NATIONAL ASSOCIATION OF REALTORS®

A Tale of Two Towns:

A Case Study on Building Communities with Sustainability and Resiliency at the Forefront

By Heather McGowan, Manager, Association Archives, National Association of REALTORS®

Edited by Melisa Camp, Sustainability Advisory Group; Erin Busche National Association of REALTORS®; and Russell Riggs, National Association of REALTORS®.

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INTRODUCTION

In 2018, the Sustainability Advisory Group (SAG) was created to "evaluate, monitor, analyze, and implement means and methods for integrating sustainability into all aspects of residential and commercial real estate…[and to] provide information and proposed resources on sustainability-related issues to the NAR Leadership Team."[i]

As part of their work providing information on sustainability-related issues, the SAG is exploring the impact of major natural disaster events on the local housing market and REALTOR®'s livelihood. In 2022, the SAG worked with NAR's Research Team to determine the impact of Hurricane Katrina on home prices in the fiscal quarters immediately following the event, compared to the quarter immediately prior. In 2023, the SAG worked with NAR's Library and Research Team to study the impact of the 2018 Camp Fire on the housing of Paradise, California.

This year the SAG has chosen to do a case study of two communities: Greensburg, Kansas and Babcock Ranch, Florida. The research focuses on the sustainable rebuilding of Greensburg, Kansas after it was leveled by a tornado and the building of Babcock Ranch, Florida from the ground up to serve as a model sustainable and resilient community in the face of Florida's weather extremes. The research focuses on sustainable and resilient policies and building practices in residential, commercial, and town infrastructure, as well as the ways each town harnessed their most abundant renewable resources. Finally, the case study discusses opportunities, challenges, and actions for REALTORS® to be advocates for sustainable building in their communities.

PT. 1: REBUILDING AFTER DISASTER IN GREENSBURG, KANSAS

On the evening of May 4, 2007, the National Weather Service warned of a large storm cell headed toward the rural town of Greensburg, Kansas. The 1,500 residents were warned via tornado siren for 20 minutes that the storm was moving their way and was producing tornadoes south of Greensburg. Residents were told to move to their storm shelters or basements immediately.[ii] At 9:45 pm an EF5 tornado "barreled through" and leveled 95% of the town.[iii]

According to the Federal Emergency Management Administration (FEMA), the tornado was on the ground for 65 minutes and it moved 28 miles. The tornado was 1.7 miles wide and had wind speeds at more than 200 miles per hour; making it the first EF5 tornado since the "Enhanced Fujita" (EF) scale was implemented in early 2007.[iv] There were 10 fatalities from this tornado within the Greensburg city limits, one in neighboring Pratt County, and one in neighboring Stafford County. More than 1,400 homes and businesses were damaged or destroyed.

BEFORE THE STORM

Prior to the storm, Greensburg, the county seat of Kiowa County, had an estimated population of 1,389 in 2006, a decline from a peak population in the 1960s of around 2000. Since the mid-1970s, Greensburg has experienced a slow population decline "as the natural gas companies that had been a major employer closed or downsized."[v] Greensburg has always been an agricultural community, with the most prevalent crop being wheat. While farming is a primary source of income for many in Greensburg, the school, hospital, and city/county government staff are also major employers. In the 2000 Census, it was determined that more than a quarter of the population was over the age of 65, more than twice the national average. The average per capita income was $18,054 in 2000 with 8.4% living below the poverty line. 17.6% of residents had a bachelor's degree or higher, suggesting that students either finished high school and went straight into the workforce or left for college and did not return.[vi]

Buildings represented the largest energy users in Greensburg before the tornado. The City of Greensburg "acted as a municipal utility, selling electricity, water, sewer, and trash services to customers in Greensburg…The city supplied electricity to residents and businesses through a power purchase agreement with Kansas Municipal Energy Agency (KMEA)." KMEA's power was mostly produced by burning coal and only about 100 MW of their energy generation came from wind. There were no instances in Greensburg of solar, solar hot water, biomass, or wind turbines for energy supply.[vii]

Greensburg's unique natural landscape and condition that made it a great place to rebuild sustainably. Situated on the Rattlesnake Creek watershed with an annual precipitation of 22.35 in, the watershed flows northeast from Greensburg, which means that stormwater management has a positive effect on the downstream watershed. It sits in a cold, humid, climate zone with hot summers and cold winters. Situated in one of the windiest parts of the US, with consistently high wind speeds year-round, Greensburg is on the prairie and direct sunlight is abundant.[viii]

Aftermath of the EF 5 tornado in Greensburg

IMMEDIATE AFTERMATH

Almost immediately after the storm, the Greensburg City Council met and decided to build the town back sustainably. The near total devastation of Greensburg allowed the community a unique opportunity to create a long-range and comprehensive community plan to rebuild.[ix] Steve Hewitt, the city manager, John Janssen, the city council president, and Bob Dixson, the town Mayor, and other town leaders met in the parking lot of City Hall and decided that they wanted to rebuild "smarter, energy efficient buildings."[x] The town leaders wanted to create a Greensburg that looked forward rather than trying to build back a declining town. They wanted a town that had opportunities for population growth, business growth, and sustainable living. Governor Kathleen Sebelius met with the council and announced to national media that Greensburg would be the "greenest city in the state"[xi] and she would dedicate the resources to make it happen. President George W. Bush declared a major disaster for the community,[xii] which mobilized $120 million in disaster relief resources from the state of Kansas, FEMA, and the USDA.

With their intention to build Greensburg with sustainability as a priority set, Greensburg town leaders then set out to work with an advisory team from the US Energy Department's National Renewable Energy Laboratory (NREL) in Golden, CO.[xiii]

In June 2007 the NREL representatives visited Greensburg and put together a plan of action alongside a list of goals for rebuilding a sustainable city.

"The goals of the DOE/NREL project included helping rebuild the city as a model community of clean, affordable, and energy efficient technologies and buildings; facilitating renewable electricity generation for long-term, clean, and economical power; and supporting the reconstruction of Greensburg with access to information and materials to achieve national goals related to energy diversity and reliability."[xiv]

READYING TO REBUILD

After the NREL's assessment, the first stage of rebuilding was the preparation of a Long-Term Community Recovery Plan (LTCR),[xv] by FEMA.

