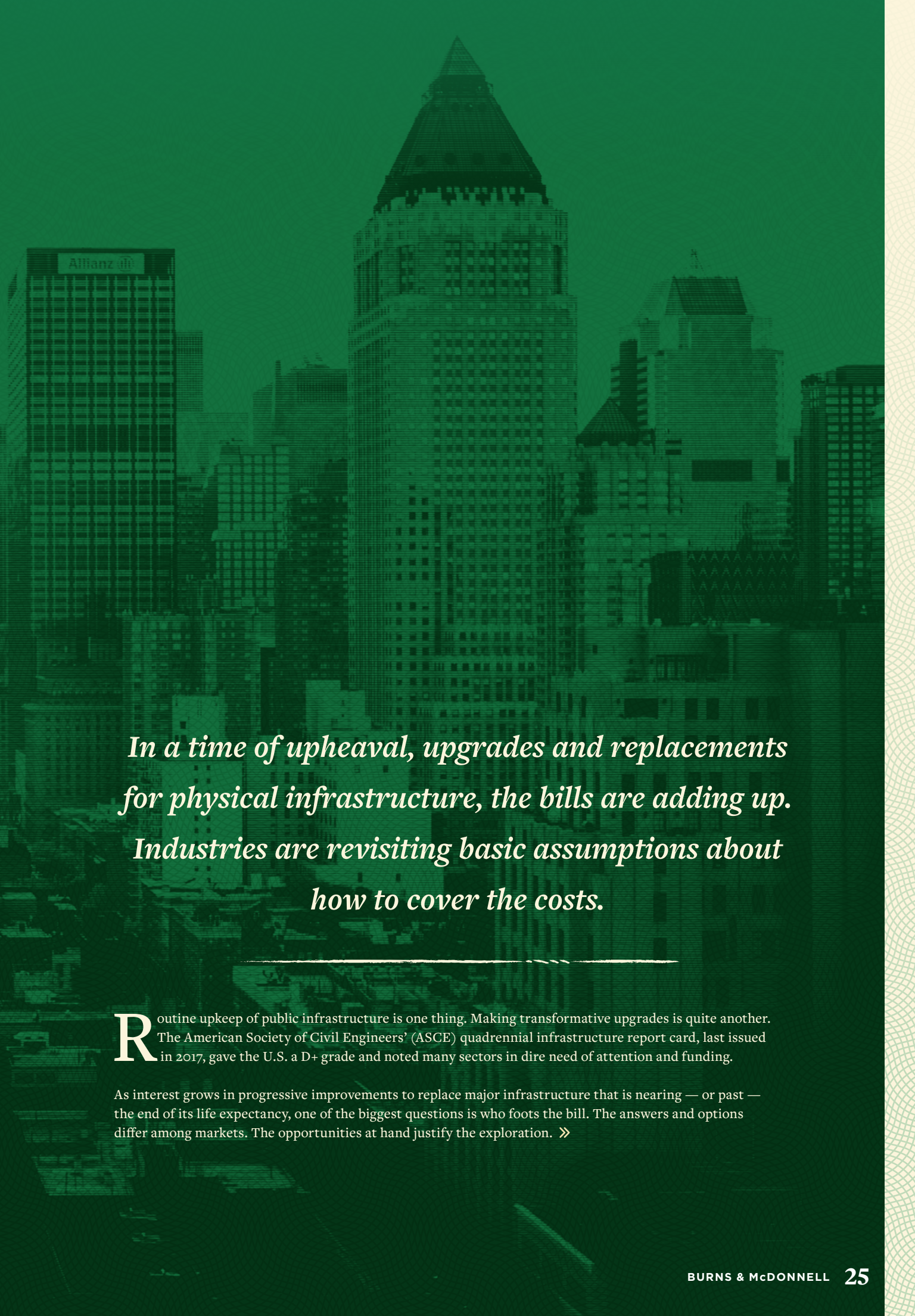




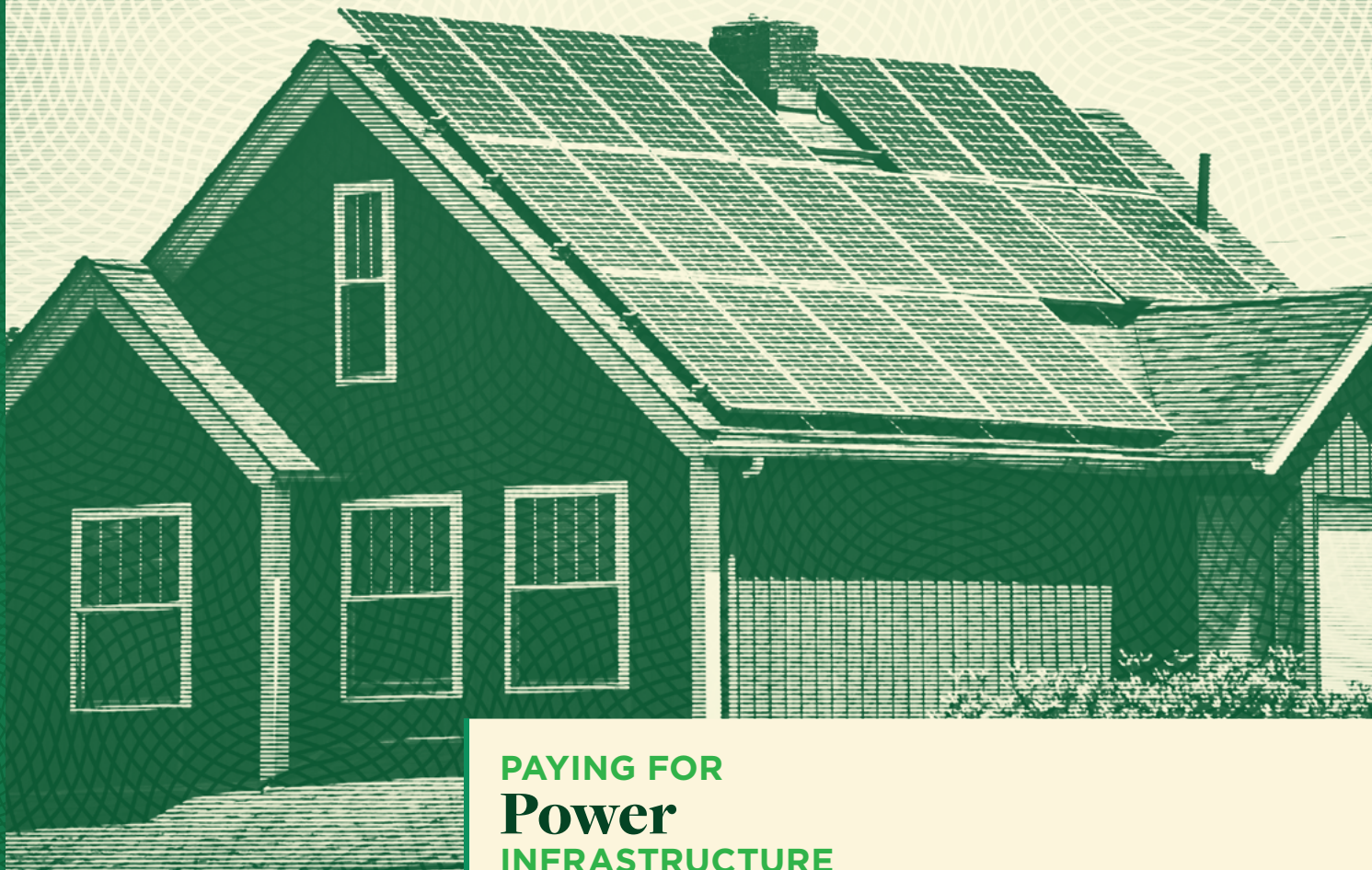
ARE YOU PAYING ATTENTION?



*In a time of upheaval, upgrades and replacements
for physical infrastructure, the bills are adding up.
Industries are revisiting basic assumptions about
how to cover the costs.*

Routine upkeep of public infrastructure is one thing. Making transformative upgrades is quite another. The American Society of Civil Engineers' (ASCE) quadrennial infrastructure report card, last issued in 2017, gave the U.S. a D+ grade and noted many sectors in dire need of attention and funding.

As interest grows in progressive improvements to replace major infrastructure that is nearing — or past — the end of its life expectancy, one of the biggest questions is who foots the bill. The answers and options differ among markets. The opportunities at hand justify the exploration. »



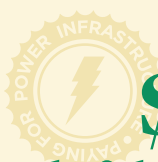
PAYING FOR Power INFRASTRUCTURE

The power industry is amid sweeping changes, both in the portfolio of sources of generation and in how that energy is delivered to customers. Everyone from municipal utilities and cooperatives to investor-owned utilities is investing in large-scale replacement and upgrades of outdated infrastructure.

Those investments — in repowering old power plants; building newer and more efficient plants; integrating ever-greater amounts of renewable power; upgrading the transmission and distribution grid for greater resilience and security; and integrating newer technologies to enhance operations and maintenance — all require significant funding. Customers want reliable power but understandably get leery when someone starts looking at their monthly energy bill.

