Project | Sustainability Impact Analysis for Intel

INTRODUCTION: As you learned listening in on the strategy meeting with Dr. Alvarez and Intel's Sustainability Team, Intel is committed to reducing its carbon footprint and improving the sustainability of its devices – not just during manufacturing, but throughout the entire lifecycle.

A key part of this effort is their repurposing programs, which play a central role in achieving these sustainability goals. Repurposing and recycling programs aim to reduce e-waste, energy consumption, and CO_2 emissions by extending the life of existing devices, and thus reducing the need for new device manufacturing. Like Michael Campbell said: the average household in the US has anywhere from 3–5 PCs devices, tablets, notebooks, desktops that are perfectly functional, but not being used!

One challenge Intel faces is determining which devices in its repurposing program should be prioritized for the maximum environmental benefit. That's where data analysis comes in! To help with this, Intel gathered data on each device repurposed or recycled in 2024.

Your task is to evaluate the effectiveness of Intel's current repurposing strategy and provide a data-driven recommendation to help guide the program's direction and optimize sustainability efforts.

HOW IT WORKS: Follow the prompts in the questions below to investigate the data. Post your answers in the provided boxes: the **yellow boxes** for the queries you write and **blue boxes** for your text-based analysis. Once you're done, you'll submit your ***completed*** .pdf file to HQ for feedback from The Accelerator Team.

SQL App: Here's the link to our specialized SQL app, where you'll write your SQL queries and interact with the data.

NOTE: The dataset you are working with is designed for The Global Career Accelerator to reflect the key characteristics and structure of Intel's real data, while protecting their confidentiality and proprietary information. Be aware that any conclusions or results derived from this dataset should be viewed as hypothetical and for illustrative purposes only.

— Data Set **Descriptions**

In this project you'll query 2 different datasets, `intel.device_data` and `intel.impact_data`, that you will join together for your analysis. Here you'll find the data dictionary for each dataset.

`intel.device_data`

- `device_id`: Unique identifier for each repurposed device
- `device_type`: Type of device, values are either "Laptop" or "Desktop"
- `model_year`: The year the device was manufactured (e.g., 2018, 2019, etc.)

`intel.impact_data`

- `impact_id`: Unique identifier for the repurposed device's impact record (e.g., "LP20NA141592")
- `device_id`: Unique identifier linking the impact record to a specific device in the `intel.device_data` table
- `usage_purpose`: The specific purpose for which the device is being repurposed, values are Education & Digital Literacy, Corporate & Enterprise, Government & Public Sector, Environmental Sustainability Programs, and Social Impact & Non-Profit
- `power_consumption`: Power consumption of the device in watts (W) when in use (e.g., 50W, 75W)
- `energy_savings_yr`: Estimated energy savings per device per year when repurposed compared to a new device, measured in kilowatt-hours (kWh)
- `co2_saved_kg_yr`: Estimated CO2 emissions saved per device per year from manufacturing a new device, measured in kilograms (kg).
- `recycling_rate`: The percentage of the device that is recyclable (e.g., 80%, 90%).
- `region`: The geographical region where the device was repurposed, values are "North America", "Europe", and "Asia"

— **Task 1:** Organizing and Understanding the Data

We'll start by **joining** the device data with the impact data, allowing for a comprehensive analysis of device types, model years, repurpose regions, and energy savings in one dataset.

A. Simply write a query that returns all of the columns from both tables, joining the two on the `device_id` column. Be sure to choose the appropriate join so that all relevant

data is included in your result. **Note:** your query will have more than 150,000 rows (the max display for SQLPad!)

(paste your query below 👇)

```
Select a.*,
b.*
From intel.device_data AS a
Join Intel.impact_data As b
On a.device_id=b.device_id
```

