THE GREENING OF THE PARKING INDUSTRY –BEST PRACTICES, AND A NEW CERTIFICATION PROGRAM FOR PARKING STRUCTURES

Rachel Yoka[1], LEED AP BD+C, CNU-A

INTRODUCTION

Sustainable building design is now mainstream. The United States Green Building Council (USGBC) and the LEED Ratings Systems have moved the market, proving that "a rising tide lifts all boats." Consumers now factor environmental effect into their buying decisions, a trend that looks to continue and intensify with the millennial generation. Renters and homeowners are willing to pay more for high-performing and better quality housing based on environmental standards. Companies recognize that indoor air quality and daylighting improve employee performance and boost retention rates. And even bottom-line businesses are investing in benchmarking and efficiency projects that have the right return on investment rates. The Urban Land Institute's Greenprint Center for Building Performance serves as a prime example of the ways developers implement benchmarking, energy efficiency, and high-performance standards in the major real estate sectors: office, retail, industrial, multifamily, and hotel.

Energy efficiency gains and higher-quality buildings in each of these sectors will be essential to reducing emissions and energy use. While the transportation sector implements its own standards and benchmarking tools to achieve greater levels of sustainability across all modes of transportation, one industry that stands at the nexus of every building type and the transportation modes used to access them is parking.

There is a key consideration that links land use and transportation: Parking is often the connection between where we are and where we want to go. Parking may not have been at the forefront of the sustainability discussion or the media surrounding it in previous years, but the professionals who work in the world of parking know exactly how important the role of their industry is to the success of our cities, towns, institutions, and businesses. Parking is big business; it is conservatively estimated to be a $30 billion industry. It directly contributes to the economic vitality and accessibility of where we live, work, and play.

KEYWORDS

Sustainability, triple bottom line, rating system, parking, garages, transportation, TDM

BUILDING A VIABLE FRAMEWORK

The International Parking Institute[2] (IPI) is the leading association of parking professionals and the parking industry, encompassing members across all sectors of development. IPI's members are parking and transportation professionals in the municipal, university, airport,

1. Vice President of Program Development, International Parking Institute, http://www.parking.org.
2. www.parking.org.

healthcare, and corporate sectors, and the business partners that serve them. As thought leaders in the industry, parking professionals adapted and used strategies to limit the use and necessity of the single-occupant vehicle through transportation demand management (TDM) strategies, long before such strategies came into vogue or were adopted by LEED standards as best practices and benchmarks of the system.

In 2011, IPI issued a landmark survey of its entire membership as the foundation for the development of a formal sustainability framework. The intent of the survey was to solicit the feedback of parking professionals to define the most relevant and impactful sustainability strategies. The survey identified a number of critical elements that would ultimately be used to construct a framework and a foundation on which to build, but also identified the two most essential elements to the industry: "green building and high-performing building standards for parking structures," and "parking facility operations supporting alternative transportation modes."

Based on the results of this inaugural survey and considerable research, IPI released its *Framework on Sustainability for Parking Design, Management, and Operations*,[3] which outlines industry-wide goals and organization action items that provide education, incentives, and forums for members to learn about and contribute to sustainable parking solutions. This framework, released in 2011 and updated in 2014, identifies seven primary strategies that are relevant, achievable, and impactful to the triple bottom line of people, planet, and profit:

- Advance and promote multi-modal transportation options that include walking, cycling, and mass transit through programs such as car and vanpools, bike storage and sharing, and carsharing. Decrease reliance on the single-occupant vehicle and vehicle miles traveled.
- Encourage alternative energy sources and energy savings technology, reduce reliance on fossil fuels, and accommodate alternative fuel vehicles.
- Gather data, conduct research, and document case studies to create a body of knowledge about sustainability in parking.
- Use effective natural resource management and reduce waste.
- Focus on TDM issues.

FIGURE 1. IPI's Sustainabilty Framework provides the industry with a guideline for decision making.

3. https://www.parking.org/knowledge-center/sustainability.aspx.

- Make informed decisions based on long-term environmental effects related to material and technology selection.
- Increase education and information sharing and promote the use of rating systems and benchmarking tools such as the Certified Green Garage Program for new and existing parking assets.

