Booz | Allen | Hamilton

Viewpoint

SWITCHED ON

HOW MENA CAN BUILD SMART GRID SUCCESS

Author:

Dr. Adham Sleiman
sleiman_Adham@bah.com

IT'S TIME TO GET SMART

Today we face an inescapable reality: digital technology now permeates almost every area of life, both personal and professional.

The way we transact, the way we do business and even the way we socialize, are influenced—if not dictated—by a plethora of smart technologies designed to meet our every-day demands, faster and more efficiently than ever. Yet, while few industries have escaped the digital tsunami that has engulfed the world, the utilities sector has remained stubbornly on the periphery. Utilities have resisted the current that has propelled firms in other sectors, such as telecommunications and banking, into cyberspace—a space where digitization and mass socialization are no longer an advantageous exception, but increasingly the norm.

In many ways, this apparent immunity is unsurprising. Utilities have historically under-invested in information technology (IT), focusing instead on the operations technologies that enable their core business of generating, transmitting and distributing power. In doing so, they have typically taken a reluctant approach to IT, viewing it as a necessary evil for customer management and revenue collection.

The tide, however, is slowly changing. Following the lead of other industries, utilities are now waking up to the insatiable thirst amongst consumers for smart, interactive services. And, in the process, they are identifying many potential benefits of smart technology, not just to the increasingly sophisticated customer, but to their own business. Enter: the smart grid.

A blend of classic electric grid with information, communication and control technologies, the smart grid is helping utilities to overcome many of the obstacles that stand in their way, delivering results for companies and consumers alike. Designed to overcome weaknesses and enable new services in conventional electrical grids, the smart grid manages vast amounts of energy and information, while delivering more and costing less—much like the Internet.

The result is greater control over the production, transmission, distribution and retail of electricity, as well as increased efficiency along with the reduced consumption and cost of energy.

This array of advantages creates a compelling case for smart grid deployment in the Middle East and North Africa (MENA), yet the early smart grid ventures in MENA's utilities space have yielded limited success to date. Across the region, smart grid projects have fallen short of expectations—a consequence of ineffective planning, weak vendor accountability, absence of 'post-mortem' analysis and focus on technology, rather than on comprehensive operating model transformation. Clearly, the progress still to be made is great if both the smart grid and utilities are to reach their potential, but so too is the opportunity.

This Viewpoint explores the trends, challenges and implications at play in the smart grid space. More importantly, it offers practical lessons to MENA's utilities and uncovers the opportunities that exist at the sweet spot where technology and tradition collide.

THE SMART GRID 101

The introduction of smart grid technologies is leading to nothing short of a paradigm shift in the utilities sphere. To understand the true potential, it is first necessary to unpack the concept and develop an understanding of its meaning.

In simple terms, the smart grid is a convergence of the electric power, communications and IT industries, built on the foundations of advanced metering infrastructure, or AMI—an integrated system that enables two-way communication between utilities and their customers.

Drawing on big data and smart technology, the smart grid adds intelligence across the existing electricity value chain to improve network efficiency, reliability and quality of service, while simultaneously integrating the actions of all grid actors—from generators and transmitters, to distributors and consumers. In doing so, just like AMI, the smart grid allows for two-way power and data flow between the utility and its customers. To achieve this efficiency and interaction between utilities and stakeholders, the smart grid operates along three architectural layers:

1. Infrastructure
2. Applications and services
3. Communications

Such connectedness is unprecedented in the utilities space and smart grid uptake is still nascent in MENA, but the fundamental technologies required to inject intelligence into the grid have in fact been in existence for more than a decade. It is only in recent years, however, that tangible technological advancement and a shift of priorities towards smart grid deployment have begun to emerge. In sum: the technologies may not be new, but much has changed on the utilities landscape.

Within the conventional grid, power generation, transmission and distribution is realized in a linear and somewhat limited fashion, with the end user's energy consumption recorded via an electromechanical meter and customers billed accordingly.

By contrast, the smart grid signals a departure from tradition, introducing a far more interconnected, distributed and intelligent dimension. While fossil fuels remain critical to energy production, the smart grid opens up new opportunities for renewable energy production and storage, while engagement and channels for two-way communication between end-consumers and utilities companies are created. Furthermore, the smart grid introduces new metering, billing and payment methods, as well as greater access to, and accuracy of, data and information for customers and utilities alike.

