SageGlass®

CONTROL SYSTEM
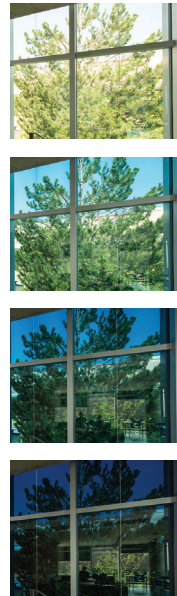
How to design daylight into your building using electronically tintable glazing.

SAINT-GOBAIN

THE SAGEGLASS CONTROL SYSTEM

INTRODUCTION

The SageGlass® control system tints SageGlass electronically to maximize daylight and outdoor views while effectively controlling heat gain and glare. The glass can be cleared or tinted as needed by the building's occupants, by the controls system directly or in conjunction with a building management system.

For more than two decades, SAGE has been pioneering the heart of the dynamic glazing system: the algorithms that control it. Effective management of solar heat and glare for energy savings and human comfort and health is more than just glass. A critical balance exists between daylighting designed for people's comfort and tinting performance to conserve or harvest solar energy. Striking this balance for each system we design, and fine-tuning how each is customized for the needs of the project, is our core competency. As the industry's leader, we understand this better than anyone.

Visible light transmission from top: 60%, 18%, 6%, 1%

SAGEGLASS 101

SageGlass can be varied from 1% visible light transmission/0.09 solar heat gain when fully tinted to 60% visible light transmission/0.41 solar heat gain when fully clear. SageGlass can also be programmed with two intermediate states, such as 18% and 6% Tvis (these two states often provide the optimal shading effects when fully clear or tinted are not necessary). With this range of variability, SageGlass presents several new design considerations for the architect and building owner.

The chart below summarizes the performance specifications of our standard glazing. SAGE offers a wide range of glazings with different insulating glass configurations, performance specifications, colors, and shapes. Please visit sageglass.com for the most up-to-date product information.

HOW IT WORKS

Dynamic glass changes tint when it receives a command from the control system. The electronics of the system are housed in Control Panels within the building. These electronics have been pre-programmed with the algorithms that carry out the commands that best meet the requirements of the project, as determined by the building's designer. Our control system includes advanced tools to manage daylighting, color rendering, energy usage and glare based on occupancy and light levels. Control can be automated with the option of manual overrides, or fully manual.
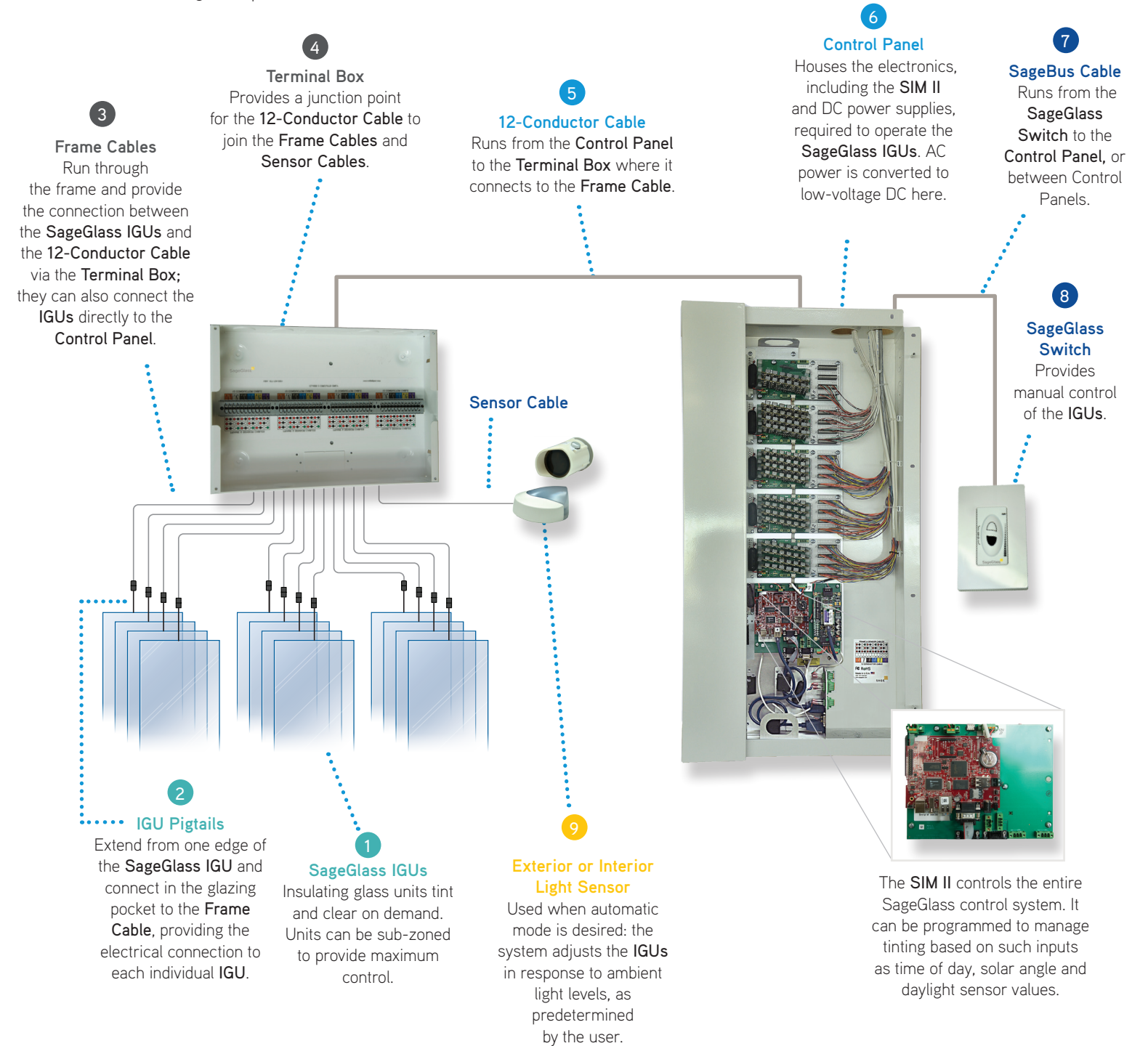
OVERVIEW OF THE SYSTEM