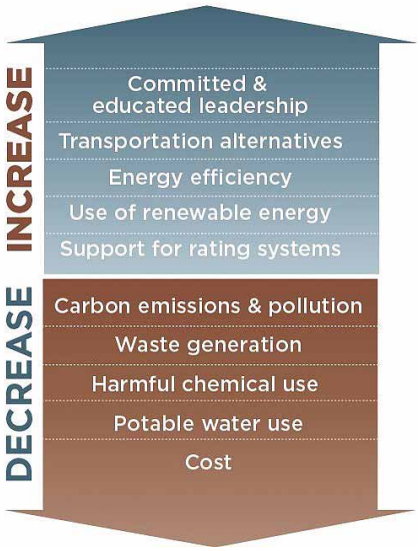
These strategies are paired with 10 action items to increase awareness and education and achieve real-world effects to improve our industry as a whole along with individual members' operations. This document now serves as the cornerstone to the parking industry's approach to sustainability, providing both vision and direction to guide the industry as whole to a more sustainable future.

IPI then released a joint publication, *Sustainable Parking Design & Management: A Practitioner's Handbook*.[4] This new reference book broke new ground – the first of its kind, addressing the complex interplay of parking, transportation, and sustainability. A collaborative effort by more than 30 experts and peer reviewers, this handbook features a deep dive on numerous topics, including best practices for operations management; alternative energy sources; materials, technologies and lighting; and rating systems, including the new Green Garage Standard.

It is necessary and forward-looking to integrate parking policy and transportation policy in urban planning projects.

—Ray LaHood, Building America's Future, co-chair, U.S. Secretary of Transportation, 2009-2013, quote in The Parking Professional, June 2014.

FIGURE 2. Sustainability goals across industries and rating systems remain consistent.



THE DEVELOPMENT OF A NEW STANDARD

In 2013, the Green Parking Council[5](GPC), a vibrant start up organization that sought to "change the nature of parking" was formed by leaders in and around the parking industry who were motivated by a vision of parking as part of a solution. GPC, now an affiliate of IPI, provides leadership and oversight for the conversion of parking facilities to sustainable, environmentally responsible assets.

Across both IPI and GPC, leaders recognized the critical role and continuing importance of LEED to the sustainability movement. Yet there was also the acknowledgment that even if LEED standards were applicable to most parking structures,[6] LEED does not capture the unique attributes and qualities of the parking garage that can contribute most to improved environmental performance. GPC decided to draft, benchmark, test, and release a new certification and rating system that was designed specifically to be applied to parking structures.

4. http://www.parking.org/publications/green-book.aspx.
5. http://www.greenparkingcouncil.org/.
6. Per the Minimum Program Requirements and Supplemental Guidance to the Minimum Program Requirements published by USGBC under the LEED rating system, parking garages are not and were not intended to be certified under LEED, For more information, please reference www.usgbc.org.

With that in mind, the GPC Certification Committee set about its work, crafting an industry specific standard that achieves the shared sustainability goals as the USGBC as well as the numerous specific standards.

Eligible Facilities

The Green Garage Certification Program Guide[7] defines an eligible garage as:

> A structure designed for the primary purpose of storing vehicles, including multi-story stand-alone garages as well as mixed-use structures with a minimum of one supported level above or below grade. Both existing buildings and new construction are eligible for certification. All facilities that participated in the Green Garage Certification Beta or the GPC Demonstrator Site Program are eligible for certification.

One of the key tenets of the system was that it would address both proposed/new construction projects as well as existing buildings. Just as LEED EBOM standards address existing buildings and operations, the new standard includes renovation and retrofit for existing structured parking. The reasoning behind this decision was backed up by the sheer number of major renovations geared around lighting and ventilation upgrades. Parking garage owners and operators across all sectors were already reaping gains through energy efficiency measures, saving on energy costs and reducing emissions and pollution from that energy use (and achieving ROI in a three- to five-year time range.) The new system would leverage the trend in upgrading facilities, educating owners about additional environmental measures that can be applied along with upgrades to technology and equipment.

Although the LEED rating system for new construction may include parking structures within the project boundary or as part of a mixed-use structure or development, existing standalone garages were wholly excluded from the LEED process. GPC sought to achieve higher levels of environmental performance in all structured parking facilities, not just those that might be able to fit into the LEED model.

"The important work of the Green Parking Council is critical to the parking industry's effort in addressing environmental and economic objectives and to make the places where parking garages are built better for the people who live near them. With Garage Certification, we now have a tool beyond a place where parking is the antithesis of sustainability to concrete and effective ways parking facilities are built and operated to support sustainability. This is a proud moment for anyone who cares about community, commerce, and the world in which we all live."

—Casey Jones, CAPP, Vice President, Institutional Services, SP+ Corporation

The Green Garage Certification BETA Process – Benchmarking the System

The pilot, or Green Garage Certification BETA version of the standard was subjected to review not only by IPI and GPC, but also by subject matter experts from parking, as well as disciplines such as architecture, engineering, property management, sustainability, energy-efficiency, academia, technology, urban land management, among others. More than 200 industry experts and technical experts by sustainability measure reviewed the BETA document to ensure the program would be both applicable and achievable as well as stringent and

7. http://www.greenparkingcouncil.org/downloads/GGCProgramGuide.pdf.

meaningful. This review process took all comments, suggestions, and criticisms carefully into account, recording and responding to each.

