Upcycle Everything

Design I (EDNS151) Call For Proposals / Fall 2023

Background

Climate change, fossil fuels, plastic, greenhouse gas emissions, landfills, old infrastructure, housing, transportation, pollution – all reasons to find new uses for old things. Processing materials, fuels, and food contributes to up to half of greenhouse gas emissions, 90% of biodiversity loss and water stress [1]. Organic waste decomosition produces carbon dioxide and methane [2]. Plastic produces waste and emissions throughout its entire lifecycle [3]. The building of new infrastructure also causes great environmental harm [4]. Recycling requires energy for reprocessing, breaking down, and reusing raw materials as well as transportation and remanufacturing, often resulting in lower quality end products. Upcycling uses existing manufactured materials, products, and or infrastructure at end of service life to produce a new product with relatively new or greater value, using less energy and polluting less than other refuse disposal options. Upcycling can apply to products, packaging, infrastructure, or even biological or chemical waste using one type of waste to neutralize the effects of another.

Opportunities

Consider opportunities to upcycle products, systems, materials, or structures in any community, be it local, regional, or global settings. Suggested considerations include textiles, consumer products, electronics, infrastructure, parts of larger assemblies, chemical waste, biological waste, etc. Projects must involve deliberation and design process to reuse or reform or reassemble components of existing items to create new items – for example, repurposing something disk-shaped (like a CD or DVD) as a coaster or using shoe as a planter would not be sufficient or novel, nor would simply replacing the original contents of a product's jar or other vessel with alternate content suffice.

The brunt of **solutions should be technical in nature**, but may touch on **any technical field**: electrical, mechanical, civil, environmental, computer science, chemical, geological, materials, mining, industrial, etc. However, **solutions must also consider the socio-technical** framework of the design challenge, not simply the technical aspects. Thus the *social context* and *ancillary* and *nontechnical* issues must be considered such as community needs, power structures, history, resources, culture, education, government policies, economics, logistics, etc. Solutions designed by student teams should represent **creative, novel responses** to some facet of the challenge.

We encourage you to explore specific dimensions of this problem as well as existing solutions so that you might materially improve upon them while steering clear of custom-built, one-off uses, except in cases of specific communities with relatively unique ongoing needs. Your solution must be repeatable and scalable—directly or indirectly impacting a significant population, while making a meaningful impact on our world.

Requirements

- The solution should be designed with a specific stakeholder group in mind, and evidence of incorporating the feedback of this group must be abundant. This includes considering the original design's purpose.
- The proposal, while showcasing and quantifying positive impacts, must also quantify the costs and identify potential negative impacts, including a risk-mitigation plan.
- Solutions may be products or processes, but must be prototyped and modeled and validated.

- All prototypes and testing must be safe to students, and the final solution must be safe to any potential users.
- Team prototyping expenses should not exceed $100, and must demonstrate key functionality and features of each team's final solution.
- Technical solutions should be designed with respect to nontechnical and ancillary issues, contextual, environmental, and social considerations, and of course stakeholders.
- There are no cost constraints on the full scale, final proposed solution, but final design deliverables must demonstrate that the cost of the solution is commensurate to the value offered.

Design Competition

At the conclusion of the semester, this human-centered, open-ended, hands-on, team design project will culminate with a judged design competition independent of grading. Student teams will present their design concepts, demonstrate prototype functionality and use, value, technical and nontechnical validation, and how user needs are addressed. Each of the Design I (EDNS151) sections' top Preliminary Round team will compete against other sections' representatives to crown overall winners in the Final Design Competition.

Final Design Competition Prizes

- First Place Overall: $1000 (split among teammates)
- Second Place: $500
- Third Place: $250
- Subject Matter Experts' Top Pick: $250

References

[1] United Nations Environment Programme, & International Resource Panel, *Global Resources Outlook 2019: Natural Resources for the Future We Want*, p. 27, 2019 [Online]. Available: https://wedocs.unep.org/20.500.11822/27517.

[2] D. Johnravindar, J. W. C. Wong, D. Chakraborty, G. Bodedla, G. Kaur, "Food waste and sewage sludge co-digestion amended with different biochars: VFA kinetics, methane yield and digestate quality assessment," *Journal of Environmental Management*, vol. 290, 112457, Jul 2021 [Online]. Available: https://doi.org/10.1016/j.jenvman.2021.112457.

[3] Rikhter, Paul, *et al*. *Life Cycle Environmental Impacts of Plastics: A Review*, National Institute of Standards and Technology, 2022 [Online]. Available: https://nvlpubs.nist.gov/nistpubs/gcr/2022/NIST.GCR.22-032.pdf.

[4] W. F. Laurance, *et al*. "Reducing the global environmental impacts of rapid infrastructure expansion." *Current Biology*, vol. 25, no. 7, pp. R259-R262, Mar 2015 [Online]. Available: https://www.cell.com/current-biology/pdf/S0960-9822(15)00219-5.pdf.