Facing myriad infrastructure challenges, both upgrades and new development, engineers and policymakers around the world are increasingly tapping into the public-private partnership model as a way to balance infrastructure financing needs and socially conscious investment goals. This model offers promising solutions to address the refreshingly responsible metrics of people, planet, profit and purpose.
Engineers and policymakers around the world face daunting infrastructure challenges due to aged legacy systems in developed countries and rapid urbanization in newly industrialized and emerging countries. Upgrades and new development of basic infrastructure are expensive, and few nations have adequate funds readily available. In recent years, however, innovative local, regional and national leaders have used private finance mechanisms to deliver creative solutions to life-impacting infrastructure challenges.

At the same time, worldwide investors of capital are becoming more sophisticated and socially responsible. Investors expect a return commensurate with the risk of their infrastructure investment, but not at the expense of the people who work at the enterprise, natural resources or the company’s vision.

The intersection of private finance mechanisms and socially conscious investment offers a promising model for addressing a range of infrastructure challenges, including meeting basic human needs in emerging nations and, in the United States, rebuilding aging infrastructure with over $1 trillion of new spending. To explore this model, this paper will define one type of investment mechanism, the public-private partnership (PPP). It will then explain the four P’s of next-generation business and examine a variety of successful PPP projects.

Modern nations face a variety of infrastructure challenges, including water, wastewater and stormwater management, electric and gas transmission and distribution, and the construction and maintenance of roads, bridges, airports and seaports.

Understanding Public-Private Partnerships
The PPP Knowledge Lab, an online resource maintained by the World Bank Group and other development banks, defines a public-private partnership as “a long-term contract between a private party and a government entity, for providing a public asset or service, in which the private party bears significant risk and management responsibility, and remuneration is linked to performance.”

Background
Public-private partnerships have been around for decades, but their popularity increased during the economic recessions of the 1970s and 1980s, when many nations were particularly concerned about rising levels of public debt. At the time, private investment was seen as a way of building out infrastructure at no additional cost (tax) to the public. While the PPP model has not proved to eliminate public debt, it still is generally considered an efficient method of public procurement. In addition, it can shield the taxpayer from risk while maintaining a degree of public accountability.

Over the last 30 years, the PPP model has been used successfully to address infrastructure needs in a variety of industries. Yet, between 2010 and 2014, it represented only an average of 7.5 percent of infrastructure investment in major developing countries. In the United States, private financing represents an even smaller portion of total infrastructure spending. Accordingly, there is tremendous opportunity to expand the role of PPPs in completing essential infrastructure projects.

Benefits of PPPs
Public-private partnerships offer numerous benefits for worldwide infrastructure projects. Because they contractually align construction, finance and the owner, all stakeholders are incentivized to collaborate in producing the best possible outcome. Schedules are often shortened, project quality is improved, risk/reward is shared among participants, and the cost is borne by the users of the infrastructure.
• **Speed.** Concurrent efforts streamline the process, often through simplified procurement strategies and engineer-procure-construct (EPC) project delivery. PPPs can raise capital faster than municipalities, and revenue and cash flow drive speed to market. Though government debt is less expensive than public financing, issuing bonds takes time and voter engagement, drawing out the process.

• **Quality.** Because of the nature and complexity of infrastructure projects, PPPs hire only the most qualified teams through a highly competitive process. Each party is then encouraged to leverage its unique skills and communicate openly with other contributors. Early stakeholder engagement and a focus on constructability allow PPPs to design out risks earlier in the process and minimize re-think and re-design. Because PPPs are responsible for operating and maintaining project assets for decades, they’re highly motivated to optimize performance and operational efficiency over the entire term of the contract.

• **Shared risk/reward.** PPPs bring in outside capital that doesn’t burden society with significant debt, especially during financial downturns and budget constraints. As such, they share risk across the private sector, among people who potentially are better suited to hold and manage it. Shared risks are assigned to the appropriate entity, so no single point of failure will bring down a PPP project. Still, because of the complexity of these projects, detailed contracts must be written to achieve success.

• **Users of infrastructure cover costs.** In a PPP, a majority of the infrastructure costs is passed only to the people who use it, rather than spread across the population. Costs may take the form of “traffic fees,” such as tolls, rental or parking fees, or other concessions. Additionally, total life cycle cost is earmarked upfront, such that asset performance is designed into the process earlier and costs are managed throughout.