The GPC and its industry partners concurrently executed the BETA process. This process had two primary and complementary goals: The first was to review and refine the standard by measuring it against more than 40 of the most progressive and innovative structured parking facilities in the United States and Canada. Each facility was ranked against the beta standard to see how it would perform when it was submitted to the final certification process. The second was to "road-test" the standard against existing garages, both newly constructed and more aged facilities, to take a hard look at each measure to ensure that the benchmarks were truly applicable and exemplified effective strategies for the named objective. The data gathered during this process was invaluable, helping to refine and improve the standard prior to its release in June 2014.

FIGURE 3. The BETA program benchmarked the pilot program across a cross section of the greenest facilities to date.

The standard as a whole provides a series of sustainability objectives for the parking industry:

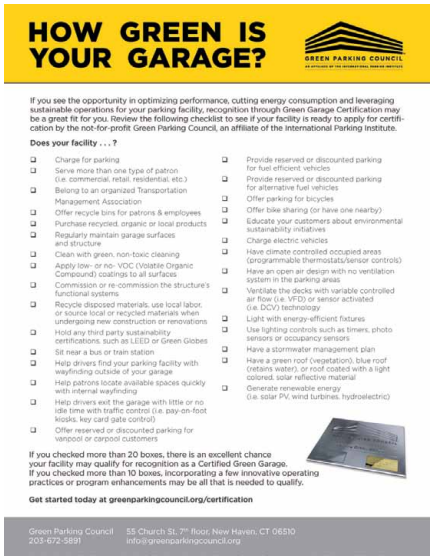
- To provide, codify, and recognize best practices.
- To advance emerging technologies with significant environmental benefits.
- To innovate and collaborate to create an improved parking structure through a more holistic, integrated team environment.
- To benchmark success as well as potential, measuring impacts to people, planet, and profit, creating greater return on investment and raising the bar on garage performance

BASICS OF CERTIFICATION

Garages receive recognition through a standard point system, encompassing a maximum of 248 points in the 48 program elements. Points are assigned to measures based on a balancing of environmental impact, achievability in new and existing structures, and relevance to economics of the asset. To encourage a balanced approach to sustainability,facilities seeking certification must achieve a minimum threshold of 20 points each in the Management, Programming, and Technology and Structure Design categories.

Green Garage Certification recognizes facility achievement with Bronze, Silver, and Gold Certification. Garages achieving 110 or more certification points

FIGURE 4. The Owner's Checklist provides a snapshot view of the attributes recognizes by the new standard.


HOW GREEN IS YOUR GARAGE?

GREEN PARKING COUNCIL

If you see the opportunity in optimizing performance, cutting energy consumption and leveraging sustainable operations for your parking facility, recognition through Green Garage Certification may be a great fit for you. Review the following checklist to see if your facility is ready to apply for certification by the not-for-profit Green Parking Council, an affiliate of the International Parking Institute.

Does your facility . . . ?

- ☐ Charge for parking
- ☐ Serve more than one type of patron (i.e. commercial, retail, residential, etc.)
- ☐ Belong to an organized Transportation Management Association
- ☐ Offer recycle bins for patrons & employees
- ☐ Purchase recycled, organic or local products
- ☐ Regularly maintain garage surfaces and structure
- ☐ Clean with green, non-toxic cleaning
- ☐ Apply low- or no- VOC (Volatile Organic Compound) coatings to all surfaces
- ☐ Commission or re-commission the structure's functional systems
- ☐ Recycle disposed materials, use local labor, or source local or recycled materials when undergoing new construction or renovations
- ☐ Hold any third party sustainability certifications, such as LEED or Green Globes
- ☐ Sit near a bus or train station
- ☐ Help drivers find your parking facility with wayfinding outside of your garage
- ☐ Help patrons locate available spaces quickly with internal wayfinding
- ☐ Help drivers exit the garage with little or no idle time with traffic control (i.e. pay-on-foot kiosks; key card gate control)
- ☐ Offer reserved or discounted parking for vanpool or carpool customers
- ☐ Provide reserved or discounted parking for fuel efficient vehicles
- ☐ Provide reserved or discounted parking for alternative fuel vehicles
- ☐ Offer parking for bicycles
- ☐ Offer bike sharing (or have one nearby)
- ☐ Educate your customers about environmental sustainability initiatives
- ☐ Charge electric vehicles
- ☐ Have climate controlled occupied areas (programmable thermostats/sensor controls)
- ☐ Have an open air design with no ventilation system in the parking areas
- ☐ Ventilate the decks with variable controlled air flow (i.e. VFD) or sensor activated (i.e. DCV) technology
- ☐ Light with energy-efficient fixtures
- ☐ Use lighting controls such as timers, photo sensors or occupancy sensors
- ☐ Have a stormwater management plan
- ☐ Have a green roof (vegetation), blue roof (retains water), or roof coated with a light colored, solar reflective material
- ☐ Generate renewable energy (i.e. solar PV, wind turbines, hydroelectric)

