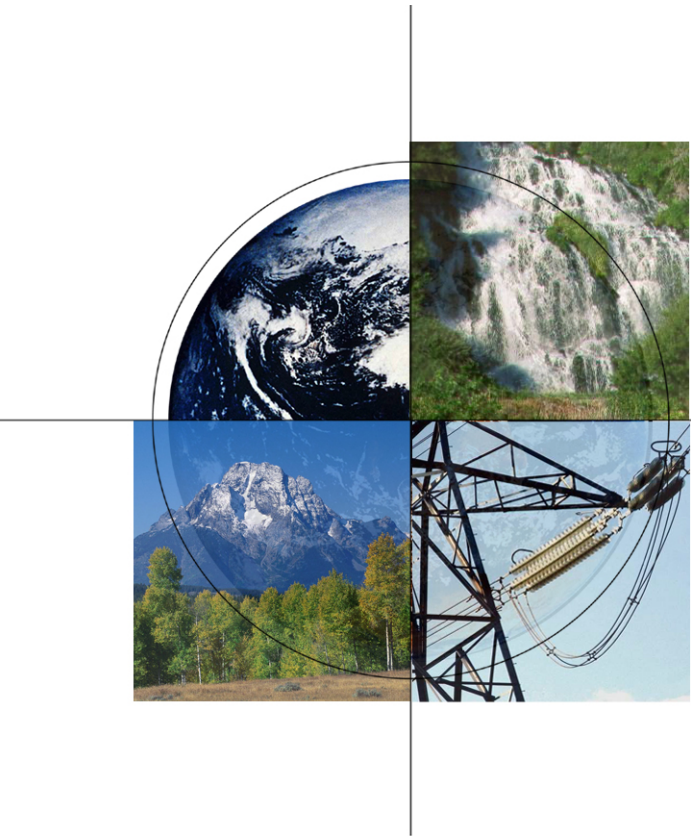
Mercury Emissions Control Technology– DOE's R&D Program



POWER-GEN International 2004 --

Hg Control – Coping with Regulatory Uncertainty

Orlando, FL
December 1, 2004

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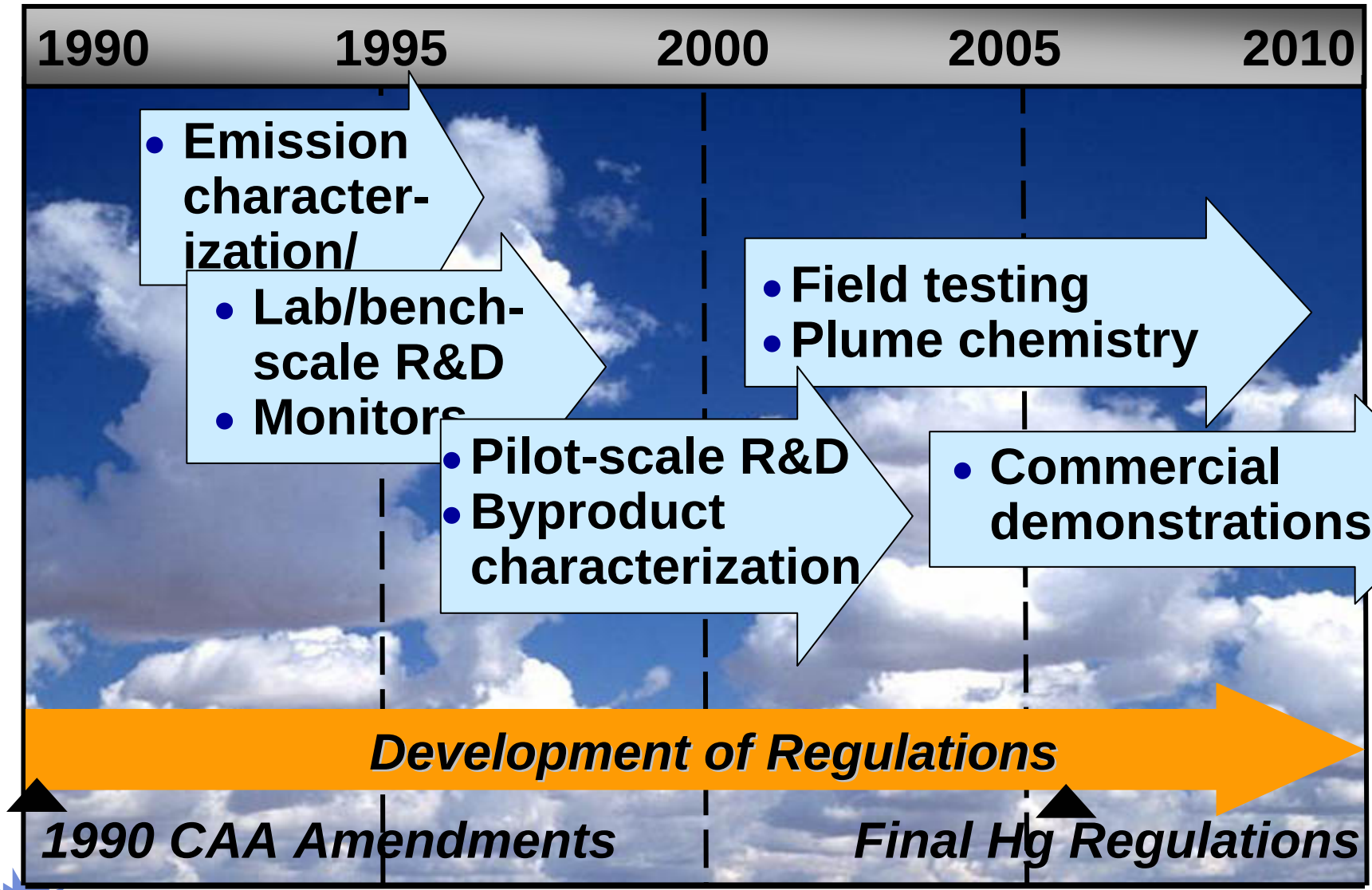
History of DOE/NETL Mercury RD&D



