Creation Calculator – Developer Note

Purpose

This calculator estimates the CO_2e emissions (grams or kg) from digital marketing asset creation, including:
- AI-generated images
- AI-generated text
- AI-generated videos
- Hardware (laptops)
- Cloud storage

The results can be used standalone or integrated with distribution & consumption phases later.

Inputs

Variable	Description	Default Unit	Notes
num_images	Number of AI-generated images	Integer	E.g. 50
num_queries	Number of text queries/prompts	Integer	E.g. 100
avg_tokens	Average tokens per query	Integer	Default: 300
video_seconds	Total video length generated	Seconds	E.g. 30 seconds
num_laptops	Number of laptops used	Integer	Usually 1
months_used	Number of months of hardware use	Integer	E.g. 1
usage_factor	% share of laptop used for AI tasks	Decimal	Default: 0.5 (50%)
storage_GB	Total GB stored	Integer	E.g. 100
storage_months	Storage duration in months	Integer	E.g. 1
green_cloud	If true, apply -30% factor	Boolean	Optional

Emission Factors (Default)

Activity	Value	Unit	Source
Image	2 g CO_2e per image	g	Tomlinson et al. (2024), PlanBe Eco

Text	0.036 g CO_2e per prompt (300 Tokens)	g	Sustainability by Numbers
Video	4.4 g CO_2e per 2 sec (1080p)	g	OpenAI Sora Paper
Laptop	9,700 g CO_2e per laptop per month	g	ResearchGate LCA
Storage	2,000 g CO_2e per 100GB per month	g	Greenly/SRI France

What is a Token?

A Token is the smallest unit of text processed by AI models like ChatGPT. It's not exactly one word or character but a chunk:
- On average, 1 Token ≈ 4 English characters (including spaces).
- Or, 1 Token ≈ 0.75 English words.

So, 300 Tokens ≈ 1,200 characters or ~225 words.

This means:

A longer output generates more Tokens, which linearly increases CO_2e.

When calculating, multiply the number of queries by (average Tokens / 300) to scale up.

Calculation Logic

Example pseudo-code:

```
image_CO2 = num_images * 2
text_CO2 = num_queries * (avg_tokens / 300) * 0.036
video_CO2 = (video_seconds / 2) * 4.4
laptop_CO2 = num_laptops * months_used * usage_factor * 9700
storage_CO2 = (storage_GB / 100) * storage_months * 2000
if green_cloud: storage_CO2 *= 0.7
total_CO2_g = sum of all above
total_CO2_kg = total_CO2_g / 1000
```

Outputs

• Creation CO_2e in grams (total_CO2_g)

Developer Notes

- · Keep units consistent (g or kg).
- · Allow overwriting default factors.
- · Support Low–Medium–High scenarios.
- · Use sliders/dropdowns for usage share, green cloud option.
- · Clearly display assumptions in output page.

References

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Calculation Logic—Detailed Explanation

```
image_CO2 = num_images * 2
```

Meaning:
This calculates the total CO_2e emissions for generating AI images.

- `num_images` = the number of images the user wants to generate.

- Each image emits about **2 grams of CO_2e** on average (based on industry data).
  So: **Total image emissions = number of images × CO_2e per image**

```
text_CO2 = num_queries * (avg_tokens / 300) * 0.036
```

Meaning:
This calculates the total CO_2e emissions for AI-generated text.

- `num_queries` = number of text prompts or queries.

- `avg_tokens` = average number of tokens per prompt (default is 300).

- `0.036` = grams of CO_2e for generating ~300 tokens.
  So: **Text emissions scale linearly with text length → more tokens = higher CO_2e**

Formula logic:
Total text emissions = number of queries × (average tokens / 300) × CO_2e per query

```
video_CO2 = (video_seconds / 2) * 4.4
```

Meaning:
This calculates the total CO_2e for AI-generated video content.

- `video_seconds` = total seconds of video generated.

- The factor `4.4` means every **2 seconds of 1080p video** emits about **4.4 grams CO_2e** (estimated from research).
  So: **Total video emissions = (video seconds ÷ 2) × CO_2e per 2 seconds**

```
laptop_CO2 = num_laptops * months_used * usage_factor * 9700
```

Meaning:
This estimates the CO_2e emissions for using hardware (laptops) during creation.

- `num_laptops` = number of laptops used.

- `months_used` = number of months the laptop is used.

- `usage_factor` = the share of time the laptop is used for AI tasks (e.g., 50% = 0.5).

·   9700 = grams CO_2e per laptop per month (based on lifecycle assessments).
So: **Total laptop emissions = laptops × months × usage share × CO₂e per month**

```
storage_CO2 = (storage_GB / 100) * storage_months * 2000
```

Meaning:
This estimates the CO_2e from cloud storage used to store files/assets.

·   `storage_GB` = total GB stored.

·   Divide by 100 because the emission factor is **per 100 GB per month**.

·   `storage_months` = how many months the files are stored.

·   2000 = grams CO_2e per 100 GB per month (based on data centre averages).
So: **Total storage emissions = (GB ÷ 100) × months × CO₂e per 100 GB**

```
if green_cloud: storage_CO2 *= 0.7
```

Meaning:
If the cloud service uses mostly renewable energy, apply a 30% reduction.
So: **Cloud storage emissions are multiplied by 0.7 when "green cloud" is true.**