F-GHG Emission Reductions A Decade of Progress through Voluntary Partnerships

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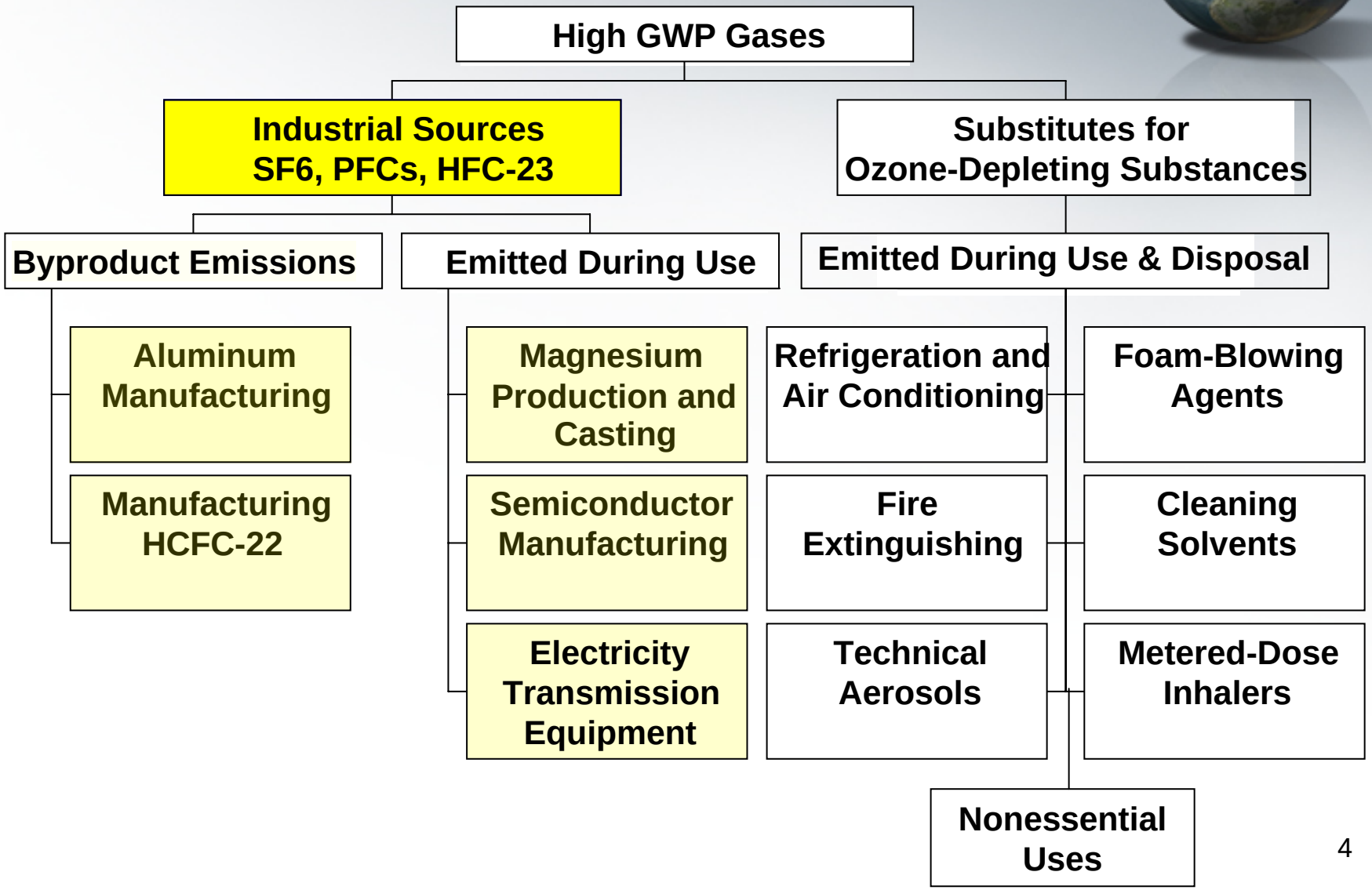
Overview

