

WV Governor's Energy Summit



Resiliency in Energy Security Panel

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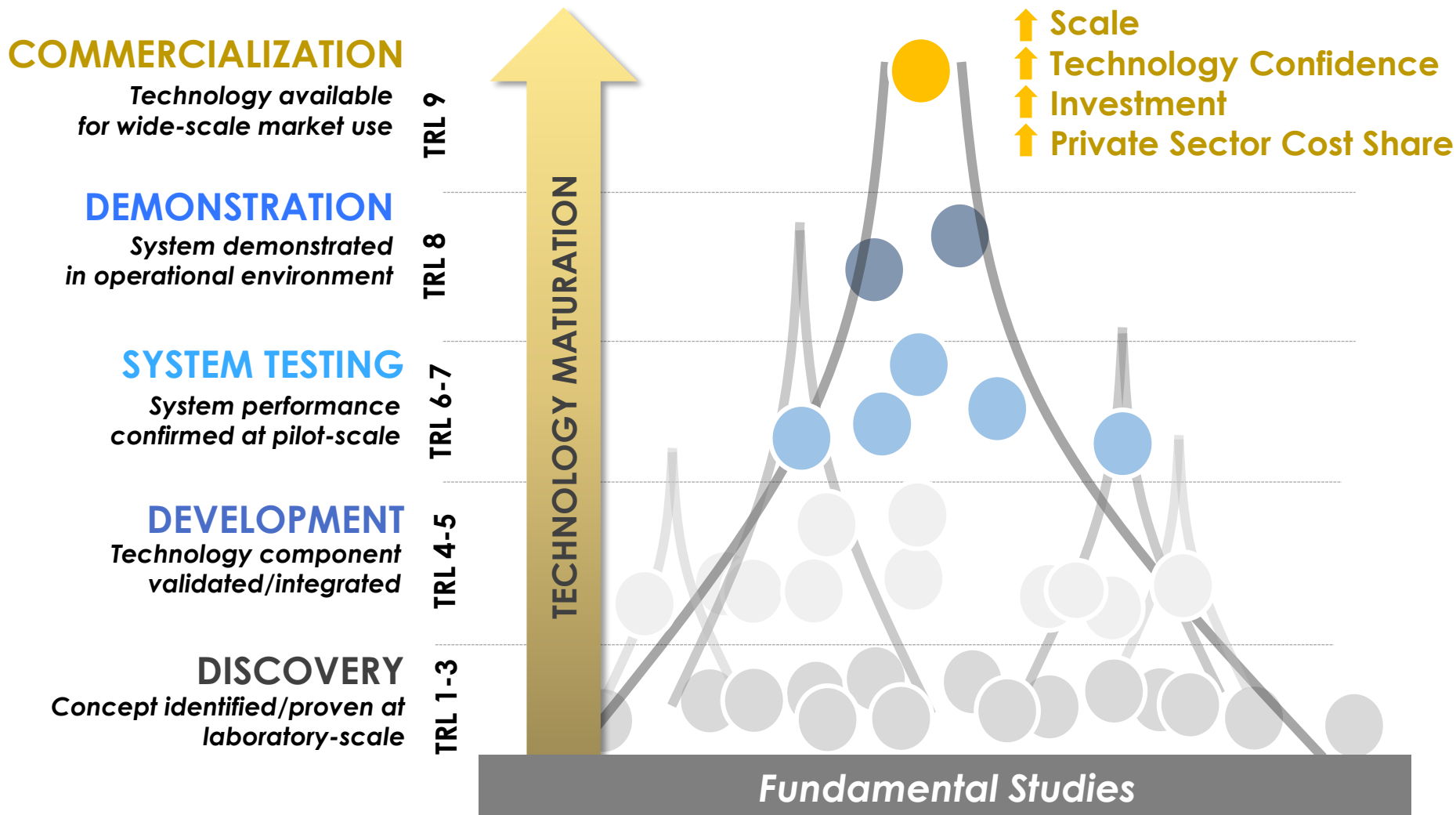
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Technology Development Pathway

