GENERAL AUTOMATED SHADING DATA FOR GEORGIA

PROJECT EXAMPLES

https://news.gsu.edu/2022/09/13/georgia-state-to-open-new-convocation-center/

Georgia State University…52 motors controlling all interior shading

https://www.linkedin.com/posts/stefanonardone_rollershades-rollerblinds-interiordesign-ugcPost-7165000924845858817-pPZ0/?utm_source=share&utm_medium=member_ios
Georgia (Rec Center)

https://www.somfy.com/projects/references?id=7828D273-C3BE-6B14-9F254C28753C5F12

8 case study projects from Somfy's website

https://www.jaxdailyrecord.com/news/2022/oct/12/fis-cuts-the-ribbon-on-new-dollar156-million-headquarters-in-riverside/

Florida…250 motors controlling all interior automated shading

https://www.palmbeachpost.com/story/news/local/2019/07/12/new-six-story-fpl-building-parking-garage-on-pga-will-be-able-to-withstand-cat-5-hurricane/4672333007/

Florida…450 motors controlling interior automated shading and hurricane shutters

ENERGY EFFICIENCY

Typically, energy efficiency levels are based on a range of 9% to 57% HVAC energy savings for residential buildings using automated shading. This range is based on modeling and case studies for various residential building types in the table below.

Study Name	Building Type	Size	Location	New Build or retrofit	Modeling or case study	Control	Savings measure	Savings
RMI Residential Shades	Residential	2400 sf	Various, USA	Both	Modeling	Automatic	Total Energy	4-7 % (New Build) 6-17% (Retrofit)
LBNL Control Algorithms	Residential	2400 sf	Various, USA	Retrofit	Case Study	Automatic	HVAC	11-13 %
PNNL 2018 Evaluation of Cellular Shades	Residential	1500 sf	Richland, WA	Retrofit	Case Study	Automatic and Manual	HVAC	9.3% cooling, 4% heating

The HVAC benefit values from the RMI residential study titled "Energy Savings from Window Shades" exceed the total energy savings values shown in the table above. These HVAC benefit values from the RMI study are found on pages 1 and 2 of the abstract, in Tables ES1 (new homes) and Table ES2 (existing homes) based on window shading and an automated Green Mode schedule. Table ES1 (new homes) shows maximum cooling savings. Table ES1 (new homes) shows maximum cooling savings ranging from

15% in Miami to 57% in San Francisco. Tables ES2 (existing homes) shows maximum cooling savings ranging from 26% in Miami to 66% in San Francisco.

TABLE ES1: MAX SAVINGS IN NEW HOMES (Trielle - Production Fit - HD Green Mode)	Max Home Energy Savings	Max Energy Bill Savings	Max Heating Savings	Max Cooling Savings
Miami	5%	$120	9%	15%
Phoenix	7%	$180	11%	18%
San Francisco	4%	$60	10%	57%
Washington DC	6%	$180	8%	25%
Chicago	5%	$110	6%	26%
Denver	6%	$100	10%	25%
Minneapolis	6%	$110	9%	27%
Aspen	6%	$90	9%	44%
Anchorage	5%	$100	8%	--

TABLE ES2: MAX SAVINGS IN EXISTING HOMES (Trielle - Production Fit – HD Green Mode)	Max Home Energy Savings	Max Energy Bill Savings	Max Heating Savings	Max Cooling Savings
Miami	16%	$580	4%	26%
Phoenix	17%	$830	8%	28%
San Francisco	10%	$410	5%	66%
Washington DC	12%	$620	11%	35%
Chicago	7%	$300	6%	33%
Denver	9%	$290	9%	34%
Minneapolis	7%	$270	7%	35%
Aspen	8%	$270	8%	51%
Anchorage	6%	$260	7%	--

In Table 6.1 on the 57th page of the 2018 PNNL study titled “Testing the Performance and Dynamic Control of Energy-Efficient Cellular Shades in the PNNL Lab Homes”, typical usage of double cellular shades is compared with typical usage of vinyl shades. The study also compares an automated usage pattern of double cellular shades vs. typical usage of vinyl shades. In both instances, the double cellular shades performed better than the vinyl shades, but they performed much better when usage patterns were optimized for energy savings. The difference in performance between the “Partial Optimal Control” and the “Typical Use” experimental homes was 9.3% (15.1% - 5.8%) for cooling and 4.7% (6.7% - 2.0%) for heating.

