RMIT UNIVERSITY

School of Science, Engineering & Technology

RMIT Hackathon 2025

Challenge 3 — Vibe Coding - Play to Impact (15%)

EcoPoly — Environmental Board Game (Project Report)

Team: Muck

Table of Contents

Executive Summary

EcoPoly is a web-based, turn-based board game that teaches systems thinking around climate change and sustainability. Players navigate a 40-space board while buying and developing properties along either Eco or Industrial paths, managing four key resources—EcoCredits, Sustainability Score, Community Influence, and Carbon Tokens—resolving event cards, and voting on policies at Global Summits. The objective is to achieve the highest Global Impact Score by the end of twenty rounds while keeping global emissions in check. The project targets a browser environment and requires no installation or backend services. It supports two to six players in a local pass-and-play format and typically lasts between forty-five and ninety minutes. Multiple modes are available, including a competitive mode, a cooperative mode where the team must keep Global CO2 below forty, and a corporate mode currently presented as a concept. At its core, EcoPoly emphasizes the educational exploration of climate trade-offs, policy design, collective action, and the interdependencies that define complex systems.

1. Introduction

EcoPoly — Environmental Board Game (Version 1.0, 2025) was developed for Hackathon Challenge 3 on Social Impact Gaming under the theme of Climate Change and Sustainability. The primary goal is to make abstract climate concepts tangible through engaging strategy gameplay and policy dynamics, allowing players to grapple with the trade-offs among economic growth, environmental stewardship, and social influence within a clear, interactive model.

2. Game Theme Topic Justification

Climate change and sustainability were chosen because they represent a defining global challenge in which policy, technology, and behavior interact in complex ways. Vietnam's exposure to sea level rise and extreme weather, combined with rapid urbanization and an urgent energy transition, highlights the need for accessible educational tools in the region. Australia's context—marked by energy exports, elevated bushfire risk, and a strong potential for renewables—adds a complementary perspective where policy debates are especially salient. Learners in both countries, and globally, benefit from simulations that make trade-offs concrete and illustrate collective action problems. EcoPoly addresses this theme by mapping real-world concepts such as carbon emissions, policy levers, and green technology to intuitive game mechanics. It forces meaningful choices between immediate profit via Industrial development and long-term sustainability via Eco development, models spillover effects by increasing Global CO2 from individual decisions, and integrates policy by enabling Global Summit votes weighted by Community Influence.

3. Potential Impact

EcoPoly is designed to foster knowledge about carbon footprints, externalities, and incentives while encouraging behavior changes through direct experience of pollution costs and the benefits of mitigation and adaptation. The game provides a structured platform for discussing

policy trade-offs in classrooms and community settings. Its pure browser implementation requires no installation, making it easy to distribute, scale, and localize. Clear iconography and modal-driven interactions support accessibility on laptops and tablets, lowering barriers to entry for diverse audiences.

4. Technology Stack

EcoPoly is built entirely with HTML5, CSS3, and modern JavaScript (ES6+). HTML provides the application structure and multiple views including menu, setup, rules, in-game, and results screens. CSS manages theming, responsive layout, and animations for elements like the board, dice, and modals. JavaScript implements the game state, mechanics, event handling, and UI updates. Persistence uses the browser's localStorage for auto-saving approximately every thirty seconds. The project intentionally avoids external dependencies or frameworks for simplicity and portability. The key files are `game_app/index.html` for the DOM structure and screen sections; `game_app/css/styles.css` for visual design and responsive rules; `game_app/js/game.js` for the core loop, board rendering, movement, and UI wiring; `game_app/js/board.js` for strategic actions and property management; `game_app/js/cards.js` for card decks, event resolution, voting, CO2 thresholds, and global events; and `game_app/js/ui.js` for general UI helpers, notifications, autosave, and keyboard shortcuts.

5. Game Mechanics Overview

Players manage four core resources: EcoCredits, which serve as the primary currency and begin at 1500; Sustainability Score (SS), an environmental performance metric that starts at 50; Community Influence (CI), representing social and political capital that begins at 0; and Carbon Tokens (CO2), a measure of pollution that also begins at 0. Each turn, a player rolls two six-sided dice and moves clockwise around a forty-space square board. They then resolve the landing space—buying or interacting with properties, drawing Green or Crisis cards, paying the Carbon Tax, receiving funds from the Eco Fund, attending a Global Summit, or collecting a Start bonus if applicable. After resolving the space, the player may take exactly one optional strategic action before ending their turn. When the turn ends, any Industrial properties the player owns contribute to their personal Carbon Tokens and increase Global CO2, after which CO2 thresholds are checked.

