CCS Deployment Pathways & Hurdles

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Topics

- **Background**
- **Two CO_2 themes**
  - **Scale- Size of the problem is without precedent.**
  - **Time- Limited time to prevent irreversible consequences.**
- **Challenges and barriers that emerge from these themes**
- **The Coal Transition Project**

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Clean Air Task Force (CATF)

- **CATF is a nonprofit environmental organization that addresses air quality and atmospheric protection issues.**
- **We employ twenty professionals with backgrounds in science, engineering, law, economics and public outreach.**
- **Headquartered in Boston but located throughout the United States.**

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Why CO2 from Coal Matters

- **Earth's two largest atmospheric challenges of the 21st century are particulate emissions and global warming.**
- **Emissions from coal power plants is the biggest factor in whether these challenges can be managed.**
- **Coal is the dominant electricity source on the planet and will expand by at least 200% in the next 30 years.**
- **Hence the paradox:**

  Coal in its current form is environmentally unacceptable *BUT*

  Coal is indispensable and inevitable to a planet growing richer.

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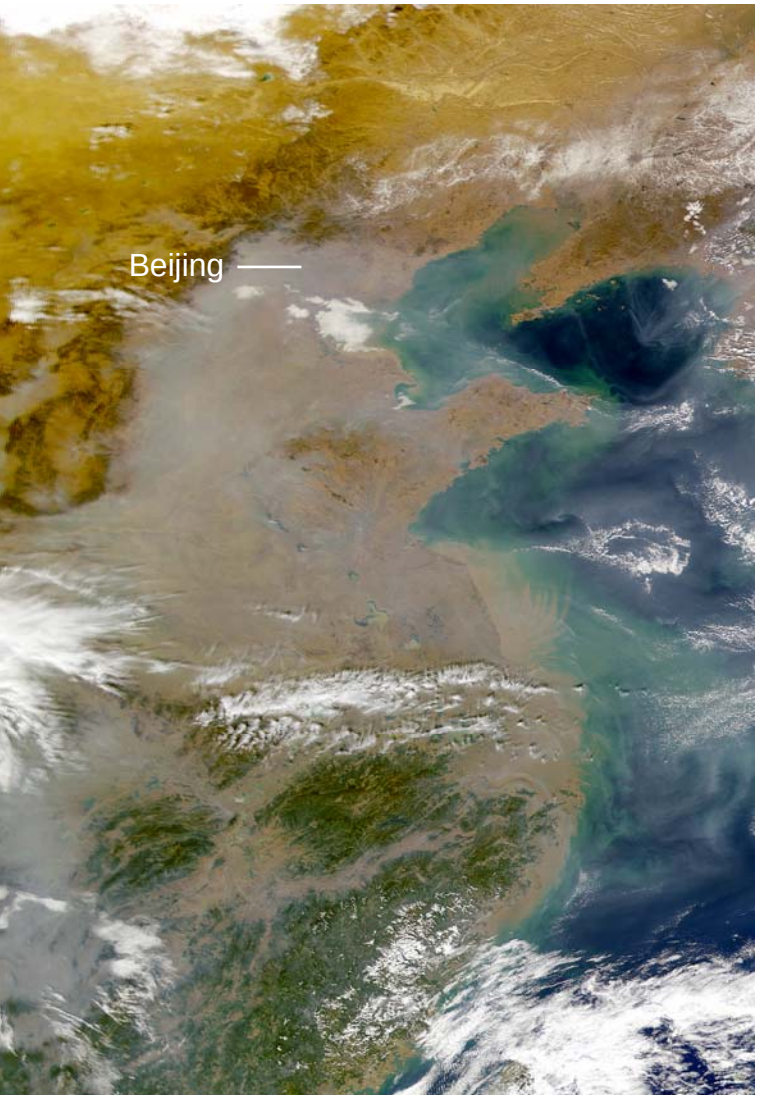
Coal plant emissions: 500,000 premature deaths annually worldwide



