ASABE
Annual International Meeting
New Orleans 2027

RESEARCH OVERVIEW Guide

Abstracts in Research Overview format replace traditional abstracts

For AIM 2027, short abstracts are being replaced by abstracts in four-part research overviews. Overviews are reviewed for quality, completeness, significance, and originality before placement in the program.

A complete abstract / research overview is the best way to keep your work from being placed in an unrelated session or declined. Incomplete submissions will not advance.

Four required sections. Each section must be 250–1,000 characters.

- **Purpose:** What question, problem, or objective does this work address?
- **Design / Methodology / Approach:** How was the work conducted?
- **Findings / Results:** What did you find or accomplish?
- **Impacts:** Why does it matter?

Submit a complete overview by January 13.

Volunteer authors, poster authors, guest speakers, and invited speakers all use the same deadline.

Incomplete or thin overviews risk rejection or mismatched session placement.

Example 1

Purpose: What question, problem, or objective does this work address?

> *Example: "This study evaluates whether a modified flush system can reduce ammonia emissions from freestall dairy barns while maintaining adequate manure removal. The objective is to quantify emission reductions and manure removal efficiency under three flush frequencies and two water-addition rates."*

Design / Methodology / Approach: How was the work conducted?

> *Example: "Air samples were collected from three freestall barns using photoacoustic analyzers. Manure depth and solids were measured before and after each flush. Flush frequency and water addition were tested in a randomized block design. Emission rates were calculated from concentration difference and ventilation rate."*

Findings / Results: What did you find or accomplish?

> *Example: "Flushing four times per day with the higher water rate reduced ammonia emissions by 28% compared with the twice-daily low-water treatment, while still achieving complete manure removal. Emissions were lowest in the morning flush under all treatments."*

Impacts: Why does it matter?

Example: "The findings support a practical operating window that lowers ammonia emissions without sacrificing manure removal. Producers can adopt a four-times-per-day schedule with existing equipment. The results also provide emission factors for air-permit modeling and new barn design."

Example 2

Purpose: What question, problem, or objective does this work address?

Example: "This research develops and evaluates a simple, low-cost torque-arm method for accurately measuring the specific energy consumed by laboratory-scale biomass preprocessing equipment. Traditional estimates based on motor current and voltage can be unreliable because motor efficiency and power factor vary substantially with operating load and speed. The torque-arm apparatus instead uses a force transducer, a known lever-arm length, and shaft speed to calculate mechanical torque and power directly. By comparing torque-based measurements with electrical estimates under no-load, partial-load, and full-load conditions, the study demonstrates the limitations of conventional methods. Its broader purpose is to improve equipment comparisons, design optimization, economic analysis, and lifecycle assessment of biomass processing systems."

Design / Methodology / Approach: How was the work conducted?

Example: "The researchers mounted either the biomass processing head on a bearing-supported swing that could rotate about the drive shaft. A torque arm of known length extended from the swing and was restrained by a linear force transducer. The measured force, arm length, sensor angle, and shaft speed were used to calculate torque and mechanical power. Load-cell output, excitation voltage, electrical current, and voltage were recorded with a USB data-acquisition board and LabVIEW at 960 samples per second. The method was applied to several biomass-processing machines and compared with conventional current-and-voltage power estimates under no-load, partial-load, and full-load conditions. Transducers were sized using motor torque and a safety factor, and the load-cell signal was zeroed to correct for gravity."

Findings / Results: What did you find or accomplish?

Example: "The results showed that conventional electrical calculations substantially overestimated mechanical power during no-load and partial-load operation because motor efficiency and power factor declined outside the full-load range. Under no load, the electrical method implied approximately 3,000 W (4 hp) of drivetrain loss, while the torque-arm measurement indicated very little actual loss. At full load, the electrical and torque-based measurements converged because the motor's nameplate efficiency and power-factor values were then applicable. The findings demonstrate that the torque-arm method provides more reliable specific-energy measurements across varying loads, especially for laboratory experiments conducted below full motor capacity. The method is adaptable but requires equipment modification and signal smoothing to address load-cell noise."

Impacts: Why does it matter?

Example: "This work gives the research community a practical, relatively inexpensive method for measuring the mechanical energy actually delivered during preprocessing. Because the torque-arm approach is less

dependent on changing motor efficiency and power factor, it can produce more reliable results than current-and-voltage estimates, especially at partial loads common in laboratory experiments. More accurate specific-energy data should improve comparisons among comminution and other preprocessing technologies, support equipment design optimization, and strengthen economic and lifecycle analyses. The adaptable method may also improve consistency across laboratories and drive systems. However, researchers must account for required machine modifications, sensor alignment, appropriate transducer sizing, and load-cell noise that may require signal smoothing."

Example 3

Purpose: What question, problem, or objective does this work address?

Example: "Small aquaculture farms rarely have 24-hour staff, yet the most dangerous low dissolved oxygen (DO) events occur shortly before sunrise. Running aerators continuously wastes energy, and machine learning forecasts need months or years of site-specific training data that new or small farms do not have. This research develops and evaluates a minimal-history, process-based framework that predicts the next 24 hours of DO using only the previous day of pond observations and inputs that can be derived from routine weather forecasts. The goal is to give producers an early-evening warning of overnight DO drops below 6 mg/L so supplemental aeration can be deployed before fish are stressed or lost, and to determine how aeration type and sensor placement affect prediction reliability."