“I’m not sure anybody knows what fair is,” says Doug Houseman, a principal consultant at 1898 & Co., a business, technology and security solutions consultancy, part of Burns & McDonnell. “Most people will cast fair in terms of what gives them personally the lowest cost.”

The reality is that energy rates reflect more than a century of ongoing subsidies and carveouts to promote specific technologies, encourage business, reduce carbon usage and promote other interests. To set a new structure for who pays, one would need to revisit the root causes of expenses as a basis to build a rate or tariff that captures those costs and bills the customers.



**\$177
billion**

*Estimated investment
gap for electricity
generation and delivery
between 2016 and 2025*

*Source: ASCE 2017 Infrastructure
Report Card*

"I don't care if it's vehicles on roads, water use or wastewater treatment, or electricity and electric vehicles," Houseman says. "Most people aren't willing to take a clean sheet of paper and sort through all the things that actually create cost to figure out what behaviors cause those costs. It would throw away 100 to 200 years of subsidizing behaviors and technologies."

As a practical matter, power providers are recovering some of their necessary incremental expenses as a rate rider — a limited-term charge on the bill that makes it clear and measurable where that money is going — rather than as an adjustment to the base rate, according to Adam Young, director of financial analysis and rate design at 1898 & Co.

"Municipals and cooperatives are having a very difficult time getting rate changes through commissions and boards," Young says. "A lot of utilities are passing cost increases through in the form of a rider."

Meanwhile, there has been some evolution in rate design structures, moving away from traditional energy-based charges.

"The biggest change in the industry now from a rate structure standpoint is the implementation of demand rates and time-of-use energy rates to more fairly recover costs from distributed generation customers," Young says.

The intent of rate changes is to eliminate existing subsidies that are becoming a burgeoning issue with many utilities. One example is addressing solar customers.

"Current rates are volumetric. Say a customer puts a solar panel on their house and they generate and use 1,000 kilowatt-hours. They could virtually wipe out their entire bill," Young says. "The solar customers are being subsidized by the other customers. Maybe 80% of the infrastructure costs are still there, but now the revenue is gone while the utility still has to back up that solar power."

Solar homes might overproduce when the sun is shining and send energy out to the grid in order to pull it back later, which means those customers are treating the grid as if it's a free storage system.

"When you change the rates, the economic viability of the distributed solar project is diminished — the customers are only getting compensation for those costs they're truly saving the utility. That's to the

benefit of customers who don't have solar panels," Young says.

Different parts of the United States — and different parts of the world — will have different approaches to how to rebalance rates to recover expenses in a more equitable manner.

"Up to 50% of the electricity from generators in parts of India is stolen before it hits the meter, so what you can do in an environment where half of the power is stolen before it's paid for is very different from what you can do in, say, California," Houseman says.

Regulators in some states in the southeastern U.S. are reticent to do anything that will raise rates for residential customers because those states are trying to attract and retain jobs, Houseman says. Whereas in San Diego, California, in order to encourage certain behaviors, time-of-use rates mean a kilowatt-hour might cost 20 cents from 10 a.m. to 4 p.m., then triple to 60 cents from 4-10 p.m., and drop back to 40 cents overnight.



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burnsmcd.com/ImpactStudies

"Different regulators, different environments, different rules and reactions — it's going to come down to not so much what's technically possible but who's in charge and what behaviors they want to subsidize and encourage or discourage," Houseman says.

Consultants like 1898 & Co. are helping power providers make the most of the revenues at hand, integrating resource planning results with rate planning, Young says. Analyses of optimal solutions need to take into consideration how they will impact the utility's financials and the customers' rates.

"For one municipal client, we recently completed an integrated resource plan looking at reducing their overall power supply cost," Young says. "We looked at different types of technologies to reduce power plant costs and wholesale costs, such that it could create savings that could be passed along to customers. If we save millions in power supply costs, it gives the utility the opportunity to either cut rates or use those dollars to pay for needed capital projects." »



PAYING FOR Water INFRASTRUCTURE

Much of America's water pipeline networks was constructed in the post-World War II boom years, and the time for replacement is looming.

There are tens of thousands of water systems scattered across the country. According to the American Water Works Association, the vast majority of those systems serve communities with fewer than 3,300 people. Those communities will struggle to afford the expense of replacing an asset constructed over decades.