The Long-Term Community Recovery Plan was "a community driven document that reflected both the priorities expressed by the community and the experience of the LTCR planning team."[xvi] Part of the work of the LTCR Plan charged the city leaders with building "community consensus around the concept"[xvii] In the farm community, the leaders pitched sustainability as an economic green, rather than a "tree-hugger green;" a more practical concept to most Greensburg residents.[xviii] The town leaders encouraged sustainable design and sustainable building practices to show how it could save residents' money.

The town did not redo building codes and greener practices were never required for residential buildings, but city leaders worked to educate the town about how green just made economic sense.[xix] The town held Public Squares, community meetings, a community design workshop, a Rebuilding Fair and group interviews and gathered comments, emails, and notes, to understand what rebuilding sustainably would look like for residents and to hear residents' concerns.[xx] With this input from both the community and sustainability leaders, the LTCR Plan became "an action-oriented menu of key projects intended to be used for making critical funding and resource allocation decisions."[xxi] The plan included everything from rebuilding key infrastructure to affordable housing programs to programs to revitalize the workforce. In tandem with the LTCR team, was the creation of the Greensburg Sustainable Comprehensive Planxxii led by BNIM Architects in KCMO.

> "The firm prepared the first phase of a highly lauded comprehensive master plan to rebuild the city, which provides a framework for the rebuilding of Greensburg based around the principles of economic, social, and environmental sustainability...The Greensburg Master Plan addressed the City's most pressing development needs including: design goals and principles for rebuilding; a conceptual design scheme for downtown Greensburg: zoning refinements, infrastructure analysis and a future land use map; preliminary housing policy recommendations; streetscape design guidelines for signature streets; preliminary energy-efficiency and policy recommendations; a strategy for building a highly walkable community; a conceptual parks and open-space layout; and preliminary cost information for the suggested strategies."

Both the LTCR Plan and the Greensburg Sustainable Comprehensive Plan were delivered and approved by the Greensburg City Council in May 2008, just one year after the tornado devastated the town.[xxiii]

HOW DID THE PLANS TRANSLATE TO ACTION?

With the LTCR Plan and The Greensburg Master Plan in hand, the city began the process of rebuilding. Residents formed a nonprofit, grassroots organization, Greensburg Greentown, to provide resources and support as Greensburg rebuilt.[xxiv] Greensburg Greentown fundraised and distributed donations, served as an educational resource for rebuilding sustainably, and as a representative to the outside community on sustainability.[xxv] The following is divided into four key parts to

investigate how Greensburg tackled their energy infrastructure, town infrastructure, commercial building, and residential building.

Welcome to Greensburg billboard lauding sustainability

Energy Infrastructure

The tornado fully destroyed Greensburg's electrical distribution system, but with insurance, state, and FEMA funding, city and local contractors were able to rebuild the distribution system and deliver electricity in six months. After learning more about the town's wind capabilities in January 2008, the city decided to retain ownership of its distribution lines and remain a municipal utility. This kept their options flexible for determining the long-term future energy choices.

In the NREL's early work, they identified wind energy as the "most cost-effective renewable source for electricity in Greensburg."[xxvi] Beginning in June 2008, wind resource data was collected and a site for wind turbines, about one mile from the major highway through the community, was determined. NREL helped Greensburg form a relationship with Kansas Power Pool, a rural electric cooperative, and an agreement for 10-12 MW of wind power was entered. Kansas Power Pool also agreed to give Greensburg access to the hydropower resources.

Beginning in 2009 and completed in May 2010, John Deer Renewable Energy (now Exelon Wind LLC) built 10 wind turbines, each rated at 1.25 MW, which together produces up to 12.5 MW of electricity, enough to power 4000 homes.[xxvii] Today, 100% of the electricity is pulled from the wind farm. Any energy that is not used by Greensburg is converted to renewable energy credits that the city can sell back to the Kansas Power Pool. When the wind is not blowing and the turbines cannot generate electricity, the Kansas Power Pool has enough renewable energy, mainly through hydropower, to power Greensburg. In addition, because Greensburg maintained the distributed electricity system, individual businesses and homes can use smaller scale wind and solar systems to power themselves.[xxviii]

As noted previously, Greensburg averages around 2,500 hours of sunshine annually, making it uniquely equipped for solar energy harvesting. Many commercial buildings and homes were constructed with south-facing solar panels to create on-site renewable energy sources. Harvesting solar energy also includes construction to maximize daylight. South facing windows, overhangs to minimize summer heating, and tempered glass to maximize light and minimize indoor temperature fluctuations.

Greensburg Wind Farm

Town Infrastructure

One of the first green projects completed by the town was to replace all the streetlights with LED lights. Funded by grant money, the city was able to replace all 303 high-pressure sodium streetlights with LED streetlights.[xxix] In fact, Greensburg became the first city in the US to install all LED streetlights. The streetlights cost the city 70% less in operating costs per year and use 40% less energy than standard metal halide streetlights.[xxx] "As an added bonus, the new lamps reduce nighttime light pollution by focusing light where it is needed: on the ground rather than in the night sky."[xxxi]

As part of the Greensburg Sustainable Comprehensive Plan, the downtown and main street areas were constructed with drought resistant landscaping and a rainwater harvesting irrigation system. The system is designed to collect rainwater in cisterns and uses that water to irrigate the landscaping. Similarly, the school, hospital, city hall, and other commercial buildings were built with rainwater collection mechanisms to irrigate landscaping and to use for low flow toilets.