INVESTMENT ON THE UP

1 'Smart Grid Market - Global Industry Analysis, Size, Share, Growth, Trends and Forecast 2013 – 2019', Transparency Market Research, November 2015

As the utilities landscape continues to shift, investment in smart technologies is rising in tandem, spurred by an increasing acknowledgement amongst utilities of the smart grid benefits, along with government mandates for energy efficiency and grid reliability. Research indicates that, tens of billions of dollars will be invested in smart grid technologies over the coming years, with a report from Transparent Market Research[1] indicating that the value of the global smart grid market will reach US$118.1 billion in 2019, up from just US$37.7 billion in 2012. Meanwhile, according to market research and consultancy firm, Navigant Research, Smart grid IT software and services are expected to generate US$17.1 billion in revenue in 2024 up from US$8.5 billion a decade earlier.

Findings from the company also reveal that almost US$600 billion will be invested on a cumulative basis world-wide between 2014 and 2023, with spending on smart grid technology growing from US$44.1 billion to US$70.2 billion during the same period.

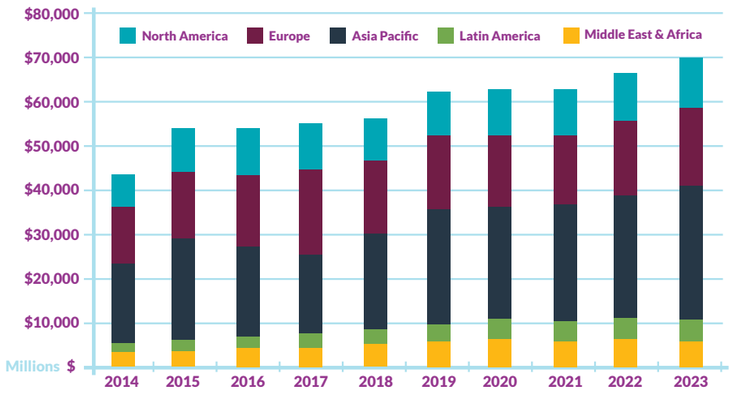
Taking a global view, it is in the world's advanced markets that the largest revenues from smart grid technology are expected to be generated. However, starting from a low base, emerging markets, including many economies across MENA, have ample room for smart grid growth and development.

With investment rising, a number of fundamental smart grid building blocks stand to gain. Here, the key focus areas include:

1. Transmission upgrades
2. Substation automation
3. Distribution automation
4. Smart metering and
5. Utility enterprise IT.

But the list does not end here; the applications and uses of the smart grid are continuously evolving, going well beyond these basic building blocks and opening up a world of new possibilities.

Smart Grid Technology Revenue by Region, World Markets 2014-2023



Source: Navigant Research

THE SMART GRID IS EVOLVING

The rise in investment in smart technologies is enabling the smart grid to continuously evolve and advance, with emerging innovations promising to benefit consumers, utilities and countries world-wide. These innovations are taking multiple forms[2].

Micro-Grids
Micro-grids are small-scale smart grids that can operate independently or in conjunction with an area's main power grid. However, micro-grid management poses a new challenge for network technologies.

Energy Storage
Energy storage devices are gaining traction with the advancement of battery technology such as Li-Ion, and the grid's compatibility with transactive energy. Efficient storage devices will play an important role in demand side management.

Smart Homes
Smart homes have smart appliances that are connected to the utility through a Home Area Network (HAN) and adjust their running schedule according to messages from the utility such as electricity rates.

Demand Response Management Systems
Demand Response (DR) Management Systems are IT systems designed to predict peak usage times and mitigate outages due to insufficient capacity. Within the DR context, the smart grid also has implications for smart appliances, as well as energy efficiency, automation and control.

Electric Vehicles
The proliferation of electric vehicles (EV) is set to modify the energy demand profile. For instance, EVs will create an added load and can be used as storage devices in Demand Side Management applications.

Electric Vehicle (EV) Charging Stations
The increased adoption of EVs has driven charging stations, both regular and fast, to mushroom. These stations will stress the existing power infrastructure and will have to respond to DR events.

Advanced Distribution Automation
Advanced Distribution Automation (ADA) extends distribution automation to distributed energy resources, further improving the self-healing properties of smart distribution systems.

Smart Renewable Energy Resources
Smart grids are designed to support energy from distributed sources, which has been favorable for the use of renewable energy sources such as wind power, solar power and geothermal energy.