If you checked more than 20 boxes, there is an excellent chance your facility may qualify for recognition as a Certified Green Garage. If you checked more than 10 boxes, incorporating a few innovative operating practices or program enhancements may be all that is needed to qualify.

Get started today at greenparkingcouncil.org/certification

Green Parking Council 203-672-3891 55 Church St, 7th floor, New Haven, CT 06510 info@greenparkingcouncil.org

are recognized at the Bronze Level; those demonstrating between 135 and 159 points earn the Silver distinction; and exemplary performers—reaching at least 160 points—are recognized as Gold Certified Garages.

The Documents

The GPC designed a tool kit that guides owners, operators, consultants, and parking professionals through the certification process from application all the way through certification and public recognition. Two primary documents form the foundation of the certification program:

- The *Green Garage Certification Program Guide* is available on the GPC website as a free download. This document contains information about application procedures and program requirements, and a breakdown of criteria by certification level. Frequently updated with process-related information, the guide offers an introduction to those interested in certification who seek a foundational understanding of the program. The toolkit also contains an Owner's Checklist—a quick reference guide to evaluate the potential for facility certification.
- The *Green Garage Certification Standard* is the technical reference document that outlines performance measures and documentation requirements of the program. The new standard draws heavily on the experience of LEED, Green Globes, and other ratings systems, applying relevant and accepted standards. It provides best practices associated with each sustainability measure as well as examples of successful facilities and programs to illustrate each measure. The manual outlines 48 approaches garages can employ to achieve sustainability and provides facilities with a pathway to reduce environmental impact and boost operational efficiency, structural longevity, community relationships, and revenue diversity. The first version of the standard does not contain prerequisites or mandatory measures; however, it does require that measures from Categories A, B, and C are implemented to ensure that facilities have approached the system in a holistic and comprehensive manner.

FIGURE 5. The Green Garage Certification Standard, released in June 2014, approaches garages as a unique building type, with distinguishing characteristics that can be leveraged to foster sustainability objectives.

Organized in three major categories, these measures provide a broad range of sustainability and operating choices with a variety of compliance paths, as well as a fourth category for innovative strategies:

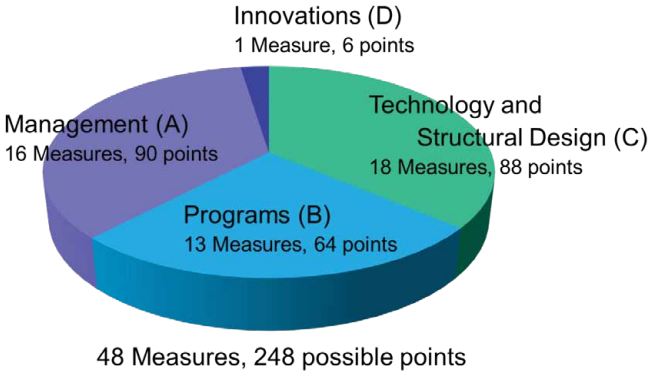
- Category A - Management highlights ways garage operations can maximize the use of a parking asset while minimizing waste. Embracing these practices ensures facility staff uses resources to their full potential. Key considerations in this category include leadership, education for all staff, and physical and infrastructure needs. Specific measures include:
    - Parking pricing
    - Shared parking
    - Proactive operational maintenance
    - Commissioning
    - Third-party certification and ratings systems
    - Credentialed management
    - Life cycle assessment
- Category B – Programs guides facility owners to new revenue sources, greater customer satisfaction, and stronger community relations. Green garage programs ensure effective vehicle ingress/egress, provide access to alternative mobility solutions, and leverage the garage's potential as a public space. Key considerations include garage functionality, TDM, transportation choices, vehicle choices, patrons, and all who interact with the facility. Specific measures include:
    - Placemaking
    - Access to mass transit
    - Carshare
    - Rideshare
    - Low-emitting and fuel efficient vehicles
    - Alternative fuel vehicles
    - Bicycle parking
    - Wayfinding systems
- Category C - Technology and Structure Design outlines the physical attributes a garage can deploy to increase energy efficiency, lower waste, and support customer mobility choice. Key considerations include energy sources, energy efficiency, water use and reuse, and technology and materials choices.
    - Idle reduction payment systems
    - Electric vehicle charging stations
    - Ventilation systems
    - Energy-efficient lighting systems
    - Lighting controls
    - Rainwater harvesting
    - Roofing systems
    - Renewable energy generation
    - Energy resiliency and storage
- Category D - Innovative sustainability initiatives not yet included within the program are incorporated through an innovation category. This category recognizes strategies not specifically included in the category, extraordinary successes in existing categories, and creativity in new technologies, materials, and programs.