Greensburg additionally serves as a compost site for Kiowa County[xxxii]and uses single-stream curbside recycling throughout the city.[xxxiii] Recently, Greensburg built an electric car charger and implemented a bike share outside of the Big Well Museum, which is next door to the Arts Center.[xxxiv]

In March 2011, Greensburg adopted a sustainable zoning ordinance.[xxxv] The Sustainable Zoning Ordinance (SZO) for Greensburg "establishes zoning districts and regulations governing the sustainable development and use of land within the City of Greensburg, Kansas."[xxxvi] The SZO breaks down the city into zoning districts that provide specific uses of land and control for land development and "each district is

further established to help attain the goals and objectives of the adopted Sustainable Comprehensive Plan."[xxxvii]

The SZO does not mandate any sustainability efforts but encourages the use of water saving landscaping and irrigation, the promotion of walkability, and the use of alternative energy systems in both residential zones and the downtown, commercial, and industrial districts. Similarly, the Greensburg Building Code does not mandate any sustainability features but allows for energy-efficient building features.[xxxviii]

Commercial Rebuilding

One of Greensburg's strongest commitments to rebuilding sustainably was their commercial real estate rebuilding efforts. "On December 17, 2007, Greensburg's City Council became the first city in the country to adopt a resolution that all city projects [municipal buildings over 4,000 square feet] would be built to the US Green Building Council's Leadership in Energy and Environmental Design (LEED) Platinum standards and would exceed the baseline code for energy efficiency by 42%."[xxxix]

This ambitious commitment to sustainability was funded by county, state, and private donors, and it was tackled fervently by builders, both local and non-local. In the end, although not all of Greensburg's commercial projects have met the Platinum standard, but many have met the Gold and Silver standards set forth by the US Green Building Council. Given the improvements made to meet these standards, today, thirteen buildings in Greensburg are saving a total of $200,000 in energy costs per year.

Arts Center: The 5.4.7 Arts Center was the "first completed public facility in the tornado-devasted town, [and] it served as a beacon for the community and their ambitious rebuilding efforts."[xl] The 5.4.7 Arts Center was designed by Studio 804, a group of third-year architecture students and faculty at the University of Kansas and was the first LEED Platinum building in the state of Kansas. The Arts Center serves as a place for community arts and provides classes, exhibits, performances, and residencies.[xli] The Arts Center has a 70% annual energy savings and the on-site renewable energy sources provide 44% of the building's total energy consumption.[xlii]

The Arts Center was built from sustainable materials including reclaimed lumber from an abandoned building, sustainably harvested lumber certified by the Forest Stewardship Council (FSC) and compressed recycled cardboard.

A few of the energy efficient features include: a south facing building orientation to maximize winter heat gain and natural light; a well-insulated building envelope made from recycled newspapers; a tight north façade that protects the building from cold in the winter; tempered glass to keep the building cool in the summer; a white roof to reflect heat away; occupancy sensors to turn off lights in vacant rooms; and cross ventilation when the skylights and sliding doors are opened.

The Arts Center also has three wind turbines to produce additional electricity; eight solar panels on the roof; and an inverter to convert power produced by wind and solar to AC energy for use by office equipment and appliances; and three 200-foot geothermal wells to heat and cool the building.[xliii]

5.4.7 Arts Center

Kiowa County Courthouse: The Kiowa County Courthouse was one of the few buildings to survive the tornado. Originally built in 1914, the Courthouse was severely damaged "by a vehicle that crashed through the roof, allowing rain to fall inside for three days and caused interior damage…Broken windows and chunks of missing brick removed by flying debris added to the sustained damage, but the concrete walls of the courthouse remained intact. Rather than tear down the building, the County chose to restore and renovate a piece of local history."[xliv] The Courthouse was completed in July 2009 and was renovated with sustainable and energy-saving technologies. It was designed for LEED Gold Certification. As of 2011, the Kiowa County Courthouse has an energy savings of 54% annually when compared to a typical building.[xlv]

Energy conservation features include: replacement of windows with high-performance low-E windows which minimize solar gain and heat loss; dimming sensors and controls in the courtroom and office spaces to adjust lights based on the amount of available daylight; motion sensors to turn lights off in unoccupied spaces; high efficiency lighting fixtures; a lighting relay system to turn all lights off at a predetermined time; low wattage lights in all parking, ambient and façade lighting; spray foam insulation was added to save on heating and cooling; and an electric multi-stage ground heat pump system extracts heat and cold from the ground through 32 300-foot deep wells; heat pump uses high-efficiency motors, fans, and compressors.

Some additional sustainable features include: keeping the existing brick and concrete structure; a rainwater harvesting system to divert clean rainwater to a 15,000 gallon underground storage tank; low flow toilets and waterless urinals reduced the amount of potable water demand by 70%; all the original wood, tile, and seating benches were salvaged and refinished using low volatile organic compound stains, sealants, and paints; a waste management plan was implemented to designate recycling and other waste; and the courthouse runs on electricity from the Greensburg Wind Farm.

Kiowa County Courthouse

City Hall: The Greensburg City Hall is the first LEED Platinum City Hall in the United States. It houses the City's "administrative offices and council chambers, which also serve as a public gathering space for town meetings and municipal court sessions."[xlvi] Greensburg City Hall has a 65% energy savings, and the onsite renewable sources provide 11% of the building's energy.[xlvii]

Greensburg City Hall incorporates both energy efficient and renewable energy technologies including: lighting controls to limit the amount of artificial light needed; energy efficient exterior lights; high performance windows that reduce heat loss in the winter and heat gain in the summer; a solar powered outdoor sign; R-22 insulated concrete forms (ICF's) to insulate the building; south facing sloped roof surfaces to maximize harnessing solar energy; a high efficiency ground source heat pump; all electric heating and hot water system that use the Greensburg Wind Farm's wind energy; humidity sensors; a permanent carbon-dioxide system reports on whole building ventilation system performance; a 4.8 kW solar panel system on the roof; a 2,800 square foot vegetated area with native plant life at the east end of the roof to protect the building from weather; low flow toilets, faucets, and waterless urinals; and the building was built with recycled content and local materials, as well as low volatile organic compounds in paints, adhesives, sealants; and fibers.[xlviii]

Greensburg City Hall

USD 422 Greensburg K-12 School: The Greensburg K-12 school was destroyed in the tornado and "school leaders and the design/construction team worked closely together to design an environmentally responsible, student-focused academic environment that reinforces Greensburg's community-wide commitment to sustainability. The 120,000-square-foot, two-story facility has the capacity to hold more than 300 students ranging from preschoolers to high school seniors. Funded by FEMA, the state, and private donations, the $31 million project was completed in July 2010 and occupied in August 2010 for the new school year.