The system is wired in sections, making it easier to install and permitting commissioning without the need to coordinate the schedules of glazing and low-voltage electrical contractors. The segmented system also facilitates maintenance and IGU replacement, if necessary. In the unlikely event of component failure, only a portion of the system is affected and can easily be replaced.

SageGlass® Clear w/SR2.0	%Tvis	%Rf Ext.	%Rb Int.	%Tsol	SHGC	U-factor	%Tuv	%Tdw-K
Clear State	60	16	14	33	0.41	0.28	0.4	15
Intermediate state 2	18	10	9	7	0.15	0.28	0.2	5
Intermediate state 1	6	10	9	2	0.10	0.28	0.1	2
Fully Tinted	1	11	9	0.4	0.09	0.28	0	0.6

Modeled with Window 6.3; 1" argon-filled IGU

SYSTEM COMPONENTS

This schematic shows the overall layout of the SageGlass control system. SageGlass IGUs connect to the Control Panel via Pigtails, Frame Cables and 12-Conductor Cables. In some cases, the wiring joins in Terminal Boxes, and in others it runs directly from the IGUs to the Control Panel. SageBus™ Cable connects the SageGlass Switch to the Control Panels. **Light Sensors** connect to either the Terminal Box or the Control Panel.

The power sources are UL Listed, Class 2 high-reliability units, ensuring safety and permitting cost-effective Class 2 wiring methods. All cable is low voltage DC, plenum-rated cable.

6 Control Panel
Houses the electronics, including the **SIM II** and DC power supplies, required to operate the **SageGlass IGUs**. AC power is converted to low-voltage DC here.

4 Terminal Box
Provides a junction point for the **12-Conductor Cable** to join the **Frame Cables** and **Sensor Cables**.

3 Frame Cables
Run through the frame and provide the connection between the **SageGlass IGUs** and the **12-Conductor Cable** via the **Terminal Box**; they can also connect the **IGUs** directly to the **Control Panel**.

5 12-Conductor Cable
Runs from the **Control Panel** to the **Terminal Box** where it connects to the **Frame Cable**.

