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# Challenges of Building Brickell CityCenter : a True Mixed use Mega Project Downtown Miami



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Christophe has 20 years of experience in construction, and he is currently leading the Preconstruction Department for the USA, Latin America and the Caribbean region, as Technical Director of Americaribe Inc. Over the course of his career, he has been involved in selecting and coordinating Architects, Designers, and Consultants for increasingly large and complex Design & Build projects with the following missions:

- Coordination of the design at conceptual and schematic stage to align design and Client's budget, and delivering coordinated design package for in house pricing or subcontractors' tenders.
- Cost Estimation of projects, from conceptual to detailed estimate.

## Abstract

*The paper illustrates the true mixed-use sides of this mega project, and what it encompasses in terms of transportation, sustainability, logistics, and all innovation features included in the scope and in the management of the job.*

**Keywords: Innovation, Logistics, Procurement, Sustainability**

## Mixed-use Program and Vision

Brickell City Centre is Miami's largest mixed-use urban development, now under construction, and as such shaping Miami's future at large. Designed to reflect the vibrant, diverse and rich culture Miami has to offer, the new architecture will be a unique feature in the downtown area. Aside aesthetics, it will include one of the industry's most innovative environmental features. Brickell City Centre rises unique in the sense that it really is about mixed use right downtown, in the heart of the financial district, offering a live-work-play destination. With its numerous green building features, pioneering underground parking solutions, and site-integrated MetroMover light rail station, Brickell City Centre strives to earn not only the LEED gold certification but bring about a new landmark in large scale sustainable urban development (see Figure 1).

On a sprawling 9 acre site in the heart of Miami, the \$1.05 billion project will redefine the city's downtown when its first phase will be completed early 2016. The development is much more than the 5 million square feet of combined retail, two luxury residential towers, two office buildings and its four star hotel. It is all about the synergy and the integration of this small city into the big picture of Miami urban environment. This ambitious vision demands forward thinking management and execution of construction. It is not just another large development, it requires careful logistics, customized procurement strategy, tight adherence to schedule, innovations, the best quality assurance and control on the market; all this under a sustainable vision that no other job in the State has set, both for the neighborhood and every single building.

Brickell City Centre's purpose is to establish a new LEED Neighborhood Development (LEED ND) certified urban redevelopment project of mixed use properties that create a well-balanced neighborhood with opportunities to work, live, shop, watch a movie, dine-in, and socialize in the established Brickell Financial District (see Figure 2).



Figure 1. Aerial View. (Source: Swire)

Five towers will be added to the skyline when the initial construction is completed; another 80 story mixed-use tower will follow. As for the economic impact, the project translates into roughly 2,500 construction jobs on average per year for four years, 5,000+ direct jobs and 2,500 indirect jobs after construction completion and more than \$5 million in ad valorem taxes for the city of Miami.

The project is directly linked to the MetroMover, a free, elevated electric metro run by Miami-Dade Transit that operates on a 4.4-mile (7 km) loop, raising hopes that the project may spur growth of the slowly evolving mass transit system in one of the most car-obsessed cities in the country (see Figure 3).

Brickell City Centre's designers are also challenging Miami's-sometimes-brutal climate. The project's most distinctive feature is a multimillion "Climate Ribbon™," a 150,000-square-foot (14,000 sq. m) canopy of steel, fabric, and glass covering the retail space that is designed to harness Miami's Caribbean breezes while deflecting the sun to create a comfortable open-air shopping environment. The highly engineered canopy, the product of a collaboration between a Paris design firm and the universities of Carnegie-Mellon in Pittsburgh and Cardiff in the U.K., is believed to be the first of its kind, and possibly the biggest passive shading and ventilation device — i.e., not dependent on air conditioning — in the country (see Figure 4).