Table 6.1. Average HVAC Savings of the Double-Cell Cellular Shades (Lab Homes testing during 2017–2018)

Experimental Home	Baseline Home	Season	HVAC savings (Average daily %)
Static use: Double-cell cellular shades always pulled down on all windows	No shades covering windows	Cooling	24.8 (±8.6)
		Heating	2.4 (±3.2)
Typical use: Double-cell cellular shades; bedrooms closed, living/dining open.	No shades covering windows	Cooling	4.7 (±1.3)
		Heating	Inconclusive
Static use: Double-cell cellular shades always pulled down on all windows	Vinyl blinds, always pulled down	Cooling	13.3 (±1.3)
		Heating	9.3 (±1.9)
Typical use: Double-cell cellular shades; bedrooms closed, living/dining open.	Vinyl blinds, typical use operation	Cooling	5.8 (±0.5)
		Heating	2.0 (±1.3)
Partial Optimal Control: HD Green schedule for common area rooms, typical use in all other rooms	Vinyl blinds, typical use settings	Cooling	15.1 (±2.0)
		Heating	6.7 (±1.0)
Occupancy Control schedule: Cellular shades pulled down in common area from 9AM to 5PM and typical use operation during all other hours	Vinyl blinds, typical use settings	Cooling	15.2 (±2.2)
Best Practices I: Operating shades in common area only. Shades open at 6AM and closed at 6PM.	Vinyl blinds, typical use settings	Heating	5.4 (±1.2)
Best Practices II: Operating shades in all rooms of the home. Shades open at 6AM and closed at 6PM.	Vinyl blinds, typical use settings	Heating	8.7 (±1.2)

Furthermore, a 12-month Smart Shade Pilot Program funded by Hunter Douglas, Rollease Acmeda, Baltimore Gas and Electric (BGE) and Illinois Window Shades and the Attachment Energy Rating Council (AERC) released results in 2023. The program's objective was to assess potential of automated shades to reduce energy usage, reduce HVAC run times and maintenance costs, optimize climate consistency throughout the home, and extend HVAC equipment. The study results indicated 13.7% electricity savings and 2.4% gas savings.

bge
AN EXELON COMPANY

January 11, 2023

BGE Smart Shade Pilot

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Smart Shade Pilot – Results

Weather normalized data analytics conducted following the completion of the pilot included:

- A two-stage approach to evaluate savings as outlined in NREL's Uniform Methods Projects Chapter 8: *Whole Building Retrofit with Consumption Data Analysis Evaluation Protocol*
- A Comparison Group was pulled from a pool of similar homes
  - Included AMI meters (12 months pre & post)
  - Similar window count & orientation
  - Same service territory (Maryland)
- Energy Consumption was provided by BGE
  - Participant AMI meters (both Electric and Gas)
    - Continuous 12 months of pre-installation & post-installation consumption
    - Included both pools of homes (participants & non-participants)
- Analysis indicated weather-normalized energy of **savings of 13.7% for electric and 2.4% for gas** for participants

The studies and data above demonstrate HVAC energy efficiency savings of more than 10% when implementing automated shades. A simple and conservative approach would be to include a ten percent (10%) energy credit for automation, given that lab, simulation, and real-world study data often exceed this value.