The board features a mix of property and event spaces. Properties span energy, urban, and natural zones, such as Solar Farm, Wind Turbine, Green Building, Public Transit, Forest Reserve, Wildlife Park, Organic Farm, Hydro Dam, Geothermal, and Marine Reserve. Industrial options include Coal Plant, Oil Refinery, Factory, Gas Plant, Parking Lot, Landfill, Mining Site, and Industrial Zone. Card spaces instruct the player to draw either a Green Card, which typically provides positive benefits, or a Crisis Card, which presents dilemmas. Carbon Tax spaces require paying fifty Credits per Carbon Token, while Eco Fund spaces award one hundred fifty Credits. Global Summits prompt policy votes, and passing or landing on Start yields a two hundred Credit bonus.

When a player lands on an unowned property, they may purchase it and choose an Eco or Industrial development path. Eco Path properties offer lower rent income but grant an immediate +5 SS and do not generate CO2 each round. Industrial Path properties produce higher rent but add +1 Carbon Token for the owner at the end of their turns. Properties can be upgraded at a cost of 150 plus 50 multiplied by the current level, increasing rent. Owners of Industrial properties can convert them to Eco at a cost of 200 plus 100 multiplied by the current level; doing so grants +8 SS, removes 1 personal Carbon Token, and reduces Global CO2 by 1. Rent for Eco properties is calculated as 100 plus 50 times the property level, while Industrial rent is 200 plus 75 times the level.

After resolving a landing, players may take one strategic action. Investing in Innovation (cost 300) draws and applies a Green Card immediately. Launching a Campaign (cost 150) adds +3 to Community Influence, increasing voting power and contributing to the final score. Offsetting Emissions allows players to pay 100 Credits per token to remove personal Carbon Tokens and reduce Global CO2. Lobbying for Policy is available once per game and lets the player propose a custom policy for a full-table vote.

Cards and events shape the game's evolving narrative. Green Cards provide benefits such as Credits, SS, CI, or CO2 reductions, often representing grants, awards, or technological breakthroughs. Crisis Cards impose challenging trade-offs that may cost Credits or reduce SS or CI and sometimes increase CO2. Every five rounds, a global event occurs, such as a UN Climate Review penalizing high emitters or a Tech Innovation Leap providing small emissions reductions and SS boosts for all players.

The CO2 system is central to EcoPoly's collective-action theme. Global CO2 rises through Industrial activity and some Crisis outcomes and falls via offsets and specific policies or events. Crossing thresholds produces shared consequences: at 10, a climate warning appears; at 20, everyone loses 100 Credits due to extreme weather; at 30, a Global Summit reminder is logged; and at 40, a Climate Crisis inflicts heavy penalties such as reductions in Sustainability Score. High personal pollution also carries risk: if a player's Carbon Tokens reach six or more at the end of their turn, they must roll for a personal disaster, which can result in lost Credits, SS penalties, or a narrow escape.

Policy and voting are realized through Global Summits. Policies are proposed and voted on by all players, with each player's votes weighted by their current Community Influence (but never less than one). Example policies include a Carbon Tax that charges fifty Credits per Carbon Token, Mandatory Emissions Reduction that removes one Carbon Token from each player, the Green Innovation Fund that grants two hundred Credits to players with SS of at least sixty, and a Community Action Grant that increases CI for everyone. Custom lobbying proposals such as Eco Property Bonuses or Carbon Penalties for heavy polluters add strategic depth and table negotiation.

The game ends after twenty rounds. Each player's Global Impact Score (GIS) is computed as Sustainability Score plus the floor of EcoCredits divided by 100, plus Community Influence, minus five times the number of Carbon Tokens: $GIS = SS + floor(EcoCredits/100) + CI − 5 \times$

CO_2. If there is a tie, the player with fewer Carbon Tokens wins; if still tied, the player with more EcoCredits prevails. In cooperative mode, the team wins collectively if Global CO_2 remains under forty at the end of the game; otherwise the team loses.