- Background on EPA Voluntary Partnerships
  - How and why they work
- Benchmark Sector Progress
  - Opportunities for further reductions and trends
- Current US Policy Developments Affecting the Future
  - EPA GHG Mandatory Reporting Rule
  - EPA Endangerment Finding
  - Congressional Activity - HR2454
- Conclusions

EPA Voluntary Emission Reduction Partnerships for PFCs, SF_6 and HFC-23

- Formed between 1995-1999 between EPA and industry
- Collaborative, voluntary agreements between EPA and companies
- Designed to cost-effectively reduce emissions
- Partners are encouraged to implement practices that are economically and technically feasible
- Each partnership has resulted in:
  - Well defined inventory methods
  - Advancing emission reduction knowledge and methods
  - Overall cost savings - improved efficiency and sector-wide collaboration
  - Motivation for—and achievement of—climate protection

Sector-specifc Partnerships



F-GHG Partnership Goals

- Accelerate cost-effective, technically feasible emission reductions
  - Profile emissions: why, how much, where, when
  - Information sharing: technical conferences, articles, government forums
  - Get results: emission reduction goals, global catalyst

High GWP Partnership Roadmap

- **Study Sector**
  - Determine sources, estimate emissions
  - Identify key companies, stakeholders, associations
- **Industry Outreach**
  - Climate change and cooperative opportunities
- **Craft Agreement**
  - Collaborative and iterative process
- **Establish Climate Protection Goal**
  - Company-specific and/or Partnership
- **Identify and Implement Appropriate Technologies**
  - Pollution Prevention approach
- **Recognize and Celebrate Success**
  - Awards, publications, information sharing

Voluntary Strategy

- Use pollution prevention hierarchy
  - optimization, substitutes, recovery/recycle, abatement
- Joint research and disclosure
  - government and industry identify priorities
- Set technically aggressive goals
  - technical optimism
  - motivate chemical & equipment suppliers
- QA/QC data
  - real progress

Memorandum of Understanding

- Define purpose and scope of partnership
- Identify EPA and partner responsibilities
- Establish emission estimation method
- Common elements but tailored to each sector

Voluntary 10+ Years Lessons Learned

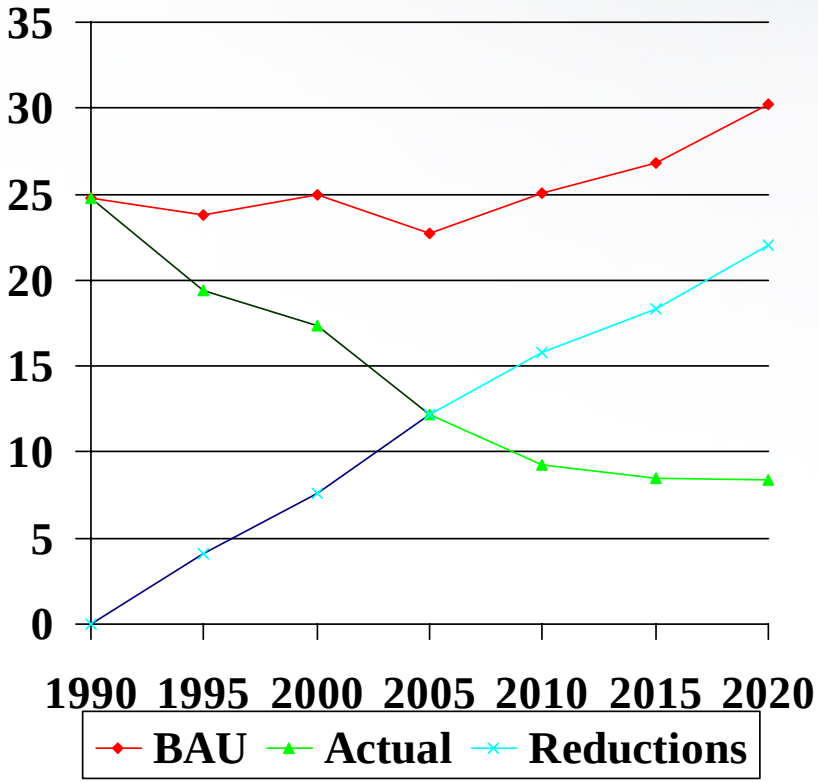
- Voluntary has worked
  - Significant reductions achieved in absence of regulation
- Targets important
  - Motivate and serve as focal point
- Industry leaders essential
  - Individual champions and leader companies save day