NASA Satellite images of coal plant air pollution (milky white areas) in Midwest US (September 2002) and China (January 2000)

Global warming

- **Coal = 40% of world's CO2 emissions.**
- **Coal dominates *growth* of CO2 emissions until 2050.**

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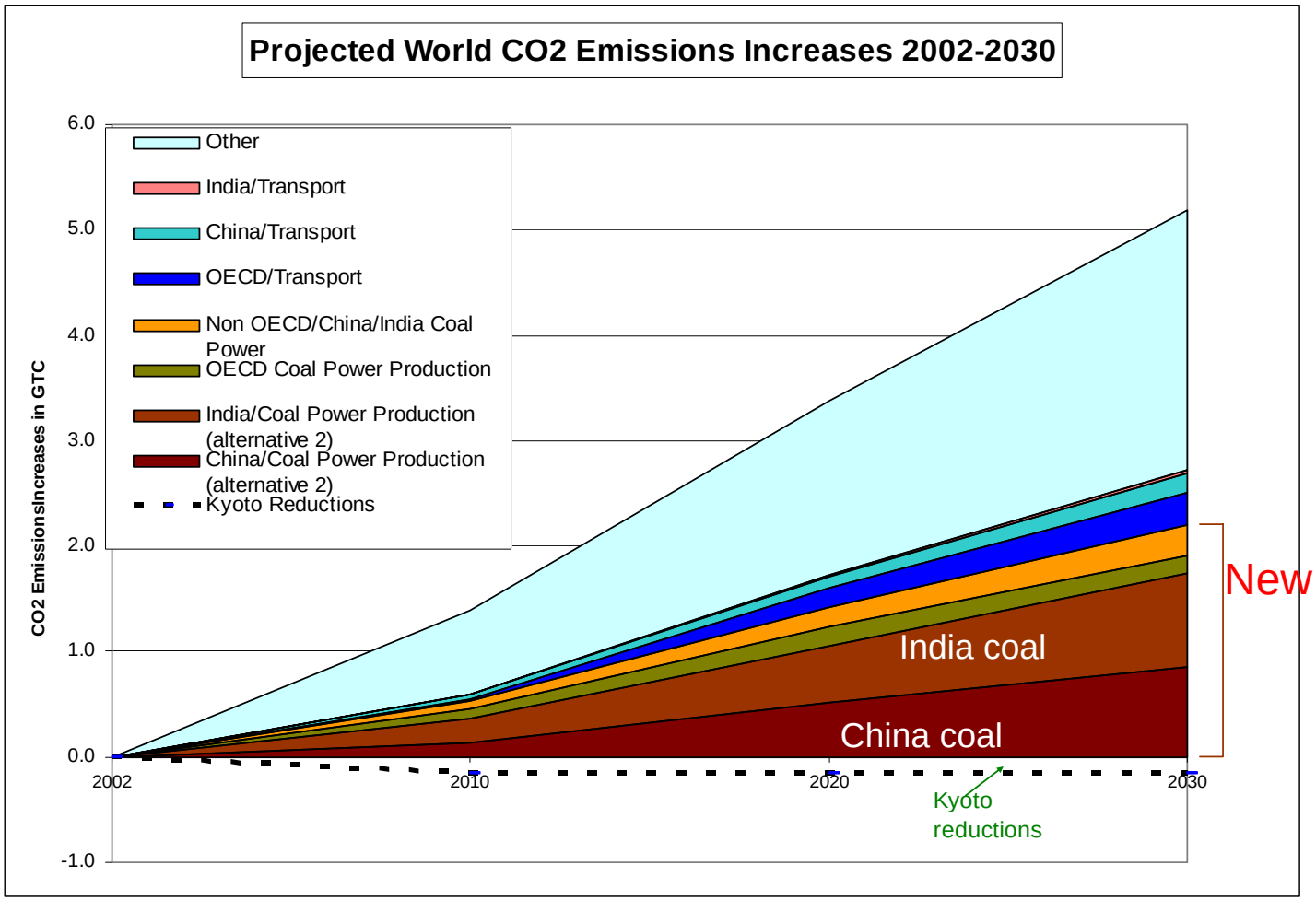
Coal dominates projected new world CO2 emissions through 2030



