

Go Green Software



**A guide for
Product Managers**





Contents

Introduction	3
Green evaluation criteria	5
Inform and educate your user	8
Give users green choices	12
Footnotes	15



Introduction

At the beginning of any new software product there is an idea, requirements, user stories and many more aspects that **define the product and document its viability.**

In many organizations, Product Managers (PMs) take the role of bringing an idea into an engineerable collection of software modules that ultimately provides a benefit to the end user with a roadmap charting the course of future releases.

In initial phases of the product ideation design process, exists the opportunity to consider best practices for more sustainable products and features, paving the way for a greener software product. This can be defined by how end users are informed on the green credentials or reducing the resources needed for the product with in turn reduces emissions and energy usage.



Product Managers can lead that transformation by thinking in two directions:

- 1 > How can product design affect overall carbon-efficiency or ideally net-zero?
- 2 > How can the user of a product be incorporated into the sustainability goal of the company and be a showcase?

Based on these two aspects there are some practices that can be applied by product managers to **design for a more sustainable future**.



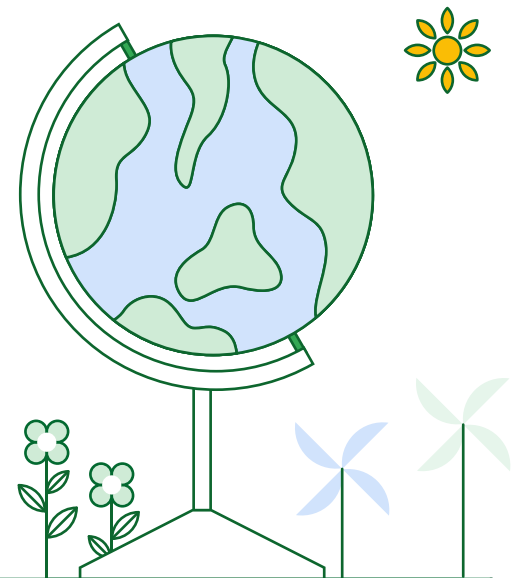
Green evaluation criteria

Complexity: Medium | Impact: Medium - High | Scope: Internal

Product management is a task of evaluation and prioritization. There are typically many ideas and features that could be built, but decisions have to be made regarding which ones need to be prioritized, e.g. within a backlog.

The usual KPIs (Key Performance Indicators) or criteria used for this prioritization are: effort and commercial impact. Effort can be described in the amount of engineering hours, story points or sprints. Commercial impact can be influenced by the estimated number of daily users, the customer(s) that could be additionally won, upsell potential or many other factors.

Taking sustainability into account would lead to a new dimension of criteria that is used to sort and prioritize the backlog and could include things like a carbon-efficiency KPI, a sustainability impact score, measuring the reduction of CO₂ emissions or defining a carbon budget for the product. **Integrating these KPIs into the common product management processes highlights the importance of sustainability.**



Let's take a look at a few examples of products and potential criteria:

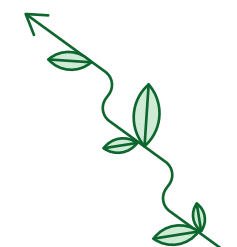
Example 1: A product manager of a fleet management software can design a product that has a direct impact on sustainability by reducing the amount of miles driven by the fleet. A criteria that could be used here could be “Fleet CO₂-savings” that could either be based on a rough categorical scale, like High/Medium/Low or 1 - 10, or could be based on a rough calculation of the reduction of CO2 emissions (based on a simplified model across all fleets). An additional benefit of this capability will be reducing transport costs. Using that criteria, **PMs could prioritize feature requests that have the highest impact on sustainability instead of only commercial aspects.**

Example 2: A product manager of an AI-based trading application could evaluate against the criteria of carbon-efficiency of its own software; leveraging capabilities like Carbon Footprint. As AI can be quite resource consuming, that KPI could be used to identify items in the backlog that improve the efficiency of the involved models and reduce the carbon footprint of the application itself. This improvement could be classified as a category (High/Medium/Low) or a percentage of improvement (e.g. 20% reduction). Another benefit is that the reduction in service usage will remove operating expenses and reduce energy needs. It is critical for product managers to identify the engineering optimisation that can be added into the backlog.

Example 3: A product manager of a (big) data platform could design and orchestrate data products to be scheduled automatically by an orchestrator that decides when to run batch processes during the day by following the availability of solar and wind power. A KPI could be used to identify processes in the scheduler's log and rank with High/Medium/Low priority which ones run first, while also estimating a percentage of emission reduction. **This calculation can be done by comparing data provided by tools such as [Carbon Footprint](#) that shows monthly emissions per product.**

Step by step guide

- 1 > **Brainstorm the criteria and its scale** (H/M/L or 1 - 10) that should be used across the processes; especially the observability matrix for reducing carbon emissions.
- 2 > **Configure these criteria in your tooling** used for product management and execution.
- 3 > **Educate and motivate** involved team members to consider that criteria.
- 4 > Constantly evaluate against that criteria and **retrospectively control the impact.**



Inform and educate your user

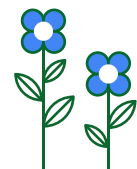
Complexity: Low - Medium | Impact: Medium - High | Scope: User-Facing

The users of a product are the best multipliers to deliver higher sustainability impact and address the world's climate challenges. **Every software product has the opportunity to inform and educate users about the aspects of climate change and the positive contributions they can make.**

This can be as simple as describing the footprint of a certain product or feature, listing the carbon emissions of the usage of a specific user or giving tips on how to improve sustainable behavior.