### RELATED CHALLENGES

PPPs also present challenges:

• **Risk of reduced innovation.** Infrastructure projects inevitably require a large financial investment, countless hours of project development, and the ability to estimate costs and appropriate usage effectively. Each of these factors introduces risk, often to the point of discouraging PPPs from taking on the additional risks associated with innovation. Incentivizing life cycle asset performance helps mitigate this concern.

• **Government expectations.** Governments tend to underestimate the risks involved in infrastructure projects and the risk premium that will be required to secure a PPP contract. Many PPP deals fall through as a result. Similarly, governments often are uncomfortable turning ownership and operations of assets over to a third party, as is defined by PPP contracts. Educating governments on the PPP process, aligning expectations early and discussing control retention keeps projects moving forward.

• **Complexity and perceived lack of transparency.** In many countries, citizens believe PPP projects lack the transparency of traditional infrastructure projects and secretly align government with big business. The absence of a bond referendum reinforces this suspicion. Encouraging governments to communicate openly with their constituents about the process and how it works helps allay concerns. Partnership contracts firmly outline expected operational expenses over the period of the concession.

• **Applicability to smaller projects.** Because PPPs incur significant startup costs and focus on value for the money, only the largest infrastructure projects currently use this model. This also reduces the number of participants able to take on projects, which then creates a very complex supply chain, broad financing tranches and long-term operational complexities. Developing a cost-effective PPP model that is appropriate for midsized projects would allow more companies to contribute to infrastructure redevelopment.
PPPs are just one option for infrastructure investment, and they may not be right for every project. Still, they should be creatively considered, particularly in the context of the four P’s of next-generation business — or triple bottom line (TBL) accounting, plus one.

THE FOUR P’S OF NEXT-GENERATION BUSINESS

The TBL framework focuses on investment results in terms of people, planet and profit. Since John Elkington introduced the framework in the 1990s, numerous for-profit, nonprofit and governmental organizations have adopted the concept as an effective means of evaluating their overall performance. Increasingly, many organizations now add purpose to their business framework, making it a quadruple bottom line (QBL).

Profit is, of course, the most familiar of the four metrics and reasonably straightforward to calculate. It refers to a company’s net income and, by extension, its ability to satisfy its shareholders. In the past, maximizing profits, possibly at the expense of workers or the environment, was sometimes thought to be a company’s main priority. However, today many prudent shareholders expect their investments to generate a profit, while also improving people’s lives and being a steward of natural resources and the planet.

Companies that prioritize people offer comprehensive benefits and a safe, inclusive work environment for their employees. At the most basic level, this involves providing fair wages, fair treatment and a strong safety culture. It also may address a variety of other quality-of-life considerations, including professional development opportunities, work-life balance initiatives such as on-site child care, and a collaborative, team-oriented workplace.

The environmental pillar of the QBL framework emphasizes good stewardship of natural resources. This includes everything from green initiatives like recycling to monitoring and optimizing air and water quality, energy consumption, solid and toxic waste management, and land use. An increasing number of investors actively seek companies that support such sustainability goals. In fact, a Nielsen global study conducted in 2015 found that nearly 75 percent of millennials and 66 percent of all respondents were willing to pay more for sustainable products.

The American Society of Civil Engineers (ASCE) defines sustainability as “a set of economic, environmental and social conditions in which all of society has the capacity and opportunity to maintain and improve its quality of life indefinitely without degrading the quantity, quality or the availability of natural, economic and social resources.”

The final pillar of the QBL — purpose — speaks to the desire to fulfill the vision of the investor and company by extending these social and environmental benefits into the future. For many organizations, this means providing for the ongoing health, welfare and safety of their stakeholders, whether by building bridges that can support a growing population, making clean water available to previously underserved communities, or delivering the value of connected infrastructure in the smart cities of the future.

FIGURE 1: World headquarters of Burns & McDonnell, ranked for the eighth year on Fortune magazine’s list of 100 Best Companies to Work For.
PPP IN ACTION

In a **smart city**, the basic infrastructure of diverse neighborhoods and communities is connected to drive operational excellence, revenue potential and sustainable customer lifestyles. To learn more, read our white paper, “Creating the Smart Cities of the Future,” at burnsmcd.com/SCFuture

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In each case, close cooperation between business and government dramatically improved the quality of life for people in these communities and countries, while delivering financial and environmental benefits and fulfilling the greater purpose of those involved.