Design / Methodology / Approach: How was the work conducted?

Example: "DO and water temperature were logged every 10 minutes from March 2024 to June 2025 at 11 sensor locations (surface or submerged, near or away from aerators) in four Kentucky State University research ponds with constant surface aeration, solar-powered diffusers, or mixed aeration in a watershed pond. Kentucky Mesonet pressure and solar radiation data supplied weather inputs. Each evening, BASEmetab, a Bayesian stream-metabolism tool, estimated photosynthesis, respiration, and reaeration coefficients from the prior 24 hours. A recursive mass-balance equation with 1,000 Monte Carlo coefficient samples then predicted DO for the next 24 hours. This first-stage test used observed next-day inputs to separate model error from forecast error. Performance was judged by a % Safe metric for minimum DO on days below 6 mg/L and by daily RMSE, with regression, seasonal, and input-perturbation analyses."

Findings / Results: What did you find or accomplish?

Example: "In a consistently aerated pond, the model safely predicted 91.77% of days when DO fell below 6 mg/L (within 1 mg/L or conservatively low), and the surface sensor away from aerators in the watershed pond reached 100%. Performance was weaker in ponds with variable, solar-driven aeration, especially daytime-only aeration. Accuracy was highest at surface sensors located away from aerators. Missed minimum-DO predictions were linked mainly to day-to-day changes in the respiration coefficient, while errors across the full daily curve were driven mainly by changes in gross photosynthesis. No consistent seasonal pattern emerged, and perturbing temperature, light, pressure, and salinity inputs changed average RMSE only

modestly. Daily RMSE (about 1.3 mg/L at the best pond) was higher than site-trained ML models but required only one day of history."

Impacts: Why does it matter?

Example: "The framework offers a path toward an evening low-oxygen warning that small producers could use without 24-hour staffing, complex control systems, or years of local training data. Because it needs only one day of pond data plus forecastable weather inputs, it could be deployed quickly on new ponds and remain usable after changes in stocking, feeding, or aeration equipment that would invalidate a trained ML model. Targeted aeration based on predicted risk could reduce fish losses while avoiding the energy cost of running aerators all night. The results also guide practical sensor placement. Next steps include testing with actual weather forecasts, improving daily coefficient selection, and pairing the prediction with low-cost automated emergency aeration for small-farm pond and in-pond raceway systems."

Example 4

Purpose: What question, problem, or objective does this work address?

Example: "Many agricultural robotics concepts envision machines that stay in the field all season, continuously scouting for weeds, disease, or pests and acting immediately. Solar panels are often assumed to solve the power problem, but continuous off-grid operation must survive long stretches of cloudy weather, which can also coincide with disease outbreaks. Building on earlier work sizing solar-battery systems for in-pond aquaculture raceways, this study asks how large an off-grid solar array and battery bank must be to reliably support an autonomous robot with a fixed daily energy demand, and whether operational changes such as seasonal shutdown, a small backup generator, or direct charging can make these systems practical."

Design / Methodology / Approach: How was the work conducted?

Example: "A charging-station model was built for a hypothetical robot that works 23 hours per day and returns for a one-hour recharge each evening. Twenty-two years (1998 to 2019) of hourly weather from the Lexington, Kentucky, ASOS station were processed with NREL's System Advisor Model (PVWatts) to estimate output from 2 to 20 kW arrays. An hourly battery state-of-charge simulation combined this output with 5 to 60 kWh lead-acid battery packs and daily robot loads of 3.6 to 24 kWh, including charge-controller and battery charging efficiencies. A configuration was feasible only if the battery never fell to 20% state of charge. Simulations were repeated for March to October operation, a 2 kW propane backup generator limited to 50 kg of fuel per year, and direct daytime charging of the robot with overnight operation."

Findings / Results: What did you find or accomplish?

Example: "Consecutive low-sun winter days, not average production, controlled system size. With year-round solar-only operation, 32 panel and battery combinations supported 3.6 kWh/day, only 12 supported 6 kWh/day, and none supported larger loads. One feasible 6 kWh/day system used a 15 kW array (42 panels, about $22,650) and 30 kWh of lead-acid storage (about $11,661 and 300 L). Operating only March to

October reduced required array size to 33 to 67%, or battery capacity to 40 to 67%, of year-round values. A generator using under 50 kg of propane per year cut battery capacity by 17 to 38% and array size by 13 to 15%; combined with seasonal operation, it supported 12 and 18 kWh/day loads. Batteries still needed at least 2.5 times the daily load. Direct charging increased the supported load in only 4 of 112 generator-assisted configurations."

Impacts: Why does it matter?

Example: "The results challenge the common assumption that adding solar panels to or near a robot will solve its power needs. For continuous in-field systems, the off-grid power supply can be large and costly relative to the robot, so energy efficiency and power-system design must be addressed early in robot development. The study gives designers practical sizing rules, quantifies the value of seasonal operation and minimal backup generation, and provides a simulation approach that can be repeated for other locations and loads. These findings help engineers, researchers, and producers judge where long-term robotic deployments are realistic today and where grid access or hybrid power will be needed. Because results depend on local weather and latitude, expanding the analysis to other regions is a key next step."