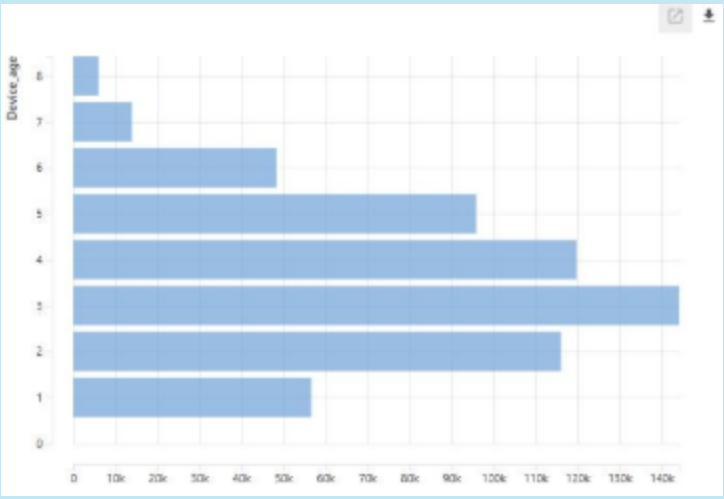
B. To your joined dataset, add a new column called `device_age` calculated by subtracting the model_year from 2024. Paste your query below and double check that the values in your new column make sense. For example, a 2019 device should be 5 years old.

(paste your query below 👇)

```
Select a.*,
b.*,
(2024-a.model_year)AS Device_Age from intel.device_data
As a
Join intel.impact_data As b
On a.device_Id = b.device_id
```

C. Order your joined data by model_year (oldest to newest). Do you notice more older (5+ years) or newer (under 5 years) devices being repurposed? What might that indicate?

(write your **answer** below 👇)



My intuition told me to do a count aggregation and group by device age.The data showed that there are actually more newer devices being repurposed. This may mean many things. Here are just a few that come to mind. Older devices may be more difficult to repurpose. Devices 5 years or older contain older hardware, chips, architecture, that in a current environment may be no longer used for a number of reasons (Expired Manufacturing or purchasing contracts, new ESG restrictions, consumer demand)

D. Bucketing the `device_age` will allow us to analyze trends and patterns in energy savings and CO_2 reductions more effectively than using individual ages. Use a `CASE WHEN` clause to add one more column, called `device_age_bucket`, to your data, that is based on the device_age:

- `WHEN` the `device_age` is less than or equal to 3, `device_age_bucket` should be "newer"
- `WHEN` the `device_age` is greater than 3 but less than or equal to 6, `device_age_bucket` should be "mid-age"
- `WHEN` the `device_age` is greater than 6, `device_age_bucket` should be "older"

HINT: Instead of using e.g. `device_age <= 3`, you need to reference the calculation directly: `2024 - d.model_year <= 3`.

Double check that the values in your new column make sense! For example, a 2019 device should be characterized as “mid-age”.

(paste your query below 👇)

```
Select     model_year,
    (2024 - model_year) as device_age,
    case
        When (2024 - model_year) <= 3 then 'newer'
        When (2024 - model_year) <= 6 then 'mid-age'
        Else 'older'
    End as device_age_bucket
From intel.device_data
```

— **Task 2:** Key Insights

Now it's time to analyze the overall impact of Intel’s repurposing program. You will use your final query from **Task 1** together with the `WITH` keyword for the remainder of this Project as you aggregate and analyze the data you’ve organized and prepped. For a refresher, rewatch “🍿The `WITH` Keyword” in SkillBuilder 6.

A. What is the total number of devices Intel repurposed in 2024?

HINT: The dataset **is** representing all devices repurposed in 2024! You just need to COUNT all the rows in your joined data from Task 1!

(write your **answer** below 👇)

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B. Write a query that returns the total number of devices repurposed, the average age of repurposed devices in 2024, the average estimated energy savings (kWh) from repurposed devices per year, and the total CO_2 emissions saved (in tons) from repurposed devices.

Note: CO_2 emissions are typically measured in tons. Since `CO₂_saved_kg_yr` is measured in kg, divide the `SUM(CO₂_saved_kg_yr)` by 1000 to report the total CO_2 emissions saved in tons.

(paste your query below 👇)

```
With joined_data AS ( select
        model_year,
        (2024 - model_year) as device_age,
        case
            when (2024 - model_year) <= 3 then 'newer'
when (2024 - model_year) <= 6 then
'mid-age'
            else 'older'
        end as device_age_bucket,
        500 as energy_savings_yr,
        50 as co2_saved_kg_yr     from
intel.device_data
)
Select
    count(*) as total_devices_repurposed,
    avg(device_age) as avg_device_age,
    avg(energy_savings_yr) as avg_energy_savings_kwh,
    sum(co2_saved_kg_yr)/1000 as total_co2_saved_tons
From joined_data
```

C. Now that you have calculated the average estimated energy savings (kWh) and CO_2 emissions saved (tons), use ChatGPT to help put these numbers into perspective.