DOE Mercury Control RD&D Portfolio

Boiler
- Combustion modification
- Chemistry modification

Polishing Technology
- MerCAP™

Plume Chemistry
- Transport/ speciation

FGD Enhancements
- Oxidation catalysts
- Reagent addition
- Ultraviolet radiation
- Electro catalytic oxidation
- SCR oxidation

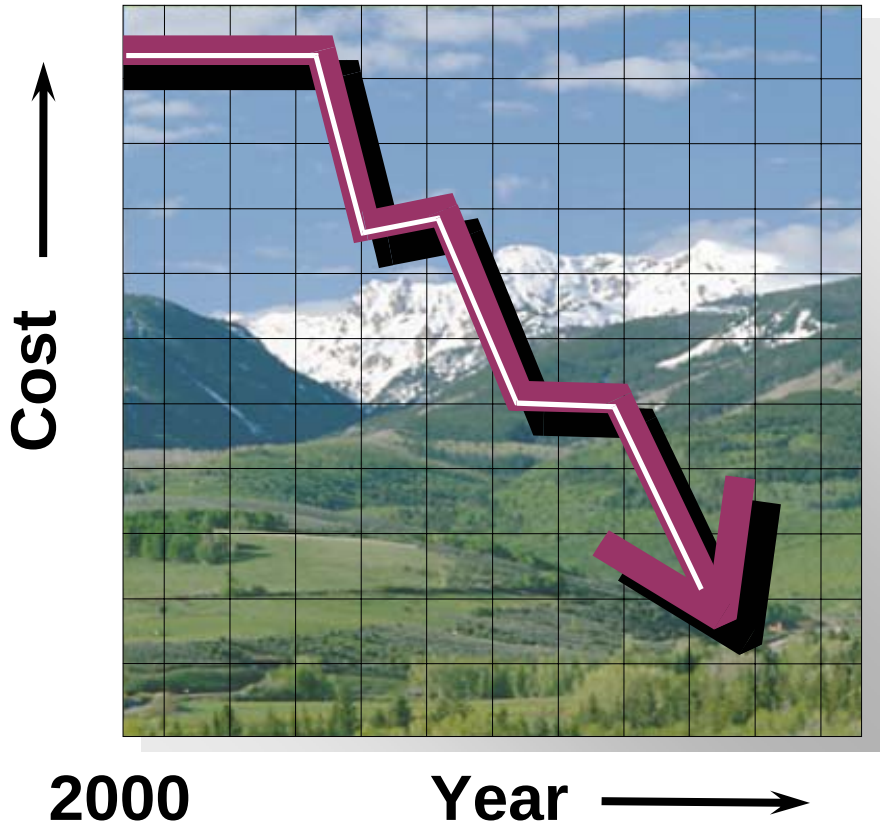
Sorbent Injection
- Activated carbon
- Amended silicates
- Halogenated AC
- Ca-based sorbents
- Chemically treated sorbents
- COHPAC/Toxecon™
- Thief sorbents

