

Bio-Based Products

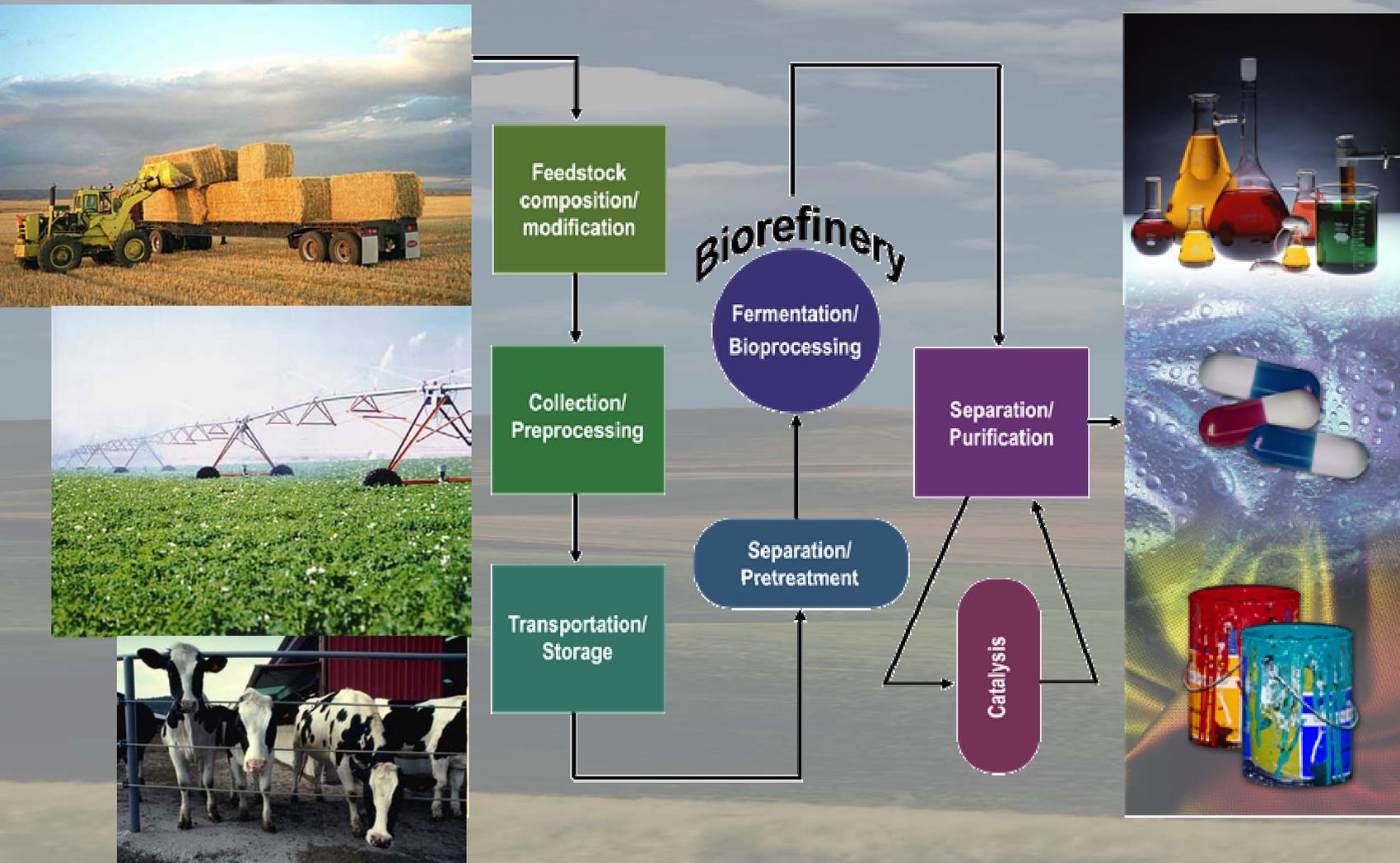
Delivering Regional Benefits



**Pacific Northwest
National Laboratory**

Operated by Battelle for the
U.S. Department of Energy

Research to produce multiple, high value products from agricultural biomass



Focus on utilizing low value feedstocks to produce multiple, high-value products

■ Feedstocks

- Low value processing byproducts (e.g. wheat midds, potato waste, corn fiber, rice hulls, pomace)
- Residues and wastes (e.g. manure, straw, paper mill sludge)

■ Products

- **Pharmaceuticals & nutraceuticals**
- **Specialty and commodity “bioproducts” (e.g. chemicals for plastics, fibers, solvents, paints, and adhesives)**
- Transportation fuels
- Heat and power

➤ area of emphasis

Regional & National Benefits

— The 4 “E’s”

Energy

Utilizes a renewable feedstock to reduce dependence on foreign oil & gas

Economy

Adds value to our rural & agricultural economy

Environment

Reduces environmental impact from agriculture & food processing residues (& supports carbon management)

Education

Provides the educated workforce necessary to support a new agricultural industry

Developing a collaboration among regional research organizations



Mission

To provide the science and technology necessary to establish a robust “bioenergy & bioproducts” industry in the Northwest, while creating technologies that are broadly applicable to the Nation’s goals for biomass utilization.