These documents and accompanying tools are supplemented and enhanced by in-person trainings for Green Garage Assessors and workshops for greater understanding and efficacy in implementing the program.

Selected Measures and Compliance Paths

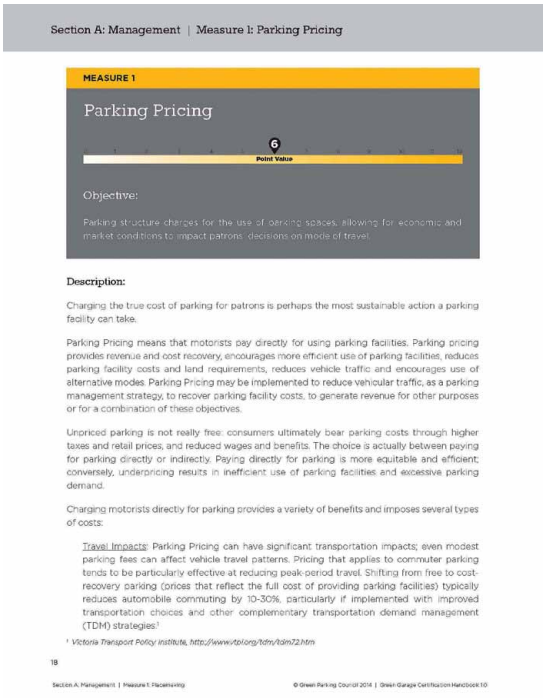
Although all the measures included in the standard are relevant to the building type, this article contains summaries of a few selected strategies to illustrate how the standard approaches the certification process.

FIGURE 5. Measures fall into three major categories, plus a category for Innovation.



Measure A1: Parking Pricing. This measure is listed as the first in the entire standard, offering six points. The objective states: "parking structure charges for the use of parking spaces, allowing for economic and market conditions to impact patrons' decisions on mode of travel." Parking pricing has significant transportation effects; even marginal parking fees affect patron travel choices and patterns. This measure is supported by data from multiple sources, including Donald Shoup's *The High Cost of Free Parking* and the Victoria Transport Policy Institute. "Shifting from free to cost-recovery parking (prices that reflect the full cost of providing parking facilities) typically reduces automobile commuting by 10-30 percent, particularly if implemented with improved transportation choices and other complementary TDM strategies[8]." Options for compliance in this category are relatively straightforward – the facility charges for parking and provides the relevant documentation as listed in the requirements. Suggested best practices abound in this category to maximize both the environmental and economic effects of this measure. This specifically addresses the nature of the parking industry and parking facilities, allowing for the unique economic conditions in this building type to further sustainability goals.

FIGURE 7. Measures include point values, objectives, and a detailed description of the impact to the triple bottom line.


Section A: Management | Measure 1: Parking Pricing

MEASURE 1

Parking Pricing

6

Point Value

Objective:

Parking structure charges for the use of parking spaces, allowing for economic and market conditions to impact patrons' decisions on mode of travel.

Description:

Charging the true cost of parking for patrons is perhaps the most sustainable action a parking facility can take.

Parking Pricing means that motorists pay directly for using parking facilities. Parking pricing provides revenue and cost recovery, encourages more efficient use of parking facilities, reduces parking facility costs and land requirements, reduces vehicle traffic and encourages use of alternative modes. Parking Pricing may be implemented to reduce vehicular traffic, as a parking management strategy, to recover parking facility costs, to generate revenue for other purposes or for a combination of these objectives.

Unpriced parking is not really free: consumers ultimately bear parking costs through higher taxes and retail prices, and reduced wages and benefits. The choice is actually between paying for parking directly or indirectly. Paying directly for parking is more equitable and efficient; conversely, underpricing results in inefficient use of parking facilities and excessive parking demand.