Coal Combustion Byproduct Characterization

Mercury Field Testing Program

Objectives

- **Have technologies ready for commercial demonstration**
  - by 2005 for bituminous coal
  - by 2007 for low-rank coal
- **Reduce emissions 50-70%**
- **Reduce cost by 25-50% compared to baseline cost estimates**



Baseline Costs: $50,000 - $70,000 / lb Hg Removed

Phase I Field Testing 2001-2003 Summary

- **Activated carbon injection (ADA-ES)**
  - 4 power plant sites
    - 2 particulate collection systems --ESPs (3) and COHPAC (1)
    - 2 coal types – PRB (1) and bituminous (3)
- **Scrubber enhancement (McDermott/B&W)**
  - 2 power plant sites
    - Both burned high-S bituminous coal
    - 1 limestone wet FGD, 1 magnesium-enhanced wet FGD

Observations From Phase I Field Tests

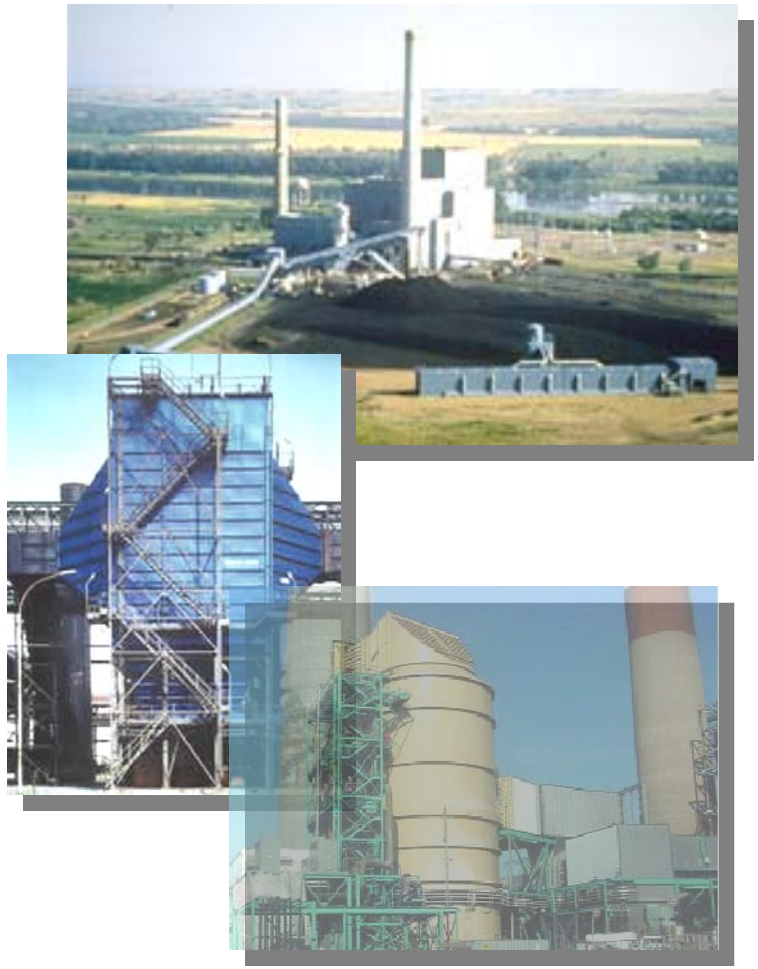
- **Moderate to high mercury capture possible with ACI:**
  - Performance depends on:
    - Particulate system – FF or ESP
    - Coal rank
    - Flue gas temperature
- **Scrubber enhancers show modest improvement in capture effectiveness**