- Supplying clean water to millions in the Philippines
- Reducing congestion for Beltway commuters in Washington, D.C.
- Streamlining air travel at New York’s LaGuardia Airport
- Relieving a transmission bottleneck on Path 15 in California
- Redeveloping historic London hospitals for the 21st century
- Bringing smart technology to London’s M25 motorway
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SUPPLYING CLEAN WATER TO MILLIONS IN THE PHILIPPINES
In 1997, only 26 percent of the population of metropolitan Manila had access to potable water 24 hours a day. Today, that number is 99 percent. This remarkable improvement is the result of an innovative partnership between Manila Water Company Inc. and the Philippine government.

CHALLENGE
Prior to 1997, the government-owned Metropolitan Waterworks and Sewerage System managed Manila’s water operations, with questionable results. Illegal connections and meter tampering were common, and widespread system leakage led to water contamination and waterborne disease. Those who could afford it paid a high price for clean water, while those who could not were forced to manage without.

The water system also was financially and environmentally unsustainable. At its peak, non-revenue water (NRW), or water system losses, reached 63 percent. Ultimately, this situation led the government to enact the National Water Crisis Act of 1995, which made it possible to transfer the operation of water services to the private sector.

SOLUTION
In 1997, a concession agreement granted Manila Water exclusive rights to land and facilities used for the production, treatment and distribution of water, including the sewage system. In 2009, the original 25-year agreement was extended for an additional 15 years, or until May 2037.

Because the National Water Crisis Act required the implementation of “urgent and effective” measures to address the country’s water crisis, Manila Water originally focused on efficiently supplying water to more customers. Eventually, organizational improvements and facilities upgrades also were introduced.

RESULTS
For the last 20 years, Manila Water Company Inc. has been the sole provider of water and wastewater to the East Zone of metro Manila, a 1,400 square-kilometer area that encompasses 23 cities and municipalities and serves more than 6 million people.

Nearly one-third of Manila Water’s customers come from marginalized communities. These low-income consumers are served by a special corporate program, Tubig Para Sa Barangay (TPSB), or Water for the Community. With support from both government and non-government agencies, Manila Water is able to provide these customers with continuous access to affordable potable water.

Moreover, Manila Water consistently demonstrates 100 percent compliance with the water quality standards of the Department of Health and the Philippine National Standards for Drinking Water. All residential, commercial and industrial customers in the East Zone now enjoy clean water, a situation that was simply unimaginable prior to the public-private partnership.

In addition to dramatically improving the quality and quantity of water in the city, Manila Water has prioritized environmental initiatives, including reducing water loss to 11 percent in 2016 and implementing state-of-the-art wastewater management practices. The company is now working to extend its successful water management methodology to additional communities throughout the Philippines, as well as in Vietnam, Myanmar and Indonesia.

4 P’S, DELIVERED
People: Meaningful jobs that make a difference for future generations
Profit: Ability to expand beyond the Philippines
Planet: Reduced contamination and disease
Purpose: Serving the poorest with a basic human need
REDUCING CONGESTION FOR BELTWAY COMMUTERS

For decades, chronic congestion plagued the Interstate 495 Capital Beltway in Fairfax County, Virginia. This changed in November 2012 with the opening of the Capital Beltway High Occupancy Toll (HOT) Lanes, a $2 billion infrastructure project developed through a PPP between the Virginia Department of Transportation (VDOT) and Capital Beltway Express LLC (CBE).

CHALLENGE

The Capital Beltway is a 63.8-mile circumferential roadway surrounding Washington, D.C., and the city’s inner suburbs in Maryland and Virginia. The Beltway originally was designed to allow long-distance traffic to bypass Washington, but rapid commercial and residential growth in the surrounding areas quickly made it indispensable for local travel as well.

Numerous widening projects have been undertaken since the Beltway opened in 1964. Nonetheless, by the 1990s, Beltway motorists were subjected to daily gridlock. A 14-mile stretch of highway in Fairfax County had only four lanes in each direction, and more than 50 bridges and overpasses desperately needed to be replaced.