In addition to the noted efficiency improvements associated with automated shading, there are demonstrated improvements in occupant comfort with respect to temperature and glare in the office environment.[1]

[1] Luna-Navarro et al. 2023. Semi-automated vs manually controlled dynamic facades: assessment

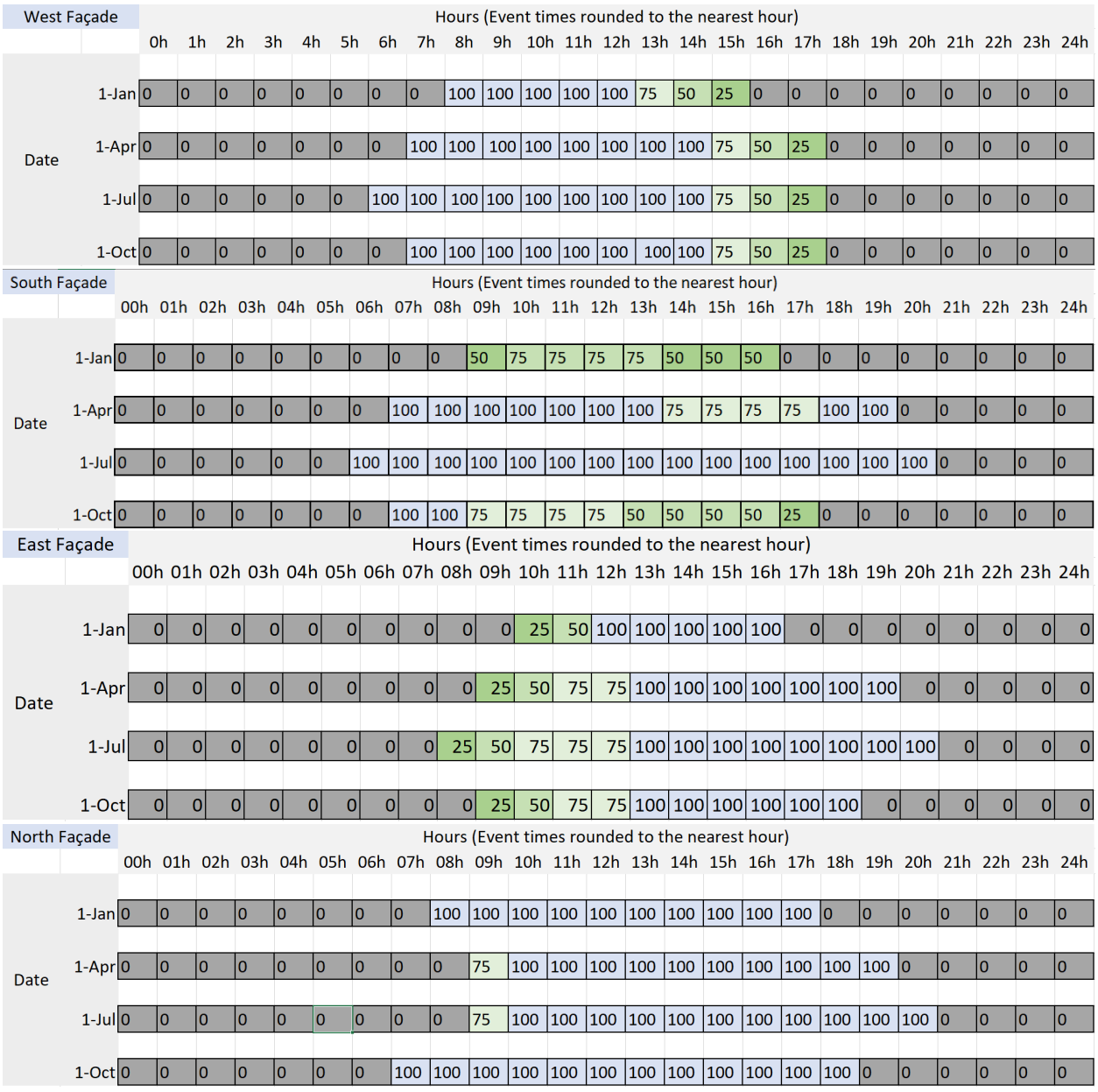
MARKET/TECHNOLOGY INFORMATION:

Request: Control schedules:

- Do you know the most common control strategies used by Manufacturers?
- Do you have any recommendations for schedules if we were to model the most prevalent schedules?