Observations From Phase I Field Tests

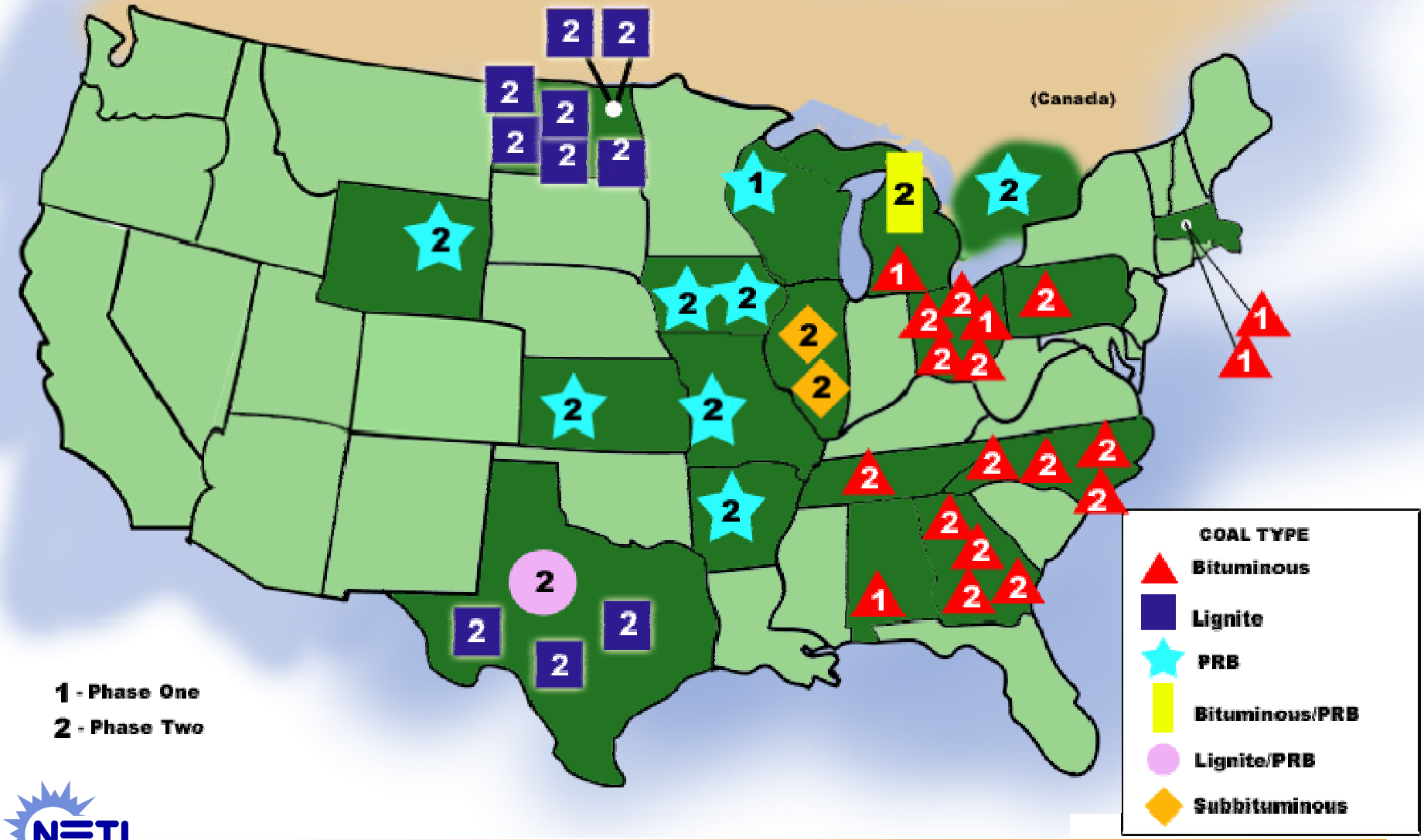
- **However, further information is needed:**
  - ***General***
    - Performance over longer periods of operation
    - By-product use and disposal
    - Impacts of load variation
    - Capture effectiveness with low-rank coals and coal blends
  - ***Sorbent Injection***
    - Understanding of in-flight capture
    - Optimize injection lance configuration
    - Effectiveness of chemically modified sorbents
    - Sorbent feed rate and costs
    - Effectiveness with small SCA ESPs
    - Impact on ESP performance and bag life
    - Need for fabric filter for units equipped with ESP
  - ***Enhanced Scrubber Capture/Oxidation***
    - Hg^{++} reduction/re-emission