Emission Reduction Pathways

- PFCs from Primary Aluminum
  - Process optimization, technology retrofits, automation of AE termination
- HFC-23 from HCFC-22
  - Process optimization, Thermal abatement
- Electric Power Equipment
  - Best practices, replace old equipment
- Electronics
  - Abatement, process optimization, more efficient chemicals

Very low emissions technically feasible in all sectors

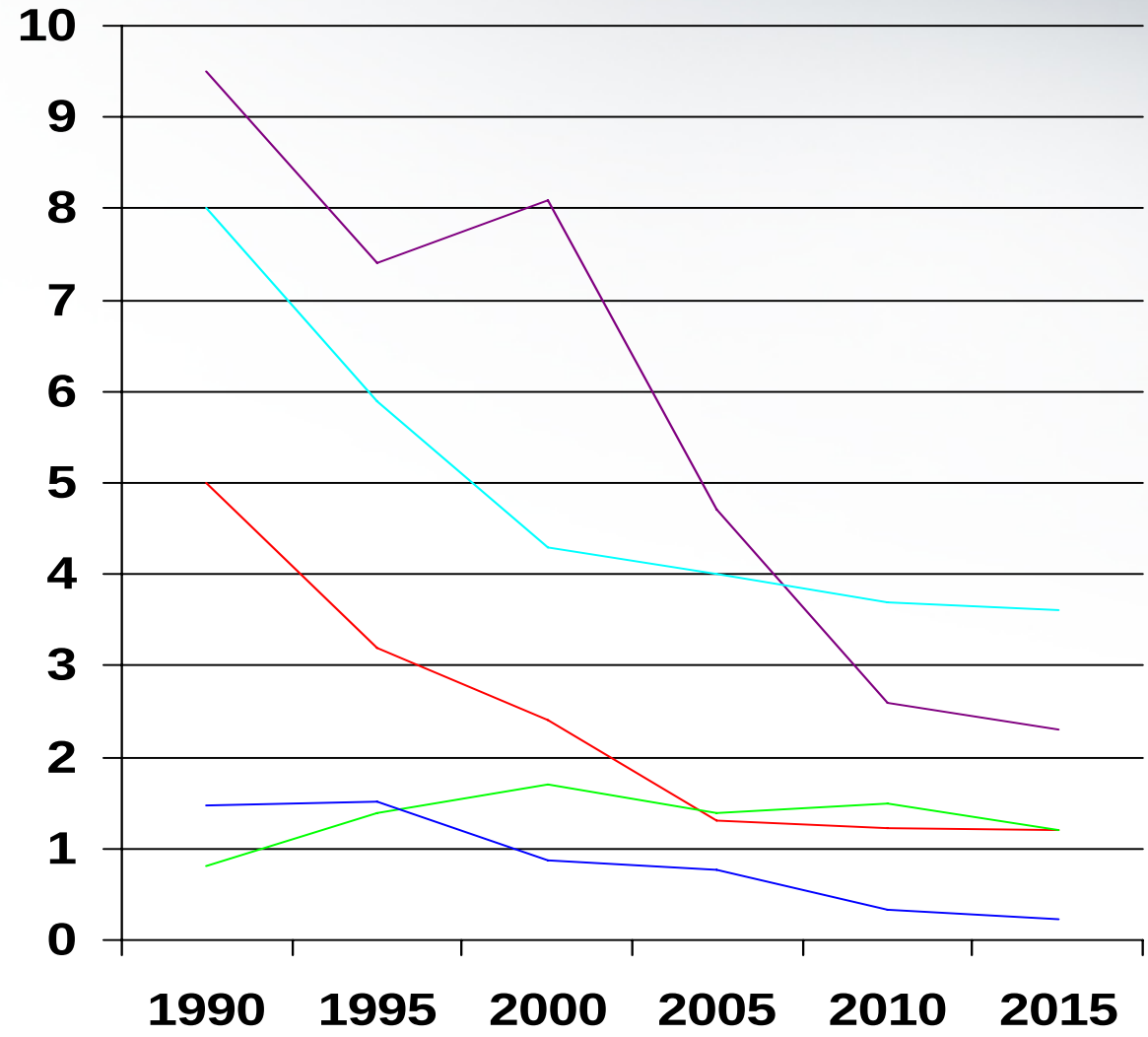
U.S. High GWP Partnerships (MtCO2eq)