"One of the really hot topics in the municipal water and sewer industry is whether utilities are adequately renewing or replacing their infrastructure, particularly underground," says David Naumann, a senior project manager specializing in financial management consulting for water systems at 1898 & Co. "Those assets, the piping systems primarily are harder to inspect and easier to ignore, and that's been a problem for a long time."

There is relatively little federal funding for water infrastructure improvements, which are primarily funded at the local level. The Clean Water Act was a major source of federal funding in the 1970s that helped build many of the large wastewater treatment plants currently in operation in the U.S., but that successful program has not been repeated.

The majority of ongoing funding is traditionally provided through user fees, while larger capital improvements often rely on some form of debt issuance. Patrick Clifford, water practice lead for the Upper Midwest at Burns & McDonnell, says the most successful funding mechanism typically used is state revolving fund (SRF) loans.



**\$1
trillion**

*Projected investment
needs for buried
drinking water
infrastructure in the
U.S. from 2011-35*

*Source: "Buried No Longer:
Confronting America's Water
Infrastructure Challenge,"
American Water Works Association*

"The challenge is now, how do I package my low-interest-rate loan with other revenue sources to provide the most impact without placing undue burden on my rate base," he says.

Another indirect factor in the funding challenge is the rise in water conservation efforts across North America.

"Across the board you're seeing our clients' water demand going down, which from an environmental standpoint might look like a good thing," Clifford says. "The problem for a municipal water system is, as demand goes down, so does your revenue.

"If you used to sell 10 million gallons a day, and now you're doing 7 million gallons a day, your revenues are down 30%. You go to any major city and they're seeing that, and they're starting to rebudget their enterprise around lower revenues."

In an industry where funding is often tight or even declining, prioritization takes on great weight. Having a robust asset management system helps prioritize necessary improvements when less money is available.

"A lot of communities might argue they can't afford to spend, say, \$1 million a year on a thorough asset management program," Clifford says. "But if you're going to spend \$50 million on your capital program this year, it makes sense to spend \$1 million so that you would know how to better target that \$50 million investment."

As water systems face hard choices while developing their capital plans, Naumann says, an increasing number are marrying rate studies with their condition assessments and renewal and replacement programs to see that cost recovery is taken into consideration.

For one recent client, Burns & McDonnell went through the municipality's geographic information system data and helped design a method for prioritizing renewal and replacement by segments of pipe, Naumann says: "We looked at different ways to phase in funding over time to address their pain points and deal with the most problematic segments first."

Rate studies help communities understand the impact of renewal and replacement work as it translates into rates.

"We see water and sewer rates increasing about 5-6% a year nationally, better than double the consumer price index," Naumann says. "It's an interesting dynamic, with pricing pressure that's rapidly exceeding the rate of increase for inflation, and it's still not enough to adequately fund underground infrastructure renewal and replacement."