Many of the efficiency measures were based on recommendations in the Advanced Energy Design Guide for K-12 School Buildings, an energy efficiency guide developed by DOE and NREL in collaboration with national professional societies."[xlix] Two nearby school districts chose to combine with Greensburg to create this county-wide facility. "USD 422 decided to combine all its facilities – seven buildings on five sites – into a single location on Greensburg's main street. This allowed the district to consolidate functions for greater efficiency, contribute to a walkable community, and become a central civic resource for this small rural community" by housing the library and large meeting rooms.[l] The new school "serves as an active teaching tool, demonstrating sustainable stewardship."li The school has a 71% annual energy savings and the onsite renewable energy sources provide 22% of the building's total energy consumption.[lii]

The building is built from sustainable materials, including exterior reclaimed wood from Hurricane Katrina and warehouses in Missouri and California. Forty-six percent of the wood, both interior and exterior are FSC certified and 24% of the other building materials are recycled, including lockers built from recycled plastic and cabinets made from wheat straw.[liii]

Additional sustainable features include: building orientation from east to west to capture abundant natural daylight; electronic timer switches and occupancy switches determine how much light to use in a space; skylights provide natural light in corridors to minimize electricity use during the day; the walls are constructed from structural insulated panels (SIPs) which eliminate heat/cold migration from the exterior and are much stronger than building with traditional wood framing; south facing windows have overhangs to limit summer solar gains and allow for winter passive solar temping; the building uses a hybrid closed-loop ground source pump

system to heat and cool through 97 410-foot deep wells; all electric heat and hot water uses the Greensburg Wind Farm for power; onsite wind generator; rainwater is captured for irrigation; low flow toilets, faucets, and waterless urinals; and all classrooms have operable windows to allow natural ventilation.[liv]

USD 422 Greensburg K-12 School hallway

Other major municipal projects include the Kiowa County Memorial Hospital and the City of Greensburg SunChips® Business Incubator. The following are a short list of some of the many major community benefits these projects provide:

- The Kiowa County Memorial Hospital was rebuilt as the first LEED Platinum critical access hospital in the US, as well as the first hospital in the US to operate on 100% renewable energy.[lv] Completed in March 2010, the Kiowa County Memorial Hospital is "a first of its kind energy efficient hospital while still meeting functional and safety requirements."[lvi]
- The City of Greensburg SunChips® Business Incubator was built as a municipal building that could provide affordable office space for small, start-up businesses in the town. The building was funded by the US Department of Agriculture, Frito-Lay SunChips division[lvii,] and actor Leonardo DiCaprio. "Completed in May 2009, the Business Incubator became the first LEED Platinum certified municipal building in Kansas. The 9,580 square-foot building features five street-level retail shops and nine second-level professional service offices.

Other commercial spaces: The major municipal projects above are highlights of Greensburg's sustainable rebuild, but there are a few other projects of note in the town: the Best Western Plus Watchman Inn & Suites (75% annual energy savings), BTI-Greensburg John Deere Dealership (LEED Platinum, 55% annual energy savings), Centera Bank (LEED Certified, 46% annual energy savings), Greensburg City Public Works (LEED Gold, 58% annual energy savings), Greensburg State Bank (36% annual energy savings), The People's Bank (51% annua energy savings), and the S.D. Robinett Building (58% annual energy savings).[lviii]

Residential Rebuilding

Finally, in addition to the commercial rebuilding, a foundational pillar of the Long-Term Community Recovery Plan was to rebuild the residential homes of Greensburg with sustainability as a central factor. Prior to the 2007 tornado, there were few homes younger than 50 years old and the utility costs on those homes were high, no matter how much residents tried to save. With no homes left, residential rebuilding started from scratch.

FEMA reimbursed insured homeowners to replace what they lost, and the federal Small Business Administration and the Rural Development Program offered low-interest loans to homeowners. The NREL estimated that a green building costs about 20% more than typical construction, but it pays for itself in utility savings. The NREL's "calculations show that for a 2000-gsf house built to achieve 30% energy savings relative to standard practice, a homeowner can save $512 a year or more on his or her energy bills than the extra cost of the slightly larger mortgage. In fact, Greensburg residents could use savings in utility bills to pay for higher energy efficiency in their new homes for a net positive cash flow every month up to a level from 30% to 50% improved energy efficiency."[lix] The NREL provided homeowners with training and oversight, when plans were developed, to obtain a Home Energy Rating System (HERS) rating to receive tax incentives or an energy efficient mortgage.[lx]

Given this data, in 2009, the city of Greensburg approved a voluntary Greensburg Green Building Program "that included partnering with the Kansas Building Industry Association to offer training, discount some services, and support public awareness about green building while giving builders a chance to understand green building techniques gradually."[lxi] There were no mandates to rebuild sustainably, but the state and the town offered tax incentives and educated residents on the cost savings of energy efficient homes. As of 2020, there are 403 housing units in Greensburg.[lxii] Of those 403 housing units 50% were built following the DOE's guidelines to be energy efficient. Many residents implemented energy efficient windows, heat pumps, solar panels, or used insulating concrete forms (ICFs).[lxiii] ICFs were a particularly advantageous option for Greensburg residents. ICFs are rated at 5 to 10 times the strength of wood frame homes. "At wind speeds of 160mph gust or higher, conventional and even moderately reinforced wood-frame homes can begin to suffer major structural damage, including collapse…In contrast, with 5 or more times the in-plane shear resistance, a typical home with ICF walls would be expected to withstand even a severe tornado with minimal damage due to wind pressure on the building."[lxiv] In addition, ICFs are better able to withstand flying debris from tornados.[lxv] ICFs are also more energy efficient and "can provide a 20 to 25% savings in annual heating and cooling costs."[lxvi]

One of the first green residential housing projects was the construction of the Prairie Point Townhomes in 2008. The townhomes are LEED Platinum certified and are estimated to use about 50% less energy than similar buildings.[lxvii] The Townhomes' features include: well insulated 2x6 walls with blown-in cellulose insulation; a well-insulated roof; "floating floor" insulation; energy efficient windows and doors; high-efficiency air source heat pumps; energy-efficient appliances; compact fluorescent lights; low flow toilets; drought resistant landscaping; and the

use of non-toxic paints, tiles, and biodegradable materials. The Townhomes electricity is fully sourced from the Greensburg Wind Farm.[lxviii]