Avoid BAU growth

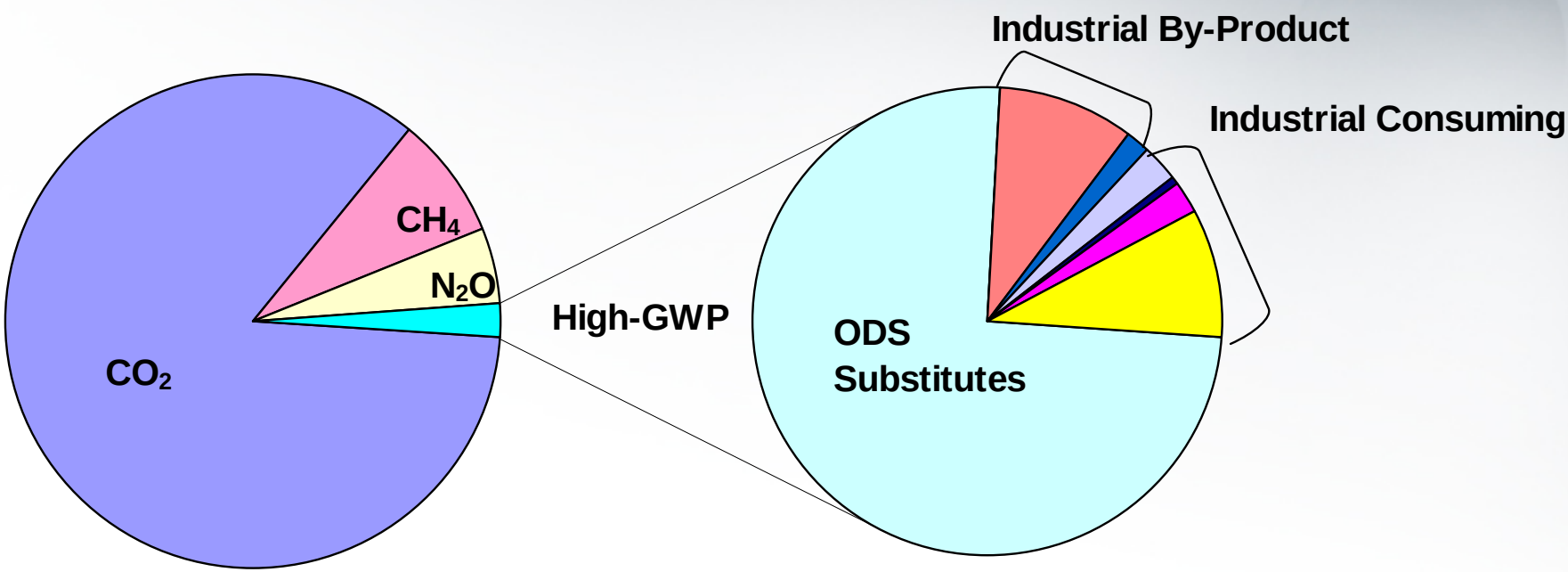
- Significant progress
- Global leadership
- More reductions to come:
  - 48.8 MMTCO2 in ‘08
  - 57.9 MMTCO2 in ’10
  - Beyond 2010? Price signal?