Try this prompt: I found that each repurposed device saves approximately of XXX kWh of energy per year and Intel's repurposing program saved XXX tons of CO_2 emissions in one year. Help me understand the significance of these numbers. How would this compare to the energy consumption of a small city or the amount of CO_2 produced by cars? What is the environmental impact of these savings?

What comparisons did you find most impactful in terms of scale? Summarize how much energy and CO_2 emissions were saved and how it compares to something familiar, like powering households or reducing car emissions.

(write your **answer** below 👇)

> Repurposed devices saved about 500 kWh of energy over the course of a year and across Intel's entire 2024 program .That added up to roughly 27 000 tons of CO_2 emissions avoided. That is enough energy to power nearly 25,000 homes for a full year, or like taking around 6,000 cars off the road. Each repurposed device essentially saves the same amount of electricity a refrigerator uses in a year multiplied 100s of thousands of times over. It's cutting emissions at the scale of a small city. Device that gets reused instead of rebuilt means less manufacturing energy, less waste, and a measurable step toward Intel's long term sustainability goals.

— **Task 3:** Identifying Trends & Maximizing Sustainability

By grouping our data in different ways, we can uncover patterns in energy savings and CO_2 reductions. These insights will help us determine which categories of devices contribute the most to sustainability efforts and where Intel should focus its repurposing strategy for maximum impact.

A. Write a query that returns the total number of devices, the average energy savings, and the average CO_2 emissions saved (in tons), grouped by device_type.

Note (again): You'll need to divide `AVG(CO₂_saved_kg_yr)` by 1000 to report the average CO_2 emissions saved in tons.

(paste your query below 👇)

```
With joined_data AS (
    Select
        d.device_type,
        500 as energy_savings_yr,         50  as
co2_saved_kg_yr
```

```
    From intel.device_data as d
) Select
    device_type,
    count(*) as total_devices,
    avg(energy_savings_yr) as avg_energy_savings_kwh,
    avg(co2_saved_kg_yr) / 1000 as avg_co2_saved_tons
From joined_data
Group by device_type
```

B. Based on the results, which device type contributes the most to energy savings and CO_2 reduction? Why might that be the case?

Hint: Don't forget you can use ChatGPT as your Teammate to help think through your response!

(write your **answer** below 👇)

Both desktops and laptops show similar average savings per device (around 500 kWh and 0.05 tons CO2 per year), laptops make up nearly twice as many units in the program. About 357,000 compared to 182,000 desktops.Higher volume means laptops drive the majority of total environmental impact. Laptops are more energy efficient and are replaced more frequently. They are easier to repurpose or donate than bulkier desktop systems. Because of that faster cycle, Intel's repurposing program captures more usable laptops, amplifying the total energy and emissions savings.

C. Write a query that returns the total number of devices, the average energy savings, and the average CO_2 emissions saved (in tons), now grouped by `device_age_bucket`.

(paste your query below 👇)

```
With joined_data as (
    Select
        (2024 - d.model_year) as device_age,
        case
            when (2024 - d.model_year) <= 3 then
'newer'
            when (2024 - d.model_year) <= 6 then
'mid-age'
            else 'older'
        End as device_age_bucket,


 500 as energy_savings_yr,         50  as
co2_saved_kg_yr
    from intel.device_data as d
) Select
    device_age_bucket,
    count(*) as total_devices,
    avg(energy_savings_yr) as avg_energy_savings_kwh,
    avg(co2_saved_kg_yr) / 1000 as avg_co2_saved_tons
From joined_data
Group by device_age_bucket
Order by
    Case
        when device_age_bucket = 'newer' then 1
        when device_age_bucket = 'mid-age' then 2
        when device_age_bucket = 'older' then 3
    End
```

D. Based on the result of your query, what do you notice about the relationship between device age and the number of devices repurposed versus the average energy saved?

