# Department of Energy Clean Coal R&D

*National Energy Technology Laboratory*

**Office of Fossil Energy**

# National Energy Technology Laboratory

- **Only DOE national lab dedicated to fossil energy**
- **90 Year history in fossil fuel research**
- **One lab, three research campuses, one management structure**
- **More than 1,200 Federal and support-contractor employees**
- **Research spans fundamental science to technology demonstrations**

*Oregon*

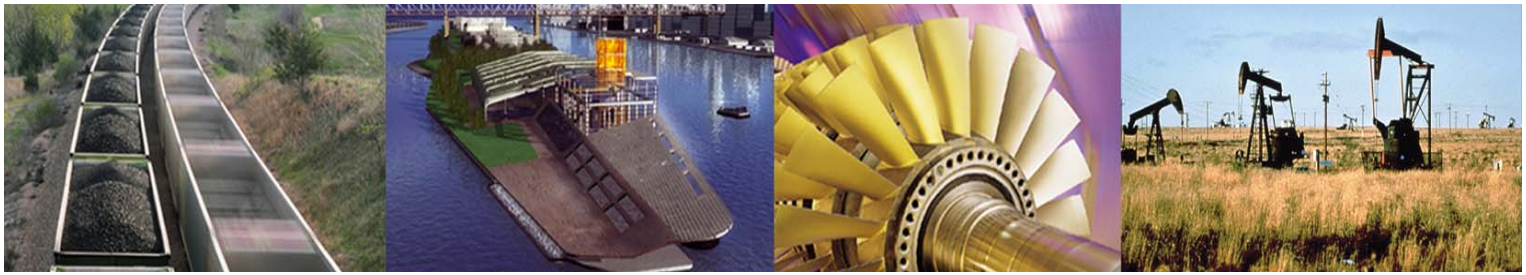
*Pennsylvania*

*West Virginia*

# Coal Research & Development

# Must Drive Technology

# To Near Zero Emissions at Reasonable Cost



# Coal Technology R&D Pathways

## *Critical R&D Challenges to Near Zero Emissions From Coal*

**Near Term Plants**

### *Pulverized Coal*

**Power Generation**

**Improve Efficiencies**

**Minimize Criteria Pollutants**

**Minimize Water Usage**

**Minimize Greenhouse Gases**

**Future Plants**

### *Advanced Coal*

**Power and Multiple Products**

**Improve Reliability**

**Maximize Efficiencies**

**Near Zero Criteria Pollutants**

**Near Zero Water Usage**

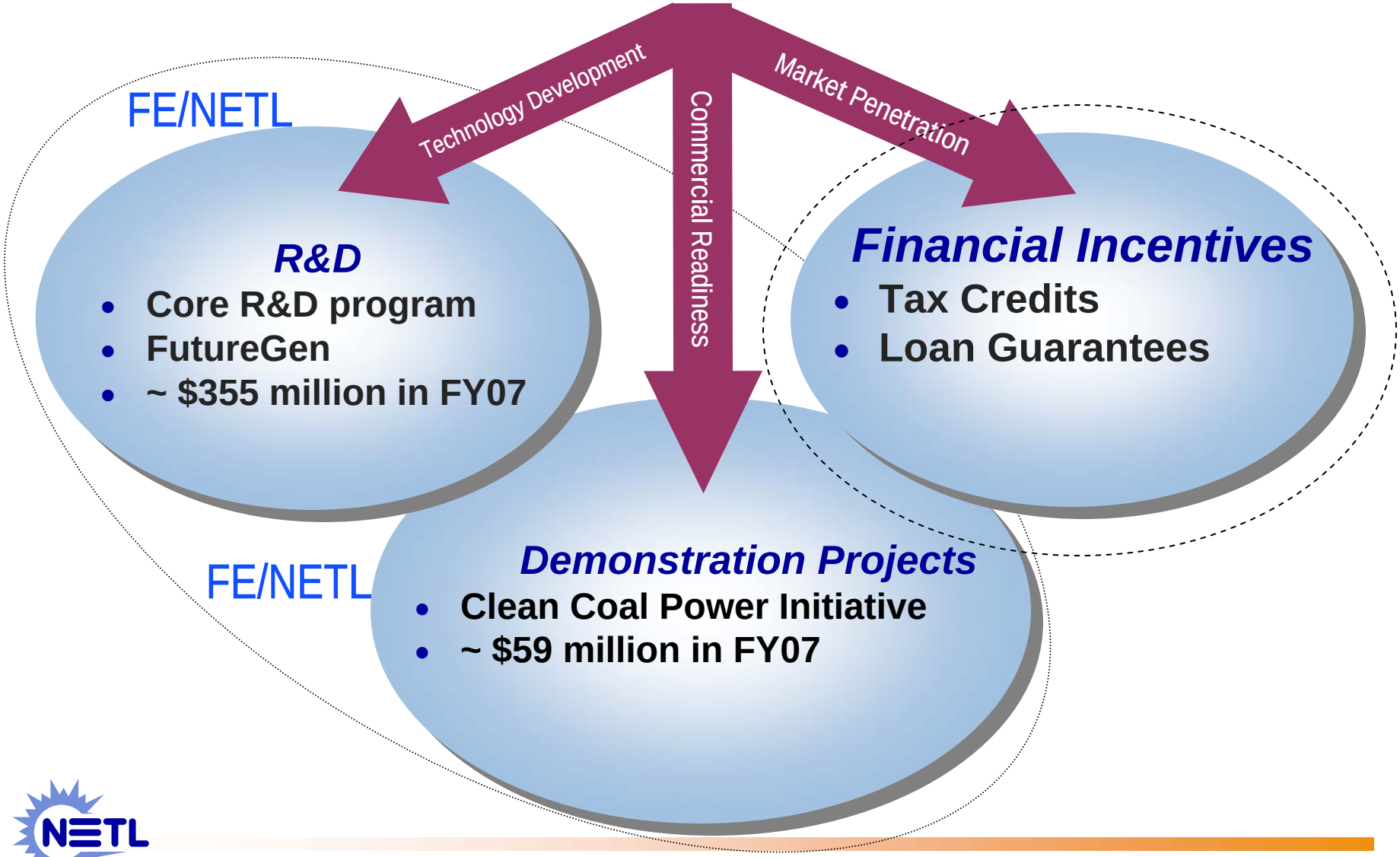