7 SageBus Cable
Runs from the **SageGlass Switch** to the **Control Panel**, or between Control Panels.

8 SageGlass Switch
Provides manual control of the **IGUs**.

Sensor Cable

2 IGU Pigtails
Extend from one edge of the **SageGlass IGU** and connect in the glazing pocket to the **Frame Cable**, providing the electrical connection to each individual **IGU**.

1 SageGlass IGUs
Insulating glass units tint and clear on demand. Units can be sub-zoned to provide maximum control.

9 Exterior or Interior Light Sensor
Used when automatic mode is desired: the system adjusts the **IGUs** in response to ambient light levels, as predetermined by the user.

The **SIM II** controls the entire SageGlass control system. It can be programmed to manage tinting based on such inputs as time of day, solar angle and daylight sensor values.

# WHICH SYSTEM IS RIGHT FOR YOUR PROJECT?

Our system is typically designed in either a **centralized** or **distributed** architecture or a hybrid of the two, depending on the size and needs of the project. Both systems can be expanded, and both can be integrated with a building management system (BMS).

CENTRALIZED CONTROL SYSTEM

The centralized SageGlass controls system allows the Control Panels to be situated in one location, up to 300 feet away from the IGUs, which simplifies placement of the controls. This configuration is typically used in projects where less than 1,200 square feet of SageGlass is being installed and also in larger systems where Control Panels cannot physically be installed near the IGUs.

The illustration below shows an example of how a centralized control system could be configured. In this example, one Control Panel is mounted in a central location inside of the building's utility closet where other building controls are housed. 12-conductor Cables run from the Control Panel to the Terminal Boxes, each of which is located in one of the three rooms where the SageGlass IGUs are installed. Frame Cables exit the Terminal Boxes and connect in the glazing pocket to the IGU Pigtails. The Terminal Boxes can also connect directly to the Light Sensors which reside in each room or outside on the façade. If the total wire length is less than 125 feet, the Frame Cable can connect directly to the Control Panel, eliminating the terminal box. SageGlass Switches – for manual control – are connected in daisy-chain fashion using SageBus Cable.

