



USE CASES ON DATA SCIENCE FOR CIRCULAR ECONOMY

Circular Economy approach refers to designing a new system such that, the externalities that we exert on the environment as we produce and consume, are mitigated. Research shows that a circular economy in Europe can create a net benefit of €1.8 trillion by 2030, while addressing mounting resource-related challenges, creating jobs, spurring innovation, and generating environmental benefits.

Data solutions have proven to be powerful catalyst for change. New technologies, such as the artificial intelligence (AI), Big Data, Internet of Things (IoT) and applied data science in general, have shown their potential to effectively address climate change through innovations. Combining two emerging megatrends—data technologies and circular economy—can accelerate a shift towards a regenerative system fit for the future. AI can help design circular products, components, and materials; operate circular business models; and optimize circular infrastructure. AI could be integral in the redesigning of systems, which creates a circular society that works efficiently in the long term.

Opportunities for Data Science usage to accelerate the transition to a circular economy –

- **To inform and accelerate efforts to design out waste and pollution**
- **To increase the effectiveness of and optimize circular economy business models**
- **To streamline the infrastructure needed to keep products and materials in use**

NOTE: The participants are allowed to pick a problem statement of their choice that aligns with the theme of “Data Science for Circular Economy”. However, if you/your team are struggling to pick an idea, you can refer to the following use cases and choose to work on one of them.

SAMPLE USE CASES & EXAMPLES (FOR REFERENCE)

We have divided the use cases in four broader heads – Reuse, Reduce, and Rethink. Student teams can use frontier data technologies (such as AI, ML, Data Analytics, IoT, Big Data, etc.) and openly available datasets to create solutions such as but not limited to the following:

REUSE

A consumer often judges the worth of a product in terms of the money they paying for it and how much effort did it take them to earn that amount. We need to start thinking about the worth of a product in terms of the amount of energy that went into getting that product to the consumer.

There is a need to rethink the traditional processes to increase resource efficiency, minimize waste and also generate profits. Digital applications can help in many ways to make the available material for reuse, or redistribute it to extend usability, or upcycle it.

Here are a few specific use cases around the same:

a. **Using artificial intelligence to generate additional revenue by reusing existing resources and processes**

Example –

- A smart platform to change consumer mindset and help them on how to reduce their carbon footprint by reusing daily household material
- Smart monitoring of goods transport to better utilize the cargo space and reduce fuel utilization

b. **Setting up a digital marketplace for second hand goods and by-product material streams**

Examples -

- Developing solutions for artificial intelligence-based sorting, segregation, and valuation of waste/by-products/second hand goods
- A smart platform to rent, sell and buy products such as second-hand clothes, foot wears, or children's toys, tools, warehouses, cooling facilities, etc.
- Smart platform for by-products exchange between APMC & Food Market, or between textile industry and utility, etc.

c. **Using data solutions to generate new products from organic waste streams**

Example -

- IOT + wet chemistry-based solutions to monitor concentration of contents in organic fertilizers to expedite the post-compost sales for small composters.
- Using smart technology to retrieve valuable materials from wastewater streams

REDUCE

Recycling is the action or process of converting waste into reusable material. Consumer's often think that if they discard the waste responsibly, it will get recycled. But in the face of our current environmental challenges, recycling won't be enough to overcome the sheer amount of waste we produce. The circular economy, however, goes right back to the beginning to prevent waste and pollution from being created in the first place. To achieve efficient processes to cut down on waste and energy wastage, data technologies play a major role in developing solutions.

A few specific use cases can be:

a. Design powered by AI/Data Science insights

Examples –

- An AI system to design say electronic components that reduce waste in manufacturing process
- AI & IoT based alloy generation processes to reduce resources wastage human errors (applicable to any other material design)
- AI algorithms to suggest design alterations to reduce material used
- AI-ML to uncover hidden inefficiencies and opportunities to improve resource utilization in manufacturing

b. Smart industry operations design and monitoring to reduce waste in operations

Example –

- Image processing and IoT sensors to detect spills or machine failure
- AI & monitoring systems for food quality maintenance during transport

c. Using data driven technologies to improve energy efficiency

Example –

- IoT/Smart meters to help households/industries monitor their energy consumption and analyze insights on reducing consumption
- Sensors to detect machine efficiency and energy utilization in the manufacturing process
- AI driven energy storage and losses reduction

d. Asset monitoring for repair and maintenance

Example –

- Smart analytics for predictive maintenance and resource lifestyle extension

RETHINK

Developing data-driven solutions to help organizations transition from conventional business models towards a transformative and circular system. A few specific use cases can be:

a. Regenerative supply chain alternatives

Examples –

- AI for perishable food product distribution based on local needs to reduce wastage in transport
- AI-ML based algorithm to detect and suggest cargo sharing, storage space sharing, etc.
- Smart management of deposit and return schemes

b. Dynamic pricing

Example –

- AI based dynamic pricing of perishable goods as they approach expiry to reduce wastage

c. Smart material sourcing to reduce linear risk exposure

Example –

- Smart mapping of vendors and suppliers transitioning to circular raw materials