SOLUTION

In early 2000, VDOT proposed a number of improvements, including high-occupancy vehicle (HOV) alternatives and upgrades to interchanges. However, the VDOT proposal encountered significant opposition due to an estimated cost of at least $2.5 billion and the planned destruction of hundreds of businesses and residences.

Two years later, Fluor Daniel, a private engineering company in Irving, Texas, submitted an unsolicited proposal to design, build, finance, operate and maintain (DBFOM) HOT lanes on the Capital Beltway at a much lower cost and with fewer residential displacements. Fluor Daniel (now Fluor Enterprises) later partnered with Transurban to improve the project’s financing and toll road operations. Together, Fluor Enterprises and Transurban operate as the Capital Beltway Express LLC.

VDOT awarded the DBFOM Capital Beltway concession to CBE in December 2007 for 80 years, including five years for construction and 75 for operation and maintenance.

RESULTS

Since November 2012, carpools, buses, emergency vehicles and toll-paying motorists have enjoyed congestion-free travel on the Capital Beltway HOT Lanes, also known as the 495 Express Lanes. Two new lanes in each direction were added to this 14-mile stretch. More than $260 million of aging infrastructure — including bridges, overpasses and interchanges — also was replaced. Carpool ramps now connect I-95 with the Capital Beltway to create a seamless HOV network that uses dynamic tolling based on real-time traffic conditions.

The Capital Beltway concession shifts some risks from VDOT, and therefore the taxpayer, to CBE. Specifically, the concession is providing approximately $350 million in shareholder equity. Another $1.2 billion was secured through a TIFIA loan and Private Activity Bonds, thereby reducing financing costs. VDOT also contributed $409 million in public funding as a subsidy, which is a much lower cost than its early estimate of $2.5 billion. In addition, contractual provisions impose safety and performance standards, make sure that excess toll revenues will be shared with VDOT, and allow VDOT to retain ownership of the land and improvements.

4 P’S, DELIVERED

People: Hundreds of businesses and homes saved
Profit: Market-based pricing via dynamic tolling
Planet: Reduced air pollution due to increased ride-sharing and buses
Purpose: Improved mobility for citizens
STREAKLINING AIR TRAVEL AT NEW YORK’S LAGUARDIA AIRPORT

Frequent delays, traffic congestion and dated facilities have earned New York’s LaGuardia Airport (LGA) a reputation as one of America’s airports most in need of an upgrade. In June 2016, the Port Authority of New York and New Jersey (PANYNJ) entered into a $4 billion PPP with LaGuardia Gateway Partners (LGP) to rebuild LGA’s Central Terminal and bring the facility into the 21st century.

CHALLENGE

When it opened in 1964, LaGuardia was designed to serve 8 million passengers annually. In 2016, it served nearly 30 million. Disconnected terminals, narrow concourses and post-9/11 security requirements make the crowding even more challenging. In addition, the facility is dated and offers few of the restaurants and shops modern travelers expect. Traffic congestion and bad weather compound the airport’s issues, leading to frequent flight delays and cancellations.

As the closest New York airport to downtown Manhattan, LGA is very important to the city’s economy. It’s also closer than Newark Liberty International Airport for some New Jersey communities. By 2015, upgrading LGA and the surrounding transportation infrastructure had become an urgent priority.

SOLUTION

Between 2010 and 2014, the Port Authority and, separately, New York Gov. Andrew Cuomo’s Airport Advisory Panel, made a number of recommendations regarding the demolition and rebuilding of LaGuardia’s Central Terminal. To facilitate modernization and efficiency, the development ultimately was extended to include a new central entrance hall and several related infrastructure projects.

To secure financing and minimize construction time for the $4 billion development, the Port Authority formed a public-private partnership with LaGuardia Gateway Partners. LGP is led by Swedish construction firm Skanska, and includes Walsh Construction, Vantage Airport Group, Meridiam, Morgan Stanley, Citigroup, Wells Fargo and Parsons Brinckerhoff. The design, build, finance, operate and maintain (DBFOM) contract was signed in March 2016 with a lease term through 2050. To date, it is the largest PPP contract in the United States.

RESULTS

In June 2016, LGP began construction on a new central terminal, which is designed to handle 17.5 million passengers, as well as a new West Parking Garage. Future planned improvements include construction of a central entrance hall to unify the previously isolated terminals, a pedestrian walkway between the new Terminal B and the new West Garage, and increased airport taxiways to reduce ground delays.

