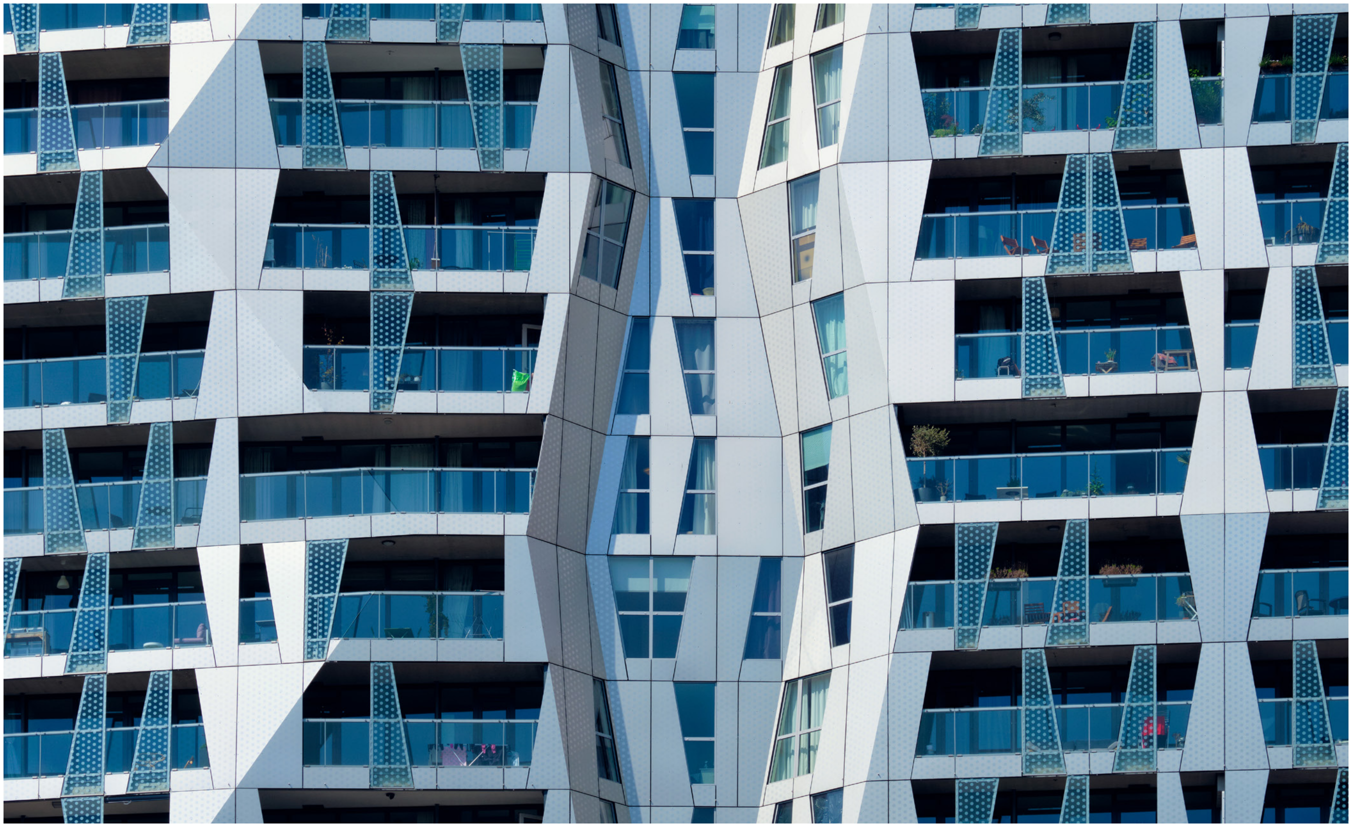
THE DETAILED 5-STEP GUIDE TO IDEATE BUILDING PERFORMANCE AND SUSTAINABLE DESIGN STRATEGIES



If each site is different, each project is different, and each client is different, then how do we come up with a consistent way of evaluating building performance across all projects? Developing a decision-making framework is critical for any endeavor but especially important in architecture where thousands of interrelated decisions must be made often with imperfect information. Data driven design processes solve this problem by using simulations to guide decision making. On a basic level, all simulations are just simplifications of reality that allow us to choose the best alternative. Thus, if we proceed by making big decisions first and work down to details later, we can ensure that our process is covering all the bases.

In this e-book, we outline 5 key steps design teams can use to simplify building performance and sustainable design analysis and help them implement a repeatable, data driven process that can be used on hundreds of projects successfully.