Equivalency is a key aspect of bringing the emissions to the physical world and the EPA² has a great tool that provides equivalencies to greenhouse gas.

For example, [websitecarbon.com](https://www.websitecarbon.com) provides a check of your website from a sustainability perspective and calculates the CO₂ emissions per visit and benchmarks it against other websites. This, or similar data, could be added to your customer facing website, informing the user about their carbon emissions. Or, once the user is logged in, their usage is tracked and they are sent a monthly report about their calculated footprint.



Other examples that show what is possible at very low cost:



> **A fleet management system** that calculates total carbon emissions from current transportation use. This also helps to report on Scope 3 emissions.



> **An e-commerce website** that details the total carbon emissions of the product, divided into material sourcing, production, logistics and typical usage.

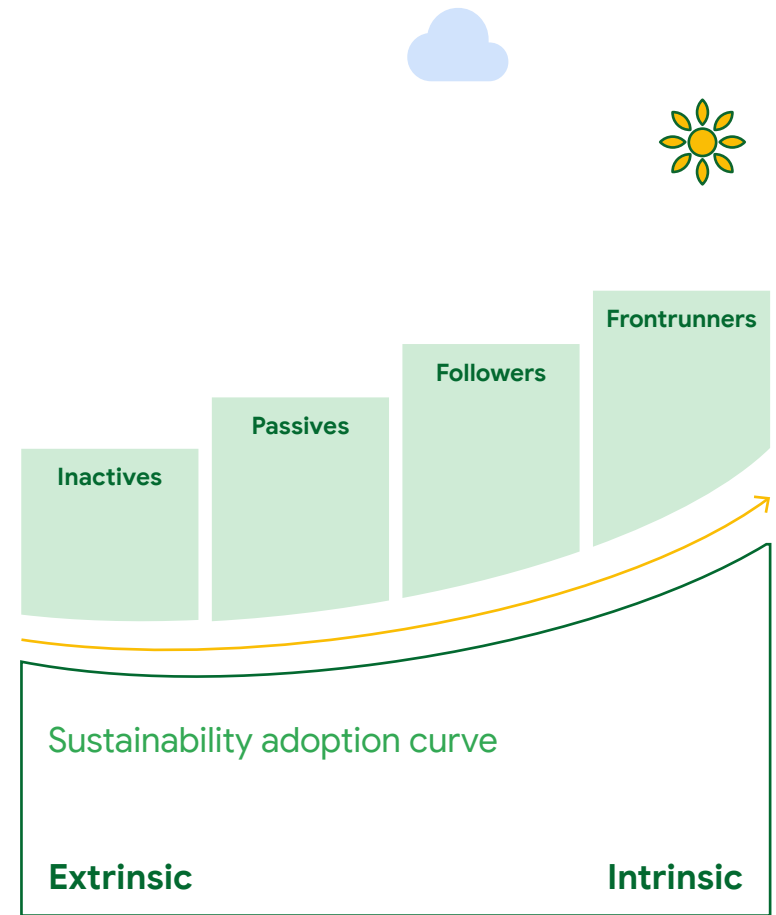


> **A website of a manufacturer of household products** (e.g. washing machines) that not only states the energy consumption of their machines, but also allows the user to create a usage profile that results in a TCO or a total energy consumption for the entire lifetime.



> **Internal procurement portal for employees** could show the CO₂e for each tool or product that an employee could procure. The simple act of showing as equivalencies starts the culture change needed.

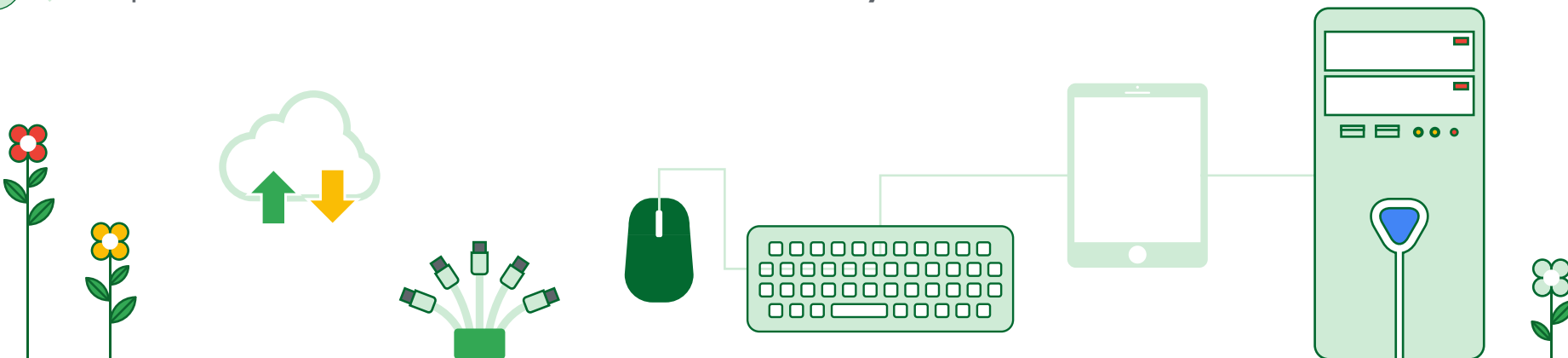
The omnipresence of such educational and informational hints helps to increase awareness about the importance of fighting climate change across all types of users. Generally there are two types: user that are sustainability-minded and users that are not. The former can also be divided into subgroups depending on their educational level and how much they act on the topic. **This article from Kerry⁴ defines four subgroups: Inactives, Passives, Followers and Frontrunners.**