These technological innovations are just one sign that commitment to the smart grid is growing stronger, as its role in satisfying and engaging customers becomes more apparent.

2 'IEEE; Department of Energy; IntelliGrid

THE BENEFITS

While the true impact of emerging smart grid trends remains to be seen, existing innovations are already delivering tangible and wide-ranging benefits, not just to consumers and companies, but to entire nations, too. These benefits are well-documented and have been formalized, standardized and modeled by national and international institutions across the globe. Here is just a selection of the advantages that the smart grid can deliver.

Proactive Consumer Participation
The smart grid arms today's consumers with a wealth of information, allowing them to explore and compare a full spectrum of pricing plans and options to buy and sell.

Resistance to Attacks on the Grid
The smart grid detects, deters and mitigates potential threats to utilities, and is able to restore systems rapidly and efficiently in the event of an attack.

Self-healing
Similarly, when a problem occurs, the smart grid is able to minimize impact, and rapidly repair and restore its systems, resulting in minimal disruption to operations.

Optimization of Assets
The unparalleled integration provided by the smart grid facilitates critical connectivity between intelligence and asset management applications.

Operational Efficiency
This interaction between intelligence and asset management results in heightened operational efficiency across the grid. Meanwhile, integration provides different power generation types, both continuous and intermittent.

Storage Solutions
The smart grid introduces new storage options, such as fuel cells, and paves the way for greater integration of alternative and intermittent energy sources including wind and solar energy.

Enhancement of Power Quality
Power quality is a priority for utilities and consumers alike in order to protect electric devices and ensure their smooth running. To this end, the smart grid offers a range of quality as well as price options, in line with needs.

Enablement of New Markets
The distributed generation enabled by the smart grid benefits existing, mature electricity markets, while also developing new ones.

THE CHALLENGES

PLANNING, DESIGN AND IMPLEMENTATION

The potential smart grid benefits are numerous, yet utilities must navigate a plethora of planning, design and implementation challenges on the path to successful deployment, with the absence of a one-size-fits-all solution counting as the overarching issue.

Just as no two companies are alike, smart grid needs, too, can vary widely between organizations. With this in mind, it is important that smart technologies are selected carefully on a case-by-case basis. The task of hand-picking them, however, is complicated in a context of technological immaturity. With the smart grid still in its infancy, the multitude of related technologies find themselves at varying stages of development, making their adoption and integration a challenging task. Meanwhile, the nascence of the market is also reflected in the lack of awareness that can exist amongst utilities stakeholders regarding the appropriate standards and best practices for smart grid deployment. In some instances, this lack of awareness is not just symptomatic of smart grid immaturity, but of a wider issue: the absence of a holistic strategy and vision. Where these critical foundations are missing, narrow scope, incomplete objectives, inappropriate allocation of resources, and fragmentation of efforts typically follow, rendering successful smart grid deployment all the more challenging.

These issues highlight the importance not just of technology, but of human capabilities, too. Without the buy-in of all stakeholders and the solid guidance of a utility company's leadership, there can be no holistic strategy or vision, and even with the best strategy in place, effective smart grid deployment cannot be realized without the support of the right team. In this regard, new skillsets will be needed across any organization to cope with the new technologies and business models ushered in by the advent of the smart grid. However, neither a utility's leadership nor its technical staff can fulfil their smart grid mandate without the existence of a proper regulatory environment. This presents a call to action, not only for utilities, but the nations in which they operate.

TECHNICAL CHALLENGES

In addition to the challenges associated with smart grid design, implementation and deployment, the paradigm shift that is underway also heralds the arrival of complex technical challenges, with cybersecurity prime amongst them.

Deploying a smart grid without adequate security could result in serious consequences such as utility fraud, loss of user information and grid stability. The smart grid's complexity and multiple entry points—from smart meters to distributed energy resources (DER)—create significant vulnerabilities that leave the grid open to breaches and attacks that can target customer data and inflict physical damage. These threats can be difficult to manage or mitigate, but the implementation of system-wide cyber security and privacy that stretch as far down as end-user devices, is a crucial first step in combatting the challenge.

In managing these cybersecurity threats, big data and analytics also have a critical role to play, yet they, too, present new and growing challenges to utilities with smart grid ambitions. The sheer size of the smart grid means that handling and processing the vast amount of data generated is problematic. More than a question of tweaking existing capabilities, converting this deluge of information into meaningful intelligence requires a complete overhaul of IT and analytics infrastructure, with the importance of analytics rising to the fore, particularly vis-à-vis demand response events.