Charging motorists directly for parking provides a variety of benefits and imposes several types of costs:

Travel Impacts: Parking Pricing can have significant transportation impacts; even modest parking fees can affect vehicle travel patterns. Pricing that applies to commuter parking tends to be particularly effective at reducing peak-period travel. Shifting from free to cost-recovery parking (prices that reflect the full cost of providing parking facilities) typically reduces automobile commuting by 10-30%, particularly if implemented with improved transportation choices and other complementary transportation demand management (TDM) strategies[1]

[1] Victoria Transport Policy Institute, http://www.vtpi.org/tdm/tdm72.htm

18

Section A: Management | Measure 1: Placemaking

© Green Parking Council 2014 | Green Garage Certification Handbook 1.0

Measure A14: Third-Party Sustainability Certification. This measure allows for both high impact and high point values in the system (up to 12 points). To recognize their comprehensive commitment to environmental sustainability, garages that have achieved a third-party sustainability certification that complements and aligns with the goals of the program will receive points in this measure, including LEED and Green Globes. This measure recognizes and reinforces third-party ratings

8. Victoria Transport Policy Institute, http://www.vtpi.org/tdm/tdm72.htm.

systems, aligning with the shared sustainability goals as depicted previously. Structures that achieve a platinum LEED rating or four Green Globes are awarded the highest point values on a weighted scale through to Certified LEED rating and one Green Globe. The measure also allows for two points under other performance systems, including Energy Star Portfolio Manager and ULI Greenprint Performance scores.

Measure B1: Placemaking. This measure acknowledges that parking structures exist within the context of a community. As businesses, these facilities can contribute to the social well-being of a community and serve as a positive neighborhood feature. Placemaking examples include a suggested range of corresponding point values. Initiatives with higher community value (i.e., greater event frequency, more extensive physical features) are awarded more points (between one and six). Listed options include engaging arts and civic associations through events; providing public access to facilities for sporting events, exercise, or youth activities (as appropriate); creating parks and green space for the public good; and more. Documentation for both physical and event-based placemaking includes narratives and images, and additional listed resources include the Project for Public Spaces.[9]

Measure B6: Carshare Program. This measure recognizes that "carshare programs reduce the number of miles driven by single occupancy automobiles. On average, a shared car removes between 9 and 13 vehicles from the road.[10] Additionally, the average carsharing participant decreases his or her driving by 27 to 56 percent,[11] reducing traffic congestion and automobile emissions." Options under this measure include partnering with an established carshare provider to create a carshare hub, or creating a standalone program, for five points each. One additional point is possible for populating the carshare hub with only hybrid or alternative fuel vehicles. The standard also provides a list of Related Measures, when applicable to the measure at hand. For carshare, these related measures include Transportation Management Association (TMA)/Organization (TMO) Affiliation, Low-emitting and Fuel Efficient Vehicles, Alternative Fuel Vehicles, and Marketing/Educational Program.

Measure C1: Idle Reduction Payment Systems. This measure's objective is the implementation of payment systems that reduce idling upon payment and exit. Properly configured, these systems allow efficient exit, reducing the amount of time vehicles wait in line and conserving energy, time, and natural resources while limiting greenhouse gas emissions. Specifically identified technologies include pay-on-foot, pay-by-cell, Automated Vehicle Identification (AVI), License Plate Recognition (LPR), and toll transponders. Like parking pricing, this measure also specifically addresses the nature of the parking industry and parking facilities, using emerging technology to limit environmental effects.

Measure C5: Electric Vehicle (EV) Charging Stations. Plug-in electric vehicles (PEV) use EV charging stations and the intent of this measure is to facilitate EV infrastructure to foster further adoption of this emerging technology. According to Navigant Research, annual sales in the United States alone are estimated to surpass 467,000 units by 2020 and will represent a significant percentage of the total vehicles on the road. Replacement of traditional fuel-combustion engines with EVs by consumers will reduce greenhouse gas emissions, but this trend requires widespread deployment of charging technology, especially in U.S. cities and metropolitan areas. This measure allows multiple compliance methods to accommodate

9. Project for Public Spaces, http://www.pps.org.
10. http://www.uctc.net/access/38/access38_carsharing_ownership.shtml.
11. http://www.uspirg.org/sites/pirg/files/reports/A%20New%20Way%20to%20Go%20vUS1.pdf.

Level I, Level II, and DC Fast Charging. Point values range and increase as charging durations improve, with the best point value at five. An additional point is available to facilities that provide EV charging to customers for free. This measure includes the best practice of integrating charging stations with on-site renewable energy generation or renewable energy purchase programs to enable vehicles to be charged with clean energy.

Measure C15: Roofing Systems. The objective of this measure is to employ roofing technology that provides environmental benefits, and the measure allows for a wide range of options. These multiple options accommodate the reality that all buildings and operations have unique considerations. This range includes green roof systems, blue roof systems, and cool roofing applications, photovoltaic arrays, and high Solar Reflectance Index (SRI) value materials. The U.S. Environmental Protection Agency encourages the adoption of cool roofs to reduce energy use, air pollution, and greenhouse gas emissions, and improved human health and comfort.[12] For most parking operations, the roof of the structure is used for parking cars, making high SRI values the simplest and most cost-effective compliance path.