For the Frontrunners and Followers, **a software that actively incorporates sustainability**, could be a reason why they choose this application or service over another one. For the Passives and Inactives it could be an impulse to **accelerate their movement on the adoption curve**.

Step by step guide

- 1 > Try to identify or classify the mix of your users according to their **adoption of sustainability aspects**.
- 2 > Brainstorm and plan product features that **inform or educate the users about sustainability** in general or the specific details of the product or their usage.
- 3 > Implement these features and **announce them to your users**.



Give users greener choices

Complexity: Low - Medium | Impact: Medium - High | Scope: User-Facing

Even more powerful than informing users is to offer them green choices. This means that the users can select from various options that clearly outline how large the impact on sustainability is. There are many examples for this across various industries:

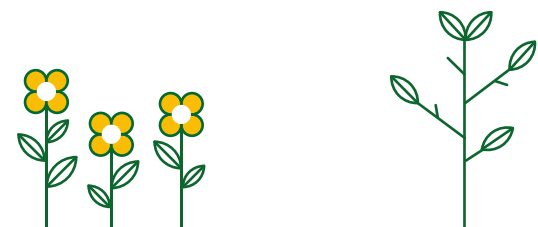
- Google Maps offers the choice to get a route that is optimized by distance, time or eco-aspects. Eco-routing calculates the route that, based on predictions, has the smallest ecological footprint.
- E-commerce stores can give their customers the choice to select more eco-friendly shipping options.

This is just a small list of examples and is a great area to start in, to transform your core business.



Step by step guide

- 1 > **Gather a team of sustainability-minded colleagues and brainstorm features** that can provide greener options to their personas. Consider the personas, their backgrounds, their needs and how you could impact their decision making.
- 2 > **Perform feedback studies with end users or customers on the importance of sustainability.** Different countries and persona groups are likely to have different needs. For example, employees may want to know how they can assist in reducing emissions.
- 3 > **Design, implement and rollout the necessary features for this.**

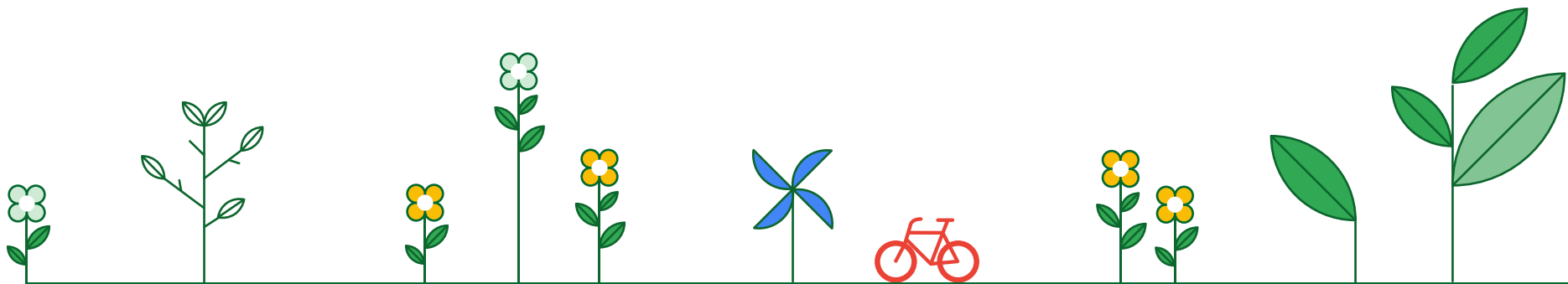




With the rapid growth in AI technologies, the role of software in our daily lives continues to expand. As this happens, it's critical that software development is done sustainably and responsibly. Following green software principles ensures products are designed with the end-user in mind; not just while the user is interacting with the software, but also in how its deployment impacts the environment in which the user lives.