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Conclusion

- **Can’t live with it.**
- **Can’t live without it.**
- **Therefore must transition it to something we *can* live with.**

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Power Company Culture Challenge

- **Barrier #1: To undertake significant GCS in 2030, power companies must make unprecedented and radical changes in corporate culture and skills.**

- **Barrier #2: Time is short. If companies don't begin to take important steps now, these changes in culture and skill sets won't happen in time.**

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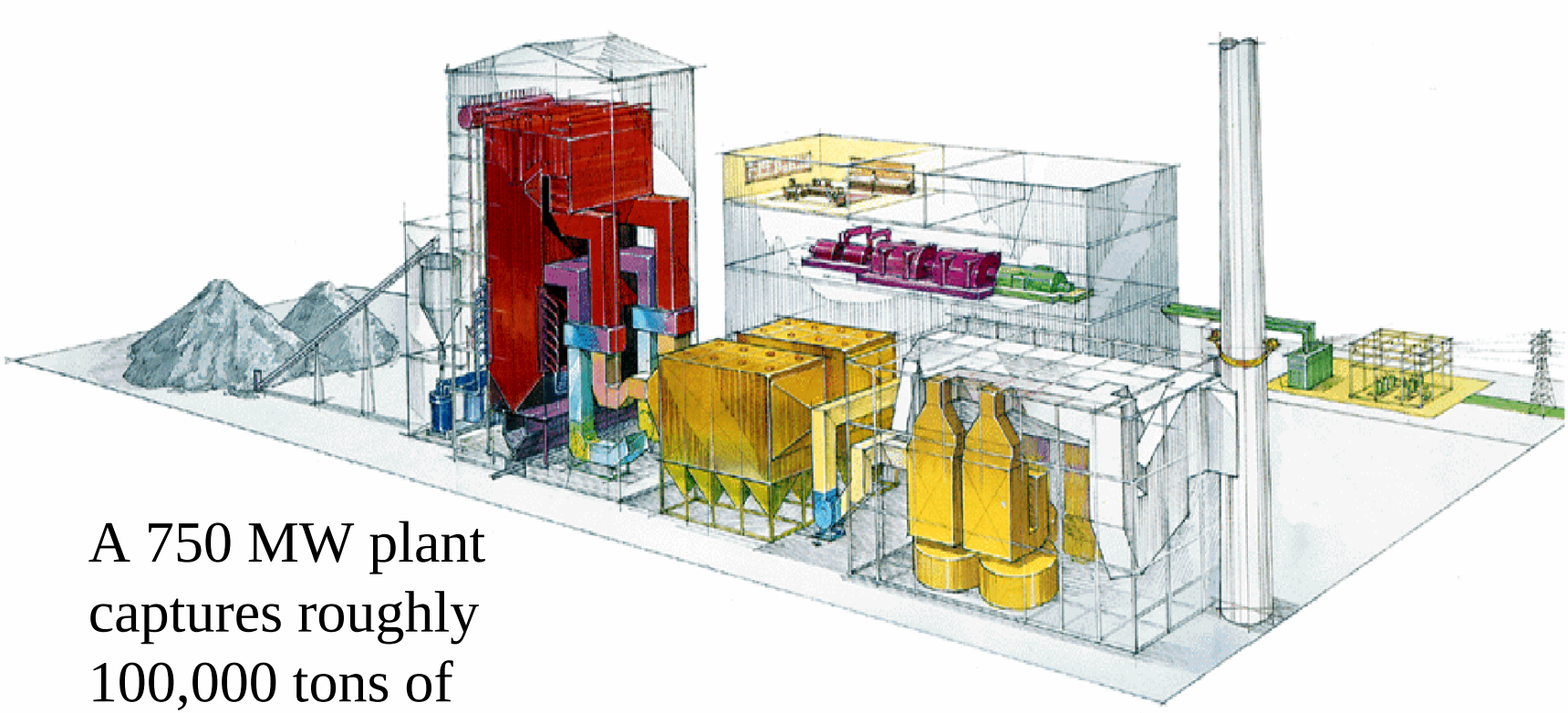
Coal Plant Today