SAGE offers three different sizes of Control Panels, each of which can control a different number of IGUs. Each large Control Panel, for example, can accommodate up to 2,000 sq. ft. of glazing.
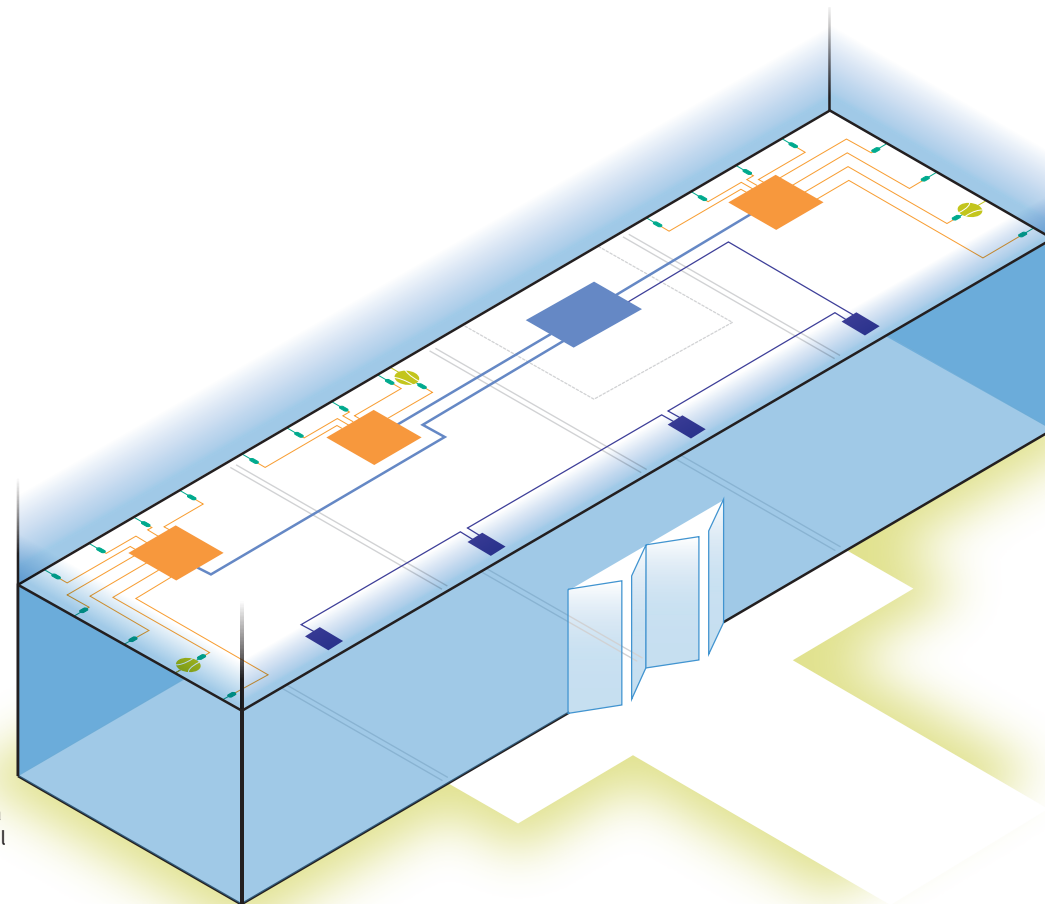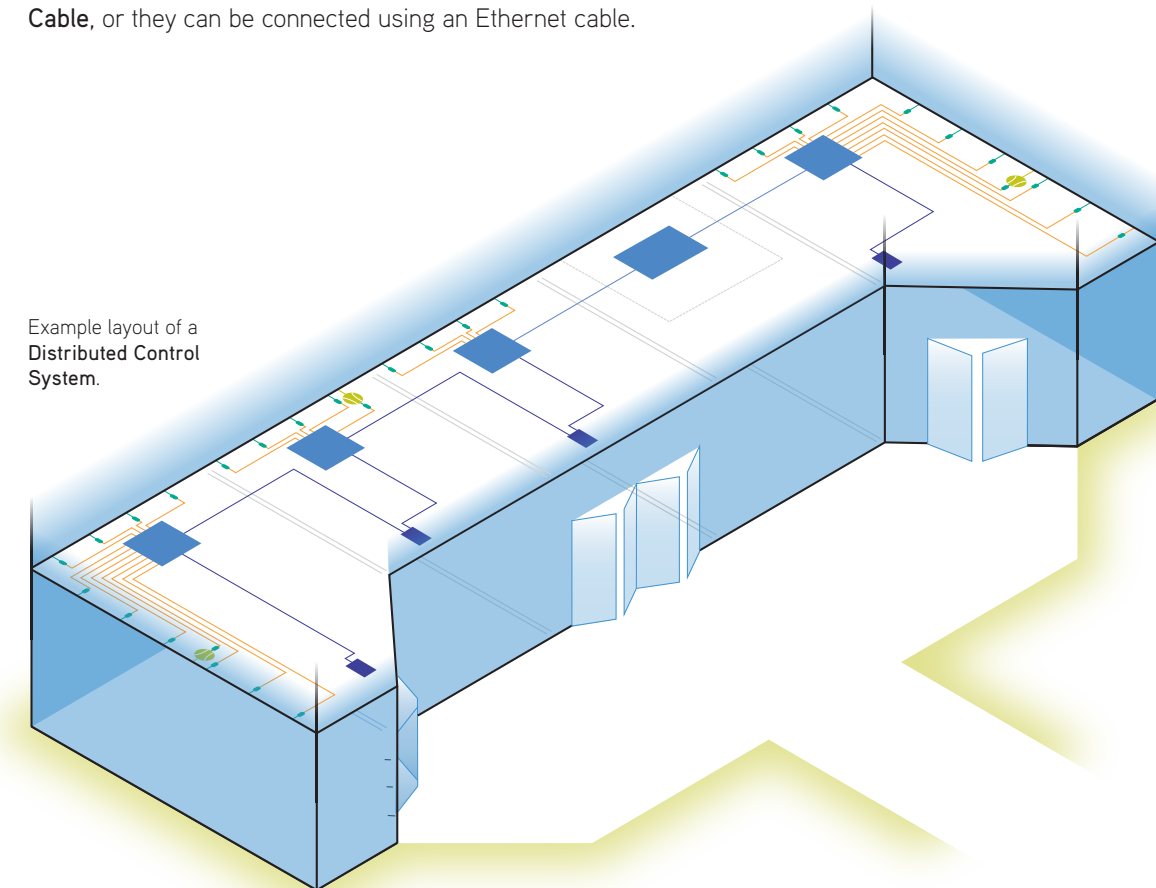

Example layout of a
**Centralized Control
System**.

