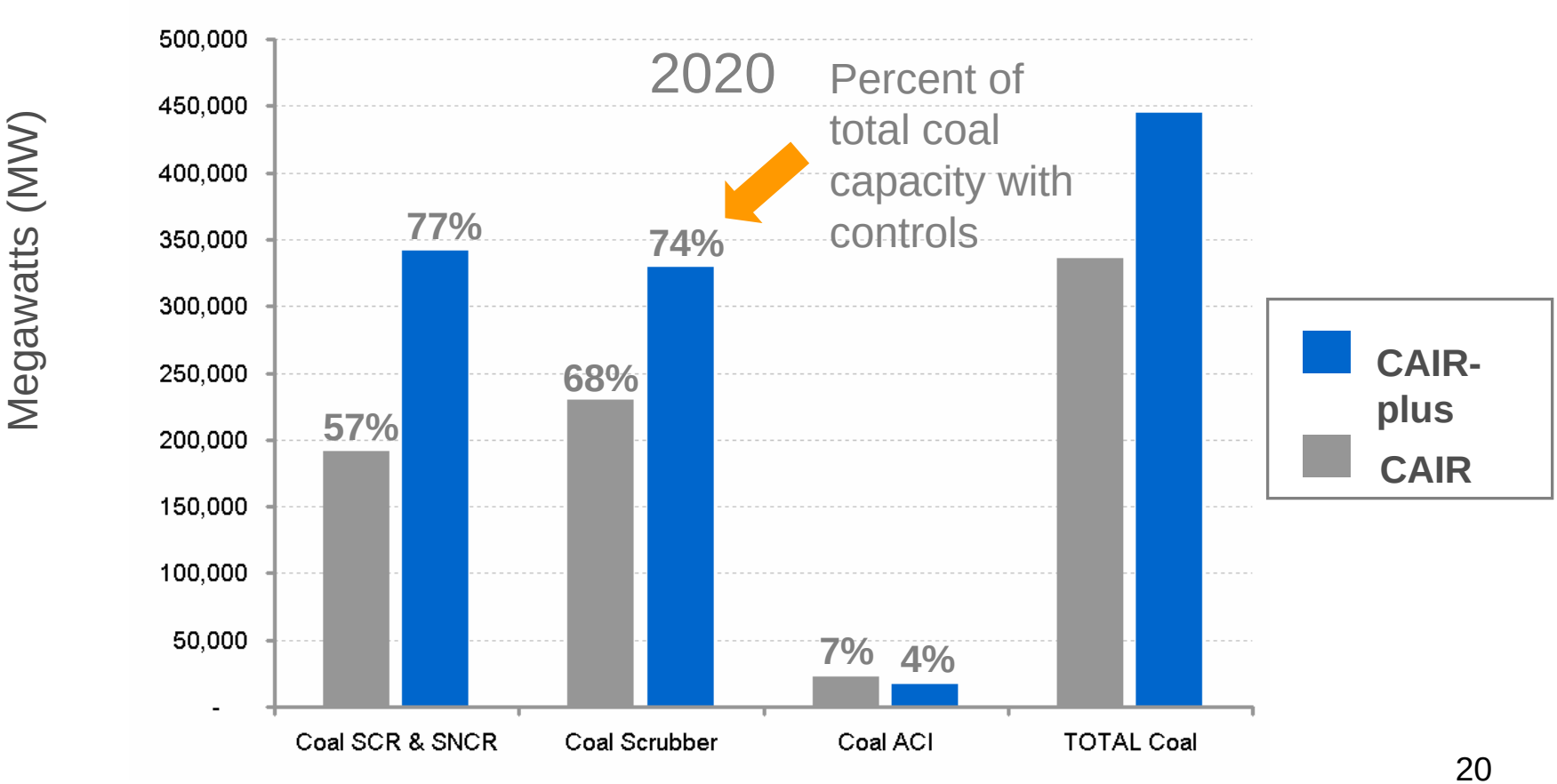
2020 Pollution Control Equipment: CAIR-plus versus VISTAS CAIR Scenario