The deluge of information now at utilities' fingertips poses a challenge not just for data management, but for communications systems, too. In a context where different vendors and service providers work independently, it is crucial that utilities develop interoperable systems with capacity to exchange large amounts of data between multiple systems.

OPPORTUNITIES

Despite the challenges, an abundance of opportunity also exists in the smart grid world. In fact, several developed countries are already leveraging the smart grid to fulfill a number of key priorities, which relate primarily to energy efficiency and reliability. Utilities in North America, for example, have focused on distribution automation and transmission modernization to achieve these goals. In fact, these two areas represent the largest share of the country's smart grid market, each with 25% to 30%. Analytics, meanwhile, represents the fastest growing smart grid technology, with a CAGR of 14.2%.

Drawing on the experiences of North America and other parts of the world, large utilities across the MENA region can build on the existing global knowledge and experience to accelerate their own smart grid initiatives, for the benefit of all stakeholders.

At the regional level, particularly for the countries of the GCC, the smart grid provides a good opportunity for nations to ultimately diversify their economies away from oil and gas, by urging them to modernize their infrastructure and lay the foundations for additional energy-saving applications and renewable energy development.

Meanwhile, for utilities companies specifically, adoption of the smart grid brings with it manifold opportunities.

Here, cost-cutting, system upgrading and maintenance, grid reliability, and customer service to end-consumers, count as just a few, with accommodation of distributed sources of energy and new sources of demand, such as electric vehicles, also presenting new possibilities for development and growth.

But, there is a caveat: for the region's utilities to be successful in their smart grid endeavors, they must develop solid strategies that promise tangible and lasting impact on the ground. The following recommendations help them to do just that.

THE LESSONS

The recommendations below focus on several key areas where utilities can better direct their attention in their campaigns to develop and implement successful smart grid strategies with lasting results.

DEFINE YOUR OBJECTIVES

The vast, sweeping scope of smart grid technology presents boundless opportunities for utilities, balanced with equally daunting challenges. The possibilities for useful application are manifold, so it's vital to define the boundaries of any smart grid program, to avoid rendering a project unwieldy. Defining objectives on a forensic level with all stakeholders, both internal and external, is critical to the success of a new initiative. Unanimous leadership buy-in is also essential if objectives are to be fulfilled effectively. The two most influential factors that shape objectives are corporate strategy and national framework, set in place by government or their independent regulators.

Objectives will naturally vary by region, and often within regions. For instance, a look across the MENA region's utilities will give an idea of the diversity of objectives. Poorer countries often struggle with revenue collection and power theft. As a result, they seek to detect theft and roll out pre-paid power in order to prop up government finances. Meanwhile, power-thirsty nations may want to shed the burden of centralized power generation, enabling distributed generation by the end-user. For their part, advanced GCC states will undoubtedly be looking to enable smart services and truly interconnected smart cities.

The importance of future-proofed plans can be crystalized by giving smart grid projects a likely timeframe. Meeting objectives like those discussed above will necessitate infrastructure investment, which may well stretch fifteen or twenty years into the future. Not only is technology likely to change, so are the driving objectives themselves. It's therefore essential to plan for both the immediate and long-term to accommodate future objectives and ensure that the infrastructure choices made today do not need replacement halfway through their lifespan.