Response:

- Local control (hand-held remotes, wall switches, app-based) is the most common control strategy. App-based controls are available for both commercial and residential use cases and allow for automated custom schedules. App based controls are growing significantly in popularity.
- Residential - Comfortability, glare and temperature are the main priorities that guide usage of automation at the residential level. Optimal schedules may differ across seasons, climate zones, and occupant behavior assumptions. For example, glare reduction becomes less of a priority if it is assumed that inhabitants are out at work during the daytime during the weekday. The seasons impact control strategies based on whether heating or cooling is necessary. Generally, during cooling dominated seasons, shades will be closed when sun is shining directly on them to minimize solar heat gain. During heating dominated seasons, shades will be left open during the day to maximize solar heat gain, unless glare becomes an issue.
- Commercial – Control strategies on commercial buildings can be more sophisticated than in residential buildings. The complexity is driven by the quantity and type of weather sensors and the capabilities of the building management system and energy management system. Automation platforms necessarily interact with a wide range of building management systems and sensors from various vendors. The sophistication of control strategies is mostly determined by the complexity of the building's energy management system and the types of sensors available to the system. Future management systems may incorporate demand response capabilities allowing utility control during grid stress events.
- The numerical value for each hour is the "openness" of the roller blind (100 – fully open, 0 – fully closed). Changes in blind position can be made in sub-hourly intervals and schedules can shift in a granular manner throughout the season. These schedules represent a simple and conservative starting point for buildings within climate zone 4. Many projects do not cover all facades with automated shading; frequently, only the west and south facades are covered.



West Façade	Hours (Event times rounded to the nearest hour)																								
	0h	1h	2h	3h	4h	5h	6h	7h	8h	9h	10h	11h	12h	13h	14h	15h	16h	17h	18h	19h	20h	21h	22h	23h	24h
Date 1-Jan	0	0	0	0	0	0	0	0	100	100	100	100	100	75	50	25	0	0	0	0	0	0	0	0	0
1-Apr	0	0	0	0	0	0	0	100	100	100	100	100	100	100	100	75	50	25	0	0	0	0	0	0	0
1-Jul	0	0	0	0	0	0	100	100	100	100	100	100	100	100	100	75	50	25	0	0	0	0	0	0	0
1-Oct	0	0	0	0	0	0	0	100	100	100	100	100	100	100	100	75	50	25	0	0	0	0	0	0	0

South Façade	Hours (Event times rounded to the nearest hour)																								
	00h	01h	02h	03h	04h	05h	06h	07h	08h	09h	10h	11h	12h	13h	14h	15h	16h	17h	18h	19h	20h	21h	22h	23h	24h
Date 1-Jan	0	0	0	0	0	0	0	0	0	50	75	75	75	75	50	50	50	0	0	0	0	0	0	0	0
1-Apr	0	0	0	0	0	0	0	100	100	100	100	100	100	100	75	75	75	75	100	100	0	0	0	0	0
1-Jul	0	0	0	0	0	0	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	0	0	0	0
1-Oct	0	0	0	0	0	0	0	100	100	75	75	75	75	50	50	50	50	25	0	0	0	0	0	0	0

East Façade	Hours (Event times rounded to the nearest hour)																								
	00h	01h	02h	03h	04h	05h	06h	07h	08h	09h	10h	11h	12h	13h	14h	15h	16h	17h	18h	19h	20h	21h	22h	23h	24h
Date 1-Jan	0	0	0	0	0	0	0	0	0	0	25	50	100	100	100	100	100	0	0	0	0	0	0	0	0
1-Apr	0	0	0	0	0	0	0	0	0	25	50	75	75	100	100	100	100	100	100	100	0	0	0	0	0
1-Jul	0	0	0	0	0	0	0	0	25	50	75	75	75	100	100	100	100	100	100	100	100	0	0	0	0
1-Oct	0	0	0	0	0	0	0	0	0	25	50	75	75	100	100	100	100	100	100	0	0	0	0	0	0