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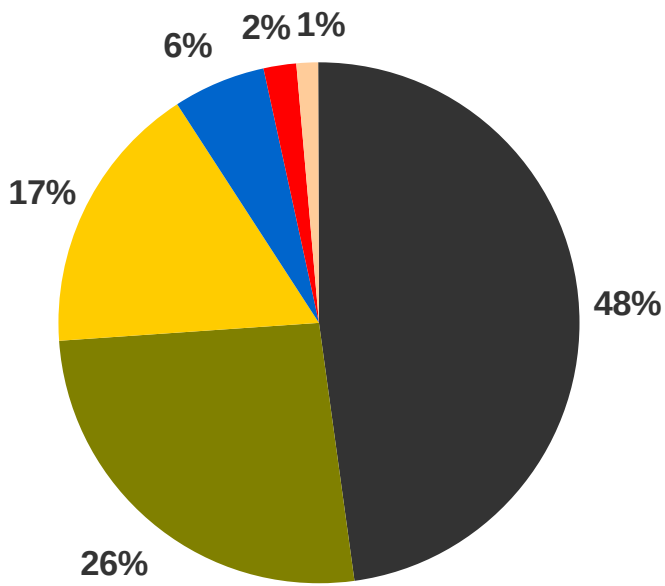
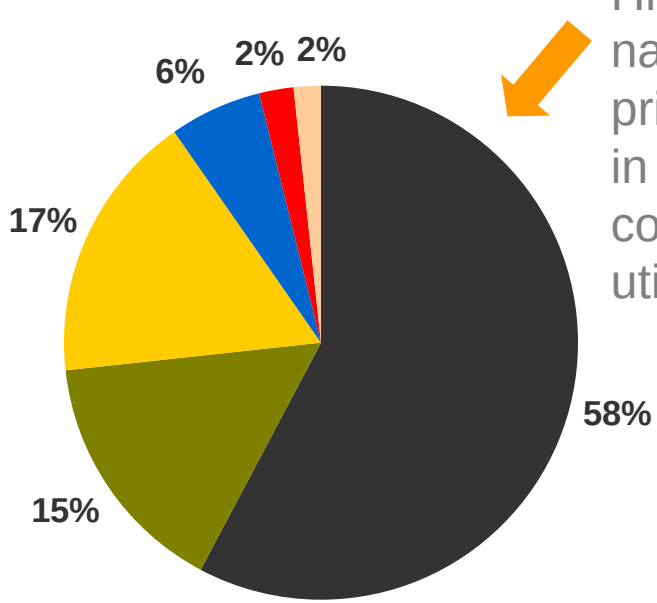
2015 Generation Fuel Mix (Gwh): CAIR-plus versus VISTAS CAIR Scenario