Phase II Mercury Control Field Test Projects

- Fourteen new projects selected
- Longer-term (1-6 months @ optimum conditions), large-scale field testing
- Broad range of coal-rank and air pollution control device configurations; focus on low-rank coals
- Sorbent injection & mercury oxidation control technologies



DOE/NETL Phase I and II Mercury Field Sites

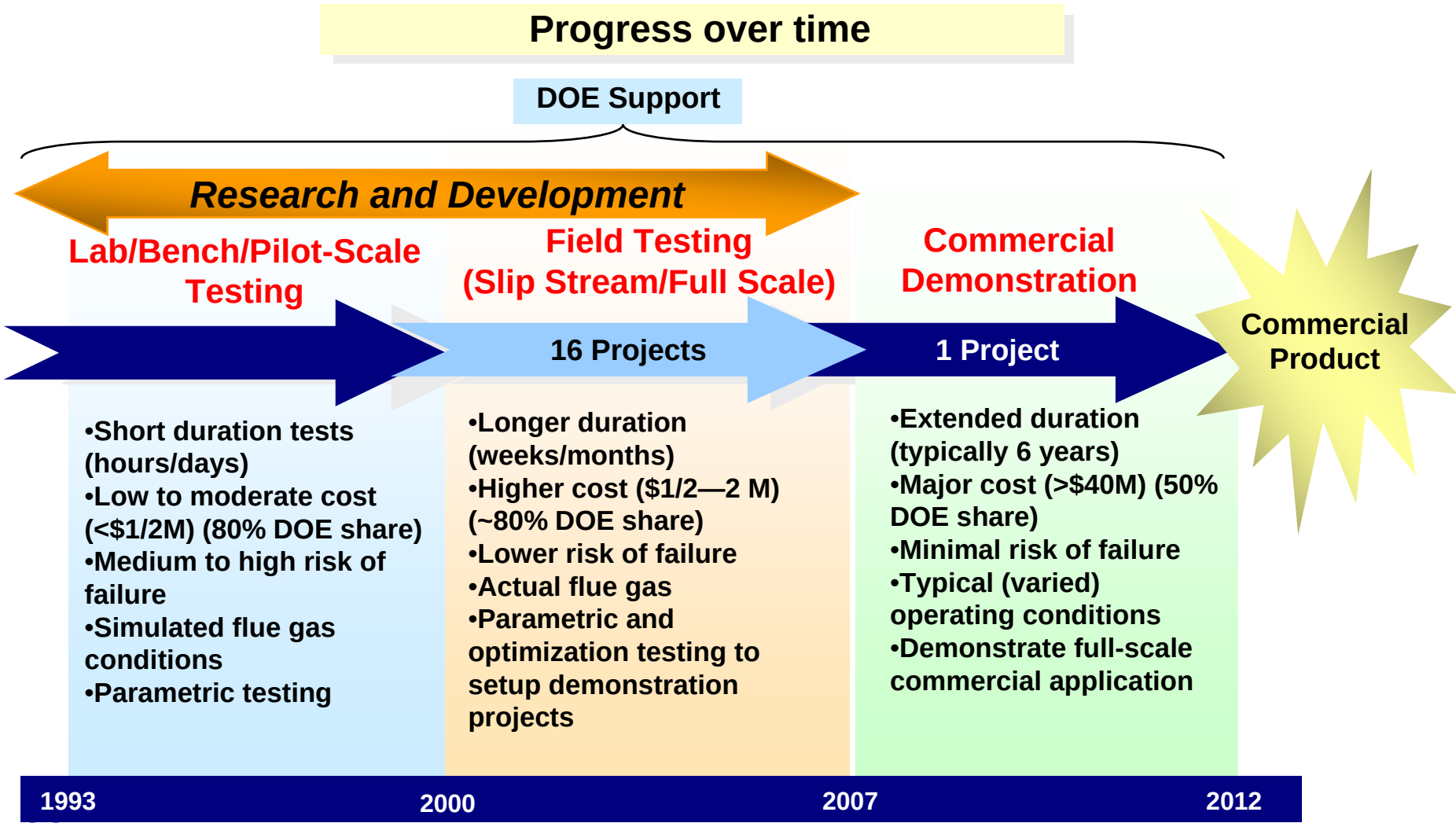


Full-Scale Demonstration of Toxecon™ Retrofit for Mercury and Multi-Pollutant Control