The idea for the ribbon developed during original planning for the project, the first major development under the city's then-untested Miami 21 zoning code, which was designed to foster urban buildings oriented to the street and to pedestrians instead of cars. Those simple concepts were blown up to a large scale to capitalize on the easterly breezes that predominate in Miami. The designers expect the ribbon to drive those breezes to the project's eastern end and channel them through the complex at a steady six knots. A computer model identified where the sun would produce hot spots at different times of the year, and the canopy and louvers were angled precisely to provide the much needed protection from the sun. The ribbon also angles up at the sides in certain areas to let warm air rise, which draws the cooler breeze through. The glass, rather than tinted, is "fritted" with tiny black dots to filter sunlight and heat. In addition, the ribbon will collect rainwater, as much as 3 million gallons a year, which will drain into cisterns and used for all watering of landscaping in the project. Because the AC systems expel cooled air to keep inside air quality high, that expelled air will go into the



Figure 2. Overall Development. (Source: Swire)



Figure 3. Retail Bridge over South Miami Avenue. (Source: Swire)



Figure 4. Retail Promenade. (Source: Swire)



Figure 5. Podium. (Source: Swire)



Figure 6. Three City Blocks. (Source: Bouygues Bâtiment)

public areas under the climate ribbon, aiding in keeping down temperatures.

### Complex Site Logistics

The project sits on two complete basements, the first of their kind in the complex Miami geology (see Figure 5). The basement garages are interconnected with tunnels providing parking garage and circulation, spanning three city blocks—the first attempt by a major developer to build underground parking despite Miami’s problematic groundwater table and lack of low permeability geological layer, preventing traditional dewatering techniques. To build the garage, teams used a newly developed deep-soil mixing technique to place a temporary cement soil mix plug and perimeter permanent sheet piling, creating a dry hole for construction. Deep Soil Mixing technology consist of in-ground blending of native soils with an injected cement grout mixture, which serves to stabilize the soil to facilitate excavation during construction activities (see Figure 6).

Brickell City Centre Project has provided approximately 194,000 cubic yards of the excavated material for beneficial reuse as backfill, both above and below the groundwater table. The underground parking, with 1,600 spaces, gave designers a simple way to engineer traffic flow and connect all the buildings underground. Traffic coming off I-95 heading east on the one-way Eighth Avenue, which links Brickell to Little Havana, will be able to quickly duck into the garage

network. These vehicles will exit the garage into the flow of traffic on Sixth and Seventh avenues heading west to I-95, keeping traffic away from the current congestion on Brickell Avenue. The same parking garage uses a smart parking management technology allowing customers and guests to quickly identify a spot, and allowing the parking operator to leverage the infrastructure by creating nesting areas, such as VIP parking, or restaurant designated parking depending on time and needs, this becomes a true marketing tool for the retail which is one of the main anchor of the project. Bridges connecting the three blocks are also provided, to provide a seamless experience for shopper, while remaining under the umbrella of the Climate Ribbon™. The pedestrian bridges become also retail spaces for tenants, maximizing results in real estate, and creating interesting architectural features both from inside and also for pedestrian at street level (see Figure 7).

Construction of the structures within the confined Brickell City Centre Project's space is not easy, and the lifting equipment involved requires careful planning. Jobsite conditions are such that several different types of tower cranes are necessary to accommodate the project's needs for coverage, while also fitting as many cranes into the project as possible to ensure that all of the coordination needed to move in, erect, climb and operate these cranes is

perfectly orchestrated to meet the demands of such a critical path project. The tower cranes fill a crucial role in the construction of the high-rise structures, as they provide the majority of the hoisting. Everything from tools, concrete form work and rebar to structural steel, equipment and concrete are lifted by the cranes, supplemented by pumps and buck hoists. Careful planning and method studies were required up front to make certain that every square inch of the project site is covered by a tower crane for construction crews. Many of the cranes fit in the 300-400 meter-ton

market range, and each tower crane design was selected to meet specific criteria, 8 different model configurations with lift capacity classes ranging from 11 to 72.5 US tons (10 to 66 tons) and maximum jib lengths from 164 to 246.1 ft. (50 to 75 m) were selected. Since this is a downtown project, space is at a premium. With the project positioned near the Atlantic Ocean coastline and constructed over more than three years, general contractor had to account for and establish safety procedures in case of hurricanes making landfall. Extra reinforcement in the post-tensioned slabs

