

SUSTAINABILITY

PROBLEM STATEMENTS

1. AI-Driven Land Use–Land Cover (LULC) Classification & Change Detection

Problem Statement

Accurate land use monitoring is critical for sustainable planning, but traditional LULC methods struggle with scale, seasonal variation, and visual similarity across land classes. An AI-driven system is needed to automate classification and detect meaningful land-use changes over time.

Core Challenge

- Classify land-cover types from multi-temporal satellite imagery
- Distinguish real land-use change from seasonal variations
- Handle noise from atmospheric and sensor differences
- Scale efficiently to large, high-resolution datasets
- Produce interpretable outputs for planners and policymakers

2. Automated Road Network Detection from Satellite Imagery

Problem Statement

Reliable road mapping from satellite imagery is essential for urban planning and disaster response, but roads are difficult to detect due to occlusions and visual similarity with surroundings. An AI-based detection system is required.

Core Challenge

- Identify roads among visually similar features
- Handle occlusions from trees, shadows, and structures
- Detect thin and discontinuous road segments
- Combine spatial and spectral information effectively
- Generalize across urban and rural regions

3. Tracking and Reducing Corporate Carbon Emissions

Problem Statement

Organizations lack unified visibility into carbon emissions across operations, making reduction efforts difficult. A digital system is required to track, analyze, and reduce emissions using data-driven insights.

Core Challenge

- Integrate emissions data from multiple sources
- Identify major emission contributors
- Track progress over time
- Simulate reduction strategies
- Support sustainability reporting and decision-making

4. Reducing Energy Waste in Commercial Buildings

Problem Statement

Commercial buildings often consume excess energy due to inefficient usage patterns. A smart analysis platform is needed to detect waste and recommend efficiency improvements.

Core Challenge

- Analyze time-based energy consumption patterns
- Identify inefficient usage behaviors
- Recommend actionable energy-saving measures
- Maintain occupant comfort and productivity
- Track energy savings over time

5. Improving Resource Efficiency in Data Centers

Problem Statement

Data centers consume large amounts of energy and water, impacting sustainability goals. A monitoring and optimization system is required to improve resource efficiency without affecting reliability.

Core Challenge

- Monitor energy and water usage metrics
- Detect infrastructure inefficiencies
- Optimize cooling and power usage
- Maintain uptime and performance
- Support sustainability benchmarking

6. Reducing Material Waste in Manufacturing

Problem Statement

Manufacturing processes generate avoidable material waste due to inefficiencies and lack of visibility. A digital system is needed to identify waste sources and improve resource utilization.

Core Challenge

- Track material usage across production stages
- Identify waste points and root causes
- Recommend process improvements
- Preserve product quality and throughput
- Measure waste reduction impact

7. Enabling Reuse of Industrial Byproducts

Problem Statement

Many reusable industrial byproducts are discarded due to poor coordination between industries. A platform is required to enable circular reuse and reduce industrial waste

Core Challenge

- Identify reusable industrial byproducts
- Match producers with secondary users
- Support circular economy workflows
- Track environmental impact reduction
- Encourage cross-industry collaboration

8. Balancing Demand on EV Charging Infrastructure

Problem Statement

Uneven demand at EV charging stations strains power grids and reduces availability. A smart demand-management system is required to balance grid stability and user access.

Core Challenge

- Analyze EV charging demand patterns
- Predict peak usage periods
- Optimize charging schedules dynamically
- Balance user convenience with grid constraints
- Improve infrastructure utilization

9. Evaluating Supplier Sustainability Practices

Problem Statement

Organizations struggle to compare supplier sustainability performance due to inconsistent data. A standardized evaluation system is required to support sustainable procurement decisions.

Core Challenge

- Collect and normalize supplier sustainability data
- Define comparable sustainability metrics
- Enable transparent supplier comparison
- Support procurement decision-making
- Track supplier improvement over time

10. Reducing Water Loss in Urban Distribution Systems

Problem Statement

Urban water systems lose significant resources due to leaks and inefficiencies. A data-driven monitoring system is needed to detect losses and improve water sustainability.

Core Challenge

- Analyze water usage and flow data
- Detect leakage and abnormal consumption
- Identify high-loss zones
- Support targeted maintenance actions
- Improve long-term water reliability