Prairie Point Townhomes

The Commercial Group, a Topeka, Kansas-based housing development and management firm that focuses on construction of low-income housing, built 6 affordable single-family homes in Greensburg. "The town's land use patterns enabled the homes to be located within walking distance of a grocery store, parks, the school, the hospital, and City Hall."[lxix] The 6 affordable homes were financed by the Kansas Housing Resource Corporation (KHRC) and were built with a plan from the DOE for high winds and energy-efficiency.[lxx]

Greensburg Greentown also constructed several sustainable homes to serve as a "living laboratory"[lxxi] for residents, greater community members, and sustainability experts to tour and learn from. The Meadowlark House[lxxii] and the Silo-Eco Home[lxxiii] both featured sustainable building materials, renewable energy features, and features that would help the homes withstand the high winds of tornados. The Silo Eco-Home was built with "6-inch-thick precast concrete walls, which took on a cylindrical form, built to withstand the high winds of tornados."[lxxiv] The home is also airtight which allows it to resist the changing air pressures of tornados and tornadic storm cells.[lxxv] The Meadowlark House was never completed after Greensburg Greentown disbanded in 2015.

OPPORTUNITIES & CHALLENGES

Greensburg, seventeen years later, is an example of what building sustainably can be. From the moment city leaders vowed to build back green, Greensburg has garnered international attention. In 2009, Leonardo DiCaprio documented the rebuilding of Greensburg in the series, "Greensburg" broadcast on the television network Planet Green.[lxxvi] Greensburg leaders are consulted "by communities around the world grappling with devastating weather events from wildfires, tsunami, earthquakes, and floods—in Australia, China, Japan, and Joplin, Mo."[lxxvii] Leaders want to learn about Greensburg's building codes, regulations, successes, and challenges, to make their vulnerable communities more climate change resistant and energy efficient.

Despite their successes, Greensburg's road to sustainability has not been perfect. Greensburg is still a rural farming town that struggles to attract businesses and residents. The population has continued to fall since 2007, with just 740 residents reported on the 2020 Decennial Census.[lxxviii] The hopes of attracting green business to town has had mixed results. A large business park was created on the east side of town to bring jobs, but today it sits empty.[lxxix] The rainwater irrigation system that was created for Main Street has never worked because Greensburg doesn't get enough rain to flush the system. The low flow toilets mean the sewer system has too many solids and the system must get unclogged. When the heat or electricity goes offline, the town must get a technician from Wichita which can drive expenses for repair and maintenance up. [lxxx] Two wind turbines were installed behind the hospital, but one fell after about a year, which reduced the amount of on-site renewable energy the hospital could use.[lxxxi] The town has also been faced with the affordability of sustainability. New construction and sustainability requirements, particularly for commercial buildings, have priced some out of the market.[lxxxii] There is still a question of whether all the new homes were built to be both sustainable and resilient to weather events. Greensburg did not make substantial changes to their building codes, and they did not require any weather or wind testing for homes or commercial structures. While many residents did make updates that make their homes more resistant to tornado damage and the LEED certified buildings are more weather resistant, the uptake was not even across the board.[lxxxiii]

CONCLUSION

Despite its challenges, the "living laboratory" of Greensburg has allowed climate and sustainability leaders and REALTORS® the opportunity to see the future of green building in action. Steve Hewitt, the city manager at the time of the tornado, stressed that green building and climate solutions must happen at the local level. REALTORS® know their local communities the best and can be advocates for what works best for the people in their community. As Mayor Matt Christianson said, "know your constituents and listen to them. Involve them in the process. Give them ownership."[lxxxiv] Greensburg's rebuilding was only successful because of the way the community came together to rebuild and rally around their town after they were blown off the map.

PT 2: BUILDING SUSTAINABLY FROM THE GROUND UP IN BABCOCK RANCH, FLORIDA

On September 28, 2022, Hurricane Ian, a Category 4 storm with wind gusts up to 150mph, made a direct hit on Babcock Ranch, Florida and its 5,000 residents. Ian was the ultimate test for the planned community of Babcock Ranch: would the planned sustainable community survive the massive storm it was specifically designed to survive? Would the buried electrical and solar generated energy keep the lights on through the storm? Would the hardened home infrastructure keep roofs, windows, and shutters on homes and people safe? Would the storm water controls keep flooding and storm surge at bay?

Hurricane Ian was lethal in Southwest Florida: "accounting for 149 deaths, [Ian] was the deadliest storm in the state since 1935. The storm also caused $112 billion in property damage, the most expensive storm in Florida history and the third costliest in United States history."[lxxxv] After eight hours, the storm passed, and the residents of Babcock Ranch left their homes to survey the damage. The town was almost unscathed.

There was little to no evidence they had just spent eight hours under a hurricane. Some newer trees had fallen over, some signs were damaged, and a few roof tiles had been dislodged, but the town was not flooded, native vegetation remained intact, and the electricity and water never went out. "Towns and developments around Babcock Ranch suffered casualties, were flooded, lost power and clean water, and in many cases had to be evacuated. Babcock Ranch not only escaped all those calamities, it even served as a safe place to which many of its neighbors were evacuated."[lxxxvi] All because careful planning of the development designed it to "not compete with Mother Nature, but to step aside and let her have her way."[lxxxvii]

Trees down in Babcock Ranch after Hurricane Ian

DEVELOPMENT OF THE SITE

The community of Babcock Ranch sits just 30 miles from the Gulf of Mexico and about 30 feet above sea level on what was once known as Crescent B Ranch owned by the Babcock family. The property supported a myriad of enterprises over the years, from cattle ranching and rock mining to tree farming and even ostrich breeding.