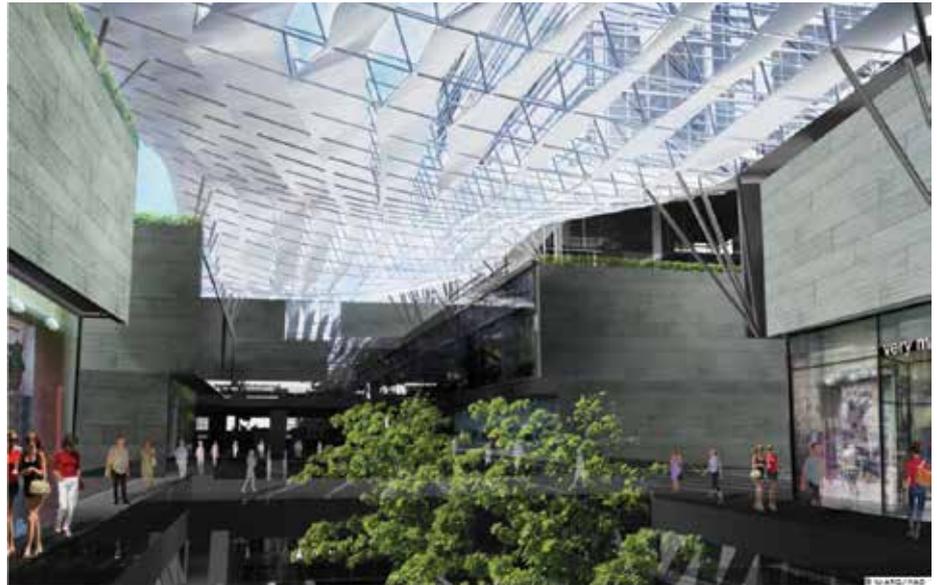


Figure 7. Climate Ribbon™ Rendering. (Source: Swire)



Figure 8. View from the River. (Source: Swire)

have been added, and priority clause with the crane provider were negotiated.

Work also involved the relocation of existing water, sewer and drainage utilities to accommodate the new building footprint and the added real estate in the Brickell area, and improve surrounding roads and sidewalks. Although buildings occupy the vastest majority of the site, utilities and hardscape is a large, vital and critical package (see Figure 8).

During the construction, the project has initially been divided into three blocks: North (BCCN), East (BCCE) and West (BCCW). Later, as superstructures were already up, an organization by use has proven to be more effective, to minimize repetitions and expedite resolution of RFIs, coordination, and use the best subs in the market for the appropriate use.

### Schedule for Phase One Construction

The schedule is developed with Primavera P6 software using critical path method (CPM).

The construction schedule is organized as follows:

- 1. Key Dates & Milestones which includes all those listed in the tender documentation including Phase One Package Schedule Milestone.
- 2. Procurement Schedule which listed major packages required to commence construction on time.
- 3. Construction activities which are split per block, sub-grouped per tower & podium.

Early in the preconstruction phase a procurement schedule has been formulated detailing trade durations for inclusion into the various bid packages to ensure that all bidders fully understood the timing of their work and

that their pricing accurately reflects the same schedule. Once bids have been reviewed and prior to any recommendation of award to the Owner a final scope review was held with the potential subcontractor and a detailed schedule was reviewed to full compliance with the project timeline goals. This final detailed schedule is initialed by the potential subcontractor and upon award will be made a part of the subcontract agreement.

This integrated schedule has been distributed to all subcontractors and becomes a useful motivational tool between subcontractors in case a contiguous subcontractor starts to impact the work the flow of the work or the schedule of a succeeding trade. Schedules will be updated on a real time basis and progress information will be tracked at the activity level and measured against established goals.

Site access, particularly on a large job as the Brickell City Centre, has been phased to ensure proper control of resources and security management. In light of this and



Figure 9. Hotel and Office Towers. (Source: Bouygues Bâtiment)

taking into account the different approaches of the site traffic management, phasing the logistic of the site is the best option.