An Active Portfolio from Concept to Market Readiness



KNOWLEDGE-BASED DECISION MAKING

- **Systems Engineering and Integration**
 - Engineering analysis
 - Pre-FEED/FEED studies
 - NEPA
- **Decision Science and Analysis**
 - Screening studies
 - Techno-economic analysis
 - Technology Readiness Assessments

Strategic Initiatives

Science & Technology Strategy for the Future

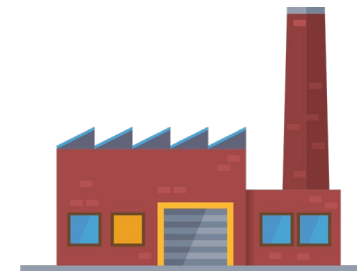
- Strengthening NETL core capabilities
- Addressing important energy and environmental challenges
- Delivering innovative technology solutions to the Nation



HIGH EFFICIENCY LOW EMISSION
POWER GENERATION



FOSSIL ENERGY INTEGRATION,
OPTIMIZATION, and RESILIENCY



MANUFACTURING HIGH-VALUE CARBON
PRODUCTS from DOMESTIC COAL

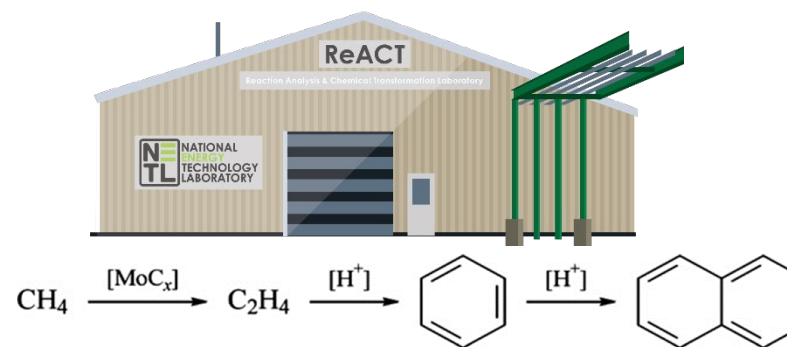
Graphene
Inks/Fluids

Carbon
Quantum Dots

Nanocomposite
Plastics



REAL-TIME DECISION SCIENCE for
the SUBSURFACE



NATURAL GAS to VALUE-ADDED
PRODUCTS

High Efficiency Low Emissions Power Generation

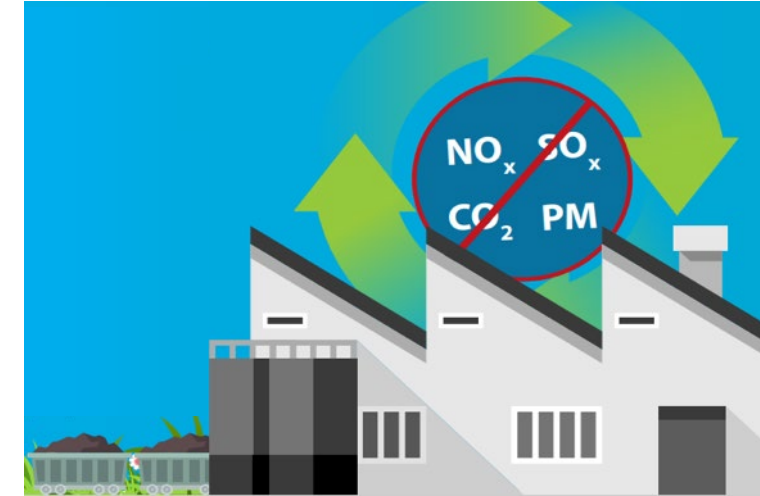
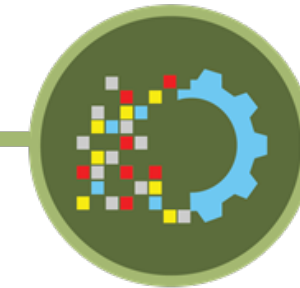
Flexible