Integrating capabilities of universities and national laboratories



Plant Science

- Plant biochemistry
- Microbial ecology
- Plant genetics
- Plant breeding

Production

- Robotics
- Sensors & controls
- Information Science
- Materials Science
- Human Factors

Processing

- Bioprocessing
- Biochemistry
- Catalysis
- Separations
- Process Engineering
- Molecular science

Utilization

- Economic & market analysis
- Systems Engineering
- Life Cycle analysis
- Materials science



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Battelle

Northwest Bioproducts Research Institute

Advanced research capabilities make new approaches possible

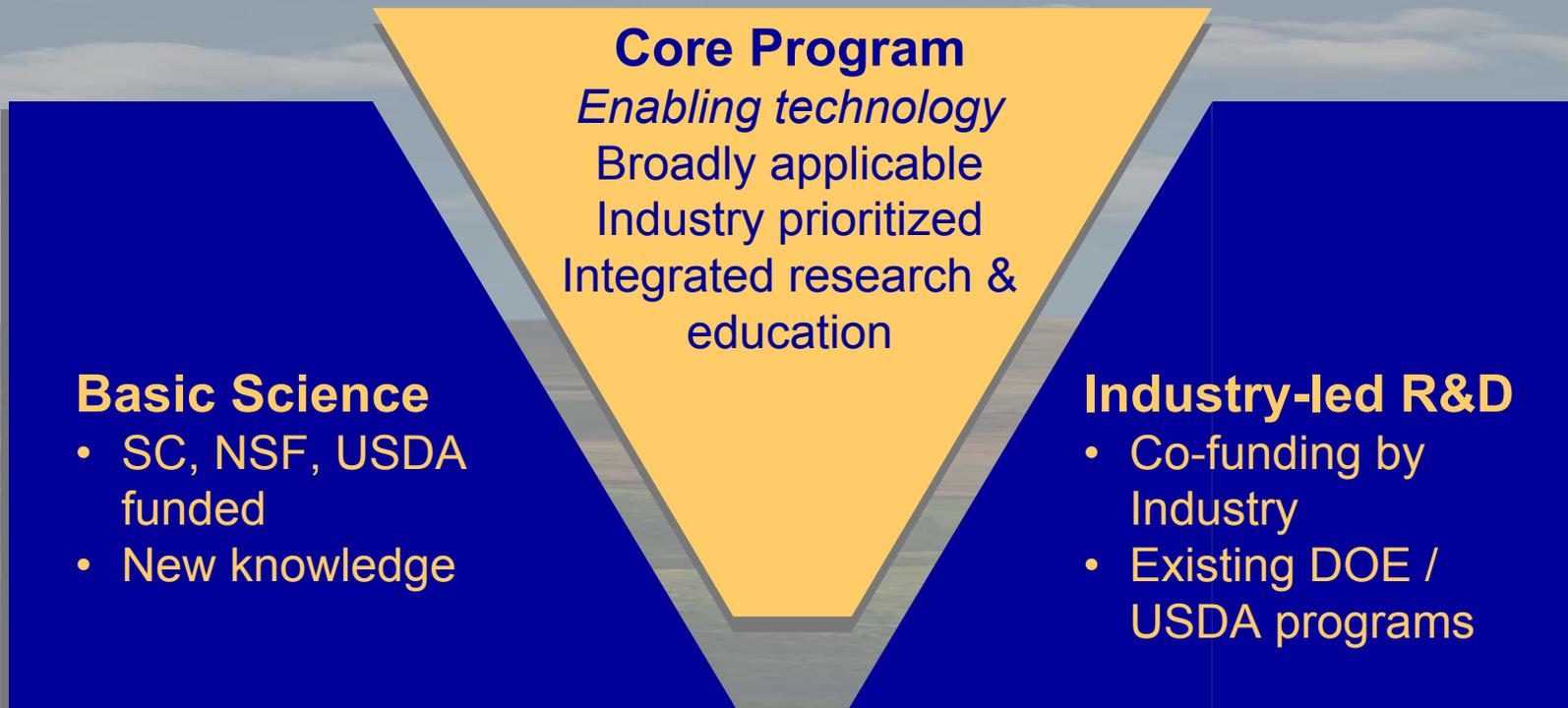
Examples:

- Biotechnology to identify novel organisms & develop new fermentation processes
- Plant biochemistry & advanced analytical techniques to develop & utilize plant-based materials
- Innovative catalyst and separation technologies to produce new specialty & commodity bioproducts



New core program focused on enabling technologies...

...to fill the gap between basic science and demonstration



Strong industry partnerships—rapid “science to solutions”

- Industry/grower advisory group to guide & prioritize core technology research
- Partner companies will work with institute researchers
- Industry will lead final development and deployment activities



Integrated research and educational institute to create technologically advanced workforce

- Create education programs that support industry and benefit the scientific community
- Establish education and training opportunities for undergraduate, graduate and post-doctoral students
- Collaborate to provide seminars, workshops, lectures, etc. for enhanced continuing education



A multi-user processing & education facility will bring researchers & technologies together

Multi-user facility

- Universities
- Laboratories
- Other government agencies
- Grower and industry partners



Unique equipment and facilities

- Integrated fermentation, chemical processing, and purification processes
- Flexible, engineering-scale equipment to provide industry-relevant process data
- Advanced analytical instrumentation
- Co-located research laboratories and teaching space

The result – a new domestic industry with regional and national impact