1. Start with the Site

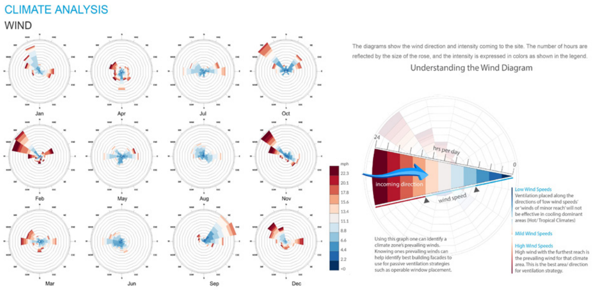
A rigorous site analysis prepares us for a data driven conversation with the owners. When introducing building performance to a project, it is critical for the designer, consultant, engineer to know which options are a good fit for the project site and then bring it up for discussion. Here are a few different types of analysis to run on a project:

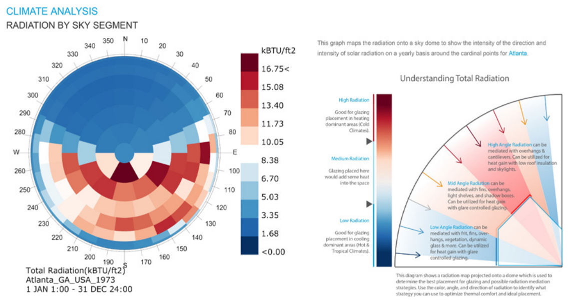
Climate Analysis

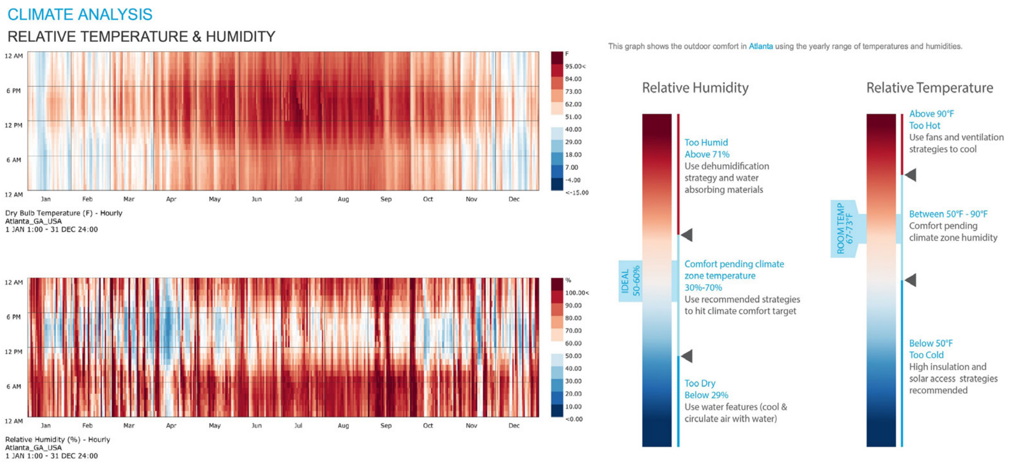
To understand how the climate is analyzed for a building's energy performance, we must first clarify what it is. Climate is the statistics of weather over an arbitrarily defined time span. It is the set of exterior environmental conditions that will impose a load on the building enclosure, including temperature, humidity, rainfall, wind, and solar radiation.

To understand all of the factors that impact the building site, designers need to have a weather file to run the analysis. A weather file is a collection of data variables such as dry bulb and wet bulb temperature, relative humidity, wind speed and direction, solar radiation, and precipitation at each hour of a typical year.

The key items to look for are dry bulb temperature, relative humidity, and solar angles as they helped determine the viability of strategies like natural ventilation, mass walls, rainwater harvesting and more. To visualize the weather data, several representative diagrams are typically generated to understand different parameters and draw conclusions on climate responsive strategies.







Walk, Transit, and Bike Score

WALK SCORE

Walk Score measures the walkability of any address. For each address, Walk Score analyzes hundreds of walking routes to nearby amenities. Points are awarded based on the distance to amenities in each category. Amenities within a 5-minute walk (.25 miles) are given maximum points. A decay function is used to give points to more distant amenities, with no points given after a 30-minute walk. Walk Score also measures pedestrian friendliness by analyzing population density and road metrics such as block length and intersection density.