Innovative

Resilient

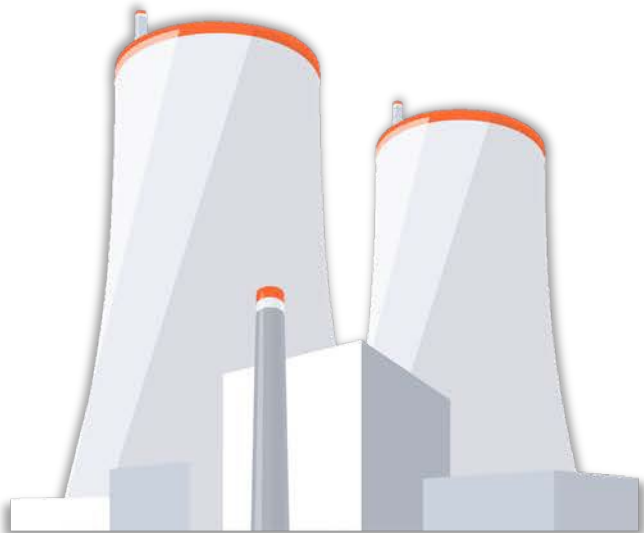
Small

Transformative



NETL Focus Areas

- **Reduce** time required to design, construct, and commission new coal-based power systems
- **Minimize** water consumption and criteria emissions
- **Be carbon-capture ready** to reduce CO₂ emissions
- **Integrate** with energy storage, coal upgrading, or other opportunities for enhanced value stream realization
- **Enhance** demand responsiveness, including rapid start-up and high efficiency operation through wide range



HISTORICAL FOSSIL FUEL POWER PLANTS

- Large; high capital costs
- Relatively slow deployment
- Inflexible (incapable of energy storage)
- Primarily focused on simple arrangements



NEXT-GENERATION FOSSIL FUEL POWER PLANTS

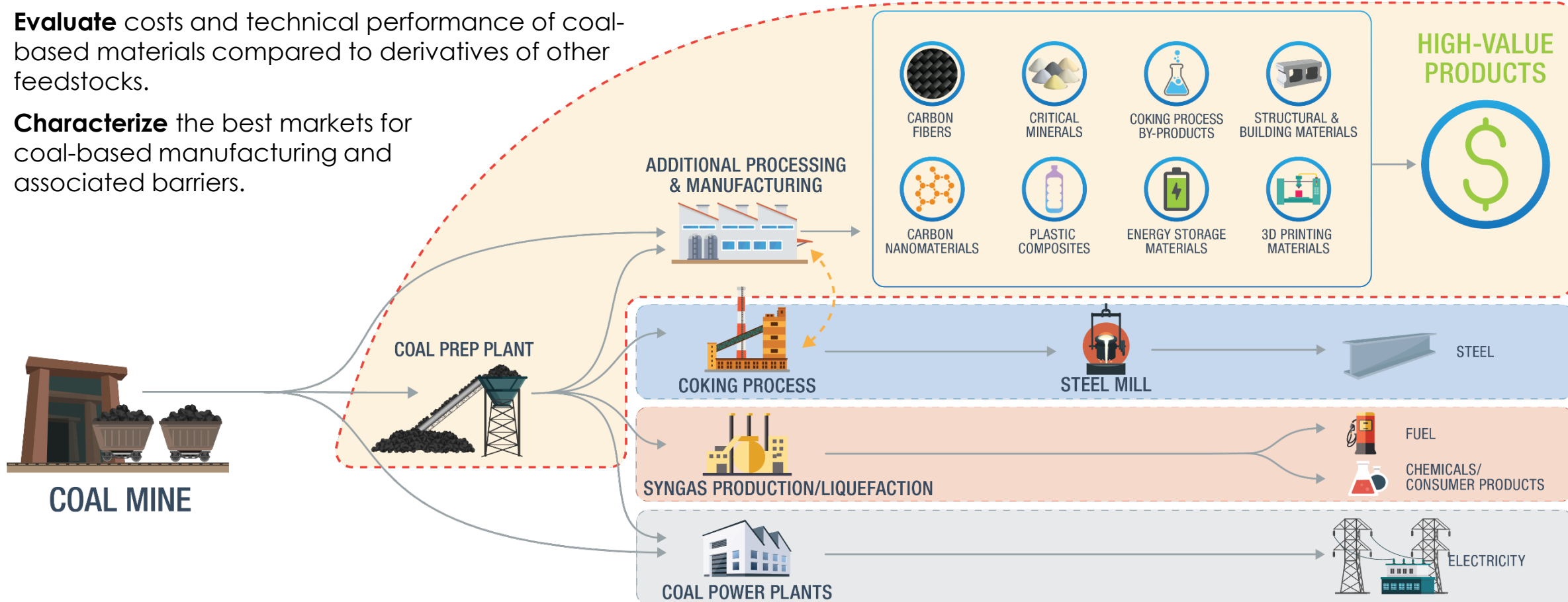
- Smaller; lower capital costs
- Faster deployment
- Higher flexibility with high efficiency at multiple loads
- Accommodating ongoing transitions from simple arrangement to complex energy systems