**Near Zero Greenhouse Gases**

**Technology Bridge to Near Zero Emissions**

**2005 - 2025**

**2025 - 2050**

# Government's Coal R&D Investment Strategy



# Critical Technology Pathways

## Innovations for Existing Plants

- Mercury control (>90% capture)
- Fine particle control – Hg
- Water minimization
- New Carbon Capture Development Program

## Gasification Systems

- Gasifier designs (cost reduction, reliability, coal type)
- Cheap oxygen (Ion Transport Membrane)
- Syngas clean-up
- $CO_2$ capture, Hydrogen separation

# Critical Technology Pathways

## Turbines

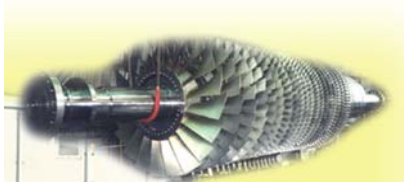
- Hydrogen turbine
- $CO_2/H_2O$ turbine
- $CO_2$ compression

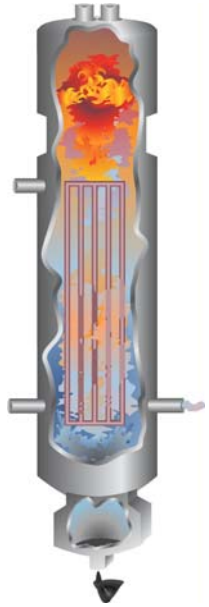
## Fuel Cells

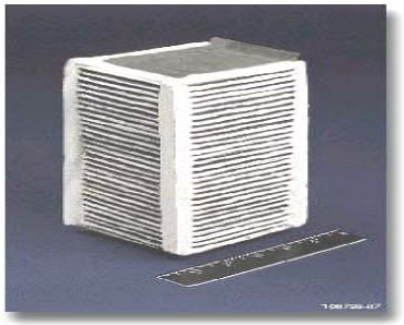
- Solid Oxide Fuel Cells
- Coal power applications
- Cost reduction & reliability