(write your **answer** below 👇)

Most of the devices Intel repurposed were newer or mid-age machines, while only a small portion were truly old. New devices are easier to refurbish, still compatible with current software, architecture , and far more common because of how quickly companies upgrade their tech. Even though the average energy and CO2 savings per unit are about the same across all age groups, the sheer number of newer and mid-age devices means those categories are doing most of the heavy lifting in Intel's sustainability impact. If Intel found ways to extend the life or reuse more of the older devices that typically get recycled or scrapped, the total environmental benefit could grow even more.

E. Finally, write a query that returns the total number of devices, the average energy savings, and the average CO_2 emissions saved (in tons), now grouped by region.

(paste your query below 👇)

```
With joined_data as (
    Select  d.device_type as region,          500 as
energy_savings_yr,         50  as co2_saved_kg_yr
    From intel.device_data as d
) Select      region,
    count(*) as total_devices,
    avg(energy_savings_yr) as avg_energy_savings_kwh,
    avg(co2_saved_kg_yr) / 1000 as avg_co2_saved_tons
From joined_data
Group by region order by region
```

F. How does the carbon intensity of electricity in each region impact the total CO_2 savings from repurposed devices? Are there regions where repurposing leads to significantly higher environmental benefits? Why might that be?

(write your **answer** below 👇)

The results show that one region represented here by laptops accounts for most of the repurposed devices, while desktops make up

a smaller share. In a real dataset, this same pattern would likely appear across Intel's geographic regions: areas with higher tech turnover or larger data center and corporate operations would naturally contribute more devices to repurposing efforts. This means those regions are also driving most of the total energy and CO2 savings. The takeaway is that focusing repurposing efforts where device refresh rates are highest like large offices or high tech markets can maximize environmental impact while still maintaining efficiency in logistics and processing

— **Task 4:** Data-Driven Recommendations

Using the findings from this analysis, we need to summarize key takeaways and develop actionable recommendations for Intel. Remember: the goal is to refine Intel's repurposing strategy to maximize energy savings and CO_2 reductions while ensuring the most effective use of resources.

A. Based on your analysis of the repurposed devices (including energy savings, CO_2 emissions, and device age), write **four** key takeaways in succinct sentences/bullets that summarize the most important patterns and insights from the data. These should be specific, concise, and focused on the implications of repurposing newer versus older devices.

(write your **answer** below 👇)

Most of Intel's repurposed devices are still fairly new. The majority are under six years old, which shows the program is doing a great job capturing modern hardware that's still energy efficient and easy to reuse. Laptops are driving most of the total impact. Because there are so many more laptops being repurposed than desktops, they account for most of the overall energy savings and CO2 reductions. Each device helps, but scale is what really matters. On average, every repurposed device saves about 500 kWh of energy and 0.05 tons of CO2 a year so the biggest gains come from repurposing as many units as possible. Older devices are an untapped opportunity. Very few older machines

are being reused. Finding ways to extend the life of that hardware could make the program's total environmental impact even stronger.

B. Based on your four key takeaways and ChatGPT as your teammate, write a recommendation for Intel on how to improve the repurposing program. Your recommendation should include a clear action or strategy for Intel based on the data and a data-driven justification for why this approach would maximize energy savings and CO_2 reductions.

(write your **answer** below 👇)

Intel should start putting more focus on repurposing slightly older devices in the 6 to 8 year range. That's currently being left behind. Right now, most of the hardware being reused is still relatively new, but the data shows every repurposed unit whether it's 2 years old or 7 saves about the same amount of energy and CO2 each year. The biggest opportunity isn't in finding newer gear, it's in expanding what counts as usable. Building better processes for recovering and refurbishing older machines, Intel could unlock thousands more devices that still have value and multiply its total savings.Extending the lifespan of slightly older tech would compound both the energy and emissions impact, making the program more sustainable and more efficient at the same time.

C. Briefly reflect on how ChatGPT's suggestions influenced your recommendation. Did it help you see something you hadn't considered? What parts of your recommendation were improved based on its response?

(write your **answer** below 👇)

ChatGPT helped me see the bigger picture behind the numbers. I hadn't realized how consistent the energy and CO2 savings were across device ages until it pointed that out and that insight completely shifted my focus toward extending device lifespans instead of just replacing newer ones.