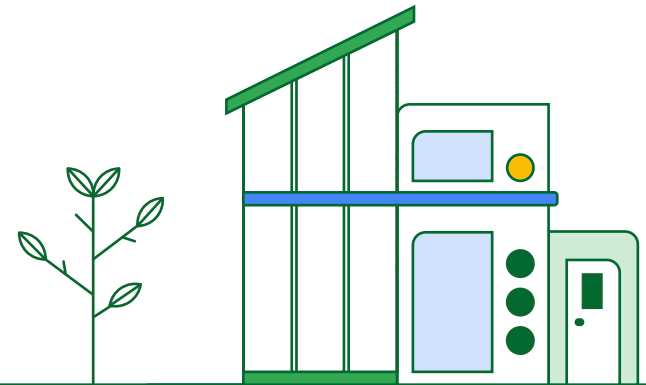
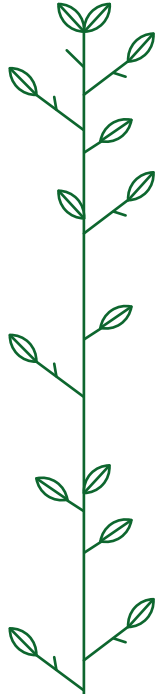
Brock Taute

Technical Program Manager, Google Cloud



Footnotes

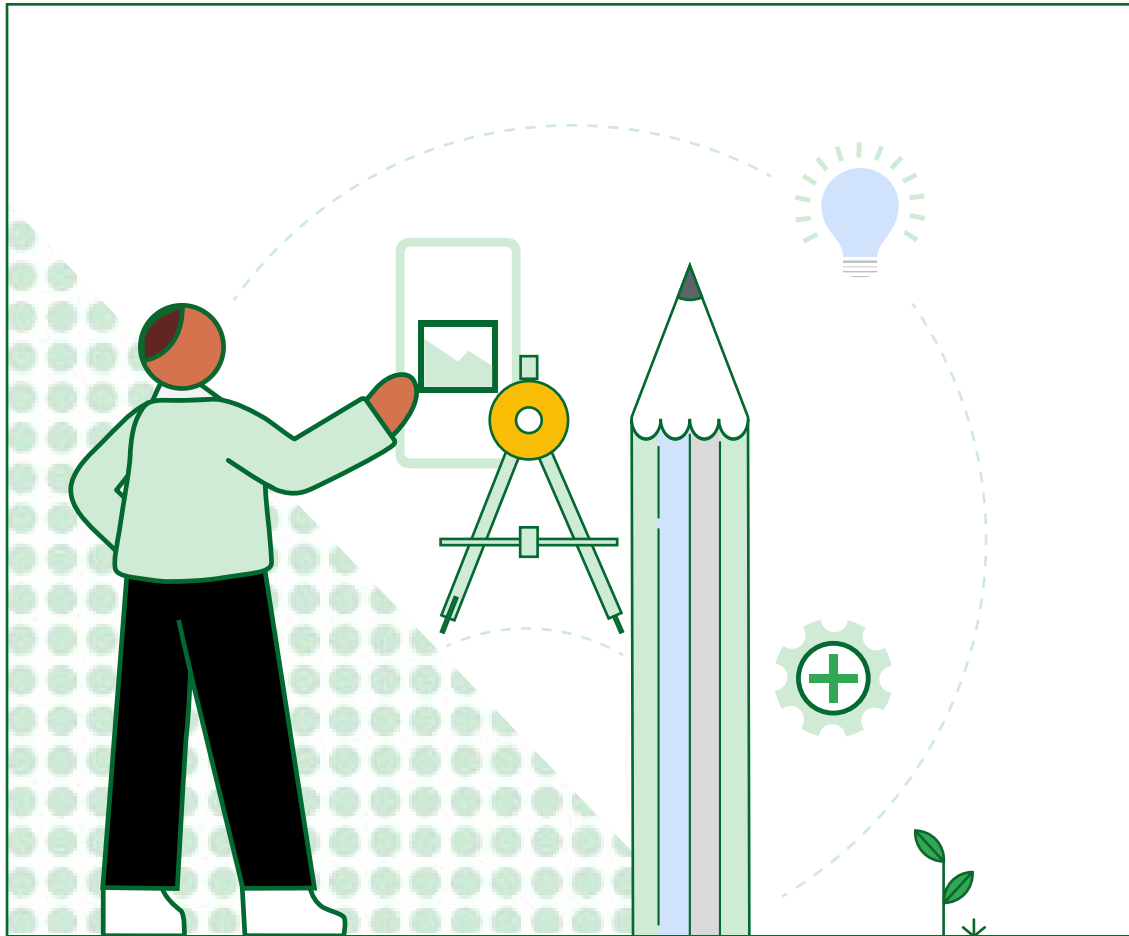
- 1 [Google Cloud: Carbon Footprint tool](#)
- 2 [Greenhouse Gas Equivalencies Calculator](#), United States Environmental Protection Agency
- 3 [Website carbon calculator tool](#)
- 4 [The Four Personas of Sustainability-minded Consumers](#), Kerry, September 2021



Google Cloud

cloud.google.com

Go Green Software



**A guide for
Product Designers**





Contents

Introduction	3
Green design practices	4
Content strategy	6
Energy usage	8
Loading times	10



Introduction

The design phase dictates a product's durability throughout its lifetime.

Around 80% of the ecological impacts of a product are locked in at the design phase¹.

Product designers are in a unique position to influence user behavior through purposeful design that minimizes carbon-producing digital waste and energy consumption.

In the software development life cycle, sustainable design principles can be applied in 2 ways:

- User experience design: optimizing for design principles and processes that impact carbon footprint from operations and content to colors and font type.
- Front-end architecture: reducing content data load and energy consumption.