CAIR



CAIR-plus

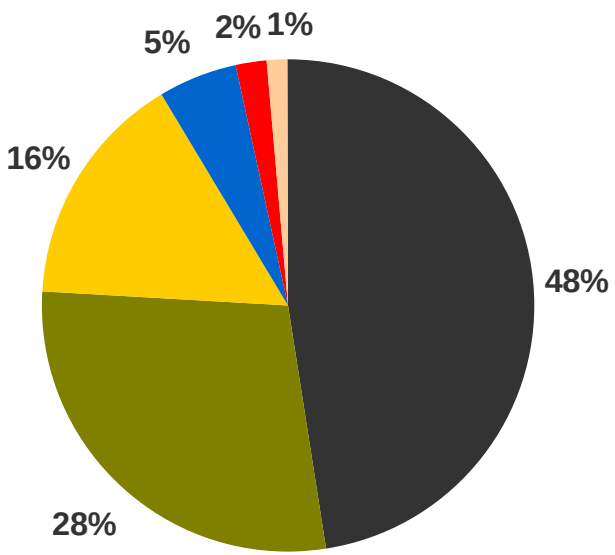


Higher natural gas prices result in higher coal utilization

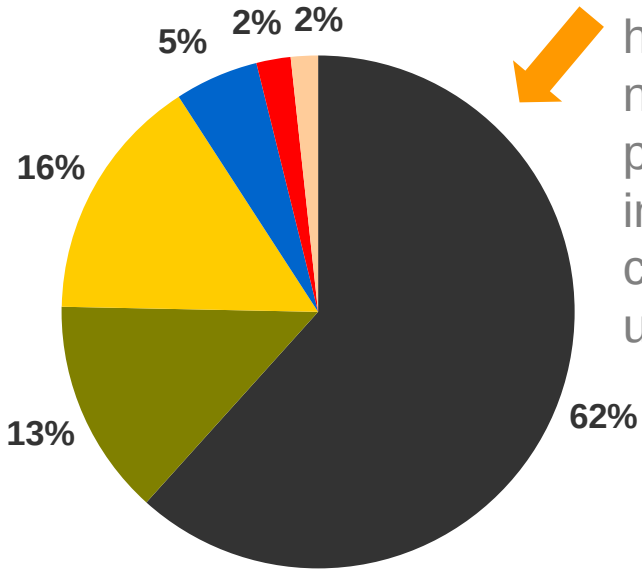
Coal | Oil/Natural Gas | Nuclear | Hydro | Renewables | Other

2020 Generation Fuel Mix (Gwh): CAIR-plus versus VISTAS CAIR Scenario

CAIR



CAIR-plus



Again, higher natural gas prices result in higher coal utilization

Coal | Oil/Natural Gas | Nuclear | Hydro | Renewables | Other

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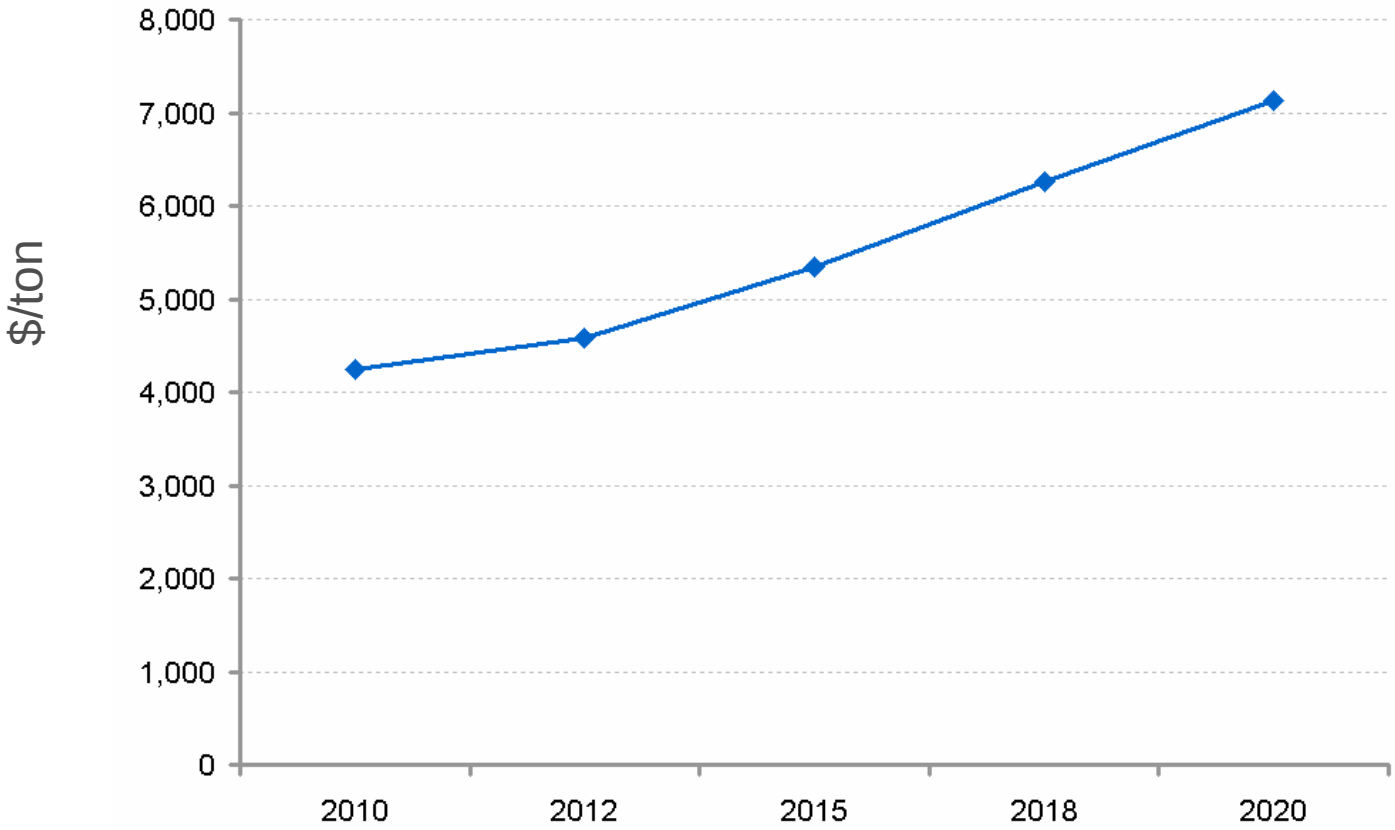
NOx Allowance Price Forecast: CAIR-plus