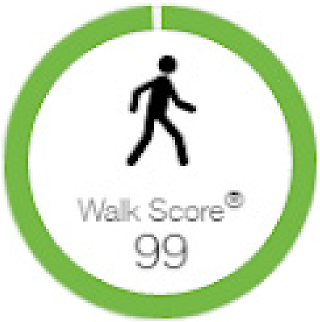
BIKE SCORE

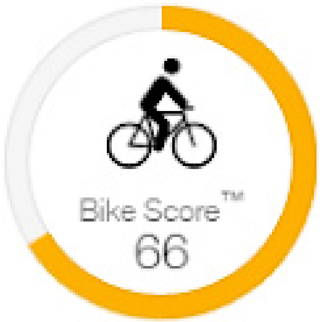
Bike Score measures whether an area is good for biking. For a given location, a Bike Score is calculated by measuring bike infrastructure (lanes, trails, etc.), hills, destinations and road connectivity, and the number of bike commuters.

TRANSIT SCORE

Transit Score is a measure of how well a location is served by public transit. Transit Score is based on data released in a standard format by public transit agencies.

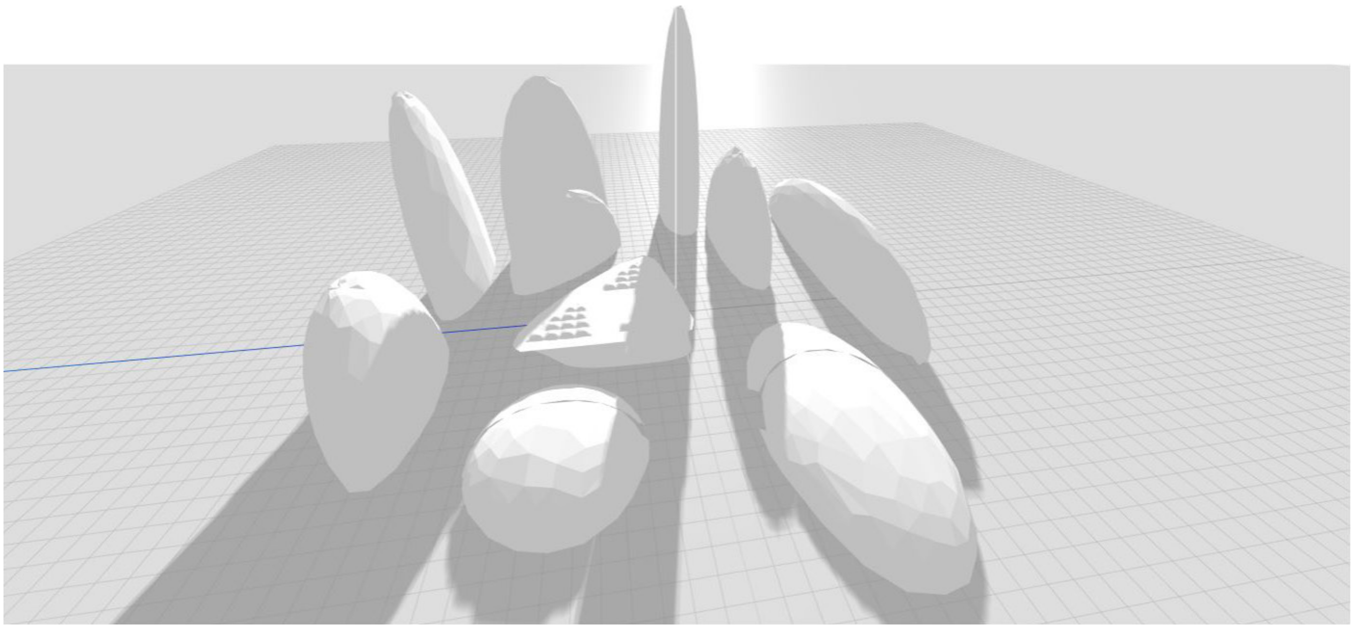
These scores help design teams determine whether the performance strategy needs to include a rigorous bike path, running trails, or other inspired features.



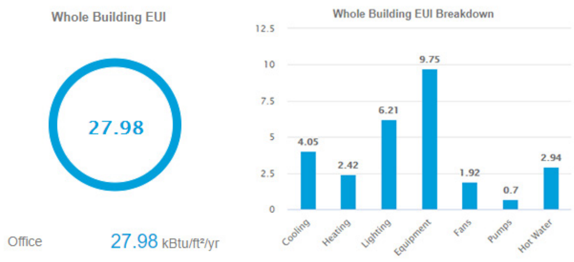


Shadow Studies

The shadow analysis allows a designer to study the amount of solar access to different parts of the site and building design, at various times of the day throughout the year. In new construction and renovation, it is important to assess the impact physical obstructions can have and/or cause, and what types of setbacks or opportunities might come about because of these unique solar situations. This visual analysis type can also be used to help regulate zoning ordinances, shape buildings and their programs, as well as address strategic concerns to natural resources and human activities. Many zoning applications require design teams to have a shadow study, so that more is known early on about the potential impacts on existing conditions.