Because the project is financed by a combination of private equity, debt, passenger facility charges, and retail and airline revenues, the burden on the Port Authority and New York taxpayers is reduced. In addition, LGP is responsible for the cost of overruns and schedule delays. Overall, the LGA project is anticipated to generate $1.3 billion in wages and $5.2 billion in regional economic activity.

4 P’S, DELIVERED

People: $1.3 billion in wages
Profit: Leased through 2050
Planet: Expected to achieve LEED Silver certification
Purpose: Supports New York City’s vibrant economy
RELIEVING A TRANSMISSION BOTTLENECK ON CALIFORNIA’S ELECTRICAL GRID

A transmission bottleneck on Path 15 between the Los Banos and Gates substations was a primary cause of the California electricity crisis in 2000 and 2001. By December 2004, the problem had been resolved, thanks to a PPP among the Western Area Power Administration (WAPA), Trans-Elect and Pacific Gas & Electric Company (PG&E).

CHALLENGE
Path 15 is an 84-mile stretch of the power transmission corridor in northern California that connects hydroelectric plants in the Pacific Northwest to fossil fuel plants in the Southwest. In the winter, electricity is sent north for heating; in the summer, it flows south to power air conditioners.

In most places along Path 15, the maximum transmission capacity is 5,400 MW. However, prior to 2004, there were only two 500-kV lines between the PG&E substations, Los Banos and Gates. Capacity in this location was limited to 3,900 MW, creating an electricity bottleneck. Though the problem had been identified in the 1990s, it wasn’t until California experienced rolling blackouts and a spike in wholesale energy prices that finding a solution became a priority.

SOLUTION
Following California’s electricity crisis, a third 500-kV transmission line was built between Los Banos and Gates, thereby raising capacity to 5,400 MW and eliminating the bottleneck.

Historically, transmission infrastructure like this would have been built by a vertically integrated utility company in order to deliver power from its own generators to its own service areas. However, as independent power producers have entered the market, exploring new models of infrastructure development has become essential.

The Path 15 project was a public-private partnership among Trans-Elect, an independent transmission company; PG&E, an investor-owned electric utility (IOU); and WAPA, a power marketing administration within the U.S. Department of Energy that operates its own transmission system.

WAPA owned the new Path 15 transmission line. PG&E completed upgrades to the line. Trans-Elect scheduled transmission of power over the line; and a fourth entity, California Independent System Operator (CAISO), operates the line. Today, the Path 15 transmission line is 72 percent owned by Duke-American Transmission Co. (DATC), with the remaining 18 percent and 10 percent owned by PG&E and WAPA respectively.

RESULTS
By relieving the bottleneck and transmission congestion, the Path 15 project made it possible to ship affordable power from one part of California to another. This benefits highly populated areas with greater energy demands, particularly San Francisco, which previously had limited access to the benefits of major transmission lines.

The $220 million project was completed on time and under budget on Dec. 21, 2004. It was the first public-private partnership for transmission infrastructure in the United States, and it was named the North American Power Infrastructure Deal of the Year by Project Finance magazine in 2003.

4 P’S, DELIVERED
People: Named North American Power Infrastructure Deal of the Year in 2003
Profit: Relieved the price uncertainty of wholesale markets
Planet: Allowed rich hydro resources of the Pacific Northwest to reach more California customers
Purpose: Delivered more affordable power for all
REDEVELOPING HISTORIC LONDON HOSPITALS FOR THE 21ST CENTURY

Two historic London hospitals, St. Bartholomew’s (Barts) and the Royal London, have a long tradition of clinical excellence. Yet, by the 1990s, their ability to serve patients was limited by outdated and poorly maintained facilities. A £1 billion PPP between the European Investment Bank (EIB) and Capital Hospitals Limited redeveloped the hospitals in order to bring 21st-century care to local patients.

CHALLENGE

Barts and the Royal London form the core of the Barts Health NHS Trust (previously, the London NHS Trust), which is the largest hospital group in the United Kingdom’s National Health Service (NHS). Because the hospitals serve over 2 million patients each year, it was essential that they remained open and fully operational during redevelopment.

