MODELA Computational fluid dynamics for the industry

The BPA Module

The BPA module is another analytical layer of our SaaS platform. It serves as a bridge, taking the static data from a **BMP test** and projecting it into a dynamic, time-dependent industrial environment. By utilizing the **ADM1 framework**, the BPA translates biological potential into operational reality.

Audience and Processes

Designed for **Plant Managers, Process Engineers, and Project Developers,** the BPA module moves beyond laboratory batch tests to simulate continuous industrial operations. It ingests kinetic data and substrate characteristics to model the behavior of large-scale digesters.

Functionality

- **Dynamic Prediction:** Forecasts daily biogas flow and methane concentration.
- **Digestate Profiling:** Tracks the degradation of organic matter and monitors the chemical properties (COD, VS, and N) of the output stream.
- **Energy Analytics:** Converts methane yields into electrical and thermal energy potential.
- **Probabilistic Output:** Provides uncertainty quantification, offering a range of results (e.g., P50/P90) to account for biological and operational variability.

Benefits

- **De-risking Investments:** By providing the uncertainty of results, the BPA allows for bankable energy forecasts and more secure supply contracts.
- **Operational Foresight:** Predict potential process instabilities—such as acidification or ammonia inhibition—before they occur in the physical plant.
- **Optimized ROI:** Maximize energy output by fine-tuning feedstock blends based on real-time biological data rather than generic estimates.

Concepts and Assumptions: The ADM1 Connection

The scientific integrity of the BPA module relies on the ADM1 (Anaerobic Digestion Model No. 1).

- **The Bridge:** ADM1 is the fundamental mechanism used to connect BMP kinetic results with the complex, multi-stage biochemistry of an industrial digester (disintegration, hydroly-

sis, acidogenesis, acetogenesis, and methanogenesis).

- **Mass Balance:** The model operates on strict conservation of mass, ensuring every unit of carbon is accounted for.
- **Scaling Factors:** It assumes that laboratory kinetics can be translated to industrial scales through specific correction factors for mixing efficiency and temperature stability.

Usage: The Three-Step Workflow

- **Integrate:** Select feedstock profiles directly from your BMP results library.
- **Configure:** Input industrial parameters, including reactor volume, and other substrate properties.
- **Simulate:** Run the engine to visualize performance curves. Users can **"stress-test"** the system by simulating loading shocks to observe the biological response.

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