## Sequestration

- $CO_2$ capture
- $CO_2$ sequestration
- Monitoring and verification







# Critical Technology Pathways

## Fuels

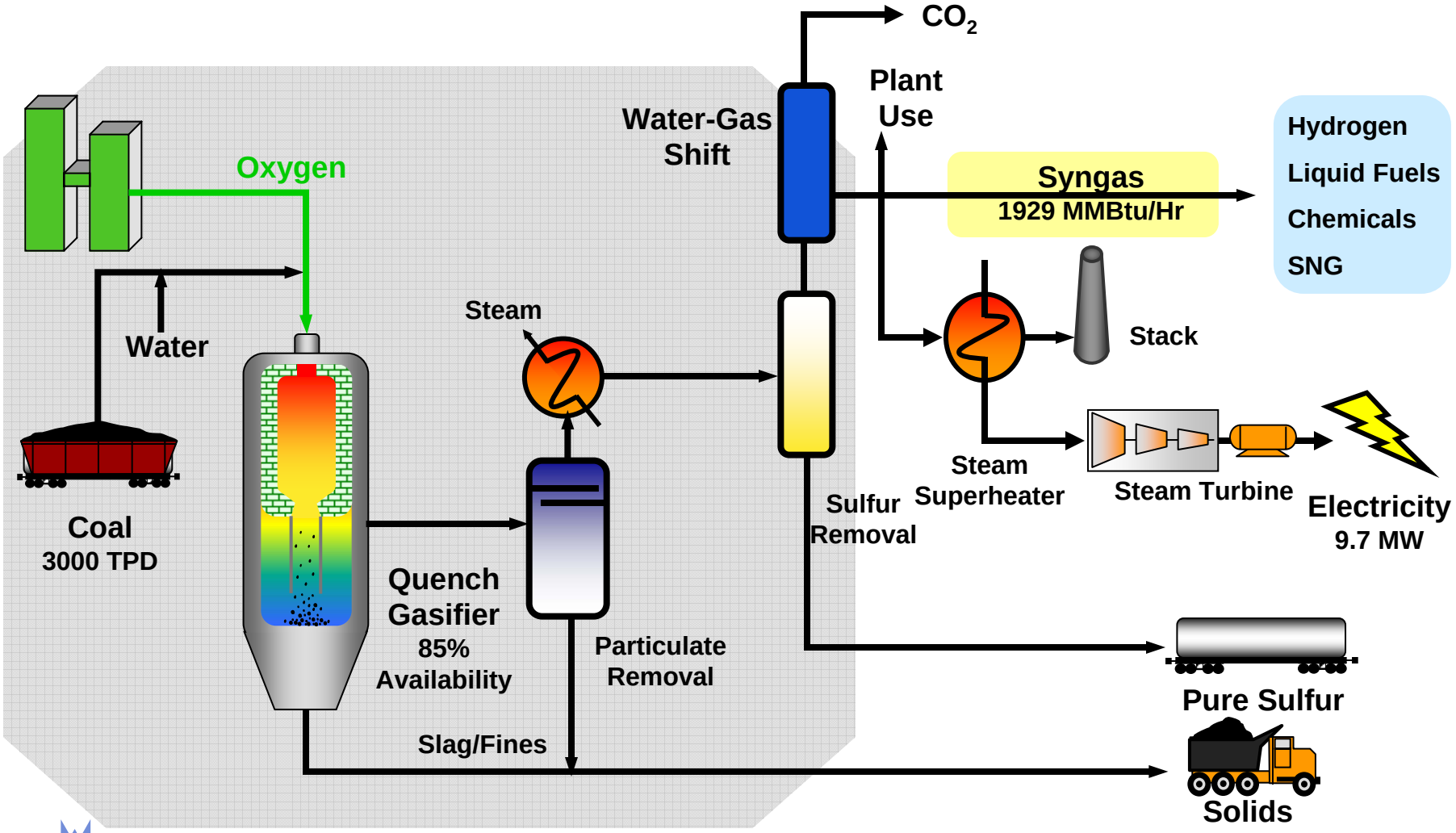
- Hydrogen production from coal
- Hydrogen purification
- Hydrogen & $CO_2$ separation