A 750 MW plant captures roughly 100,000 tons of SO2 and 5,000 tons of NOx

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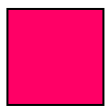
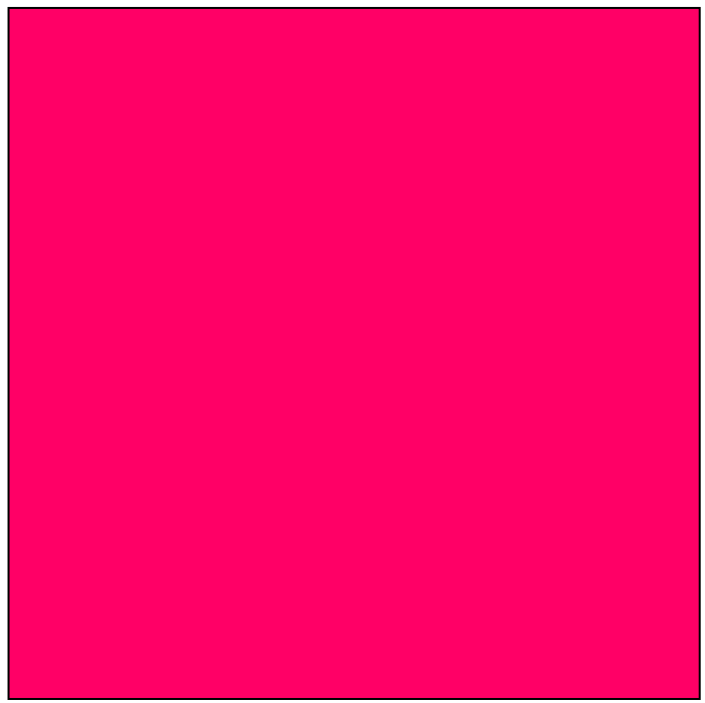
Pollution Removal Requirements (Gas Phase)