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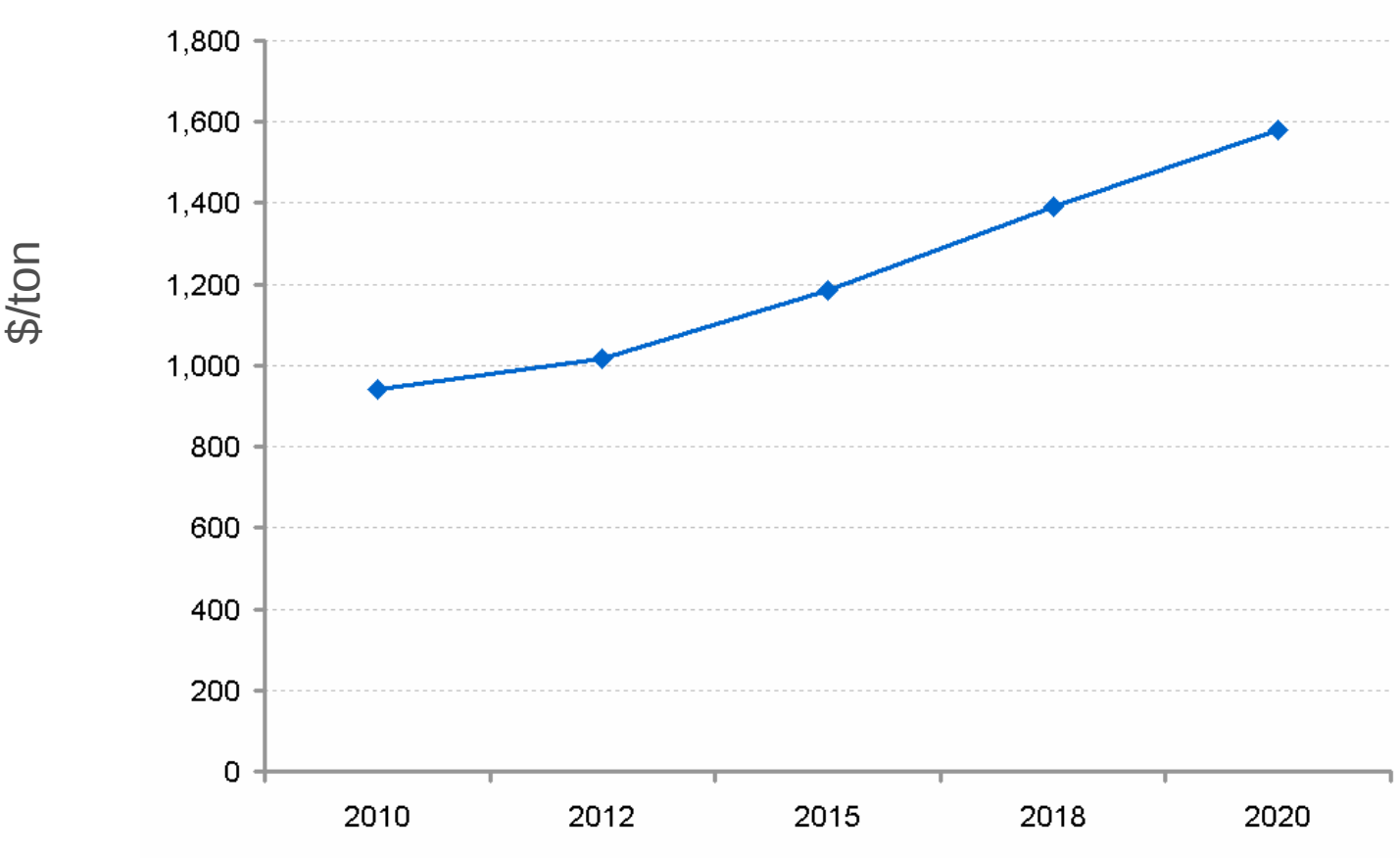
SO_2 Allowance Price Forecast: CAIR-plus