Syd Kitson, of Kitson & Partners, purchased the land in 2005 and almost immediately sold 73,000 of the 91,000 acres back to the state of Florida "to be conserved, creating a pristine brush and swamp wilderness tract that will stretch almost unbroken from Lake Okeechobee to the Gulf of Mexico."[lxxxviii] Today the Babcock Ranch Preserve "protects regionally important water resources, diverse natural habitats, scenic landscapes and historic and cultural resources in the rapidly developing southwest Florida corridor."[lxxxix] The remaining 18,000 acres were set aside for the development of Babcock Ranch, but Kitson only planned to build on about half of that land, leaving "about 90% of the original acreage in preservation forever."[xc]

From the start, "the planned new development was intended to be a showcase of innovation in preserving the environment, producing clean energy, promoting sustainability and resilience, and protecting people from powerful storms." Kitson launched the idea "to prove that a new town and the environment could work hand in hand," and he did it at a time when reporters at press conferences sometimes asked him to explain what sustainability meant.[xci] Parts of the site — specifically, where Kitson planned to locate his new town — had already been cleared, so there was no need to cut down any more trees or clear-cut other vegetation. Other areas were comprised of forested spaces and natural wetlands that, in keeping with the project's environmental goals, were preserved, while additional new wetlands were also created elsewhere on the property.[xcii]

Kitson started development in 2005 with the water work, buried utilities, and sewer lines. The 2008 housing crisis slowed the project for many years but gained steam again with the leading-edge solar farm in 2015. In 2016, ground was broken for the town and the first residents moved in in 2018.

Kitson and his team of architects, land planners, and engineers worked for over a decade to create a community that strives to exist in harmony with two elements of plenty in southwest Florida: the water and the sun.

WATER

One of the biggest aspects to surviving unpredictable Florida weather is stormwater controls. Early on, architects, land planners and engineers explored different options for hydrology and topography to identify the historical flow of water on the site.[xciii] One of the main goals was to preserve the natural drainage of stormwater across the property. "On a traditional development project, that natural flow would be largely ignored and replaced by concrete channels and steel pipes to control the direction in which the water moves. While Babcock Ranch certainly installed pipes, control structures, and other artificial water infrastructure, and repurposed preexisting canals and other irrigation features,"[xciv] they strove to preserve the preexisting controls whenever possible. This meant that in many cases, the land was left alone and not built upon as traditional development might call for.

In addition to working with the natural water flow, Babcock Ranch was built up an additional 3 feet to 6 feet above the storm surge area. This was accomplished by dewatering a series of preexisting artificial lakes from the site's mining operations and extracting some 2.5 million cubic yards of dirt to use as fill in the areas being developed. To this day, Babcock Ranch has never brought in any artificial fill, continuing their commitment to sustainability. These artificial lakes were then combined into the single 320-acre Lake Babcock, which was refilled naturally with ground and rainwater.

Existing wetlands were left alone, but artificial wetlands were planned to "detain and clean stormwater and provide habitats for flora and fauna" with specific native vegetation.[xcv] The wetlands were designed to mimic both natural flows and provide stormwater management, according to civil engineer Amy Wicks, P.E., the engineer of record for Babcock Ranch Community.

> "The water management system is a multi-faceted design that utilizes a natural systems approach, coupled with redundancy to protect infrastructure. While the system internal to Babcock Ranch starts with a series of rain gardens that ultimately lead to lakes for stormwater attenuation (detention), these systems then utilize a series of created wetlands and natural flow-ways for storage, similar to how natural wetlands act as storage during large storm events naturally. [Babcock Ranch's] lakes are all interconnected throughout the entire community, and the connections are redundant," Wicks outlined, "...so the system can operate both in parallel and in series."

During extreme events, such as hurricanes, this distributed approach is highly advantageous, because it prevents blockages of culverts from causing flooding. "By having a system that operates both in series and in parallel, the system will flow a different direction with little effort," Wicks explained, "allowing it to function normally, even with blockages."[xcvi] The water from Babcock Ranch ultimately flows into the Caloosahatchee River, which flows into the Gulf of Mexico.

The development's commitment to better stormwater management extends to its road network. Instead of crowning the roads in the middle and sending stormwater to sewer inlets on each side, the town's roads were designed to send water to rain gardens either in their centers or off to one side, thus reducing the amount of concrete or steel infrastructure required and helping to treat the water naturally.[xcvii]

Once the stormwater controls were in place, the water infrastructure for the town had to be built from scratch. The drinking water plant and water distribution system draw from the Sandstone Aquifer beneath Babcock Ranch. Water is "pumped through to the new plant and run through nanofiltration membranes that remove naturally occurring calcium ions and softens the water, instead of reverse osmosis...The water is aerated to remove hydrogen sulfide gas and disinfected with chlorine before being stored in a million-gallon storage tank. From there it is distributed to businesses and homes [that] require the use of WaterSense appliances and fixtures."[xcviii] WaterSense appliances are required by the EPA to use 20% less water. The wastewater reclamation facility collects "wastewater from showers, sinks, and toilets...where it becomes "effluent" or reclaimed water after being treated with carefully cultivated bacteria, filtered, and disinfected with chlorine. The water is then discharged into a closed" 110-acre lake that features a

pump station for a gray water irrigation system, “instead of wasting potable water.”[xcix]

In tandem with sustainable water infrastructure, water conservation is woven into the green infrastructure of Babcock Ranch. From landscaping with native, low impact plants to constructing a weir system to restore historical hydraulics of the Curry Lake Preserve ecosystem and rehydrate surrounding wetlands. This area is now home to a thriving ecosystem. Native vegetation has reclaimed the land from invasive species, crayfish have returned to its waters, and hosts of birds once again call Curry Lake home.[c] Residents are also encouraged to practice water sustainability not only to save on their utility bills, but also to prevent water pollution.[ci] Lawns can only be 30% grass and the intent of using native trees and plants is to “provide tree coverage to help reduce the heat island effect, shade homes, and provide long-term value.”[cii]

Babcock Ranch’s abundant water

SOLAR

Babcock Ranch is the first solar-powered town in America, “producing clean energy at a utility scale, which empowers residents to minimize their environmental footprint at no additional cost.”[ciii] To harness the power of the sun, Kitson partnered with Florida Power & Light to build the FPL Babcock Ranch Solar Energy Center and FPL Babcock Preserve Solar Energy Center on 870 acres of land. The 687,000 solar panels combined generate 75MW of clean energy. The “FPL arrays produce enough electricity to power 30,000 homes, which is more than will exist at Babcock Ranch”[civ] at its completion. The FPL Babcock Ranch Solar Energy Center was designed this way, to ensure that the net production of clean, renewable energy at Babcock Ranch exceeds the total amount the town consumes. The unconsumed power is fed into

the FPL grid. The solar array is supplemented with solar panels on building roofs and "solar trees" throughout the town.