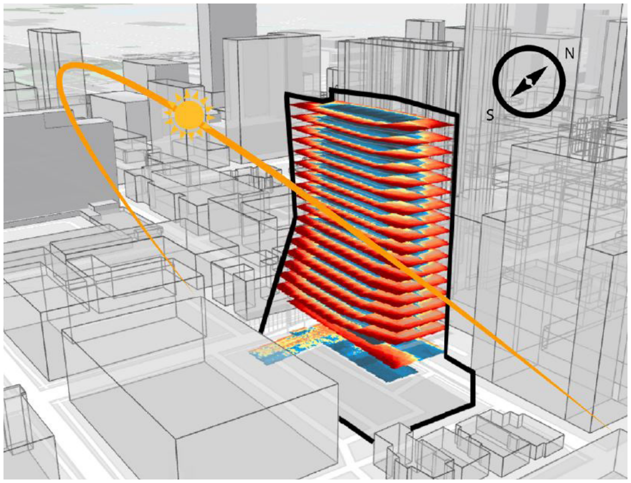


2. Understand the Benchmarks



In most cases the owner/decision maker is not as aware of the impact of building performance and sustainable design strategies and how other buildings of a similar typology perform. This makes it critical for the architect/ engineer/consultant to present benchmarks before the building performance strategies. The benchmarks help the team to set realistic targets for the project and the proposed strategies help meet these targets.

Here are the key metrics to present:



Energy Use Intensity (EUI) – This metric helps explain your buildings energy usage and eventual utility bills. It is expressed as energy per square foot per year. It is calculated by dividing the total energy consumed by the building in one year (measured in Kbtu) by the total floor area of the building.

Spatial Daylight Autonomy (sDA) – This metric describes the percentage of floor area that receives at least 300 lux for at least 50% of the annual occupied hours.

Annual Sun Exposure (ASE) – This metric describes how much of the space receives too much direct sunlight, which can cause visual discomfort (glare) or increase cooling loads.

Carbon Emissions (kgCO2e) – This metric is the amount of Greenhouse Gases (GHGs) the building produces during its operations and activities.

Cost ($/Sqft)– This metric represents the total cost of the project, payback period, and ROI.

3. Explore a Range of Strategies

In the concept, schematic, and early design development phase, it is helpful to explore a range of strategies that could be a possible fit. This requires an integrated workflow where each profession can add strategies relevant to them.

Below is an example:

Architects: Explore massing and glazing percentage options.

Civil: Explore strategies to reduce storm water runoff. Also, take a look at grey water or black water facilities with the potential for cisterns.

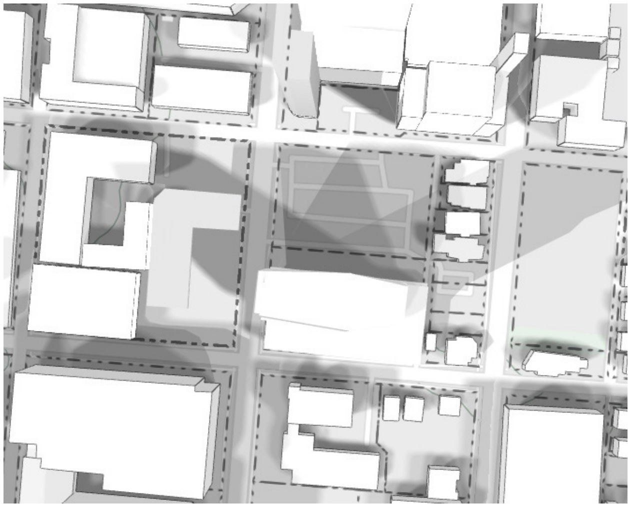
Mechanical: Explore varying mechanical system types that would be a good fit for the project. Evaluate the potential for natural ventilation in select spaces.

Electrical: Explore a range of sensor options, Photovoltaic panel options, battery and resiliency options.

Plumbing: Explore a varying degree of low flow fixtures to help the owner/decision maker find the right balance.