North Façade	Hours (Event times rounded to the nearest hour)																								
	00h	01h	02h	03h	04h	05h	06h	07h	08h	09h	10h	11h	12h	13h	14h	15h	16h	17h	18h	19h	20h	21h	22h	23h	24h
Date 1-Jan	0	0	0	0	0	0	0	0	100	100	100	100	100	100	100	100	100	100	0	0	0	0	0	0	0
1-Apr	0	0	0	0	0	0	0	0	0	75	100	100	100	100	100	100	100	100	100	100	0	0	0	0	0
1-Jul	0	0	0	0	0	0	0	0	0	75	100	100	100	100	100	100	100	100	100	100	100	0	0	0	0
1-Oct	0	0	0	0	0	0	0	100	100	100	100	100	100	100	100	100	100	100	100	0	0	0	0	0	0

MARKET INFO

Any information on the automated shade market that you might have at your disposal would be useful in reviewing this application. A few key pieces of the market we are interested in learning more about:

- The most common automated shades (cellular or roller shades, battery vs plug in vs subpanel) that are being sold…

Response: The most common interior shading products sold are roller shades. Battery operated models are most common in residential and wired models are the most common in commercial.

Request: The cost premium for automating shades

Response:
Commercial - $500 per motor add-on to manual shade per 48 square feet of shaded window including installation.

Based on prior modeling work conducted for a commercial office building prototype, automated shading was able to reduce energy consumption by ~13%.[2] With the dollar value of savings adjusted according to changes in billing rates from when the study was originally conducted (2017) to December 2023, the savings are approximately $30,000 annually. Assuming energy prices continue increasing the same % each year (4.8%) as in the 2017-2023 period, the marginal cost of adding motors (~$304,000) would be paid back within nine (9) years. The extent of shading covered glazing on outside walls was ~29,200 square feet, requiring 608 motors, assuming each motor would be assigned 48 square feet of shading. The north facing wall of the building was not covered with automatic shading and did not impact costs.

Residential – $700 per motor add-on to manual shade per 48 square feet of window including installation.

The Rocky Mountain institute conducted a study on the impact of automated shades on PNNL's prototype home, a 2,400 square foot home with 357 square feet of window area.[3] Assuming 48 square feet of window per motor, 8 motors are required, at a cost of $5,600 assuming $700 per unit. Applying the annual energy savings for the San Francisco simulation (5,129 kWh) to the current rates results in an annual savings of ~$1,800. The resulting payback period is approximately three (3) years.

Automated shading has the ability to not only reduce operating costs, but capital costs as well. Reducing peak AC loads would allow for using smaller, less expensive units, or potentially avoiding AC altogether in mild climates. A report published by Guidehouse indicates that the CAPEX savings opportunities for automated shading will only grow as the climate changes in the future.[4]

Request: The main manufacturers of automated shades

Response: Main manufacturers of automated shades include but are not limited to: Draper, Graber, MechoShade, Lutron, Hunter Douglas, Altex.

Other Manufacturers from the AERC membership list[5] include:
Shade Manufacturers – Glen Raven, heroal, Levolor, Mecho Systems, Mermet, Phifer, Renson, Rollease Acmeda, Thermeshade

Automation/Motor Manufacturer – Heroal, Levolor, Mackinac, Mecho Systems, Rollease Acmeda, Thermeshade

Request: The current market share of automated versus non automated shades in residential/commercial buildings

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[2] Pollock, 2017. Somfy – LEED Related Analysis.
[3] Rocky Mountain Institute, 2015. Energy Savings From Window Shades.
[4] Guidehouse, 2021. Solar Shading Study Documentatio Slides – The potential to disrupt rising cooling demand and overheating in European Buildings.
[5] Membership - AERC Energy Rating

Response: It is estimated that as of 2022, 9% of the 30 million interior shade product market (residential & commercial) was motorized, as opposed to manually operated.

Request: The growth of the automated shade market

Response: The growth rate is generally in the 9 - 10% range year-on-year, with some variation according to industry market projections. Growth projection rates were based on the current 5+ percent Federal funds interest rate lending environment. Recently projected rate cuts may accelerate these growth rates.