The General Phasing has been split as follow for each block:

- Stage 1: Start of podium basement below High Rise Tower corresponding to each Interface Interim Milestone
- Stage 2: Start of the remaining Podium basements to each Interface Substantial Completion Milestone
- Stage 3: Podium & Towers structural works
- Stage 4: Podium & Towers structural works, Façade and Trades works
- Stage 5: Podium & Towers Trades works before the first tenant turnover
- Stage 6: Podium & Towers Trades works after tenant turnover

The major traffic during the superstructure works has been involved: concrete trucks,

concrete pumps, and trailer trucks supplying reinforcement for concrete structure, steel structure, façade and general material supply. Storage and delivery are precisely coordinated with the subcontractors, and multiple solutions have been implemented at once:

- Renting offsite storage and yards
- Just in time delivery
- Intermediate storage with the subs

The success of Brickell City Centre is absolutely dependent on the success of the Subcontractor and Vendor Procurement Process. The determination of when to award subcontract work is paramount to developing this strategy. The procurement schedule is an essential step in achieving the overall project delivery date.

Choosing the appropriate subcontractor is critical to the success of any project. Factors that we take into account in developing a subcontract award strategy include:

- High rise experience
- Local labor knowledge and overall ability to meet labor requirements, with global vision, especially for material procurement
- BIM experience / coordinating with BIM
- LEED Experience
- Ability to work in large complex projects
- Financial strength, bonding capacity
- Performance track record (both in quality of work and treatment of extras)
- Appropriate level of sophistication and technical expertise to meet the specific requirements of the project
- Management and Field teams experiences
- Previous relationship and experience with Owner, Design Team and Contractor
- Subcontractor work load
- Review specified materials to see if alternate LEED are compliant