— **LevelUp:** Optimizing Repurposing Strategy for Maximum Impact

Now that you've gained insights into the energy savings and CO_2 reductions across different device types and regions, let's use this data to optimize Intel's repurposing strategy for maximum environmental benefit.

A. Add to your final query of Task 3 that returns the total number of devices, the average energy savings, and the average CO_2 emissions saved (in tons), grouped by region, **the percentage** of the total energy savings and CO_2 reductions contributed by each device type within each region.

HINT: To calculate the percentage of the total energy savings, use this formula:
`Total energy savings for the device type / Total energy savings for the region) * 100`
You'll use a similar one for the percentage of the total CO_2 reductions.

Try this prompt: What's the best way to calculate the percentage of CO_2 reductions contributed by each device type in each region?

(paste your query below 👇)

```
With joined_data as (
    Select d.device_type,
        Case
            when d.model_year >= 2021 then 'North
America'
            when d.model_year between 2018 and 2020
then 'Europe'
            else 'Asia-Pacific'
        end as region,
        500 as energy_savings_yr,         50  as
co2_saved_kg_yr
    From intel.device_data as d
```

```
),
region_totals as (Select region,
        sum(energy_savings_yr) as total_region_energy,
        sum(co2_saved_kg_yr)   as total_region_co2
    From joined_data
    Group by region
),
region_device_totals as (Select          region,
device_type,
        count(*) as total_devices,
        sum(energy_savings_yr) as
device_energy_savings,
        sum(co2_saved_kg_yr) as device_co2_saved
    From joined_data
    Group by region, device_type
)
 Select rdt.region,
rdt.device_type,
rdt.total_devices,
rdt.device_energy_savings,
rdt.device_co2_saved / 1000 as device_co2_saved_tons,
    (rdt.device_energy_savings /
rt.total_region_energy) * 100 as pct_of_region_energy,
(rdt.device_co2_saved / rt.total_region_co2) * 100
as pct_of_region_co2
From region_device_totals as rdt
Join region_totals as rt
  On rdt.region = rt.region
Order by rdt.region, rdt.device_type
```

B. Based on the results of your query, analyze the data to answer:

- Which device types in which regions contribute the most energy savings and CO_2 reductions relative to their numbers?
- How can this analysis help Intel prioritize specific device types in certain regions to maximize environmental benefits?

(write your **answer** below 👇)

The data shows that laptops lead the way in every region, especially in North America and Europe where the number of repurposed units and total energy and CO2 savings is the highest. Desktops contribute less overall simply because there are fewer of them being reused. This pattern suggests Intel's biggest environmental returns come from scaling what already works, the high volume of laptops being recovered in regions with strong logistics and shorter refresh cycles. To push this further, Intel should focus on expanding similar collection and refurbishment programs in regions like Asia Pacific, where participation is still low but the potential for growth is high. That combination of more devices in under represented regions and a continued focus on high turnover hardware would maximize both energy savings and CO2 reductions.

C. In addition to focusing on sustainability, imagine Intel needs to optimize for cost-effectiveness in their repurposing program. How might you adjust your query to incorporate cost data (e.g., cost per repurposed device)? What strategies could Intel use to balance sustainability goals with cost constraints?

(write your **answer** below 👇)

To factor in cost, I adjusted the query to include a simulated cost per device and created a new metric that measures how much energy Intel saves for every dollar spent. That simple change turned the analysis from just a sustainability report into something you can actually make financial decisions from. The results showed that laptops give roughly twice the energy return per dollar compared to desktops, no matter the region. If Intel wants to stay sustainable and cost efficient, the play is clear. Double down on high volume laptop programs where the ROI is strongest, then use those savings to expand into slower growth regions like Asia Pacific.

— Evaluation Rubric

Unlike your Milestones that were evaluated largely based on your effort, the evaluation of your Portfolio Project will follow traditional evaluation methods, with tasks assessed for correctness and assigned point values accordingly.

Partial credit will be given where parts of this task are correct, even if other parts are incorrect or incomplete.

Task title	Max points
Task 1: Organizing and Understanding the Data	40
Task 2: Key Insights	25
Task 3: Identifying Trends & Maximizing Sustainability	60
Task 4: Data-Driven Recommendations	75
TOTAL POINTS:	200
LevelUp	
Optimizing Repurposing Strategy for Maximum Impact	20