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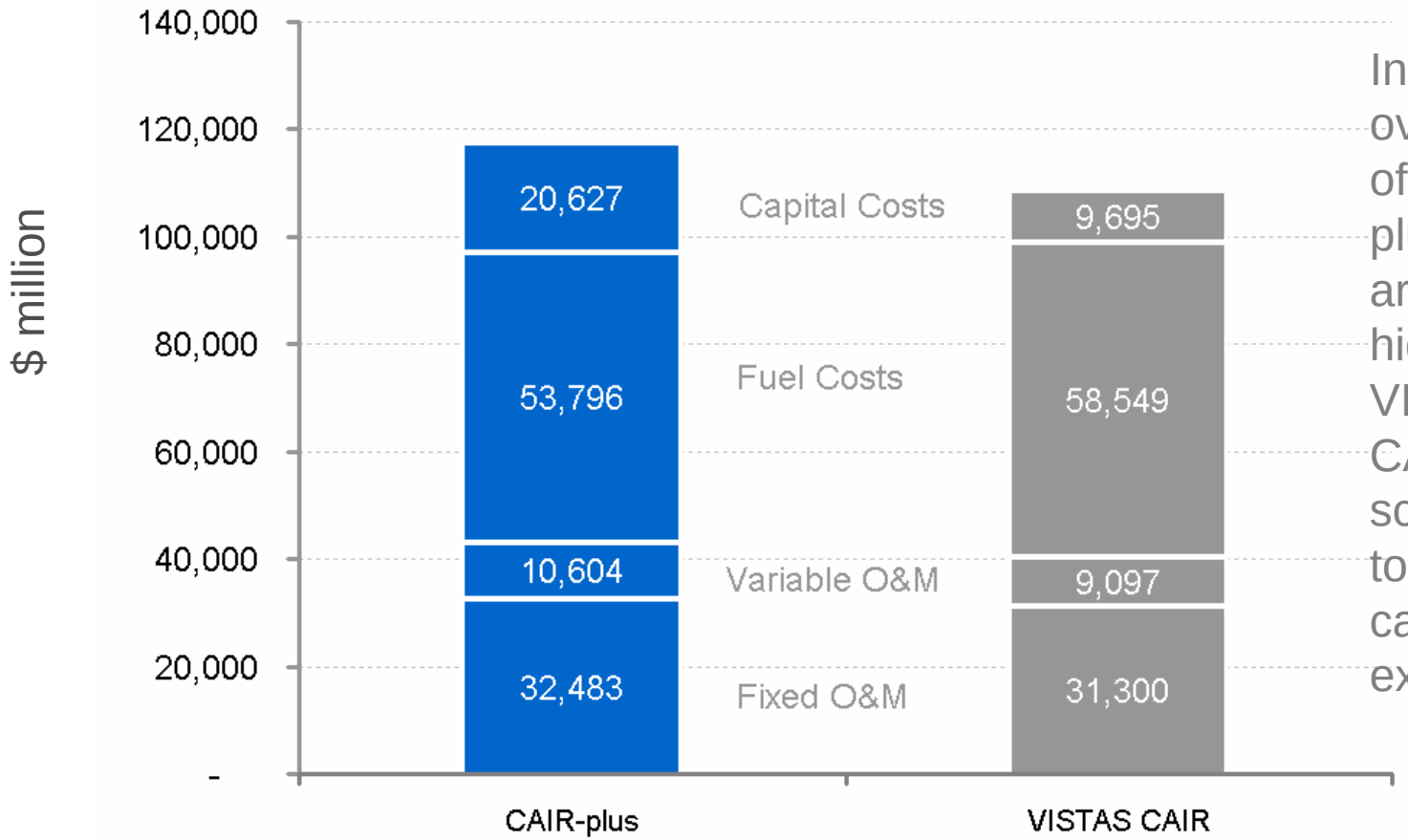
2015 Electric Power Industry Costs: CAIR-plus versus VISTAS CAIR Scenario



