EcoCity Builder

Software Testing Artifact
Pre-Implementation Test Plan

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1 Introduction

1.1 Purpose

This document defines the systematic testing strategy for EcoCity Builder prior to full system implementation. It outlines planned test cases, expected behaviors, potential uncertainties, and validation procedures.

1.2 Scope

Testing will evaluate:

- User authentication functionality
- Game session management
- Sustainability metric calculations
- Boundary enforcement
- API integration
- Database integrity
- Security protections

1.3 Testing Approach

The testing strategy includes:

- Functional testing
- Boundary and edge-case testing
- Integration testing
- Security testing
- Validation of sustainability scoring logic

Since implementation is ongoing, this document specifies expected results and identified risk areas.

2 Test Case Specifications

2.1 TC-01: User Registration

Test ID	TC-01
Feature	User Account Creation
Preconditions	User not already registered
Test Data	Name: Test User Email: test@example.com Password: SecurePass123
Expected Result	Account created, password stored as secure hash, unique email enforced, redirect to dashboard
Risks / Uncertainties	Email duplication handling incomplete; password hashing not integrated; inconsistent validation layers
Validation Plan	Verify database insertion and confirm hashed password storage

2.2 TC-02: Input Validation

Test ID	TC-02
Feature	Invalid Input Handling
Test Data	Email: invalidemail Password: (empty)
Expected Result	Submission blocked, error displayed, no database entry created
Risks / Uncertainties	Missing sanitization; frontend/backend rule mismatch
Validation Plan	Confirm validation enforced both client-side and server-side

2.3 TC-03: Game Session Initialization

Test ID	TC-03
Feature	New Game Session Creation
Expected Result	GameSession record created; default metrics initialized; turn number set to 1
Risks / Uncertainties	Incorrect default metric values; state mismatch between frontend and backend
Validation Plan	Compare displayed values with stored database snapshot

2.4 TC-04: Decision Impact Calculation

Test ID	TC-04
Feature	Infrastructure Decision Processing
Test Data	Economy +10; Environment -15; Carbon +20
Expected Result	Metrics updated deterministically; turn incremented; decision recorded in database
Risks / Uncertainties	Metric overflow; negative values allowed; concurrent update conflicts
Validation Plan	Ensure metrics bounded within predefined limits (e.g., 0–100)

3 Boundary and Edge Case Testing

3.1 TC-05: Carbon Threshold Enforcement

Test ID	TC-05
Feature	Environmental Failure Condition
Test Data	Carbon = 95; Action +10
Expected Result	Carbon capped at maximum threshold; game over triggered
Risks / Uncertainties	Threshold not enforced; failure state not triggered
Validation Plan	Confirm fail-state logic activates when limits exceeded

4 Integration Testing

4.1 TC-06: API Communication

Test ID	TC-06
Feature	Decision Submission API
Expected Result	Backend validates request; metrics updated server-side; updated state returned to frontend
Risks / Uncertainties	Invalid JSON structure; missing authentication verification; state synchronization issues
Validation Plan	Validate API contract and authentication enforcement

5 Security Testing

5.1 TC-07: SQL Injection Protection

Test ID	TC-07
Feature	Input Sanitization
Test Data	test@example.com' OR '1'='1
Expected Result	Input sanitized or rejected; no unauthorized access; no database corruption
Risks / Uncertainties	Raw SQL queries; improper parameter binding
Validation Plan	Enforce prepared statements and parameterized queries

6 Overall Validation Strategy

Prior to deployment, the system will undergo:

- Manual verification of sustainability formula calculations
- Database integrity inspection
- API contract validation
- Boundary stress testing
- Security-focused penetration testing