These selected measures offer insight into how the parking industry approaches sustainability. The adoption of the certification standard by major real estate developers and institutions represents the widespread acceptance that is emerging in the parking industry and beyond.

"We fully support efforts to continue the focus on energy efficiency and sustainability - whether in the built office environment or in garages that support them. Materials, envelope, lighting, ventilation and energy can all be positively impacted through design and execution that takes the core principals of conservation into account. We look forward to working with the Green Parking Council as it continues to execute on its plan to provide a level of standardization for certification in the built garage space."

—Brad A. Molotsky, EVP and General Counsel,
LEED - Green Associate, Brandywine Realty Trust

CASE STUDIES

The parking facilities summarized here participated in the 2012-13 beta phase of Green Garage Certification and now that GGC has been launched, these sites are likely to be among the first in the U.S. to achieve certification.

Case study 1

Bank of America Plaza Garage
Brookfield Properties
Los Angeles, California

The 2,218-space plaza garage is a 1.05 million square-foot, nine-level parking structure serving an office tower in downtown Los Angeles. This self-park facility—a GPC Demonstrator site and BETA facility for the Green Garage Certification program—features multiple patron amenities and sustainable features.

The facility received LEED Gold Certification in 2011 and ranked as one of the most progressive in the Green Garage Certification BETA process. Located in a vibrant hub of

12. http://www.epa.gov/hiri/mitigation/coolroofs.htm

commercial and cultural activity downtown, the plaza illustrates the role and results of placemaking. The majority of the garage is covered with a park that incorporates both trees and turf grass and provides amenity space for patrons and the public. The park and plaza above the garage host a farmers market as well as free events featuring community art and other landlord-sponsored activities.

The facility also incorporated multiple programs to participate as a good neighbor in the community. Green initiatives are shared with tenants through eblasts and elevator "captivate screens" that showcase sustainable strategies during patrons' elevator travel. Marketing materials are made available to share the facilities' commitment to sustainable parking practices.

The facility offers EV charging stations, dedicated EV parking, and tire inflation stations to ensure that patrons' vehicles run as efficiently as possible. Additional amenities include an on-site mechanic and car wash and electronic parking

FIGURE 8: The Bank of America Plaza Garage, a self-park facility, was a GPC Demonstrator site and BETA facility for the Green Garage Certification

FIGURE 9: Amenities are marketed and promoted to patrons in a variety of ways, including brightly painted walls and effective signage.

validation system. Management practices include green waste management practices as well as green purchasing and cleaning products for facility maintenance. The facility provides real-time availability information via the ParkMe smartphone application that alerts customers to available spaces.

Energy efficiency measures include occupancy sensors to ensure ventilation efficiency, lighting upgrades to save on energy consumption and emissions, and electrical systems commissioned to make sure the technology is working as planned. A natural gas cogeneration plant powers a portion of the facility. Dimmable fluorescent lights are set to 75 percent of maximum consumption to provide energy efficient lighting.

Case study 2

National Renewable Energy Laboratory (NREL) Garage
United States Department of Energy
Golden, Colorado

The parking structure on the U.S. Department of Energy's National Renewable Energy Laboratory (NREL) campus doesn't look like an ordinary parking garage. Opened in 2012, the facility meets demand for 1,800 parking spaces for campus staff. At 578,320 square feet, the five-level structure is a showcase for energy efficiency and renewable energy technologies.

The facility provides 198 green vehicle spaces for low-emitting, fuel-efficient, carpool, and vanpool vehicles, 20 HOV-only spaces (carpool and vanpool vehicles only), 30 covered bicycle parking spaces, and 36 EV charging stations. Renewable energy sources adorn much of the structure, with a 1.153 megawatt solar array on the rooftop and south façade. The façade design features recycled aluminum and maximizes daylight and ventilation through an open air design.

The facility, designed to maximize energy efficiency and decrease usage, cost, and emissions, is 90 percent more energy efficient than an ASHRAE 90.1 2007 baseline design. This efficiency is achieved in part through large light wells and an open atrium that reduces the need for lighting by 75 to 100 percent during the day. When lighting is required, the facility uses highly energy-efficient LED lighting. Electronic level occupancy detection was also installed for enhanced wayfinding, reducing the time for staff to find an available space along with the accompanying fuel consumption and emissions.

