AI Usage Across the M-REGS Project

1. System Architecture & Flow Design

- AI assisted in **structuring the full recycling pipeline** into modular components (Shredder → Sorter → Pyrolyzer → Reforming → Gas Cleanup → Condenser → SOFC → Power Management → Outputs).
- Using AI, we generated **Mermaid flowcharts** to visualize workflows clearly and consistently.
- This modularization allowed us to quickly adapt the Mars system into a Dhaka-only plastics recycling version.

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2. Technical Specification Generation

- AI produced **SolidWorks-ready spec sheets** for each module (dimensions, operating parameters, materials).
- Specs included engineering details like **operating temperature ranges, catalyst types, filtration stages, and housing dimensions**.
- These were used as a **Bill of Materials (BOM) baseline** to guide CAD modeling.

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3. Simulation & Performance Modeling

- AI helped us **estimate energy yields** from waste through pyrolysis and SOFC conversion.
- Built models for **thermal energy reuse** (pyrolyzer heat loops), **water recovery rates**, and **waste-to-product ratios**.
- For Earth applications, AI integrated **NASA POWER weather API** data to calculate solar energy availability based on location and time span.

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4. Software Development & Dashboard

- AI generated production-ready **React dashboards** for real-time system monitoring.
- Features included:
  - **Sliders** for waste intake and projection days.
  - **Switches** for diversion overrides.
  - **Dynamic charts** for solar, SOFC, and thermal energy output.
  - **Sustainability metrics** (water reuse %, energy self-sufficiency, waste utilization).
- AI also structured backend logic so **all values update dynamically** with user input and API data.

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5. Cost Modeling & Localization

- AI scraped **local cost references** for solar panels, shredders, and industrial components in Bangladesh, allowing realistic cost projections.
- Enabled us to estimate per-unit costs (~USD $16k–$29k) for a Dhaka deployment.
- For Mars, AI projected **mass, energy demand, and modular scalability** instead of monetary cost.

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6. Storytelling & Communication

- AI generated a **professional video script** with scene sequencing, narration flow, and background visuals.
- Helped us refine **presentation pacing**: who we are, the problem, the idea, the system breakdown, and impact.
- Enhanced clarity by **stitching technical explanations into an engaging narrative**.

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7. Creativity Amplification

- Instead of replacing our input, AI amplified our creativity by:
    - Suggesting **energy cascading** (pyrolyzer → dryer → heat exchanger).
    - Structuring a **circular water loop** for zero-loss recovery.
    - Designing a **projection slider** in the dashboard for futuristic “what-if” simulations.
    - Helping us balance **Mars vs. Dhaka requirements** (high-tech self-sufficiency vs. cost-effective simplification).

Conclusion

Across the full M-REGS project, AI was a **co-designer, simulator, and communicator**. It provided:

- **Structure** (flowcharts, specs, dashboards)
- **Computation** (energy, cost, efficiency modeling)
- **Creativity support** (new design ideas, presentation flow)

Our human contribution was in **contextual insight, local adaptation, and creative engineering decisions**. AI accelerated technical execution, while our creativity ensured M-REGS is not just technically feasible but also **culturally and operationally relevant —** whether on **Mars or in Dhaka**.