DISTRIBUTED CONTROL SYSTEM

With this configuration, multiple Control Panels are located throughout the building. For larger projects, this results in lower installation costs. As shown in the illustration below, the Control Panels are sited as close as possible to the IGUs, for example, above suspended ceilings or in closets. They may be mounted in a plenum area or flush mounted in a wall. The Control Panels connect to the IGUs (or to the Light Sensors) via the Frame Cable which attaches in the glazing pocket to the IGU Pigtail.

Panels can be connected in a daisy chain fashing using **SageBus Cable**, or they can be connected using an Ethernet cable.


Example layout of a
**Distributed Control
System**.

IN MULTI-FLOOR BUILDINGS

Our systems are easily scalable by connecting control systems on each floor with a simple Ethernet cable. This simplifies wiring and reduces installation costs, while providing maximum flexibility.

BUILDING MANAGEMENT SYSTEM

Any of the systems described above can integrate with a BMS via BACnet, LonWorks, or dry contacts. Complete BMS control is possible but most often a design with overrides, set-point changes and occupancy inputs is desired for maximum control.
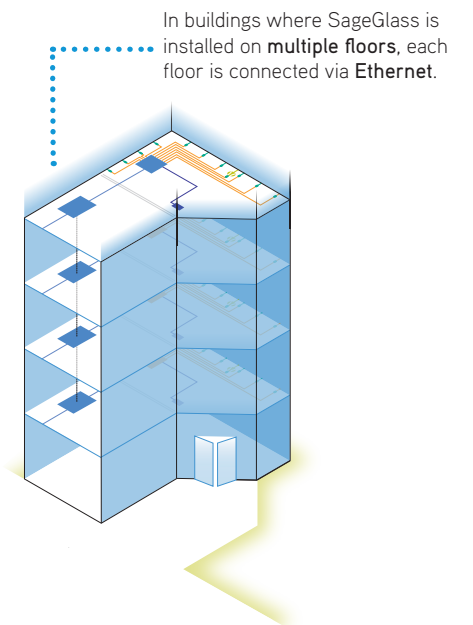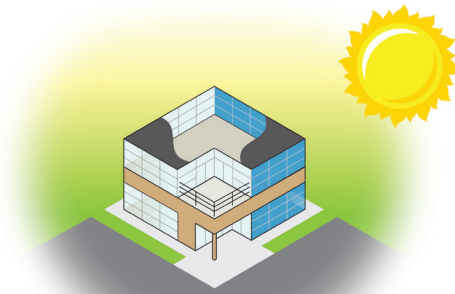
In buildings where SageGlass is installed on **multiple floors**, each floor is connected via **Ethernet**.
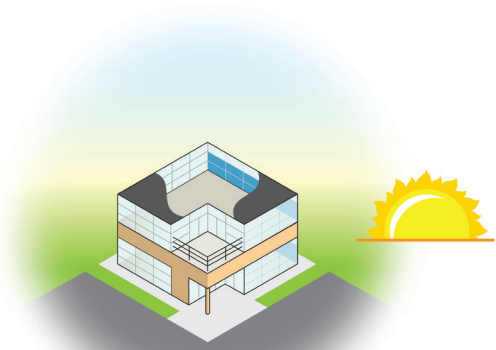
SUNRISE: The sun's low position on the horizon means light shines directly on the east elevation, creating glare. That facade is set to tint, while the rest of the building is set for maximum daylight harvesting.

A DAY IN THE LIFE OF SageGlass

These illustrations provide examples of daylighting strategies that incorporate automatic and manual controls to manage sunlight the most effectively. Zoning design depends on many factors including building orientation, occupant location and needs, and interior space design. Our system is highly customizable and can be programmed to meet the needs of almost any project.