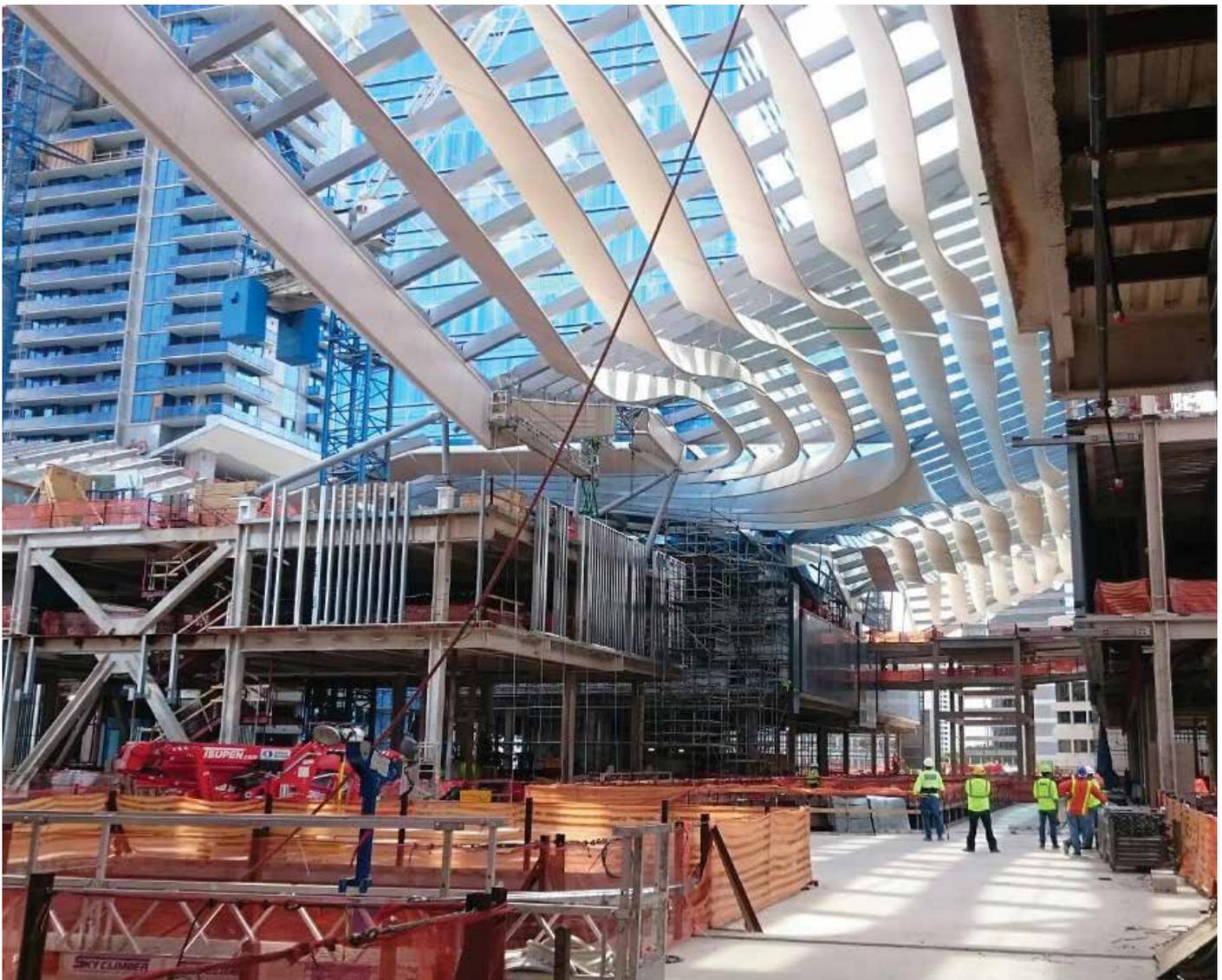


Figure 10. Climate Ribbon under Construction. (Source: Bouygues Bâtiment)

- Continuous collaborative effort to support the design and provide target value design solutions
- Change order management

During and after the pricing stage, extensive Value Engineering/Alternates has been explored, providing a detailed pricing of the ads and the credits for the alternate materials. Multiple mockups, showrooms have been built and tested by the Owner' and design teams. South Florida is mostly a service and tourist oriented economy, thus, sourcing out of State and overseas has been deployed, adding another level of complexity to the project to manage cost, quality, lead times, and LEED regional points requirements.

### Safety

On the whole site, safety equipment is similar and following the American regulations more oriented to individual safety equipment (harness) than to collective equipment (rails). The General Contractor has a safety department to verify that these requirements are properly implemented on site.

Proper accesses such as ladders, scaffolds or temporary stairs had to be installed on site for evacuation purposes. This is supposed to be used in case of buck hoist breakdown or emergency evacuations.

Each opening is surrounded by wooden rails nailed to the slab to prevent falls. Those rails are also installed around the perimeter of buildings, at each floor when it is necessary. Safety nets are also added to the rails to prevent any small item or material fall.

When rebars are coming out, they are using plastic rebar caps for protection.

When workers are performing in high areas: H>6 feet (1.8m), they have to be properly equipped with harnesses and tied to stable elements. The required solution is to embed straps into concrete vertical elements. During the table flying process, there are rails nailed on top of the tables but workers spend time to build and install other safety rails on the slab edge before the table removal. They do that in order to have a safe area directly after the table flying operation.

Harnesses are also compulsory for climbing formwork or rebar cages (see Figure 9).

### Proposed Fire Protection and Life Safety Code Compliance

The proposed fire protection and life safety code compliance approach for the buildings in accordance with the applicable codes for the project and serve as a master guide for code compliance for the project team and also for the City of Miami Building and Fire Departments through design and construction of the project.

### Variety of Construction Techniques

A variety of construction techniques have been deployed to optimize the delivery of each and every use in the project, based on design and schedule.

This mix brings an appropriate design response, but also generates added complexity and coordination during construction. This has been carefully managed on the three blocks of the project.

- Condominium & Hotel General Construction Methods:
  - Structural Frame: Poured/cast in place concrete construction; the hotel has an outrigger steel truss embedded in the concrete frame at mid height.
  - Exterior Walls: Concrete masonry units and glass window wall.
- Podium General Construction Methods:
  - Structural Frame: Steel frame construction;
  - Exterior Walls: Metal stud walls with exterior sheathing, stucco, and decorative metal exterior panels.
- Office Towers General Construction Methods:
  - Structural Frame: Steel frame construction around a concrete shear wall core;
  - Exterior Walls: unitized curtain wall glazing.
- Garage General Construction Methods:
  - Structural Frame: Poured/cast in place concrete construction;
  - Exterior Walls: Concrete masonry unit (CMU) block with decorative metal exterior panels.