Based on these principles, product designers can use these practices to build products with sustainability and accessibility in mind.



¹ [Sustainable Product Policy, European Commission](#)

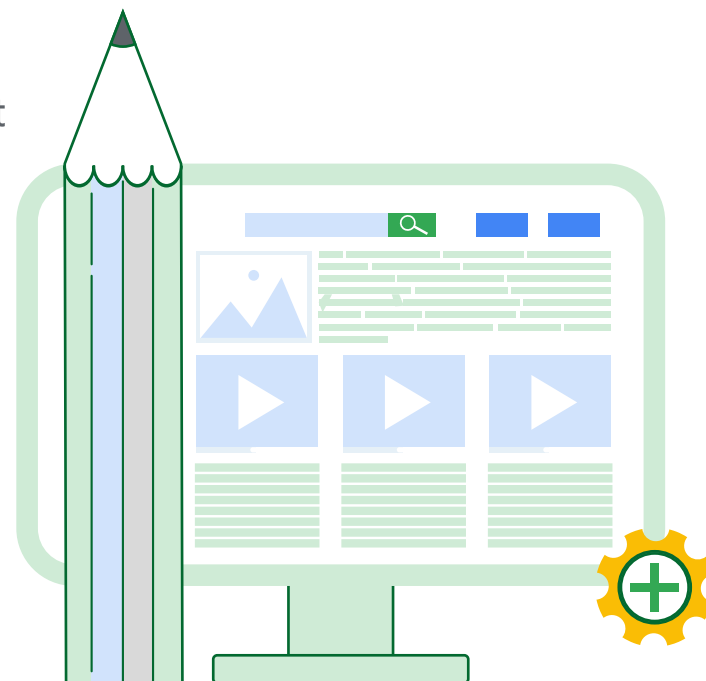
Green design practices

Complexity: Medium | Impact: High | Scope: User-Facing

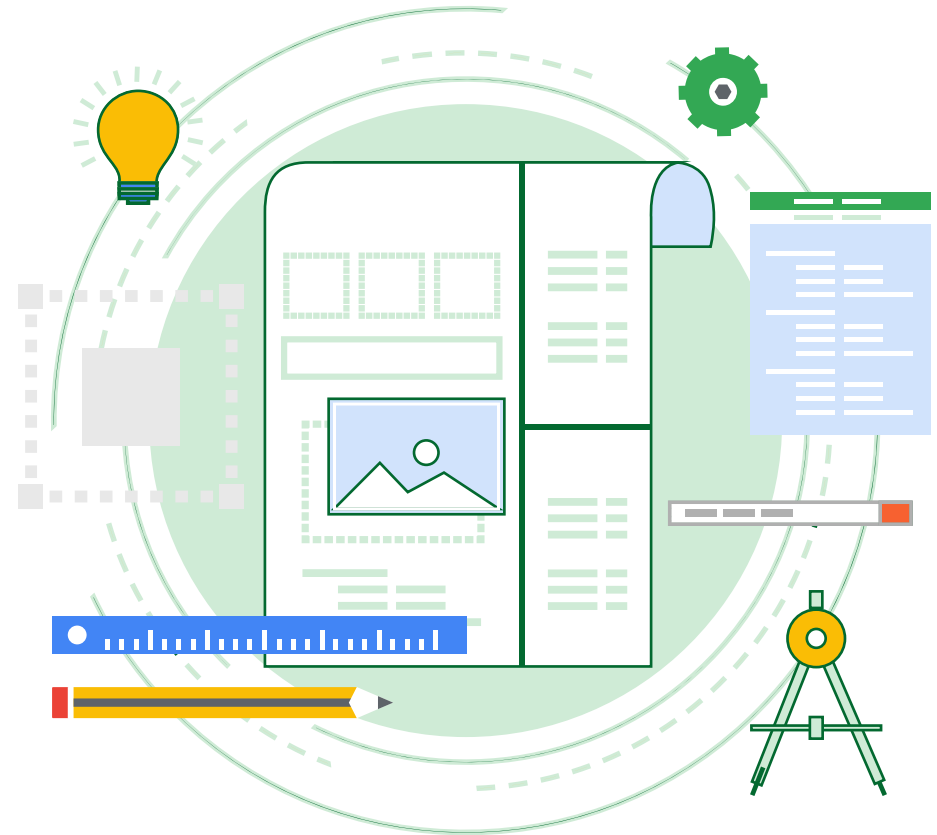
Product designers, UX designers, and front-end developers have a role to play in designing a green software by putting in place operational foundations that can lead to less energy consumption.