Sector Trends: Emissions (MtCeq)



Source: Actual & CAR 2005

U.S. GHG Emissions (2006)



7054 $MtCO_2e$

148 $MtCO_2e$

Sector Trends and Highlights

- Aluminum
- Electric Power Systems
- Semiconductors
- Magnesium
- HCFC-22 Production

No or very low emissions technically feasible in all sectors

PFCs from Primary Aluminum

- Emission reductions
  - Process optimization, technology retrofits, automation of AE termination, training
- 100% Participation by US Industry
  - Pioneered PFC measurements and inventory methods
- Collaboration with International Aluminium Institute
  - EPA/IAI Standard PFC Measurement Protocol
  - Very low AEF demonstrated for all technology types

HFC-23 from HCFC-22

- By-product emissions
  - Process optimization, Thermal abatement
- 100% Participation by US Industry
- Extensive auditing completed to verify reductions and support inventory methods
- Reduced emissions by 64% from 1990 to 2006

F-GHGs in Electronics Sector

- Uses PFCs, NF3, HFCs and SF6
  - Cleaning vapor deposition tools and etchants
  - Different products use different mixes of gases
  - Companies have unique and highly proprietary “recipes”
- Processes “consume” some of the F-GHG
  - What goes in does not come out
  - Different rates for different gases
- Abatement technically feasible but expensive and energy intensive
- US Partnership pioneered use of NF3
  - Significantly higher process efficiency
- Very high grow sectors: semiconductors, FPD, photovoltaic
- US voluntary partnership catalyzed global voluntary emission reduction efforts
  - World Semiconductor Council
  - Flat Panel Display

SF6 in Electric Power Systems

- High voltage switchgear and gas insulated substations
  - SF_6 must be used in current grid design
- Knowledge and experience on emission reductions from voluntary program
  - Best practices, accelerated replacement of leaky equipment, recovery/recycling
- US industry has made good progress, can do more especially thru equipment replacement
  - Annual emissions rate reduced by 2/3 since 1999

SF_6 in Magnesium Production

- US Partnership goal to eliminate SF6 emissions by end of 2010
  - IMA has followed US lead with same goal
- Substitutes: SO_2, HFC-134a, Novec™
- US Partnership completed numerous melt protection studies on alternative cover gases to document technical feasibility and build confidence in substitutes
- Partnership phase out on schedule

Areas of Voluntary Focus for 2009 and Beyond

- Improve inventory tracking and reporting
  - High quality data
  - Methods sound but require well organized, rigorous systems
- Continue to explore and expand emission mitigation options
  - Identify new options, reduce costs
  - Extremely long atmospheric lifetimes
- Encourage sector-wide strategies and information sharing
  - Domestic and International
  - Complementary programs such as Asia Pacific Partnership Clean Development and Climate

US Policy Developments

- EPA GHG Mandatory Reporting Rule
- EPA Endangerment Finding
- Congressional Activity - HR2454

Conclusions – Moving Forward

- **Change is underway**
  - A lot of policy uncertainty, but strong focus on tackling climate change
- **F-GHG reductions are an important part of the climate protection**
  - Most potent greenhouse gases
  - Avoid irreversible impacts on climate
- Opportunity to act now
  - Technically feasible, cost-effective reductions available now
  - Minimize cost impacts of any future regulatory regime
- Full spectrum of policies and measures being considered
  - Using Partnerships to prepare for the future

Contacts and Resources

Thank you!

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