Babcock Ranch is also home to an innovative battery storage system. "When completed in March 2018, Babcock Ranch housed the largest solar-plus-storage system operating in the US. Created by FPL, these ten large gray steel battery storage units can store 1 megawatt of power and discharge for 4 hours. The new battery storage system ensures a steady supply of power on partly cloudy days and at night."[cv]

Designed to withstand a Category 5 hurricane, the solar power infrastructure features concrete utility poles, buried electrical lines, and other robust elements that during Hurricane Ian helped keep the power on in Babcock Ranch while surrounding communities went dark. "We were basically the only place in southwest Florida that had power," Kitson says, "and it's because we had spent so much time working with FPL to harden the infrastructure."

The Babcock Ranch Solar Farm

COMMUNITY INFRASTRUCTURE, RESIDENTIAL, AND COMMERCIAL DEVELOPMENT

The town's infrastructure is woven with these sustainable and green development ideas at the forefront. The homes and commercial buildings built at Babcock Ranch "must achieve no less than a Bronze Standard of certification"[cvi] from the Florida Green Building Coalition (FGBC). The FGBC's Green Home Standards are designed to promote sustainability and resiliency within the unique climate of Florida. The FGBC's "Green Home Standard is designed to decrease the burden on the environment while increasing the value of the home…Homes accumulate points towards certification. Points are awarded for incorporating green features into the construction of the home. These points are divided into several categories within the Home Standard including Energy, Water, Site, Health, Disaster Mitigation, etc.…FGBC has four levels of certification: bronze, silver, gold, and platinum."[cvii] In order to meet the required Bronze Standard, homes must have 0-30 points above the minimum point threshold.

Residential:

Babcock Ranch homes incorporate technology like low-flow water fixtures, WaterSense appliances, rainwater harvesting systems, recycled and "healthy" building materials, native vegetation, and energy efficient insulation into their homes to achieve these points. All homes use electric heat pumps for all heating and cooling and each home includes an EV charger built in for charging electric vehicles, bikes, and golfcarts.[cviii] Vitally, the whole town has buried electric and fiber optic networks to ensure that each home is equipped with free one gigabyte internet speeds that won't go out with high winds and downed trees.[cix]

All the homes in Babcock Ranch, with their energy efficient features, are designed to use, at a minimum, 20% less energy than traditional homes and be able to withstand up to 150mph winds.[cx] Hip roofs are used on most single-family homes to protect against high wind, because of the better performance in high wind than gable roofs.[cxi] All homes must have continuous load paths that connect the roof to the walls, with hurricane straps embedded in the concrete that wraps around the trusses. Concrete masonry unit walls are connected to the foundations with rebar that extends up inside the masonry units, which are then filled with additional concrete. All homes and businesses also feature either operable storm shutters or impact glass, and anything that could get tossed about in hurricane winds — from trees to playground equipment, park benches, and trash containers — is braced or anchored in place.[cxii] Homes that are built from such "durable materials resistant to wind, should incur less damage and repair/replacement costs over their lifetime."[cxiii]

Commercial:

The commercial buildings at Babcock Ranch are held to the same high FGBC standards, including the Founder's Square retail, restaurant, and gathering spaces. The Babcock Neighborhood School opened its doors in 2017 as a "charter school that offers a place-based environmentally focused "greenSTEAM" education program."[cxiv] The school is integrating the unique sustainability features of the community into an education that encourages young people to explore sustainability and climate change. The school also features a 40,600-square-foot field house also serves as an emergency shelter for the surrounding area. The facility is built to ICC 500 standards for storm shelters, "the minimum requirements to safeguard the public health, safety, and general welfare relative to the design, construction, and installation of storm shelters constructed for protection from tornados, hurricanes, and other severe windstorms." The ICC standards include load amounts for wind speeds, construction elements, like requirements for sealed joists and building envelopes, and methods of testing.[cxv] The fieldhouse can accommodate up to 1,626 people.[cxvi]

Babcock Ranch's Founder's Square

Community Infrastructure:

The FGBC's Green Home Standards also account for walkability or centralized communities to rely less on cars and more on public transport, walking, and biking. Babcock Ranch was developed with the idea of the 15-minute city in mind. The 15-minute city is an "urban model that allows everyone, in every neighborhood, to meet most of their daily need within a short walk or bike ride of their home."[cxvii] The 15-minute city is not only a boost to local economies, providing more foot traffic to main streets, but it promotes better air quality, more green space, and a more active lifestyle for residents. "Babcock Ranch was designed with walkability and bike-ability in mind. Centrally located retail, co-working spaces, and entertainment destinations are connected by carefully planned trail, sidewalk, and roadway designs that make it easy to leave the car at home."[cxviii] Babcock Ranch has 50 miles of trails, 100 miles of sidewalks, and a bike lane on every road. Babcock Ranch is also testing out autonomous vehicles "to shuttle residents on demand." Kitson envisions families moving down to just one car when the service is fully functional and operating to provide things like food delivery and school drop-off. [cxix]

CHALLENGES

While Babcock Ranch's pre-planning for sustainability and resiliency has paid off in many ways for the residents, they still face some of the same challenges as most homeowners in other communities in Southwest Florida.

One of the major challenges for the region is insurance coverage and rising insurance rates. While Babcock Ranch was built inland and above sea level and is not in a FEMA designated flood zone, the risk of flooding is still present, forcing homeowners to purchase additional flood insurance. This comes as an additional financial burden to Florida homeowners on top of private insurance providers raising premium and deductible rates or pulling out of the region all together.

When private insurance is not available, residents must use the state of Florida's Fair Access to Insurance Requirements Plan (FAIR) called Citizen's Insurance. These plans are much more expensive than regular private insurance and

the growing climate crisis in Southwest Florida is leading the system to insure more and more Floridians with no access to private flood or home insurance.