6. Educational Integration

EcoPoly embeds learning directly into its mechanics. The Eco versus Industrial property decision models the tension between immediate profit and long-term environmental value. Externalities are represented through Global CO_2, which rises from individual Industrial choices but penalizes all players when thresholds are crossed. Policy and influence are captured by CI-weighted voting, demonstrating the role of social capital and governance in shaping outcomes. Crisis cards and events provide a window into both mitigation and adaptation strategies, showing how each has costs and benefits. As players manage resources and navigate policies, they experience how interconnected systems produce emergent outcomes, encouraging systems thinking.

7. Development Process

The development began with concept ideation to define the core loop—roll, move, resolve— alongside dual development paths and meaningful CO_2 thresholds. Using prompt-driven workflows (see the `prompts/` directory), the team iterated on concepting, code generation, and refinement. Implementation milestones included the dynamic board layout and rendering, the turn engine and action phases, and the property system with rent calculations, upgrades, and conversions. The card decks (Green and Crisis) and their effect application were built in tandem with the policy deck and voting flow, including CI-weighted votes. Global events occur every five rounds to maintain table-wide engagement. The user interface was polished with modals, animated dice, a persistent activity log, and responsive design. Quality-of-life features such as keyboard shortcuts and autosave via localStorage were added to improve usability.

8. Features Summary

EcoPoly features a forty-space board populated by properties, events, and Global Summits; dual property development paths with upgrades and conversion mechanics; and clear displays for four player resources. It includes three card decks (Green, Crisis, and Policy), strategic actions with a once-per-game lobbying option, and a CO_2 system with thresholds and personal disaster risks. Global events trigger every five rounds to impact all players. The game supports both cooperative and competitive goals, with a conceptual corporate mode for future differentiation. The interface is responsive and animated, with modals and an activity log to maintain clarity. Keyboard shortcuts—Space to roll, Enter to end a turn, Esc to close modals, and H for help—streamline interaction, and an autosave process uses localStorage approximately every thirty seconds.

9. Challenges and Solutions

Balancing the incentives between Eco and Industrial development required iterative tuning of rent values, upgrade costs, Sustainability bonuses, and CO2 penalties to keep both paths viable. To ensure that all players remained engaged throughout, the design incorporated global thresholds and events that affect everyone, as well as CI-weighted voting to involve all players in policy decisions. Clarity of feedback was improved through informative landing, property, card, and summit modals, supported by a persistent activity log. Operating as a pure frontend application posed constraints addressed by using localStorage for persistence, eliminating external dependencies, and optimizing DOM updates. Early versions experienced board layout collisions near corners, which were resolved by adopting a perimeter-distance placement algorithm.

10. Testing and Iteration

Testing combined manual playthroughs with two to four players to validate pacing and balance, with iterative tuning of card effects and the impact of CO2 thresholds. The UI was exercised across viewport sizes to verify responsive behavior at common breakpoints. Sanity checks covered edge cases such as purchasing, upgrading, and converting without sufficient funds; automatic deck reshuffling when a deck runs dry; voting logic when CI is zero (treated as one vote); Start bonuses when wrapping; and personal disasters at high personal CO2 levels. Notable limitations include the corporate mode, which is currently present in the UI but not fully differentiated in rules and logic; the 30-CO2 threshold, which currently logs a Global Summit reminder but relies on board or future enhancements for automatic triggering; and several late-stage Green or Crisis cards with large effects that may need further balancing.

11. UI/UX Design

The visual identity embraces an eco-focused palette with greens and blues and uses warning accents to denote crises and taxes. Information is arranged to keep the player oriented at all times: the left sidebar shows the current player and available actions, the center houses the board and dice display, and the right sidebar presents all players with an activity log. Modal-driven interactions provide clear, step-by-step decision points for property purchases, card choices, and voting. Accessibility is supported through high-contrast elements, legible sizes, and keyboard shortcuts, while emoji serve as quick visual cues for resources and space types.

12. Architecture and Code Organization

EcoPoly is implemented as a single-page application in vanilla JavaScript. A central `gameState` object maintains all mutable state, including players, board spaces, decks, and active mode. Responsibilities are clearly partitioned across modules: `game.js` manages lifecycle flow, board rendering, movement, and landing resolution; `board.js` implements strategic actions and property management utilities; `cards.js` defines card decks and handles card flow, policy voting, CO2 thresholds, and global events; and `ui.js` contains helper utilities for notifications, autosave, and keyboard handling.