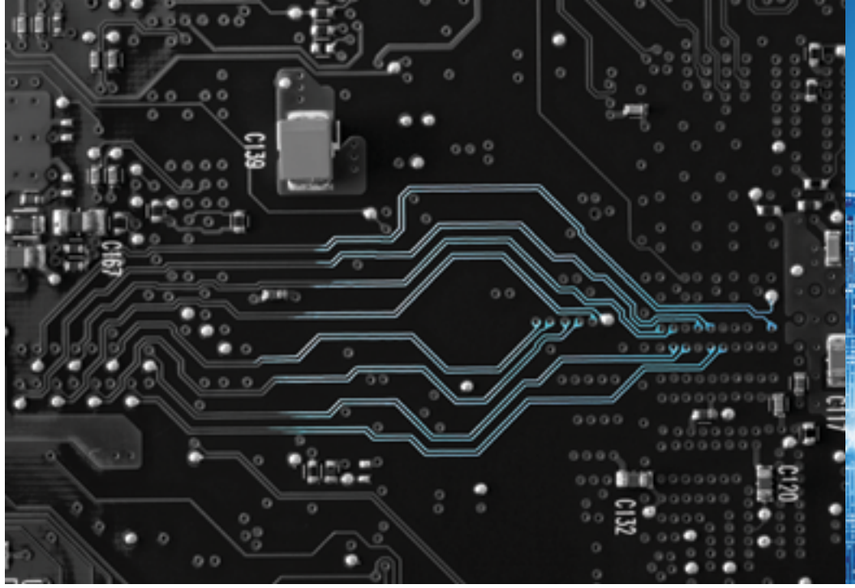
EMBRACE DATA IN DECISION-MAKING

Utilities face several fundamental questions when deciding how to implement smart grid projects; for instance, whether a one-shot, turnkey approach, or phased development would be most appropriate. There are examples across the global market showing utilities that have opted for the first approach – procuring the infrastructure, design, deployment and operation in one shot. At the same time, there are others that have effectively put themselves in the integrator's position, buying components separately and integrating or deploying them independently or through subcontractors.

In making the decision, utilities have to consider their risk appetite, internal capabilities and know-how as well as the key strategic objectives that they are looking to achieve through the process. For example, nationalization might be a key objective, or the build-up of internal capabilities to realize the project in-house. Conversely, it may become clear that the in-house route is compromised by lack of technical know-how or maturity, pointing decisively to the turnkey route and outsourcing.

When seeking to answer strategic questions, utilities need to generate and harness the power of data available to them. In that way, operational questions such as whether infrastructure and services should be procured upfront, or whether infrastructure should be deployed by region, customer segment or even by value and condition, can be answered confidently.

"When seeking to answer strategic questions, utilities need to generate and harness the power of data available to them."



DO YOUR DUE DILIGENCE

When procuring technology for smart-grid rollout, utilities need to consider several key factors if they are to avoid becoming an unsuccessful field trial of unproven technology, or the dumping ground for obsolete technology. First up is the sheer number of vendors, each pushing competing or complementary technologies. Navigating through this maze of products and features can be a daunting task. Rather than a kneejerk choice of one product that seems to fulfill its needs, the utility should conduct thorough due diligence. Just a few of the factors for consideration include: obsolescence of the technology, its openness and interoperability, its supporting vendor base, the extent of existing deployments, security, futureproof-ness and expected evolution roadmap.

This due diligence must be accompanied by a recognition amongst utilities that there is rarely a single technology that can efficiently fulfill the requirements of nation-wide deployment. They should therefore plan and be ready to harness a mix of technologies to cover all conditions and situations. It is also important to build links with a number of providers to avoid becoming the locked-in prisoner of a vendor with a proprietary and closed product.

PROOF YOUR CONCEPT

Evidence that the technologies comprising a smart grid can successfully integrate should not be left until rollout. Instead, the roadmap to deployment should include a proof-of-concept stage, during which the vendors can demonstrate that their products work together, in a closed and controlled environment. The next step should be to pilot the technologies in real-life conditions at all the different types of sites in which they're set to be used. This measure is intended to prove that the chosen technologies will in fact work in the field and to test the vendor's ability to deploy them effectively.

CHART THE COMPLETE COURSE

The road to smart grid rollout is littered with the bleached bones of failed pilot programs. It is therefore vital for utilities to understand why these programs failed in order to plan in such detail that future pilots don't suffer the same fate. Here, proof-of-concept alone isn't sufficient to guarantee successful fulfillment of objectives.

The MENA region has a host of examples of advanced metering infrastructure (AMI) pilots that led nowhere. The technology was proven, but the project still stalled. Why? As discussed above, the answer lies in planning beyond the pilot, whatever the outcome. It is every bit as important to provide guidance for failed pilots as it is for successful ones. Having answers to questions such as, "Do we sign up the whole country to the vendor that pilots successfully?" or "Do we trial other vendors and technologies too?" can help keep vital momentum behind the project, irrespective of the outcome.

Without clear answers to these questions, the roadmap is incomplete and the impetus to finalize the pilot is lost. Trialing multiple technologies and setting a mechanism from the beginning for decision-making, post-pilot, are integral parts of developing the roadmap and ensuring that it leads to the desired destination.