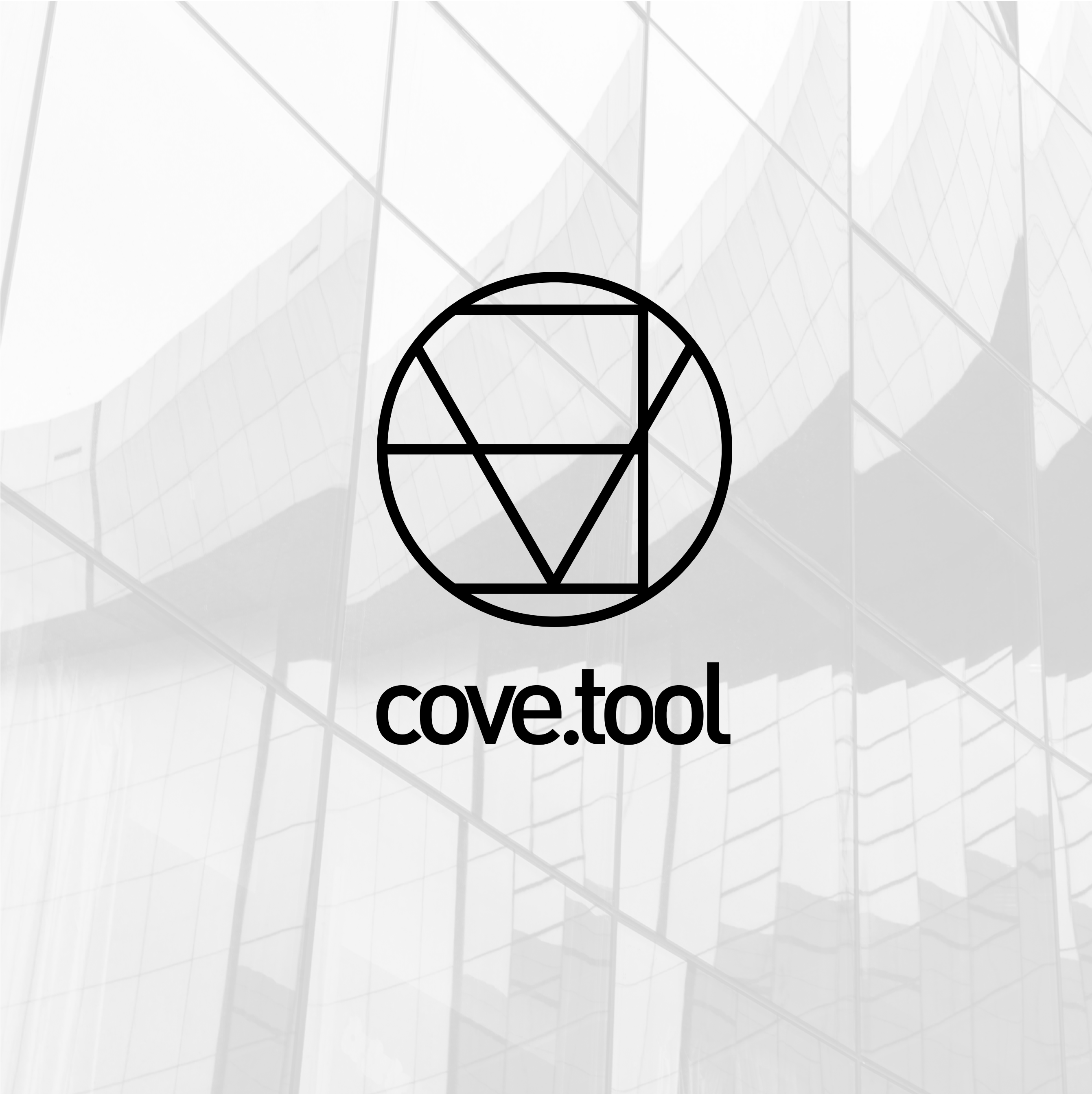
4. Share Strategies with Owner

Now that the team has done an analysis of their own strategies, it is time to showcase it to the owners. This step enables the team to weed out any strategies that the owner/decision maker may be biased against. Having the data at hand helps remove bias, but in certain cases, the bias is too strong and is driven by past experiences and makes the strategy not applicable for the project. If this happens for some of the strategies you put together, save that information for future project use, since every owner/decision maker is different! Here is an e-book focused on how to make aesthetically appealing sustainability diagrams for project presentations.



5. Propose a Bundle of Strategies the Project Can Afford

Going through steps 1-4 will help design teams develop a rigorous list of strategies that are viable for the project. Using a building performance analysis tool, the team can now run through a holistic cost vs energy optimization to test out all the possible combinations for different strategies and pick out the best one. As an example. if the team had 4 strategies for improved wall and roof insulation, 4 strategies for improved glazing, 3 strategies for shading, 5 strategies for mechanical systems, 3 strategies for photovoltaic panels, that is a total of 2880 possible “bundles” each with a different performance and a different cost. The team can then parse through these options to pick the top 3 optimal bundles to share with the owner/ decision maker for a rigorous data driven decision and path forward for the project. Here is a project case study where the design team successfully completed the 5 steps.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