13. Future Enhancements

Future iterations will focus on online multiplayer via sockets and AI opponents for solo play, a more nuanced corporate or hidden-role mode, and themed scenario packs such as Vietnam's coastline adaptation or Australia's bushfire seasons with tailored decks. Audio design (sound effects and music) and richer animations will improve immersion. Progression systems including achievements, leaderboards, and analytics will support classroom use. Localization into English and Vietnamese (and beyond) will broaden reach, while accessibility audits and improved screen-reader flows will further reduce barriers. Finally, expanded save/load slot management and in-game settings will provide better control over the experience.

14. How to Run / Play

To play EcoPoly, open `game_submission/game_app/index.html` in a modern desktop browser such as Chrome, Edge, Firefox, or Safari. No server is required; the game runs locally in the browser. From the menu, set up the number of players and select a game mode, then follow the on-screen prompts to proceed through each turn. Keyboard shortcuts speed up play: press Space to roll the dice, Enter to end a turn, Esc to close a modal, and H to open help.

To export this report to PDF, use your Markdown tool's export feature or copy the content into Word or Google Docs and export from there. Save the output as `project_report.pdf` and place it in the `game_submission/` directory.

15. Evaluation and Impact

We found the game to be a powerful tool for understanding climate change and sustainability. Throughout our sessions, we learned to explain concepts like emissions, mitigation, and adaptation by making decisions in the game and seeing their outcomes. The mechanics helped us recognize externalities—how one player's choices could affect everyone—and showed us the importance of policy in managing these impacts.

EcoPoly challenged us to weigh short-term gains against long-term consequences, especially when choosing between industrial and eco-friendly development paths. The voting system, where our influence depended on our actions, made us think carefully about persuasion and collective decision-making. We also saw firsthand how cooperation and competition can shape the results when managing shared resources like global CO2.

After each game, we reflected on our strategies and discussed "what-if" scenarios, which deepened our understanding of climate issues. Keeping a decision journal and participating in post-game debriefs helped us connect the gameplay to real-world challenges and possible solutions. Overall, EcoPoly made complex environmental topics engaging and relevant, and encouraged us to think critically about our role in addressing global problems.

16. Conclusion

EcoPoly translates climate complexity into approachable strategic play. By tying profit, policy, and pollution together—and by making collective risks visible through thresholds and voting—the game provides a meaningful, discussion-ready experience for classrooms and communities. The current build is fully playable, browser-based, and extendable. With further iterations on balance, scenarios, and multiplayer, EcoPoly can become a versatile educational platform for climate literacy.

17. Appendices

A. Full Rules (concise)

EcoPoly supports two to six players, each starting with 1500 Credits, 50 Sustainability Score, zero Community Influence, and zero Carbon Tokens. On a turn, a player rolls, moves, resolves the landing space, may take one strategic action, and ends the turn—at which point Industrial properties add to personal CO_2. Unowned properties can be purchased on landing with a choice between Eco and Industrial development; owned properties collect rent when another player lands on them; and landing on your own property allows management actions like upgrades or conversion. Card spaces prompt drawing a Green or Crisis card. Carbon Tax spaces levy fifty Credits per Carbon Token, while Eco Fund spaces award 150 Credits. Summits call a vote on a policy, with CI providing vote weight (minimum one). Players track Global CO_2 with thresholds at 10, 20, 30, and 40, and face a personal disaster roll at CO_2 of six or more. After twenty rounds, the highest GIS wins; ties are broken first by fewer Carbon Tokens and then by more Credits.

B. Card Catalog

Examples of Green cards include "Plastic-eating enzyme," which grants +10 SS and removes 2 CO_2; "Efficiency award," which awards 200 Credits and +5 SS; and "Carbon capture breakthrough," which confers +20 SS and removes 20 CO_2. Crisis cards feature dilemmas such as "Mega drought," where players pay Credits or lose SS; "Wildfire threat," which forces investment in protection or loss of SS; and "Air pollution," where installing filters trades Credits for SS. Representative policies include a "Carbon Tax" at 50 per token, "Mandatory Emissions Reduction" that removes 1 CO_2 from each player, and the "Green Innovation Fund" that grants 200 Credits to players with SS of at least 60.

C. Key Formulas

Global Impact Score is defined as $SS + floor(EcoCredits/100) + CI - 5 \times CO_2$. Rent for Eco properties is $100 + 50 \times level$, while rent for Industrial properties is $200 + 75 \times level$. Upgrade cost is $150 + 50 \times level$. Converting Industrial to Eco costs $200 + 100 \times level$.

D. Screenshots

See `game_submission/screenshots/` for gameplay captures and UI illustrations, following the provided screenshot instructions.