Manufacturing High-Value Carbon Products from Domestic Coal

Develop and utilize carbon materials to maximize the value of domestic coal

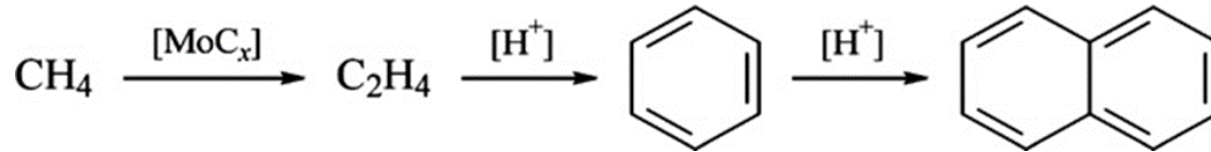
NETL Focus Areas

- **Identify** new manufacturing processes for converting coal into high-value products beyond traditional energy markets.
- **Evaluate** costs and technical performance of coal-based materials compared to derivatives of other feedstocks.
- **Characterize** the best markets for coal-based manufacturing and associated barriers.



Natural Gas to Value-Added Products

Rapid Advancement in Process Intensification Deployment (RAPID) Manufacturing Institute Project

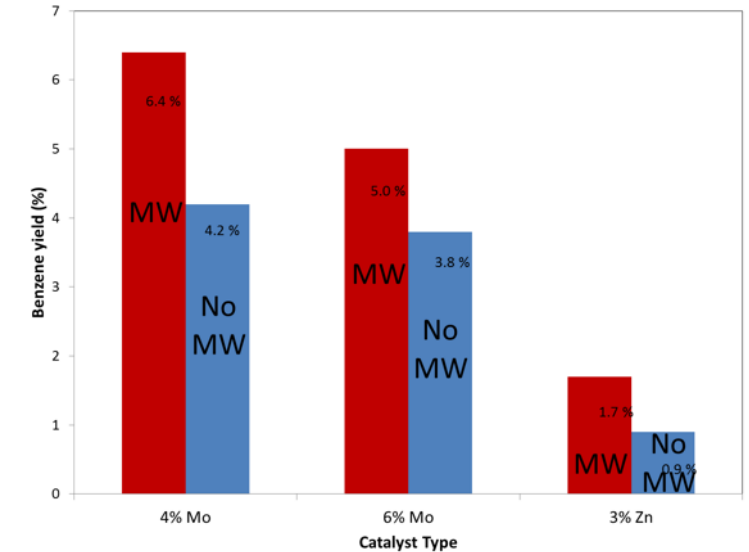


Microwave-assisted Catalysis for Process Intensified Modular Production of Value-Added Chemicals from Natural Gas

Funding Agency: DOE Advanced Manufacturing Office (AMO) thru AIChE's RAPID Institute

Partners: NETL, WVU, University of Pittsburgh, and Shell

Duration: 2018-2021 (4 Year)



Reaction Analysis and Chemical Transformation (ReACT) facility features

Fuel flexible – gaseous hydrocarbon fuels, coal, liquid hydrocarbon fuels, biomass, coal and biomass mixtures, and syngas

Equipped with advanced diagnostics – high-speed imaging, thermal imaging and online gas analysis

Wide range of temperature and pressure (1000°C/600 psi)

Fully automated 24/7 unattended operations

- Increase power cycle efficiency
- More power generation for less fuel
- Fewer emissions
- Optimize chemical reactor designs for specific chemical transformations



Real-Time Decision Science for the Subsurface

