Biotechnology Systems (BS) & Energy & Natural Resources (ENR) Crosswalk

Skilled to Meet the Moment: Students working with microbes, data, and biological systems are learning energy and environmental solutions.

- ✓ Biotechnology courses already address **clean energy, sustainability, and, environmental protection**
- ✓ Strong alignment with **CTE, Perkins V, and science credit integration**
- ✓ Clear pathways into **bioenergy, environmental, and research careers**

Biotechnology Systems (AFNR)	ENR Standard	Shared Focus	Example Lesson Meeting Both Standards
MN.BS.03.05 – Biofuels Production	**ENR.02 – Clean Energy**	Renewable fuels & energy conversion	Produce ethanol or biodiesel via fermentation or transesterification and analyze energy output and emissions.
MN.BS.02 – Scientific Applications	**ENR.06 – Ecological Research & Development**	Lab methods & data integrity	Collect, analyze, and document data on environmental samples related to energy or resource use.
MN.BS.03.06 – Bioremediation & Waste Management	**ENR.07 – Environmental Protection**	Pollution mitigation	Design a bioremediation strategy using microbes to address soil or water contamination.
MN.BS.01 – Ethics, Policy & Regulation	**ENR.07 – Environmental Regulations**	Policy & public impact	Analyze a biotechnology-related environmental regulation and its effect on energy or resource industries.
MN.BS.03.03 – Industrial Biotechnology	**ENR.05 – Conservation & Land Management**	Resource efficiency	Evaluate how bioproducts or bioprocesses reduce material, water, or energy use.
MN.BS.02.04 – Lab Safety & Waste	**ENR.01.01 – Workplace Safety**	PPE & hazard mitigation	Conduct a lab safety audit using OSHA-style hazard and waste classification.
MN.BS.03.02 – Microbes & Enzymes	**ENR.02 – Clean Energy**	Energy from biological systems	Investigate enzyme activity in bioenergy or food-energy systems and evaluate efficiency.

Career Callouts: Where Biotech + Energy Connect

Bioenergy & Renewable Fuels
Biofuels Technician • Bioprocess Operator • Fermentation Specialist

Environmental & Sustainability Science
Environmental Technician • Bioremediation Specialist • Sustainability Analyst

Laboratory & Research Careers
Biological Technician • Research Assistant • Quality Control Analyst

Policy, Regulation & Compliance
Environmental Compliance Specialist • Regulatory Affairs Technician

Biotechnology-Focused Mini Lesson Bank

1. Biofuels Production Lab
Students produce and test biofuels, comparing efficiency and environmental impact to fossil fuels.

2. Bioremediation Design Challenge
Design a microbial-based solution to clean contaminated soil or water.

3. Life Cycle Analysis of Bioproducts
Evaluate the energy and resource footprint of a bioproduct from raw material to disposal.

4. Lab Safety & Waste Management Audit
Assess lab procedures for safety, waste reduction, and environmental compliance.

5. Policy & Ethics Debate
Role-play stakeholders debating biotechnology solutions to climate or energy challenges.

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