A 75 percent waste diversion ratio was achieved through recycling during the construction process, and 35 percent of building materials contain recycled content. The facility manages stormwater through a rooftop drainage system and perimeter bioswales to the main campus detention and water quality pond, allowing for increased natural discharge. In addition, native and drought-resistant vegetation around the facility provides stormwater surface infiltration, wildlife habitat, and ecological compatibility to adjacent natural areas.

At NREL, we have found that any building type, be it large or small, office or a parking structure, can be built and operated sustainably at typical construction costs. Best results occur, though, when specific sustainability goals are incorporated into the project contract. Green Garage Certification will make relevant sustainability goals clear and usable by all building owners early in the planning process.

— Jennifer Scheib, M.S., Engineer, NREL

FIGURE 10: The façade design features recycled aluminum and maximizes daylight and ventilation through an open air design.

FIGURE 11: The facility features a substantial photovoltaic array and programs for alternative fuel vehicles.

Case study 3

San Diego Miramar College Garage
Miramar College
San Diego

The 815-stall San Diego Miramar College Garage, a four-story facility adjacent to a police substation, features an educational display with detailed information about this sustainable project. The 270,000 square-foot garage reserves 60 spaces as "Flex Staff" parking, available to students and the public after 6 p.m. The other 92.7 percent of parking is unreserved, increasing turnover, maximizing the use of these spaces, and allowing for shared use of the resource. Amenities for patrons include both bicycle parking and reserved parking for EVs.

Energy efficiency measures feature design elements that naturally complement one another: natural ventilation, mix-mode system, operable windows, solar chimney, and low-albedo vegetation. As part of the façade and building design, the facility features a variegated roof system and a living trellis on the side of the parking structure that retains and filters stormwater and helps combat the urban heat island effect.

As part of the San Diego Community College District's recycling program, each campus plant operations supervisor, custodial staff member, and waste management employee is trained in ongoing recycling management and operations to achieve maximum waste diversion ratios. More than 75 percent of construction waste was recycled or diverted from the local landfill during construction. The facility uses non-potable water for (recycled water supplied by the San Diego County Water Department) for irrigation and flushing toilets.

FIGURE 12: San Diego Miramar College's new facility approaches sustainability through multiple objectives, including maximizing turnover.

Case study 4

"The Wave" Mixed-Use Facility
Casino Reinvestment Development Authority
Atlantic City, N.J.

The Casino Reinvestment Development Authority (CRDA) and Atlantic City are engaged in long term planning and activities to redevelop and revitalize the city beyond the gaming industry. A key goal of this strategic plan is to develop a more active and vibrant environment, especially with regard to walkability and the streetscape.

Designed as a major urban infill project, the garage is located adjacent to a new retail/outlet development. The structure shared a mix of uses, supporting the parking needs of restaurants, residences, a hotel, and a convention center. This diversity of uses maximizes the use of the facility, allowing for higher turnover. Situated on a previously disturbed site that included a parking lot, the location was key to the sustainability of the project – transit-accessible, urban infill, and located near existing retail.

The garage and façade were designed with the intent to foster pedestrian activity, reduce the number of automobile trips, and, as a result, reduce congestion and vehicle emissions. The mixed-use facility accommodates 16,000 square feet of ground floor retail and a parking office. A recent addition to the program, a local university has located its arts program, artists' studios, and a gallery in the frontage at grade.

Memorable features include edge lighting, colored elevator core lighting, metal screening, and an LED digital billboard. The unique lighting components portray visual waves around the top of the parking facility with changing colors and a video screen. These features contribute to a livelier atmosphere along the streetscape. Although this energy use is higher per square-foot than a typical parking garage, the aesthetics and atmosphere of this destination warranted a different approach. These design elements are offset by energy efficient lighting, EV charging stations, and a 54,000 square-foot rooftop solar array.

FIGURE 13: The garage is constructed on a previously disturbed site, as a major urban infill project designed to enliven and activate the streetscape.

FIGURE 14: Amenities include electric vehicle charging stations for patrons and walkability to nearby destinations.

FIGURE 15: A significant photovoltaic array powers electric vehicle charging stations with clean energy and feeds electricity back to the grid.

CONCLUSION: THE NEXT GENERATION OF PARKING STRUCTURES

Each of these case studies demonstrates just how sustainable a parking garage can be when planned, designed, and maintained properly. These are only a few examples of the strides made by the parking industry, which is keeping pace with the sustainability movement. The garages in design now and even in conceptual planning will extend far beyond the benchmarks of these structures. Green Garage Certification and the accompanying standard will continue to evolve, improve, and grow. The release of Version 1.0 of the standard is a milestone towards gaining greater sustainability as an industry.

Perhaps the most forward-thinking and progressive category is the Innovation category. This open-ended category allows for the creativity and innovation that will drive us forward as an industry – transforming parking garages into a platform for greater sustainability.