Extensive new construction had to be planned around existing facilities, with particular care for historical landmarks and strict planning regulations in central London. Traffic, business hours, noise restrictions and access to surrounding amenities had to be considered in construction scheduling. In addition, because the redevelopment project would be very visible, stakeholders had high expectations for its aesthetics.

SOLUTION

In April 2006, EIB and Capital Hospitals Limited reached financial close on a public-private partnership to redevelop the hospitals. The project was financed through index-linked bonds issued by Deutsche Bank and Morgan Stanley, an index-linked loan from the EIB, and mezzanine and subordinated debt. Skanska, Innisfree and Equion each had a vested interest in the project.

The design, build, finance and operate agreement included three components. Capital Hospitals Limited would demolish a historically insignificant 1930s building adjacent to Barts and replace it with a state-of-the-art cancer and cardiac center; demolish 13 buildings at the Royal London and build a new 17-story hospital in its place; and operate and maintain both hospitals until 2048.

Construction was staged to allow the hospitals to continue serving patients and to accommodate heavy pedestrian and road traffic. To address logistical challenges, many elements of the buildings were pre-fabricated. This process limited material on-site, reduced transportation emissions and created a safer working environment.

RESULTS

The project improved both access to and quality of care for patients throughout the east and city of London. In 2010, the hospitals served 868,000 patients; in 2014, they served 1.4 million. The new Royal London includes the nation’s preeminent trauma and emergency care center, one of the largest renal care centers in Europe, and the city’s second-largest pediatric center. Barts has been transformed into a Cancer and Cardiac Centre of Excellence.

From the outset, sustainability was a high priority. At the Royal London, 96 percent of demolition waste was recycled. Salvaged materials, including sinks and bricks, were sorted and sold to private buyers. Later, 4,500 cubic meters of demolished material was crushed and used for piling mat. The project achieved the NHS Environmental Assessment Tool (NEAT) rating of Excellent and has received a number of sustainability awards.

The members of Capital Hospitals Limited maintained close collaboration throughout. Redevelopment was completed on time (except for one 11-day delay between construction phases) and on budget. Ongoing innovations in areas such as energy efficiency, asset management and asset control will continue to improve quality of care and reduce costs.

4 P’S, DELIVERED

People: Improved access to quality healthcare and enhanced quality of life
Profit: Includes a contract to provide operations and maintenance until 2048
Planet: 0 percent of project waste sent to landfill, focus on energy efficiency and sustainability
Purpose: Positions the hospitals for continued improvement in care and asset management
BRINGING SMART TECHNOLOGY TO LONDON’S M25 MOTORWAY

In the early 2000s, congestion on London’s M25 motorway routinely brought traffic to a standstill. The U.K. Highways Agency determined that additional lanes and smart technologies were needed, but the global financial crisis of 2008 made it exceedingly difficult to obtain financing. A public-private partnership brought creative solutions to life.

CHALLENGE

The M25 is a heavily trafficked orbital roadway around London and the second-longest ring road in Europe. It covers 117 miles and has 1,800 structures, including bridges, gantries and tunnels. Approximately 200,000 vehicles, or 15 percent of the traffic on U.K. motorways, use the M25 daily. Because nearly 20 percent of the United Kingdom’s road freight passes through southeastern England, the M25 is essential to the nation’s supply chain.

By 2008, transportation planners were concerned about projected double-digit traffic growth and an anticipated traffic spike during the London 2012 Olympic Games. Widening the motorway and improving operations had become essential. Unfortunately, the launch of the project’s financing competition coincided with the collapse of world financial markets in September 2008.

SOLUTION

The Highways Agency granted a 30-year concession to Connect Plus in May 2009. The contract involved widening 37 miles of the M25 to four lanes, converting an additional 28 miles into a smart motorway, and refurbishing the three-quarter-mile A1(M) Hatfield Tunnel.

The PPP also includes an operation and maintenance agreement that runs through September 2019. During this time, Connect Plus will operate and maintain the entire 117-mile motorway, the “stubs and tails” that connect to London and its two busy airports, and all 1,800 structures on the M25.

To offset the increased financial risk faced by banks during the recession, the U.K. Department of Transportation (of which the Highways Agency is a part) publicly committed up to £500 million in project backing. Later, it developed a rebate mechanism that provided additional security to its lenders, while also preventing the selected bidder from generating excessive profits.

Ultimately, financing was secured from a group of 16 banks, the EIB and shareholder equity.