## Advanced Research

- Materials
- Sensors and controls
- Advanced visualization software

# Gasification Provides "Multiple Product" Capability

## *(Power, Hydrogen, Liquid Fuels, Chemicals, SNG)*



# FutureGen: Integrating Function for R&D Program

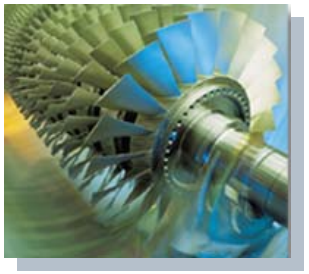
Fuel Cells

FutureGen

Carbon Sequestration

Gasification with Cleanup Separation

$H_2$ Production

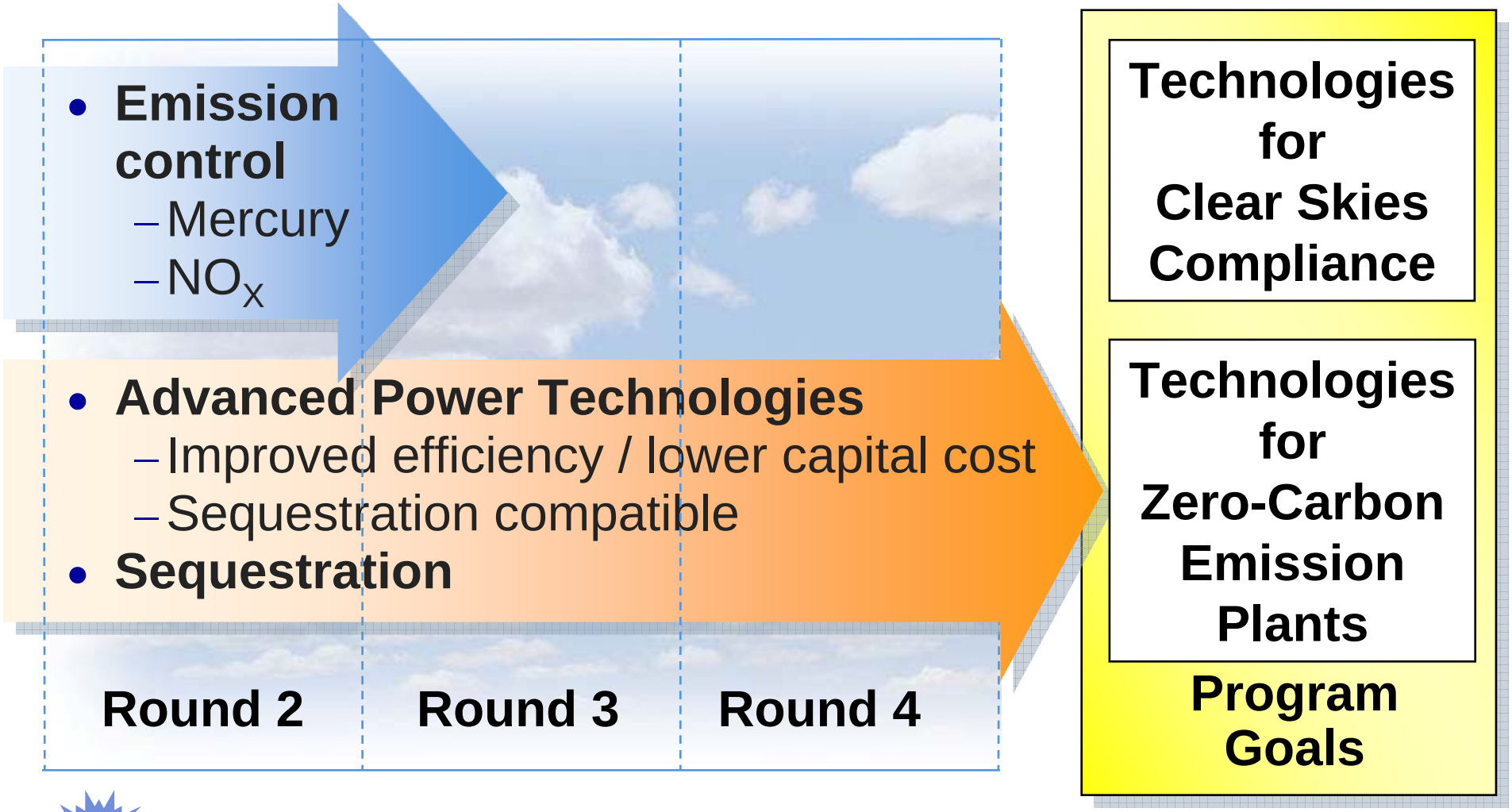


Optimized Turbines

System Integration

NETL

# Clean Coal Power Initiative



# Let's Get Back To Mercury