

Thermal Bottom Ash Drying to Reduce Water Burdens and Facilitate Critical Mineral Recovery and Carbon Capture, Utilization, and Storage Integration

Improving Efficiency, Reliability, and Flexibility of Coal-Based Power Plants (Phase I – Pre-FEED)

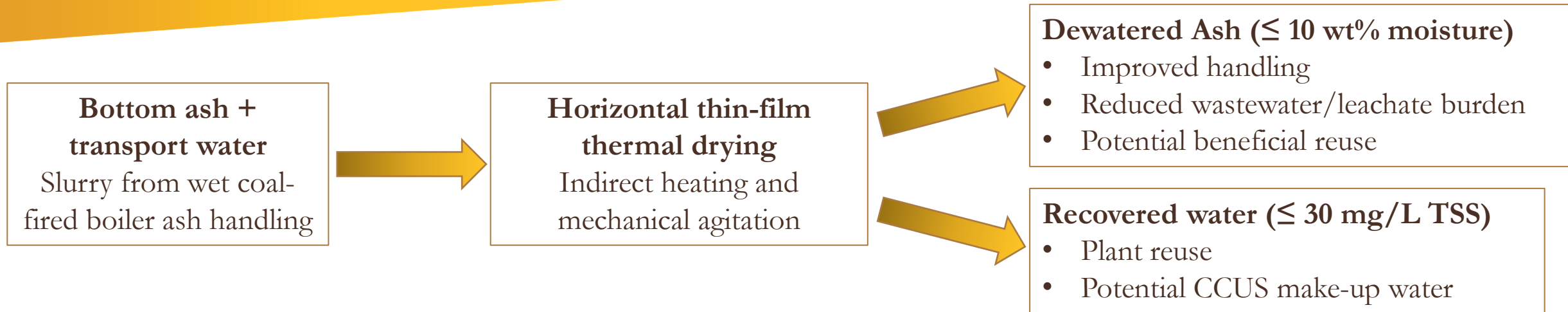
DOE Award: DE-FE0032737

Project performance period: Oct 2026-Sep 2027

Funding summary: \$399,931 (federal), \$99,983 (cost share), \$499,914 (total)

Erica Belmont, Ph.D. (PI), Trina Igelsrud-Pfeiffer (Co-PI)

Project Overview



Project goals and intended impacts:

- Reduce wastewater and leachate generation through prompt thermal drying of bottom-ash slurry.
 - Impact: Reduced water handling/storage and treatment costs.
- Produce a dewatered solids stream to improve handling and facilitate future use (e.g., critical mineral recovery).
 - Impact: Reduced handling/storage costs and potential new revenue streams.
- Recover dryer water for internal process reuse (e.g., bottom ash transport) and future CCUS integration.
 - Impact: Reduced water costs for current and potential future operations, plus potential new revenue streams.

Project Participants



Laramie River Station — Wheatland, Wyoming

- Phase I evaluation site, Phase II/III host site to be confirmed
- Three generating units, 1,710 MWe net/1,860 MWe gross
- B&W pulverized coal boilers, sub-bituminous coal
- Commissioned 1980-1982
- Emissions controls: low-NO_x burners w/FGR, SCR/SNCR, wet/dry SO₂ scrubbers, dry sorbent injection for sulfuric acid mist, activated carbon injection for Hg control, ESPs.



UNIVERSITY OF WYOMING

University of Wyoming
Project lead; technical and economic integration



**Basin Electric /
Laramie River Station**
Site data; operating basis; plant integration strategy



Buss-SMS-Canzler
Horizontal thin-film dryer
OEM; equipment specification



Halker Consulting
Pre-FEED engineering; AACE
Class 4 cost estimate

Technology Selection



Attribute	Mechanical dewatering	Conventional direct thermal drying	Horizontal thin-film drying
Water removal	Removes free water	Dries wet solids/sludges	Single-step slurry to dried solids
Heat transfer / gas handling	No thermal evaporation duty	Direct contact with a hot gas stream	Indirect contact through a heated wall
Water recovery	Separated liquid stream	Recovery at low partial pressure of water	Vapor undiluted by heating gas
Application experience	Established general dewatering approach	Established general drying approach	Demonstrated on range of liquids/slurries/solids

Phase I will determine whether established HTFD advantages translate to bottom-ash slurry at utility scale.