In 2015, the overall costs of the CAIR-plus policy are 8% higher than VISTAS CAIR scenario due to higher capital expenditures

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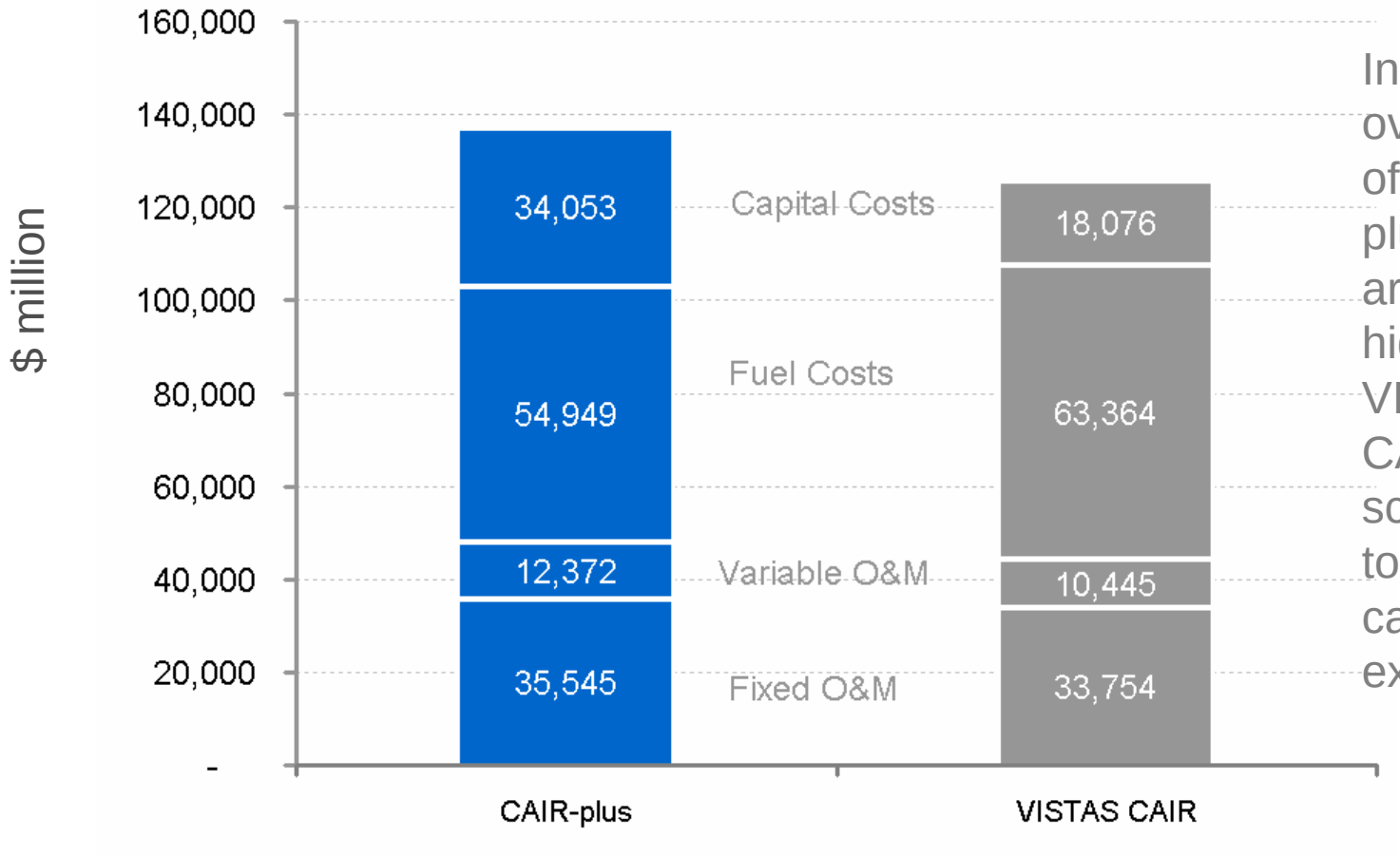
2020 Electric Power Industry Costs: CAIR-plus versus VISTAS CAIR Scenario



In 2020, the overall costs of the CAIR-plus policy are 9% higher than VISTAS CAIR scenario due to higher capital expenditures