However, insurance companies in Florida are offering discounts for policyholders that "fortify their homes against hurricane force winds by strengthening and securing roofs and shutters...The state also offer tax exemptions for impact resistant windows, doors, and garage doors. National Flood Insurance Plan (NFIP) policy holders can lower their premiums by raising their properties up, moving equipment off the bottom floor, and providing flood openings to allow floodwaters to flow from the interior to the exterior."[cxx] Babcock Ranch having been planned with all these factors in mind, is saving residents on insurance rates, but the price of those rates in Florida remain well above the national average and the risk of total private insurance company withdrawal remains high.

Intertwined with high insurance rates, is the cost of living in Babcock Ranch. According to Realtor.com, the median listing price for a home in Babcock Ranch is $425,000 and the median sold home price is $460,000[cxxi] Compared to the Charlotte County median home price of $400,110,[cxxii] Lee County median home price of $437,540,[cxxiii] and the Florida state median home price of $414,990,[cxxiv] Babcock Ranch is pretty on par. The added expense of a Homeowners Association fee, which ranges from $1400 to $4000 annually, based on the neighborhood, can make ownership in Babcock Ranch more expensive than other areas in the counties.[cxxv]

While Babcock Ranch is not the only community in Florida with an aim for sustainable and resilient building, Babcock is generally more affordable than other communities. Hunters Point, a housing development in Cortez, Florida with 31 homes and plans to build 55 more, has seen success in recent years with solar power, generating 35% more electricity than originally modeled, and surviving extreme weather. During Hurricane Milton in October 2024, Hunters Point's solar battery system ensured residents never lost power. Despite the similar resiliency, Hunters Point has a much smaller footprint and home prices range from $1.25 million to $1.6 million, compared to Florida's average of $400,000.[cxxvi]

CONCLUSION

Babcock Ranch is a growing, innovative community and, despite the insurance and resilience challenges impacting Florida homeowners, is thriving as a sustainable and resilient solar town. In October 2024, Babcock Ranch faced another head on hit, this time from Hurricane Milton. At least 2,000 Floridians, many from nearby Fort Myers, fled to Babcock Ranch, where they were housed in the school and the field house. Syd Kitson estimated that hundreds more sheltered in the private homes of Babcock Ranch's 10,000 residents. Like the damage from Hurricane Ian, the damage after Hurricane Milton was minimal: some downed trees and a traffic light, but the community never lost power. The state of Florida has seen economic losses in the tens of billions of dollars from back-to-back hurricanes, Helene and Milton, but Babcock Ranch suffered no economic loss. [cxxvii]

The intentional years of development dedicated to managing stormwater, flooding, and low-lying flood zones before the town broke ground proves that planning with sustainability and resiliency can protect communities, homes, and businesses from major climate destruction. Babcock Ranch's robust harnessing of solar energy gives them an ever-renewable resource to power their vision into the future. The construction of infrastructure, homes and commercial buildings with

hurricanes, flooding, and wind in mind further ensures that people experience higher peace of mind that their homes and livelihoods will be protected from Florida's extreme weather events.

PT. 3: WHAT CAN REALTORS® DO?

Both Greensburg and Babcock Ranch serve as incredible examples of the benefits, and challenges, of building sustainably and resiliently. These two cities intentionally looked at their climates and mapped out the advantages and disadvantages. They chose to harness the strongest elements and to minimize impacts from the most destructive. While most projects for REALTORS® do not consist of building entire towns from the ground up, there are a multitude of lessons to be learned and applied to new construction, and to existing homes and commercial buildings.

The REALTORS® and Sustainability Research Report from NAR shows that about half of homebuyers are interested in sustainability.[cxxviii] To best inform themselves, REALTORS® can take the free "Intro to Sustainability and Resiliency" course to learn more about "the value proposition of sustainability" and gain an understanding of how to talk with clients about sustainability in real estate.[cxxix] In addition, NAR offers several micro-courses on sustainability topics, including solar basics, energy audits & HERS ratings, resiliency, and waste diversion in construction.[cxxx] If REALTORS® are interested in building upon their green education beyond these free courses, REALTORS® can earn NAR's GREEN Designation, designed "for agents looking to learn about issues of energy efficiency and sustainability in real estate." The GREEN Designation gives REALTORS® the most up-to-date, comprehensive knowledge on sustainability.

Taking the lessons from these educational offerings, REALTORS® can work with clients to find them the sustainable options are best suited to them. Can agents inform clients about improving gables on roofs to be more resistant to strong winds blowing them off? Does the client's area have a company that works with builders to create exterior walls from insulated concrete forms? Can solar panels be installed on roofs or windows replaced with more energy efficient ones? What are the insurance options for clients living in flood zones? What is the energy savings on a home with sustainable or energy efficient features?

By asking these questions, REALTORS® can connect their clients with resources on obtaining energy-efficient mortgages, through conventional mortgage loans, FHA-insured loans, and VA loans, or the energy efficient home tax credit, to offset the cost of making green improvements.[cxxxi] REALTORS® can take NAR's free course "Intro to Sustainability and Finance" to learn about energy efficient features to improve a home's efficiency or resilience, as well as the options for green financing for homeowners.[cxxxii] With knowledge from this course, REALTORS® can help clients understand the costs and savings associated with making sustainable upgrades or building a new green home or commercial building.[cxxxiii] REALTORS® can help clients understand resilient homes and making informed choices about building materials and design based on the climate risks in their area.[cxxxiv]

In addition to helping clients understand the economic side of sustainability, it is important for REALTORS® to help clients understand the insurance market and advocate for changes to the insurance market in high-risk areas. NAR's Insurance Committee and Advocacy team is actively working with legislators to reform National Flood Insurance Programs and private flood insurance marketplaces. They are also working to advocate for state or federally funded insurance and mitigating rising premiums and deductibles.[cxxxv]

REALTORS® must be climate advocates to strengthen their communities and to protect their clients from rising climate risks. Using the lessons from Greensburg and Babcock Ranch, REALTORS® can work to make changes in their own advocacy and business to create sustainable and resilient cities, towns, and regions.

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