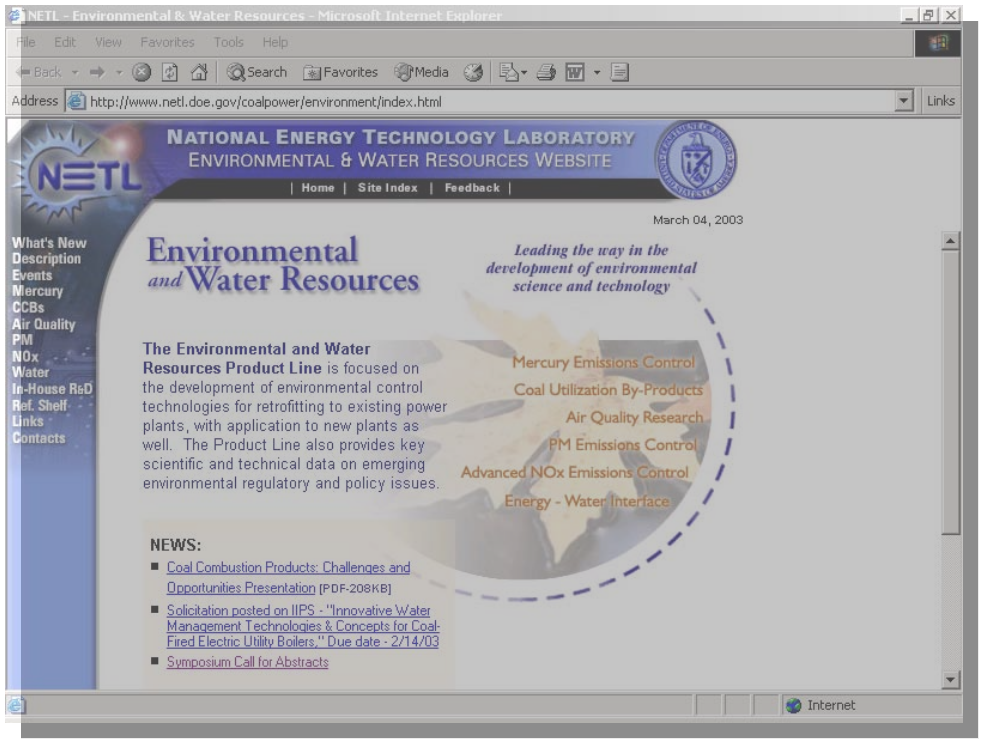
- **Demonstrate:**
  - Multi-pollutant control with PRB coal
    - 90% Hg reduction
    - 70% SO_2 reduction
    - 30% NOx reduction
  - Hg recovery from sorbent
  - Hg CEM performance

We Energies Presque Isle Power Plant

Stages of Mercury Control Technology Development



DOE/NETL Environmental and Water Resources (Innovations for Existing Plants Program)



To find out more about DOE-NETL's Hg R&D activities visit us at:

http://www.netl.doe.gov/coal/E&WR/index.html