By collaborating with the rest of the product development team from product managers to software engineers, product designers can make the design process **more efficient and minimize waste of time, resources, code, and effort.**

There are a few green principles to consider when creating style tiles (font, colors and imagery, iconography) for a business. The steps below help make design decisions greener by being less wasteful in all aspects. **Best practice is to always refer to your page weight as you make design decisions from which the following recommendations stem from.**



- **Optimize your design processes by reducing operational inefficiencies, building effective design workflows and reducing bottlenecks between design and development teams.**
- Instead of diving into wireframes first, create a design system with a pattern library with a well documented style guide to maximize reusability and recycling whilst minimizing waste. **The wireframe becomes a matter of merging components to create a user journey.**
- **Use system fonts that are default on the user's machine to reduce load time and number of HTTP requests.** Fonts that are not on the user's device are hosted on external servers and hence need more HTTP requests, same goes for embedded fonts. Best practice is to use a maximum number of two fonts and use fonts designed for screen.
- **Choose darker colors which reduce energy consumption, however be mindful of accessibility by using high-contrast stylesheet.**
- Using responsive web design can take longer for page loading because the assets resize based on the viewport size of a requester. However, **with progressive enhancement and mobile first strategy**, this can enhance accessibility and usage of fewer resources.



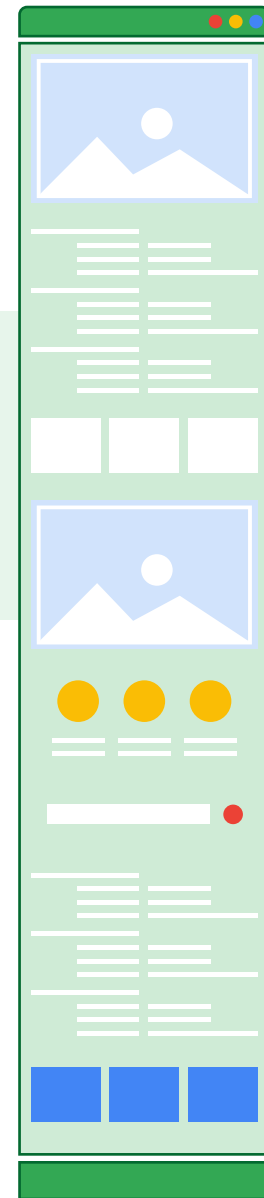
Content strategy

Complexity: Medium | Impact: High | Scope: User-Facing

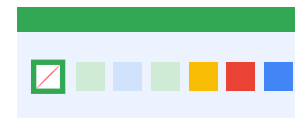
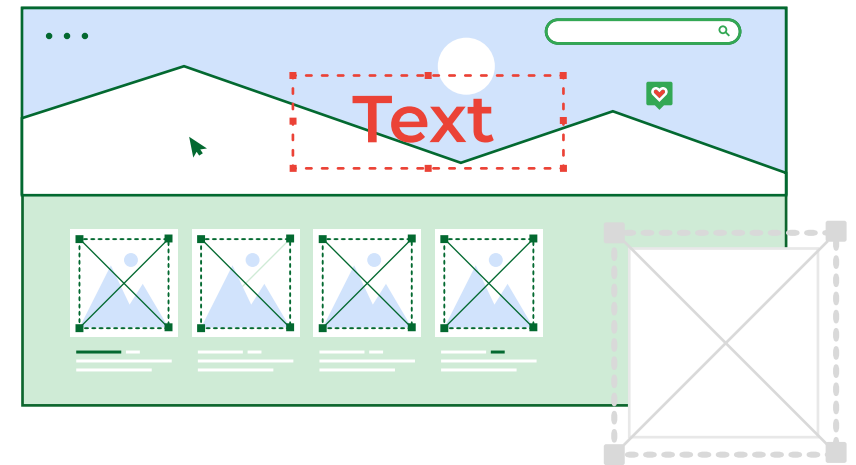
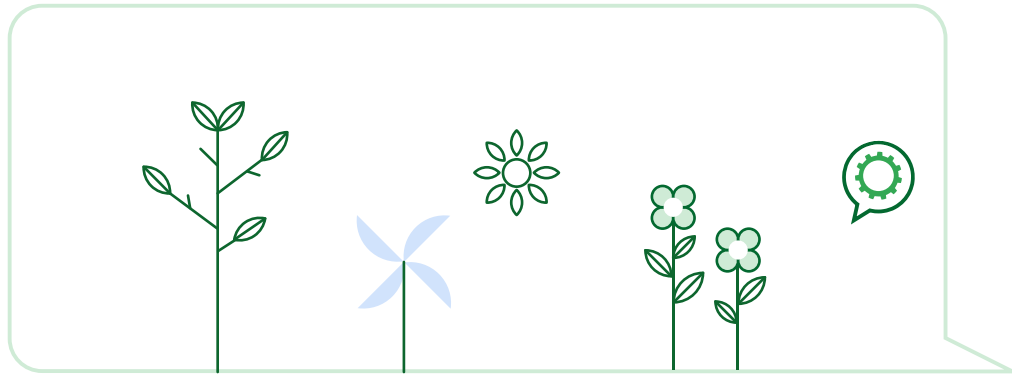
As mentioned in the previous section, the goal for product designers is to reduce page weight. Content such as images and videos contribute immensely to that.

Optimizing for greener content management is a balancing act between maintaining visual integrity and content compression.

- Simplify wireframes by reducing the number of web pages needed to complete a user journey.
- When designing default settings, **give users the opportunity to control functions such as notifications or backups**. As an example, your product can use less energy by checking for data whenever the user opens the app, instead of every two minutes.
- **Serve only the content that's critical to complete a user journey.** Images and videos are predominant contributors to page weight. A great user experience is green in its nature as it minimizes waste. Designers have to ask the question “does this content add any value to the user? Is it necessary for the user journey completion?”