- **Today**

NOx, SO_2



- **2030**



NOx, SO_2, CO_2

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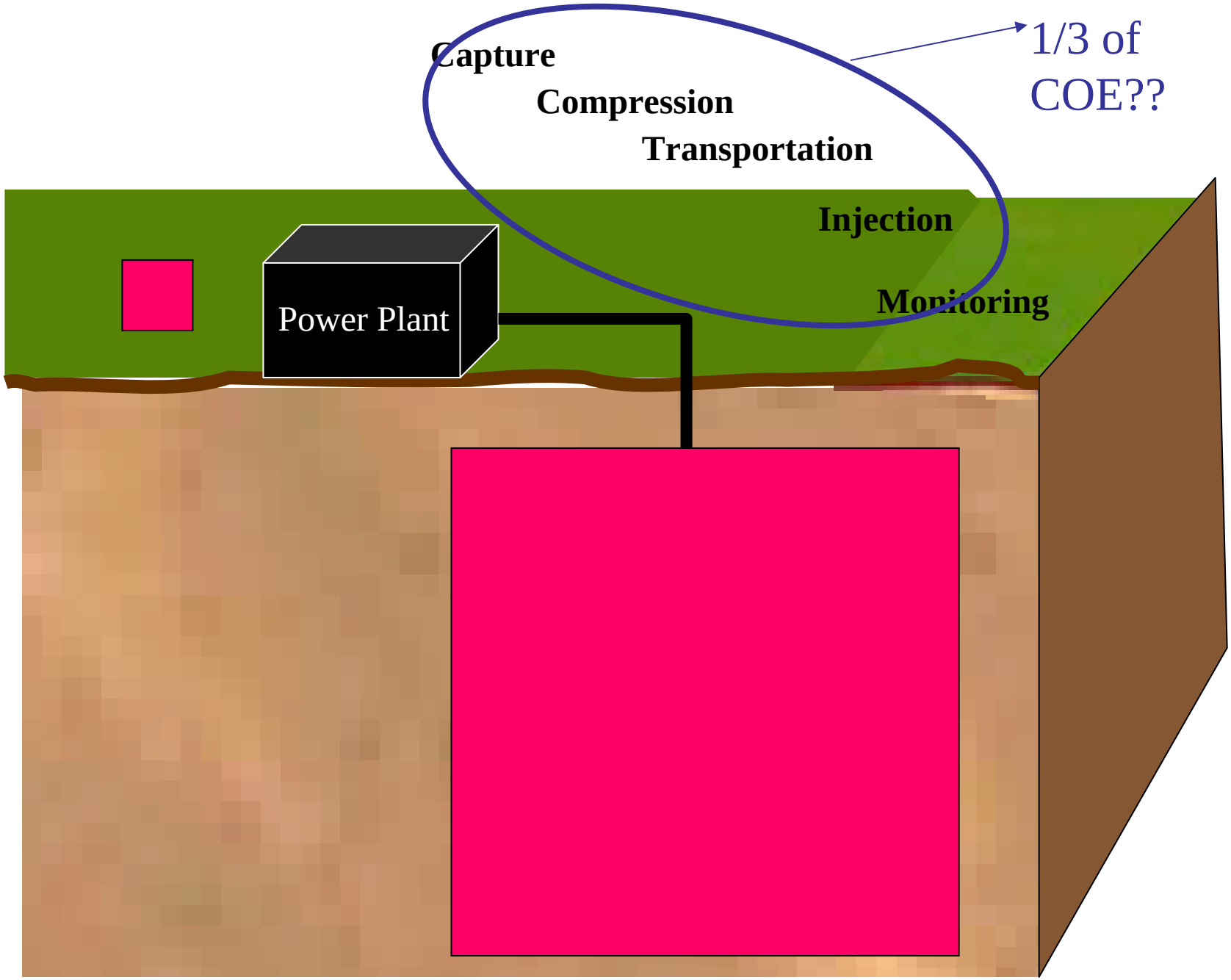
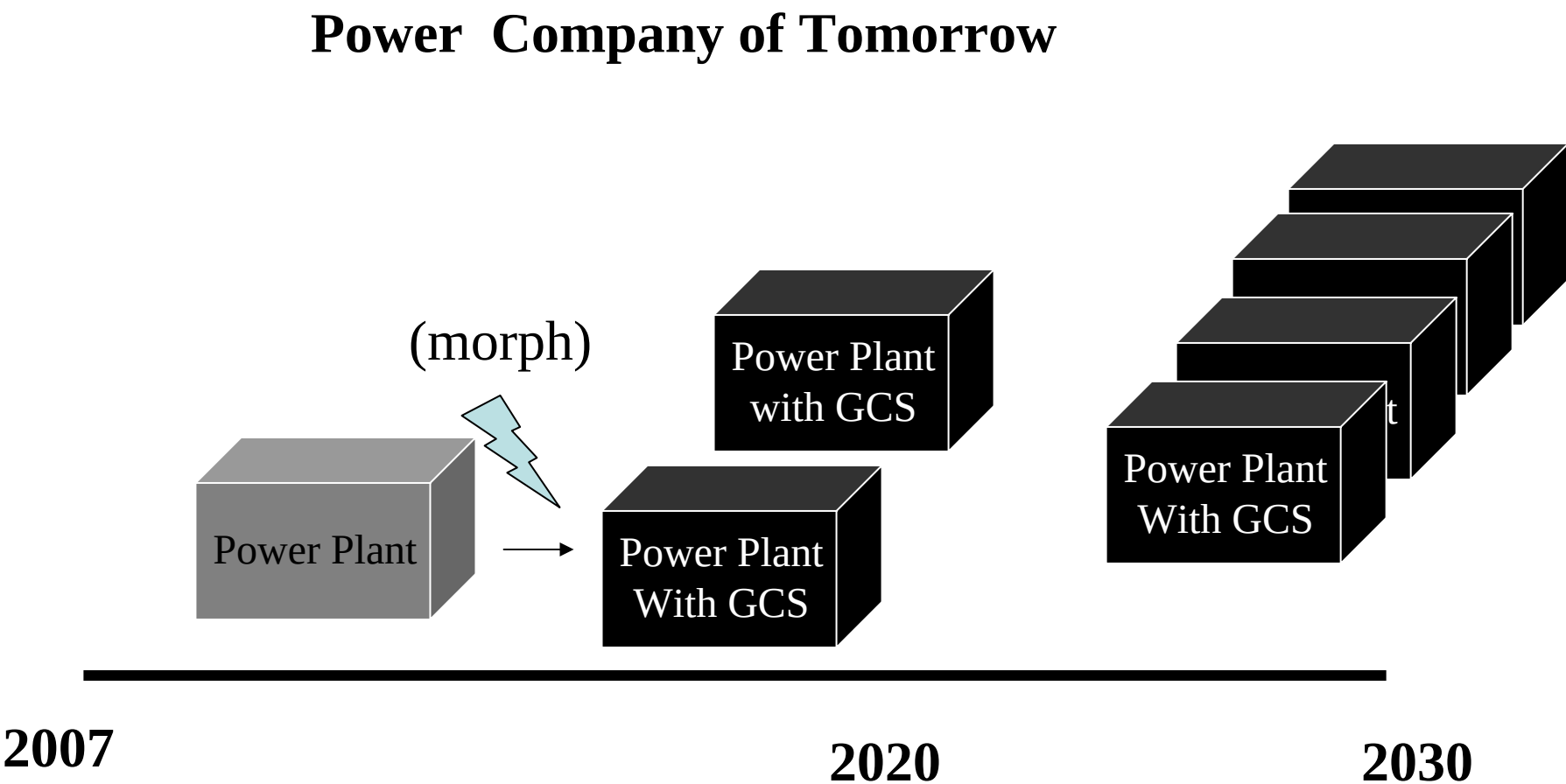