KEEP VENDORS ENGAGED

While it can be good practice to trial several technologies concurrently, this approach is not without its own challenges; principally, keeping vendors committed to the project. Slicing the pie too thinly between too many potential suppliers risks reducing the attractiveness of the eventual business, threatening the quality and price of the product in the process.

Because there is no such thing as an off-the-peg solution to a utility's smart grid needs, suppliers need to engage in substantive prototyping or tailoring of their product to secure the business. This is a costly and involved process that they're unlikely to want to undertake if the potential reward is diminished by the involvement of multiple competing vendors.

“ The successful rollout of a smart grid will necessitate fundamental changes to the structure of the business, including the required skillsets and job descriptions of the staff. ”

PLAN FOR SEISMIC SHIFTS

Utilities need to consider that, as well as sparking change in public behaviour and engagement; smart-grid implementation is also likely to be reformative of the utility itself. The successful rollout of a smart grid will necessitate fundamental changes to the structure of the business, including the required skillsets and job descriptions of the staff. Certain jobs may be made obsolete; meter readers, for example. Yet the new technologies will introduce new jobs into the organization too, such as system administrators or cyber security experts. These, often seismic, shifts need to be recognized and planned for. The successful smart grid program will plan for the transformation and include the necessary change, communication and public relations management.

BALANCE YOUR PRIORITIES

Many of the major markets in the MENA region are encouraged, as a listed objective, to increase use of local products and resources, thus improving national capabilities. When translated into public-sector policy, this leads to preferential treatment of regional manufacturers and service providers. However, it’s crucial that such noble intentions don’t jeopardize the smart grid project, and unqualified manufacturers with immature or unproven products may do exactly that. A useful compromise would be to allow international market leaders to forge partnerships with MENA companies to train and improve national capabilities.

IN CONCLUSION

The march of utilities towards smart success may be lagging behind that of other industries, but it is an unstoppable rally nonetheless. Indeed, it is no longer a matter of if, but when, they begin to roll out smart grid infrastructure, irreversibly changing the utilities landscape as they go. To reap the rewards, each utility must draw up its own path and carefully consider their individual objectives, situation, capabilities and risk appetite, recognizing that there is no one-size-fits-all approach. Yet, while needs and circumstances may vary, utilities face one common reality: the smart grid rewards are bigger than ever for those who plan diligently and who stay plugged-in and switched-on to the smart evolution now shaping our world.

Dr. Adham Sleiman
Vice President

Dr. Adham Sleiman is a Vice President with Booz Allen Hamilton and a senior leader within the Digital practice, where he spearheads the firm's Middle East and North Africa Digital Energy & Environment and Enterprise Technology platforms.

Dr. Sleiman specializes in digital transformation spanning the whole lifecycle from strategy development and planning, operating model development (including shared services design) and business process re-engineering, business case development, technology requirements definition, procurement support and/or outsourcing, to implementation oversight and technology operations and service management.

Dr. Sleiman has advised both public- and private-sector clients in the Middle East and Europe in the past 12 years. In doing so, he has worked across a broad range of industry sectors including chemicals, utilities, financial services, telecoms, healthcare, transport, energy and technology. As leader of the Digital Energy platform in the region, Dr. Sleiman supports the technology and smart grid agendas of a large number of MENA utilities.

Dr. Sleiman holds a Ph.D. in communications and signal processing, as well as a master's degree in electrical and electronic engineering, from Imperial College London.

Author:

Dr. Adham Sleiman
Vice President
sleiman_Adham@bah.com
+971 2 69 13600

About Booz Allen

Booz Allen Hamilton has been at the forefront of strategy and technology for more than 100 years. Today, the firm provides management and technology consulting and engineering services to leading Fortune 500 corporations, governments, and not-for-profits across the globe. In the Middle East and North Africa (MENA) region, Booz Allen builds on six decades of experience partnering with public and private sector clients to solve their most difficult challenges through a combination of business strategy, digital innovation, data analytics, cybersecurity and resilience, operations, supply chain, organization and culture, engineering and life-cycle project management expertise.

With regional MENA offices in Abu Dhabi, Beirut, Cairo, Doha, Dubai and Riyadh, and international headquarters in McLean, Virginia, the firm employs more than 22,600 people globally, and had revenue of $5.41 billion for the 12 months ended March 31, 2016. To learn more, visit mena.boozallen.com. (NYSE: BAH)