- **Use SVG format for logos, icons and shapes** as they can scale up and down without adding to the **page weight**. Raster files such as PNG and JPEG files are in many cases bigger in size than vector files, hence use only when absolutely necessary.
- **Replace physical products such as paper** with online versions such as online billing and online contracts.
- **Design with standard HTML and CSS markup for accessibility** on all devices so as many different users as possible can access your content and they are easily findable on search engines.



Energy usage

Complexity: Low | Impact: High | Scope: User-Facing

Product designers play a vital role in how user experience is energy heavy. When designing, there are considerations to take into account to minimize energy consumption as much as possible.

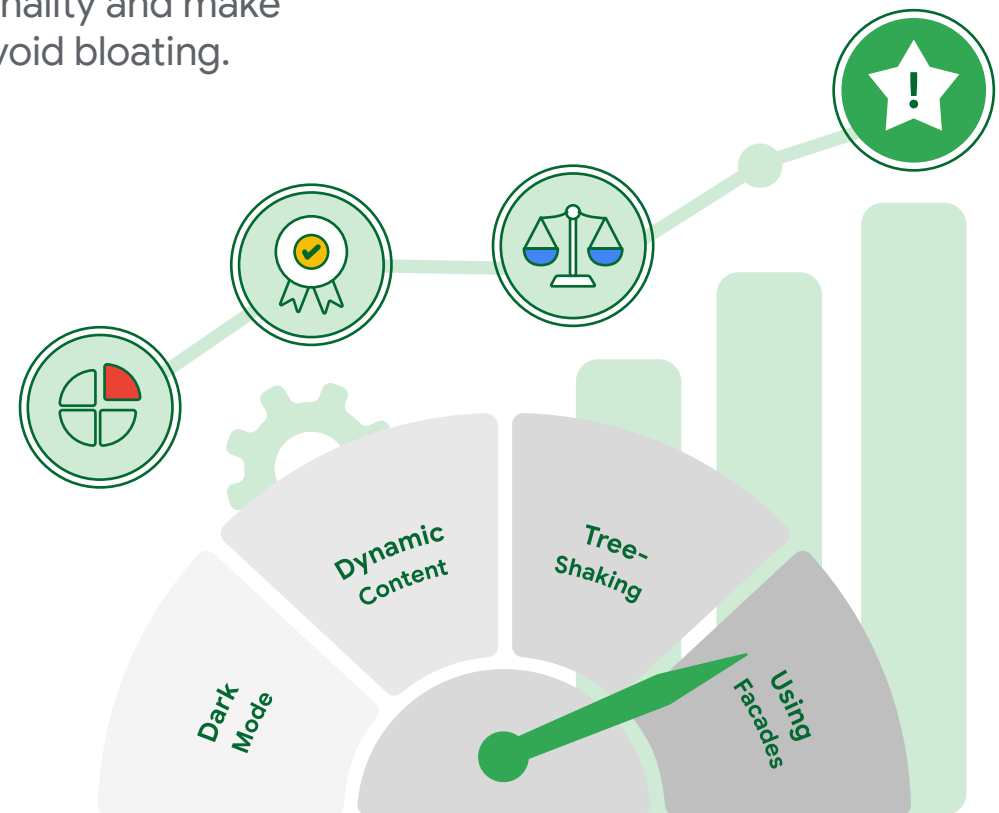
For example, knowing that dynamic content is energy heavy and what the workarounds are if the content needs to be served but at the same time needs to be energy conscious.

Every decision you make as a designer has an impact on the energy consumption of the users. Here are some tips you can utilize to minimize energy usage.

- **Use dark mode for pixel energy efficiency.** Making sure that you support dark mode will allow your users on OLED-powered devices to have energy savings up to ~40%.
- Reduce and optimize dynamic content on your pages on the client and server side by serving static pages wherever possible. **If using CSS animations**, use performance tools such as Chrome DevTools or Performance tab to debug animations that are slower due to rendering.



- **Reduce the size of your JavaScript bundles and overall scripts needed.** Tree-shaking is a good approach to eliminate unnecessary code and remove duplicate dependencies. After that, code-split based on the section of the page, and only serve the code that's absolutely required for functionality and make sure that you audit your third-party code to avoid bloating.
- **A facade is a static element that emulates a dynamic component, designed to look like the original element,** and only load the required functionality whenever requested by the user. This can be implemented for heavy third-party embeds, such as videos, but it could also be applied to serving lower-resolution or graphic based images².



[2 Lazy load third-party resources with facades, Performance Audit, Chrome Developers, Google, December 2020](#)

Loading times

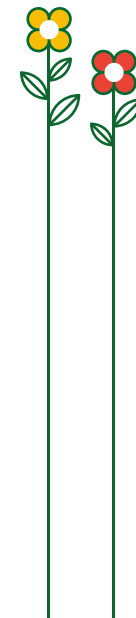
Complexity: Low - Medium | Impact: Medium - High | Scope: User-Facing

A sustainable user experience design and fast loading time goes hand in hand together because it is all about using less for better results for users that we are solving for.

