SOLAR STUDIES

Quantifying buildings' interaction with sunlight to improve efficiency and comfort, prevent dangerous glare, measure shadow, and leverage clean onsite generation

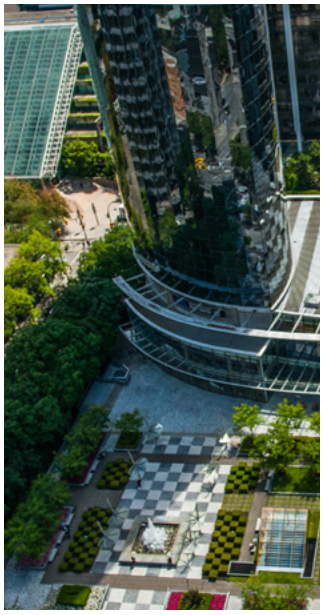
By learning in detail how your project responds to sunlight, you can:

- Improve operating efficiency and occupant comfort
- Avoid (or mitigate) dangerous or adverse conditions such as glare and shadow
- Optimize your strategies for solar power and generation

Our Service

We provide engineers, architects and designers with the information they need to fully understand how their buildings or developments interact with the sun. We can tell you, for example:

- How much solar energy is available to your project (even for complex buildings or large areas)
- The quantity and quality of daylight inside your building (see also our services focused on daylighting)
- Where your building's shadow falls and how it moves (even moment to moment)
- Whether there is glare from a proposed or existing building, whether the glare is dangerous, and what to do about it



We have developed a suite of proprietary tools that allow us to quickly provide detailed, customized results to help guide design decisions. These tools have been benchmarked and show good agreement against more time-consuming research-grade rendering software and real-world measurements.

But beyond giving you numbers, we help you understand how to use them to improve your project. We provide a holistic analysis, drawing on the whole range of RWDI's expertise to provide a comprehensive, appropriate solution. For example, if adding a canopy to prevent glare will cause a problem with snow buildup, we'll catch it and adjust our recommendation.

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RWDI is a valuable partner to clients seeking to...

Explore Innovations

- Achieve low-energy, net-zero/net-positive designs by leveraging passive solar strategies
- Craft master plans that maximize daylight and outdoor comfort for everyone
- Design for high performance through early, unbiased, assessment of energy needs and system sizing
- Plan for interaction among multiple buildings
- Plan for visual and thermal impacts on surrounding surfaces and airspac

Create Opportunities

- Open markets by making a financial case for clean generation
- Save money with reduced artificial lighting
- Minimize glare risk through early advice on façade design
- Position and market exceptional, meticulously considered spaces to premium clientele

Meet Challenges

- Balance system performance, feasibility, and payback by quantifying available solar energy
- Keep natural turf healthy in redesigned sports venues
- Keep pedestrians, spectators, and athletes comfortable by considering both sun and wind in stadium design
- Create beautiful, comfortable spaces by balancing passive daylight versus glare and overheating
- Meet stringent shadow reporting requirements through precision analysis
- Mitigate impact on built context (e.g., neighboring power systems) by quantifying loss of energy potential due to shadowing
- Respond to legal challenges related to glare and shadows through source and mitigation analysis and verification of resolution

Fulfill Expectations

- Report internal daylight conditions for certifications, such as LEED v4 and WELL
- Report shadows to meet common city building planning requirements
- Report internal and external glare and thermal impacts to ensure the impact of reflections from a building are minimized

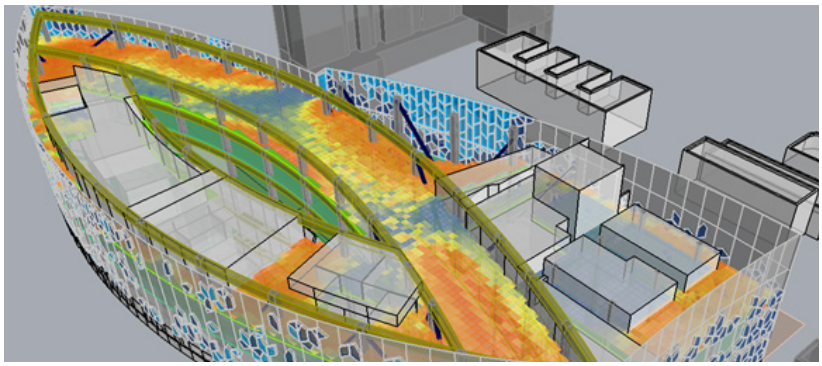
How we work

Fundamentals

- We start by tapping our meteorological experience to find or create the most accurate available solar and sky data in relation to the site.
- Next we compute the total solar energy received on the surfaces in question—the "incident flux." This calculation can be based on "typical" climate files used in the industry, on measured solar data, or on mathematical algorithms that predict ambient localized solar conditions.
- Once we know the incident energy flux, we consider the material properties of the surfaces. These properties define how the sun's energy is reflected from, transmitted through and absorbed by the facade.
- Then, depending on the questions to be answered, reflections from and shadows cast by the building are tracked. We then compute their impact on, for example, human vision, heat gains, plant health, or daylight.

Interiors

We take what we know about the received and reflected solar energy and combine it with what we know about the building's glazing, shape and interior layout. We then evaluate options for internal daylighting, artificial lighting, sensor placement and sensor schedules. We also identify areas where heat gain could cause problems.



Energy systems

We determine how much solar energy is incident on the façade. An accurate estimate of this figure is critical to designing passive solar heating and to evaluating the feasibility and financial viability of solar power systems. By quantifying the feasibility of solar generation, clients have more flexibility in achieving green certifications (e.g., LEED) and may discover new permitting and financing avenues.

New shadows

We can quantify shadows to answer any question. The estimate can be based on duration and/or size, as required by some municipalities. We can also state how much a building will reduce the solar radiation incident on nearby solar power systems. With our proprietary software, we can estimate shadowing in time steps as small as 1 or 2 minutes. Many analyses can be completed in just a few hours.

Stadium renovations

We can determine how new shadows caused by renovations will affect the light available to the turf. Going further, we can assess how this change will affect the health of the grass. (We look at levels of photosynthetically active radiation [PAR]—the specific type of light that stimulates plant growth.) This kind of analysis is often coupled with studies of human thermal comfort. This approach helps the client find the proper balance between light and comfort: providing shade for spectators while allowing enough light to reach the playing surface, so that supplemental grow lights are not needed.