RESULTS

Commuters, tourists and freight drivers traveling around London now benefit from reduced congestion, fewer delays and increased safety. Toll plazas and cash collection have been eliminated at the Dartford Crossing, a busy bridge and tunnel structure at the River Thames. Sensors were added throughout the system to monitor traffic flow, including on both private and non-privatized feeder roads. As traffic approaches the M25, it can be metered for flow, speed and tolls.

The M25 project is one of the United Kingdom’s largest and most successful public-private partnerships. In 2009, it was named European Public-Private Partnership Deal of the Year by Project Finance International.

4 P’S, DELIVERED

People: Improved safety and shortened travel times
Profit: Named European Public-Private Partnership Deal of the Year in 2009
Planet: Decreased fuel consumption and CO₂ emissions by reducing congestion
Purpose: Supports London’s growth and economy
CONNECTING FIRST NATIONS COMMUNITIES TO THE ELECTRICAL GRID IN CANADA

For years, First Nations communities in Ontario, Canada, relied on costly and environmentally unfriendly diesel generators to power their homes, businesses and schools. A public-private partnership between Five Nations Energy Inc. (FNEI) and Hydro One Networks Inc. (HONI) built a 115-kV transmission line to connect three previously isolated communities to the electrical grid.

CHALLENGE

Three indigenous First Nations communities on the shore of James Bay were dependent on diesel generators for power, because connecting to the grid would require building transmission lines through 270 km of muskeg, or swamp. Each year, about 1.1 million gallons of diesel fuel had to be transported to the remote community. This was expensive, and spills were common. Many of the diesel generators were unreliable, leading to frequent power outages.

To reduce outages, support growth and eliminate the environmental impacts of transporting and burning diesel fuel, FNEI, the only First Nations-owned electricity transmission company in Canada, sought an affordable way to connect the James Bay communities to the electrical grid.

SOLUTION

In 1997, it was determined that a 270-km, 115-kV transmission line and several substations were needed and feasible. However, financing would be a challenge for the newly incorporated FNEI. To address a shortfall of 13 million Canadian dollars, FNEI formed a public-private partnership with Hydro One Networks, the largest electricity and distribution company in Ontario.

HONI has a stated mission of developing respectful and positive relationships with indigenous peoples. It was willing to help FNEI secure financing, despite economic circumstances that other private entities might have found prohibitive. Through the sale of a variety of assets to HONI, FNEI raised 11 million Canadian dollars. It also borrowed, and has since repaid, 2 million Canadian dollars from SNC Lavalin, the engineering firm that constructed the transmission line.

FNEI was required to self-insure the transmission assets for 5 million Canadian dollars. HONI agreed to cover losses up to that amount until FNEI was able to build its financial reserves. HONI also formed an operations and maintenance agreement with FNEI to satisfy demands from regulators and lenders that the system be protected.

RESULTS

Clearing for the transmission right-of-way began in early 2000. The line was activated and two communities, Fort Albany and Kashechewan, were connected in the fall of 2001. Construction of the remaining section was completed in March 2002, and Attawapiskat was connected the following year. It is estimated that the new transmission line will save provincial and residential governments at least 150 million Canadian dollars over its lifetime.

Today, the First Nations communities on James Bay have access to reliable, affordable electrical power. The air is cleaner, greater economic development is possible, and the overall quality of life has been improved. In addition, the project serves as a valuable model for other First Nations communities seeking connection to the grid.

4 P’S, DELIVERED

People: Respectful and positive relationships with the indigenous people
Profit: 150 million Canadian dollars in savings over the project lifetime
Planet: 1.1 million gallons of diesel fuel transport and usage eliminated
Purpose: Cleaner air and improved quality of life for indigenous First Nations
TRANSMITTING ELECTRICITY OVER LONG DISTANCES IN MEXICO

Wind farms in sparsely populated Oaxaca generate ample energy for the much larger population of central Mexico, but existing transmission lines lack capacity to deliver the necessary power. Recent regulatory reform is paving the way for PPPs to address this need.

CHALLENGE

Since 2006, the state of Oaxaca has invested heavily in wind farms. Its wind zone, or La Ventosa, now contains 28 of Mexico’s 35 operating wind farms and has an aggregate generating capacity of 2,360 MW. This represents 81 percent of the nation’s wind power, yet Oaxaca is home to only 3.5 percent of consumers.