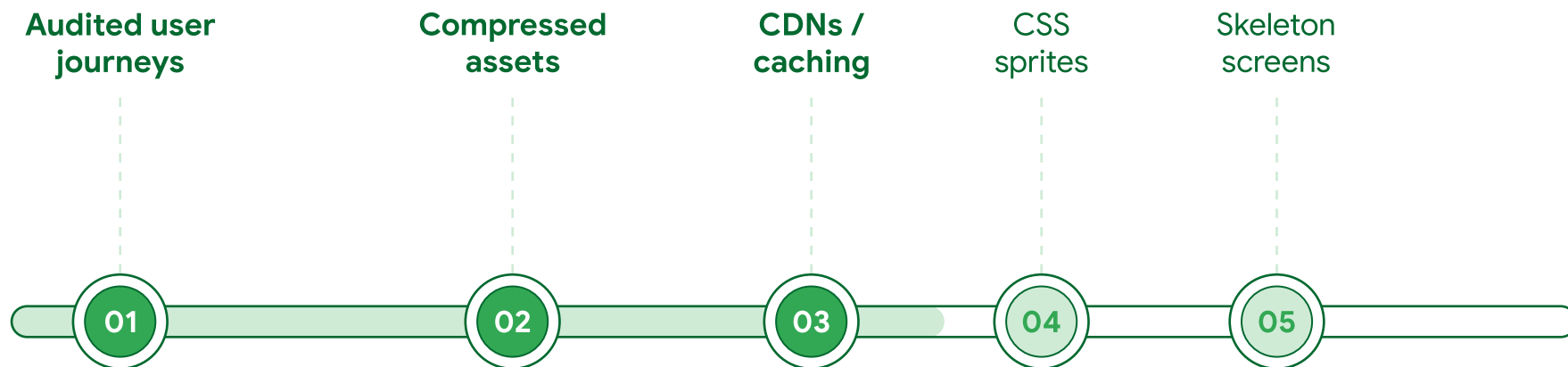
For users, if the loading time takes more than 3 seconds, they will abandon the site.

Hence, optimizing for fast loading is critical to a product design. As a product designer, it is essential to understand the impact of your design choices on the loading time over sleek looking design.

- Audit your existing user-facing digital touchpoints and ask yourself whether there are unnecessary pages and dead ends. **Does it take the least amount of clicks it should to complete a user journey?**
- **Compress and optimize your assets that are critical to user experience.** This applies to images, videos, fonts and code. Choose the most appropriate format for the use case. For example, vector formats are the most efficient for logos, png or jpeg formats for photography, and videos for animated content instead of GIFs.



- **Leverage content delivery networks (CDN), caching, and service workers.** To avoid unnecessary requests for repeated users, enable HTTP Cache for your static assets. Service worker cache offers fine-grained control over what is cached and how caching is executed. **Using CDNs, reduce the distance that data is moving when a page is loaded.**
- **Use CSS sprites** which is a single file that consists of a collection of images, stylesheets, and JavaScript libraries that a HTML document can access and call into use on a website. This reduces the number of HTTP requests.
- Instead of dull spinners, use skeleton screens to load page faster and improve user experience as **users will know what to expect once the pages loads.**

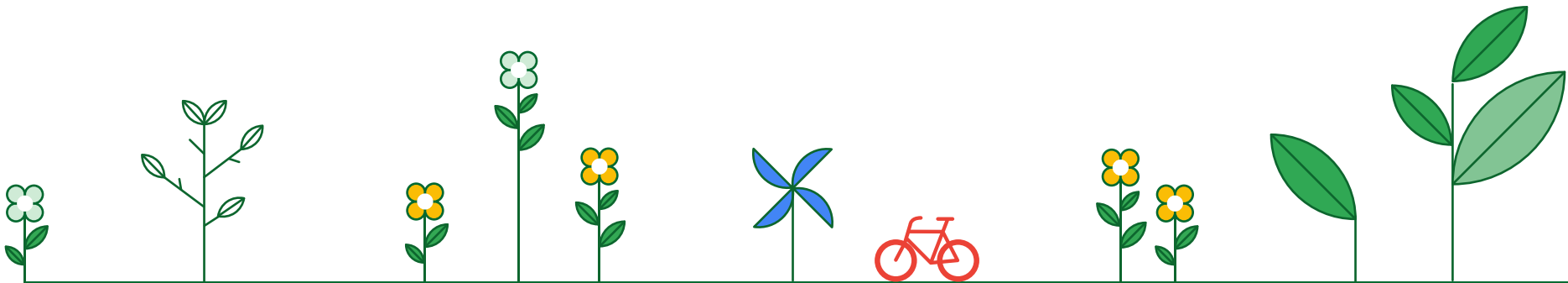




Our cloud customers are increasingly interested in transforming the way they design great products while leveraging carbon and energy optimization practices to achieve measurable emissions reduction. At the forefront for those moving the needle is early x-functional alignment across the product design lifecycle, shared CO₂e optimisation principles, and clear goals and monitoring mechanisms to measure success and highlight learnings along the way.

Ben Pickering

Digital Transformation Consultant, Google Cloud Consulting



Google Cloud

cloud.google.com