NIGHTTIME: If maximum vision is desired (imagine wanting to look out over a city skyline, for instance), the windows can be cleared. On the other hand, light pollution can be reduced by fully tinting the glass.
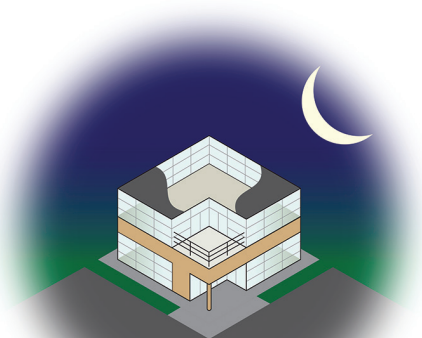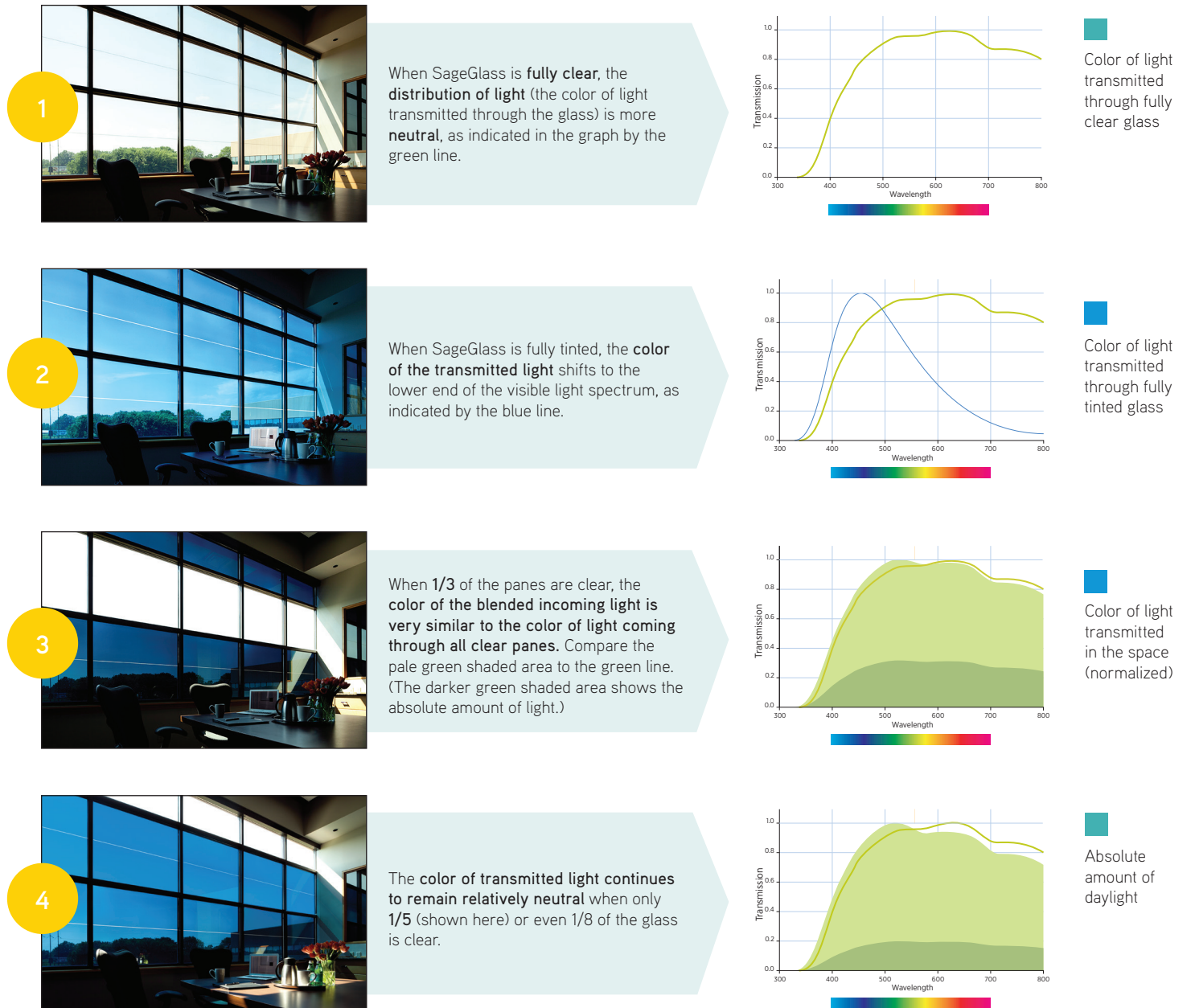
EARLY AFTERNOON:

As the sun passes overhead, the windows change to compensate. Glass on the east and south elevations tints based on zoning strategies. In this example, because the sun is overhead, the control system calls for intermediate states in certain zones to achieve specific light levels.
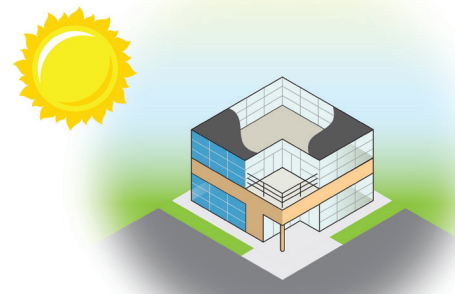
LATE AFTERNOON:

Direct solar gain becomes an issue. Occupants near the west windows need to block heat gain, while elsewhere in the building people want to clear the glass for maximum daylight. Both heat and glare control is optimized by zoning strategies.
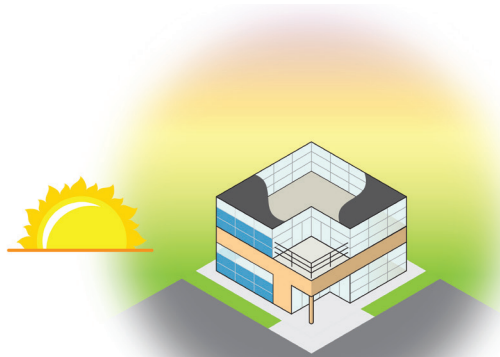
SUNSET: Glare is

created as light shines directly through the glass where occupants are sitting. The windows transition into fully tinted mode to block that straight-line glare. The top windows, however, enter clear mode to harvest as much daylight as possible.

ZONING

Zoning can be set up in any configuration desired: by room, by building orientation, by row or column. The design is limited only by your needs and imagination.

ZONING FOR NEUTRAL TRANSMITTED LIGHT

To achieve neutral color rendering within a space where the glass is very dark, as is the case when SageGlass is fully tinted, some percentage of more neutral light must be allowed in. We achieve this by zoning. Zoning allows specific panes to be tinted as required for glare and heat control, yet allows others to be left clear to provide more neutral lighting in the space. As the graphs below illustrate, it takes very little light coming through the clear glass to achieve this effect.

Zoning strategies are highly important in ensuring a **feeling of natural light** in the space.

1 When SageGlass is **fully clear**, the **distribution of light** (the color of light transmitted through the glass) is more **neutral**, as indicated in the graph by the green line.

Color of light transmitted through fully clear glass

2 When SageGlass is fully tinted, the **color of the transmitted light** shifts to the lower end of the visible light spectrum, as indicated by the blue line.

Color of light transmitted through fully tinted glass

3 When **1/3** of the panes are clear, the **color of the blended incoming light is very similar to the color of light coming through all clear panes.** Compare the pale green shaded area to the green line. (The darker green shaded area shows the absolute amount of light.)

Color of light transmitted in the space (normalized)

4 The **color of transmitted light continues to remain relatively neutral** when only **1/5** (shown here) or even **1/8** of the glass is clear.

Absolute amount of daylight

Modeling data provided by John Mardaljevic, Professor of Building Daylight Modelling, School of Civil & Building Engineering, Loughborough University, UK

SageGlass®

GET IN TOUCH

SageGlass® is the pioneer of the world's smartest dynamic glass and is transforming the indoor experience for people by connecting the built and natural environments. Electronically tintable SageGlass tints or clears on demand to control sunlight and prevent heat and glare without the need for blinds or shades. SageGlass dramatically reduces energy demand and the need for HVAC by blocking up to 91 percent of solar heat. As part of Saint-Gobain, SageGlass is backed by more than 350 years of building science expertise that only the world leader in sustainable environments can provide.

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