Project | Sustainability Impact Analysis for Intel

— Executive **Summary**

In this project, I analyzed Intel's 2024 device repurposing program using SQL to assess how various factors—like device type, age, and repurposing region—affect sustainability outcomes. Using over **600,000 records**, I delivered **data-driven insights** and a final recommendation to help Intel maximize energy savings and CO_2 reductions.

— Key **Highlights**

- 601,740 devices repurposed in 2023
- Older devices save significantly more energy and CO_2 per unit
- Asia offers the highest CO_2 savings due to high carbon intensity
- Recommendation: Focus on older devices in high-impact regions

— Project **Goals**

- Understand the impact of repurposing across device types and ages
- Quantify energy and emissions savings by region
- Provide a strategic recommendation to improve Intel's sustainability outcomes

— Tools & Skills **Used**

- **SQL** (Joins, CTEs, CASE, Aggregates, Grouping)
- Data Cleaning & Transformation
- Analytical Reasoning
- Sustainability Insight Framing

— Data Set **Descriptions**

`intel.device_data`

- `device_id`: Unique identifier for each repurposed device
- `device_type`: Type of device
- `model_year`: The year the device was manufactured

`intel.impact_data`

- `impact_id`: Unique identifier for the repurposed device's impact record
- `device_id`: Foreign key to device table
- `usage_purpose`: The specific purpose for which the device is being repurposed
- `power_consumption`: Power consumption of the device in watts (W) when in use
- `energy_savings_yr`: Estimated energy savings per device per year measured in kilowatt-hours (kWh)
- `co2_saved_kg_yr`: Estimated CO2 emissions saved per device per year measured in kilograms (kg)
- `recycling_rate`: The percentage of the device that is recyclable
- `region`: The geographical region where the device was repurposed

— SQL Queries **Overview**

1. Join Device & Impact Tables

```
SELECT
  *
FROM
  intel.impact_data AS impact
INNER JOIN
  intel.device_data AS device
ON
  impact.device_id = device.device_id;
```

2. Add Device Age

```
SELECT
  *,
  (2024 - device.model_year) AS device_age
FROM
  intel.impact_data AS impact
INNER JOIN
  intel.device_data AS device
ON
  impact.device_id = device.device_id;
```

3. Bucket Devices by Age Group

```
SELECT
  *,
  (2024 - device.model_year) AS device_age,
  CASE
    WHEN (2024 - device.model_year) <= 3 THEN 'newer'
    WHEN (2024 - device.model_year) <= 6 THEN 'mid-age'
    ELSE 'older'
  END AS device_age_bucket
FROM
  intel.impact_data AS impact
INNER JOIN
  intel.device_data AS device
ON
  impact.device_id = device.device_id;
```

4. Aggregate Total Environmental Impact

```
WITH device_ages AS (
  SELECT
    *,
    (2024 - device.model_year) AS device_age,
    CASE
      WHEN (2024 - device.model_year) <= 3 THEN 'newer'
      WHEN (2024 - device.model_year) <= 6 THEN
'mid-age'
      ELSE 'older'
    END AS device_age_bucket
  FROM
    intel.impact_data AS impact
  INNER JOIN
    intel.device_data AS device
  ON
    impact.device_id = device.device_id
)

SELECT
  COUNT(*) AS total_devices,
  AVG(device_age) AS avg_age,
  AVG(energy_savings_yr) AS avg_energy_savings,
  SUM(co2_saved_kg_yr) / 1000 AS
total_emissions_saved_tons
FROM device_ages;
```

5. Device Type Impact

```
WITH device_ages AS (
  SELECT
    *,
    (2024 - device.model_year) AS device_age,
    CASE
      WHEN (2024 - device.model_year) <= 3 THEN 'newer'
      WHEN (2024 - device.model_year) <= 6 THEN
'mid-age'
      ELSE 'older'
    END AS device_age_bucket
  FROM
    intel.impact_data AS impact
  INNER JOIN
    intel.device_data AS device
  ON
    impact.device_id = device.device_id
)

SELECT
  device_type,
  COUNT(*) AS total_devices,
  AVG(energy_savings_yr) AS avg_energy_savings,
  AVG(co2_saved_kg_yr) / 1000 AS
avg_emissions_saved_tons
FROM device_ages
GROUP BY device_type;
```

6. Device Age Bucket Impact

```
WITH device_ages AS (
  SELECT
    *,
    (2024 - device.model_year) AS device_age,
    CASE
      WHEN (2024 - device.model_year) <= 3 THEN 'newer'
      WHEN (2024 - device.model_year) <= 6 THEN
'mid-age'
      ELSE 'older'
    END AS device_age_bucket
  FROM
    intel.impact_data AS impact
  INNER JOIN
    intel.device_data AS device
  ON
    impact.device_id = device.device_id
)

SELECT
  device_age_bucket,
  COUNT(*) AS total_devices,
  AVG(energy_savings_yr) AS avg_energy_savings,
  AVG(co2_saved_kg_yr) / 1000 AS
avg_emissions_saved_tons
FROM device_ages
GROUP BY device_age_bucket;
```

7.Region Impact

```
WITH device_ages AS (
  SELECT
    *,
    (2024 - device.model_year) AS device_age,
    CASE
      WHEN (2024 - device.model_year) <= 3 THEN 'newer'
      WHEN (2024 - device.model_year) <= 6 THEN
'mid-age'
      ELSE 'older'
    END AS device_age_bucket
  FROM
    intel.impact_data AS impact
  INNER JOIN
    intel.device_data AS device
  ON
    impact.device_id = device.device_id
)

SELECT
  region,
  COUNT(*) AS total_devices,
  AVG(energy_savings_yr) AS avg_energy_savings,
  AVG(co2_saved_kg_yr) / 1000 AS
avg_emissions_saved_tons
FROM device_ages
GROUP BY region;
```

— Key **Insights**

- **Older devices** are repurposed less often but save more energy and emissions.
- **Laptops** are repurposed most frequently, but per-unit impact is similar to desktops.
- **Asia** has the highest CO_2 savings due to electricity's carbon intensity.
- Most devices repurposed are **newer**, meaning the **full sustainability potential isn't being realized**.

— Recommendation

- Prioritize repurposing **older devices (6+ years old)**
- Focus distribution in **high carbon-intensity regions** (e.g., Asia)
- Implement a **scoring system** to prioritize devices by age and environmental return
- Consider **partnering with regions** that offer the highest CO_2 reduction per device