Phase I Technical Approach

Design Basis

Site data and slurry characterization:

- Ash production and water balance
- Operating variability
- Solids/particle characteristics
- Drying behavior, abrasion, fouling



Pre-FEED

Integrated system design:

- Equipment technical and cost specification
- Process & equipment configuration
- PFDs & heat/material balances
- Utilities & plant interfaces
- Plot plan & constructability
- Preliminary HAZOP
- AACE Class 4 estimate



Integration & Business Case

Plant-level economic impact:

- Critical mineral valuation
- CCUS conceptual design
- CCUS water quantity/quality needs
- Recovered-water integration
- CAPEX/OPEX
- Business case analysis



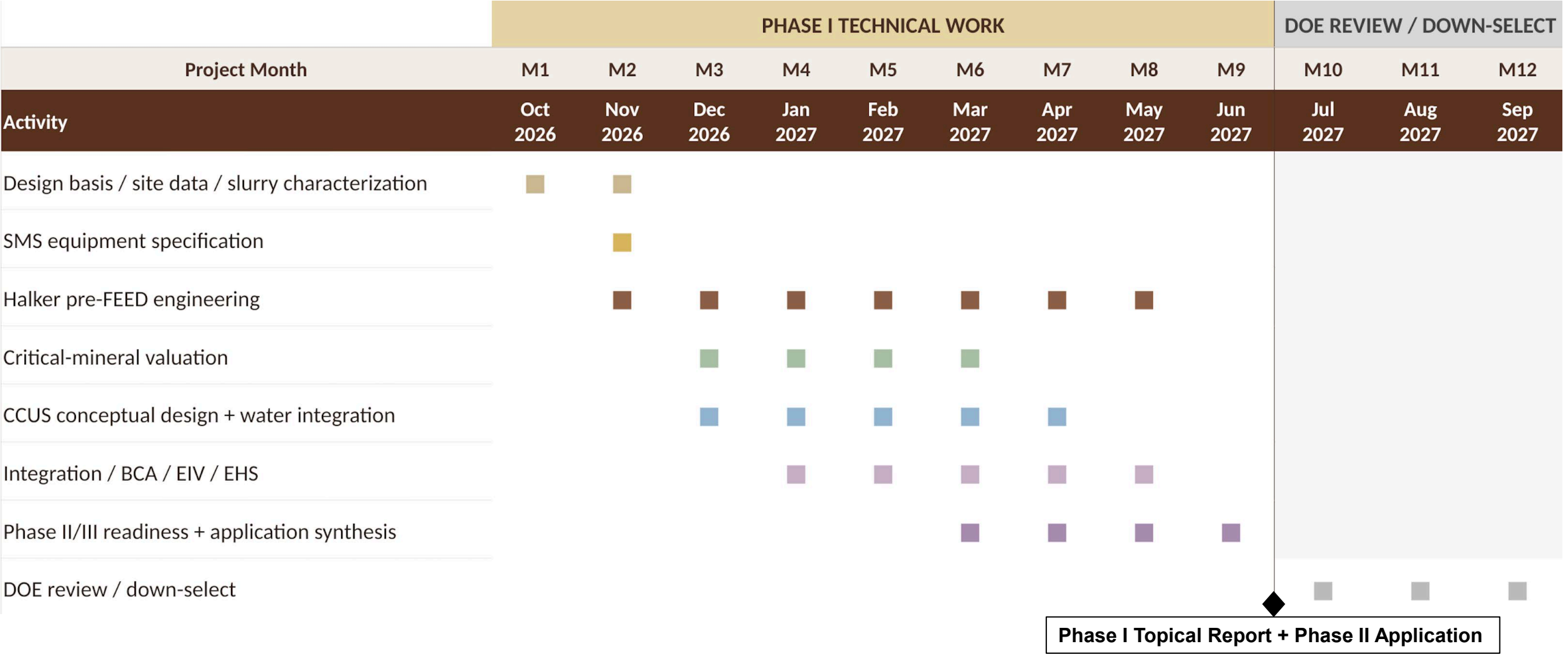
Phase II/III Readiness

De-risking of future demonstration:

- Environmental Information Volume for NEPA review
- EHS risk assessment
- Host and team confirmation
- Cost-share and execution planning

Phase I outcome: establish technical, economic, environmental, and execution basis for advancement to FEED and demonstration.

Project Timeline



Success Criteria & Key Risks

Phase I Success Criteria

Technical / Engineering

- Design achieves ash residual moisture of ≤ 10 wt%
- Dryer specifications, utilities, and plant interfaces defined for 50% slipstream demo
- Pre-FEED and AACE Class 4 estimate complete

Water Integration

- Design achieves recovered water TSS ≤ 30 mg/L
- Recovered water quantity and quality evaluated against plant reuse and CCUS make-up requirements

Economic / Deployment

- Business case analysis complete, key sensitivities identified
- EHS, permitting, and constructability issues identified
- Phase II host, team, cost share, and execution path defined

Key Risks & Mitigation Strategies

Slurry properties: abrasion & fouling

- **Medium likelihood/Medium impact**
- Laboratory characterization of slurry properties
- OEM identification of any pre-processing needs

Business case: uncertainty & cost

- **Medium likelihood/High impact**
- Heat provision scenario modeling for efficiency
- Sensitivity analysis on key cost and performance drivers

Phase II readiness & commitments

- **Medium likelihood/High impact**
- Early and ongoing potential host site/team engagement and cost share identification

Schedule risk

- **Low likelihood/High impact**
- Parallel BCA, EIV/EHS, CCUS, Phase II/III readiness
- Regular coordination and milestone reviews

Acknowledgment & Disclaimer

Acknowledgment: This presentation is based upon work supported by the Department of Energy under Award Number DE-FE0032737.

Disclaimer: This portion of the presentation was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.