# CleanTech — Problem–Solution Fit

## Problem Statement

Inefficient waste segregation systems in urban environments result in poor recycling rates, increased landfill overflow, and environmental degradation. Manual waste classification is error-prone and unsustainable at scale.

## Proposed Solution

CleanTech is an AI-powered image classification system that uses transfer learning (VGG16 model) to automatically identify whether waste is biodegradable, recyclable, or trash. It is accessible via a Flask-based web interface for real-time predictions.

## Dataset Collection

- Source: Kaggle  
- Classes: biodegradable, recyclable, trash  
- Format: .jpg, .png, .zip

## Activity 1.1 – Importing Libraries

import tensorflow as tf  
import keras  
import pandas as pd  
import numpy as np  
import matplotlib.pyplot as plt  
import os, random

## Activity 1.2 – Reading and Visualizing the Dataset

- Dataset unzipped and loaded using pandas  
- Images randomly selected and visualized using IPython.display and matplotlib  
- Dataset structured into 3 folders: biodegradable, recyclable, trash

## Prediction Verification

- Biodegradable → Correct  
- Recyclable → Correct  
- Trash → Correct

## Data Augmentation

Skipped — dataset was already preprocessed and cropped. However, typical augmentation methods include rotation, flipping, zooming, and brightness adjustment to improve generalization.

## Architecture

project/  
├── app.py (Flask backend)  
├── templates/ (HTML templates)  
├── static/ (uploads, styles)  
└── Vgg16.h5 (trained model)

## Conclusion

CleanTech provides an intelligent and scalable solution for smart waste classification. By automating waste sorting using AI, cities can promote sustainability, reduce environmental harm, and streamline waste management processes.