There is an urgent need to transmit much of this power to the nearly 25 percent of consumers who live in central Mexico. However, Oaxaca’s wind generation capacity far exceeds the available transmission capacity. This shortfall has been apparent for some time, but strict government control of the nation’s transmission infrastructure has hampered development of much-needed transmission line infrastructure.

SOLUTION

Electricity transmission infrastructure traditionally has been developed by the Mexican Federal Electricity Commission (CFE), either through public works agreements under federal procurement laws or through financed public works agreements. When private entities built transmission assets, they were operated by CFE or another public entity.

This began to change in December 2013, when the Mexican Federal Constitution was amended to allow private entities to participate directly in all aspects of power generation, supply and trade. This movement, known as Mexican Energy Reform, has made it possible for CFE to partner with private entities on public infrastructure projects, even to the extent of attracting new domestic and international business interest.

RESULTS

In late 2016, CFE published tender guidelines for the nation’s first HVDC transmission line project. The project includes construction and operation of a 600-km, 500-kV transmission line with capacity of 3,000 MW to efficiently carry power from Oaxaca to Mexico City. This is the first public-private partnership of its kind under Mexican Energy Reform.

The PPP will involve two distinct arrangements. A $1.2 billion agreement to build, operate and transfer assets (BOT) will allow the private partners to finance, build, maintain, operate and upgrade the assets. Wheeling capacity will then be transferred to CFE.

A second $500 million build, lease and transfer (BLS) agreement will govern construction of AC transmission lines below 69-kV that pass through transformers. Under this arrangement, the assets will be owned by a trust until the initial investment has been recouped. At that point, CFE will acquire ownership of the assets, but the trust will continue to operate and maintain them throughout the 25-year term of the agreement.

4 P’S, DELIVERED

People: Expands opportunities for good jobs in Oaxaca
Profit: Includes a 25-year contract for operations and maintenance
Planet: Brings rich renewable resources to load
Purpose: Reforms Mexico’s energy and business interests
CONCLUSION
Every four years, the American Society of Civil Engineers (ASCE) grades American infrastructure in terms of its physical condition and needed financial investment. Its most recent evaluation, the 2017 Infrastructure Report Card, gives the United States a D+. Other developed nations with aging infrastructure face similar challenges. At the same time, the basic needs of more than 1 billion people around the world remain unmet.

In the near future, the United States is planning to spend more than $1 trillion to address identified shortcomings across the entire infrastructure spectrum — from aviation, ports, roads and railways to energy, water and wastewater management. Public-private partnerships will offer unique solutions to the infrastructure challenges of the developed world. They also can be used to build out the clean water, sanitation and electricity infrastructure needed in newly industrialized and emerging nations.

By bringing 21st-century technologies to bear on the world’s most pressing infrastructure challenges, engineers and investors can improve the future health and welfare of billions, while laying the foundation for the smart cities of the future.

Yet before this can become a reality, further exploration is necessary to define a repeatable PPP process, identify the organizational changes that will accommodate concurrent PPPs, and make sure that PPPs consistently deliver the greatest value for their many stakeholders.

In addition, an effective approach is required for midsized projects. This will open PPP participation to a greater number of organizations, which will in turn foster creativity in infrastructure design and development worldwide.

BIOGRAPHIES
MIKE BEEHLER, PE, a vice president at Burns & McDonnell, has written and presented extensively on the subjects of security, reliability-centered maintenance, program management and the smart grid. More recently, he has written, presented and consulted on industry megatrends, advanced technologies and smart cities. Mike has a Bachelor of Science in civil engineering from the University of Arizona and a Master of Business Administration degree from the University of Phoenix. He is a registered professional engineer in eight states, a member of IEEE and CIGRE, and a Fellow in the American Society of Civil Engineers.

JEFF CASEY, MIET, business development director for Burns & McDonnell in the United Kingdom, has been responsible for helping clients deliver more than $16 billion in energy projects over the past decade. He relies on his experience as an engineer and project manager to develop innovative and cost-effective solutions to his client’s unique challenges. Jeff has a Bachelor of Science in electrical engineering from the University of Nebraska and is pursuing a Master of Business Administration degree from New York University. He is an active member of IEEE, CIGRE and the IET.