Capture
Compression
Transportation
1/3 of COE??
Injection
Monitoring
Power Plant

Not Just Once, But a Lot!
And Quickly!



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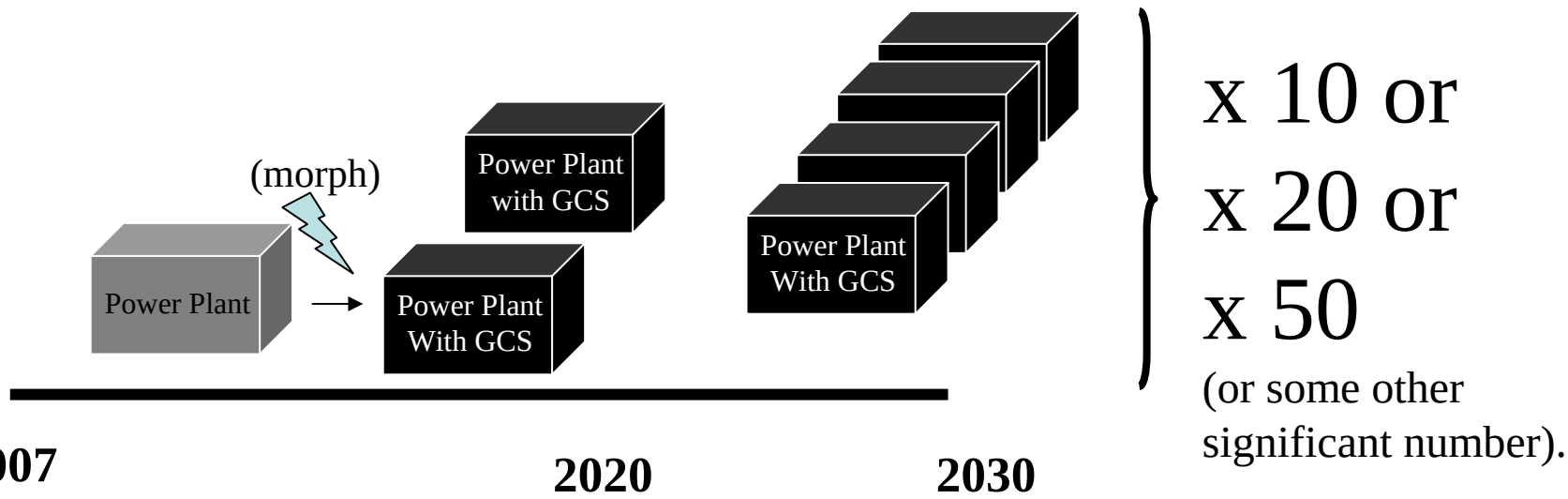
National Policy Challenge

- **Barrier #3: There's no federal policy to drive the scale of change that is needed across the entire power sector.**



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Technology Challenge- Power Plant

- **Barrier #5: New coal plant being built today are dominated by the same old technology. New coal plants built today must have strong CO2 retrofit capability. In practice, that means coal gasification must be the preferred technology for commercial coal power plants today.**
  - **Post-combustion PC research and demonstrations should continue and be encouraged, but until these demonstrations meet with success, the demanding timeframe and scale needs of GCS require building upon where the greatest success is likely.**

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Technology Challenge- Power Plant

IGCC versus PC

- **Horserace Issue: Some respected sources argue:**
  - **While IGCC has a carbon capture cost advantage over PC technology today, that advantage may not be sustainable.**
  - **One day, PC with post-combustion capture could be less expensive than IGCC.**
  - **Therefore, building PC today and adding GCS later may be better than building IGCC today.**

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Technology Challenge- Power Plant

IGCC versus PC (continued)

- **Commercial Availability**
  - **IGCC has a 10-year plus head start over PC on carbon capture:**
    - The technology to isolate CO2 from an IGCC is commercially available today.
    - Post-combustion capture technologies for PC are expected to be commercially available around 2020.
  - **The commercial availability gap counts! The scale and speed with which GCS is needed is daunting enough. Waiting until 2020 to begin serious deployment of coal-based power plants with GCS may have serious climate consequences.**

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Technology Challenge- Power Plant

IGCC versus PC (continued)

- **Options**
  - **IGCC path leads to more technology options than the PC path**
    - IGCC:
      - Better turbines
      - Improvements on current gasification technology- refractory, ASU, clean-up systems, etc
      - Different gasification technology platforms- transport reactor, molten metal, hydrogasification,etc
      - Underground coal gasification
      - Fuel cells
      - polygen
    - PC
      - Oxycombustion, amine stripping, chilled ammonia
      - Improved metallurgy
  - **The likelihood of significant cost reductions improves as technology optionality increases.**

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Technology Challenge- Sequestration

- **Barrier #6: While the science supports the view that GCS is safe, large scale testing in multiple basins is needed to understand issues posed by deploying the technology at large scale.**

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NGO Culture Challenge

- **Barrier # 7: The environmental community prefers energy efficiency and renewables to coal for understandable reasons. But coal transition is so vital to preventing climate change and difficult to achieve that it will take active support from the environmental community to accomplish.**

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CATF Coal Transition Project

- Priority Project Facilitation
- Utility & Regulator Outreach
- Media
- EOR facilitation
- Midwest CCS Roadmap development

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