### Innovations and Sustainability

A number of forward thinking ideas and recent technologies have been implemented on this mega project; thus minimizing the impact of a

large and dense structure on the environment, with tunnel, bridges, traffic study (see Figure 10):

- Parking Management system
- LEED / BMS Integration to monitor Water and Energy consumptions, providing a central dashboard to monitor, inform, engage and reduce energy consumption:
- BCC will be an intelligent building in terms of monitoring all mechanical, electrical, and building managements systems. HVAC BMS system is used to monitor Power, Water, and Comfort in the Building for to meet all the LEED Gold building requirements.

In addition, to monitoring the entire site from one room, the controls are able to display all operating systems in one screen. The system can identify alarms, generate work orders, and change set points in the systems in entire 5 million square feet. This system could be expanded in the future to plug in other systems for digital signage, shopping monitoring and tracking, and the smart parking to one individual dashboard.

The same system monitors all security systems, access control. This is a web-accessible touch-screen interface continually displays "live" resource use and calculates in real time money earned from rainwater harvesting, power consumption, and other cooling systems.

- Room control integration with hotel check-in software, in a seamless manner
- Climate Ribbon™, provide non air-conditioned space for the retail promenade, favoring/ IMPROVING natural ventilation and provide shade to the public, while collecting rainwater for recycling into other building usage.
- Electric vehicle charging stations, promoting the use of electrical vehicle downtown, to reduce CO2 emissions
- Flood control by automated flood gates in some strategic areas of the retail, to help maximize the retail use and safeguard the underground infrastructure.
- Low flow plumbing fixtures to reduce water usage
- Providing bikes racks for all uses in the project, and combining the existing metro station, to invite more people to use public transportation
- On the project management side, innovative solutions have also been

deployed such as the collocation of all team members, owner's rep, architect, consultants, inspectors, general contractor and major subs in the same building, next to the project, providing effective communication and problem solving spirit in one spot. This allowed integrated design development to continue to occur while structures were being erected, giving the flexibility to the Owner to incorporate design changes, while fast track coordination was happening in one hub. Proactive scheduling services were also provided, from very detailed scheduling to sequences' coordination, to monitor two or sometimes three shifts, six days a week on simultaneous blocks.

- BIM use have been implemented from day one to provide a fully coordinated model of the project, under the coordination of BIM managers at General Contractor's levels, with dedicated BIM modelers with the trades, to provide clash detection and constructability reviews (see Figure 11)

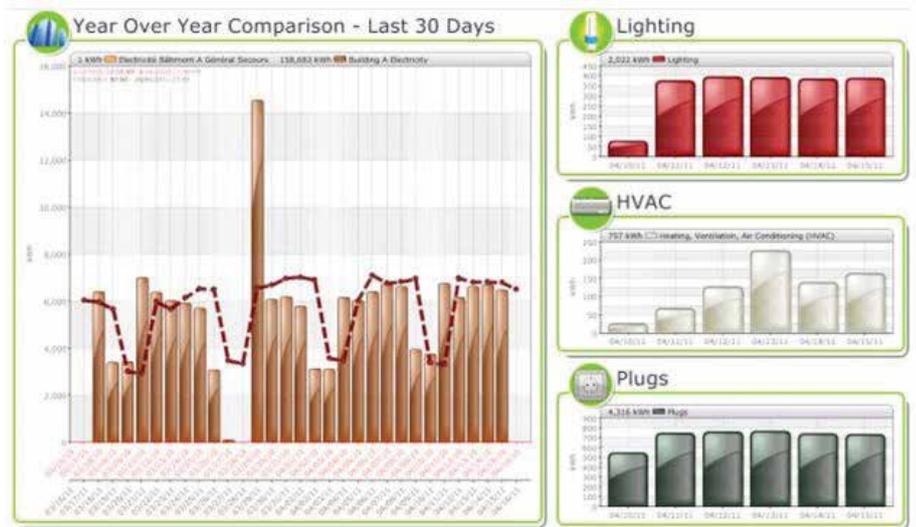


Figure 11. BMS Dashboard (Source: Bouygues Bâtiment)

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