CONSIDER Collaboration

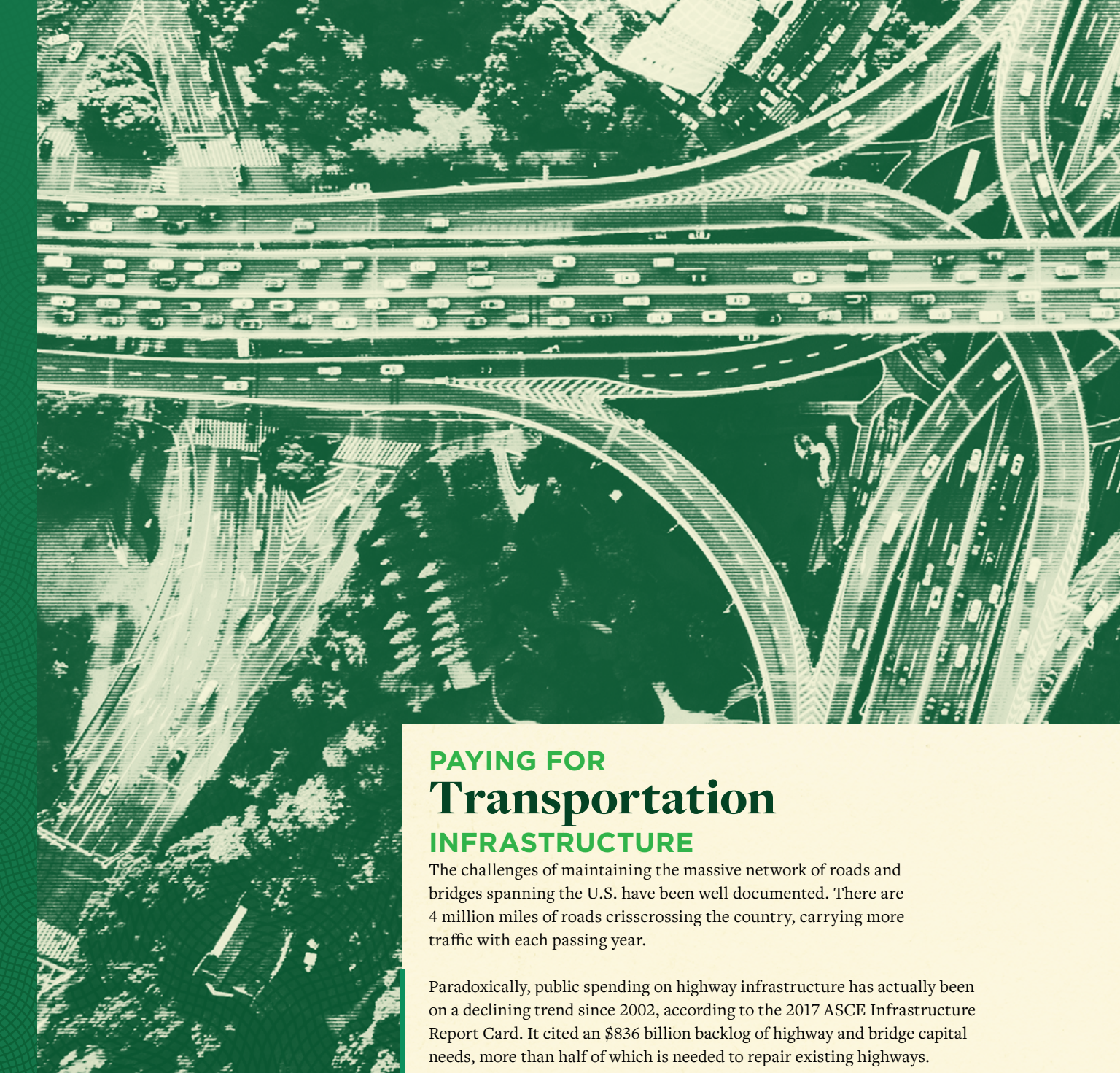
The U.S. water industry has struggled in the aftermath of the 2008 recession, when municipalities had to cut back on spending significantly, according to Patrick Clifford, water practice lead for the Upper Midwest at Burns & McDonnell. One option to make more efficient use of available funding is to use collaborative project delivery techniques like design-build to implement capital spending faster and more efficiently than more traditional municipal utility approaches. Clifford cautions that in many states, the terms of state revolving fund loans prohibit design-build solutions, although more states are revisiting that option and changing terms to allow it.

For the ratepayer, that typically manifests itself in higher bills. With water revenues in many cases going down through conservation while infrastructure needs continue to grow, the only way to cover the cost is to increase rates, Clifford says. Compounding the issue, wastewater bills are typically based on water consumption, so declining water usage affects both utilities.

"If you're a publicly run water/wastewater utility and your rates are continuously going up, your constituents are not going to be happy," Clifford says. "But if you have a robust asset management plan and documentation as to why and how you're making decisions, it's going to better support the funding request."

Some water systems are implementing smart metering and similar technologies in an effort to better track usage and detect leaks more quickly, which should save money over the long term. But the practical payback is not yet substantial, Naumann says.

"Instead of the electric grid's metering of time of use in a day, in the water industry it's more a matter of measuring usage in a month," he says. "While you can sometimes detect problems in somebody's house with smart metering that's pinging you every 15 minutes, peak costs are typically recovered through monthly rate structures." »



PAYING FOR Transportation INFRASTRUCTURE

The challenges of maintaining the massive network of roads and bridges spanning the U.S. have been well documented. There are 4 million miles of roads crisscrossing the country, carrying more traffic with each passing year.

Paradoxically, public spending on highway infrastructure has actually been on a declining trend since 2002, according to the 2017 ASCE Infrastructure Report Card. It cited an \$836 billion backlog of highway and bridge capital needs, more than half of which is needed to repair existing highways.

Overburdened and underfunded roads and bridges are an undeniable and growing safety risk.

“Most people don’t think about something until it doesn’t work,” says Meghan Jansen, a leader in the planning and policy group at Burns & McDonnell. “As long as we’re able to drive and we’re relatively happy with the condition of our roads and bridges and we can’t see any problems, it’s not really an eminent concern. One of the challenges is education around this issue and increasing awareness so people will want to invest their time to explore solutions.”

Much of the funding for repairs, replacements and improvements comes from gasoline taxes, which were last raised at the federal level in 1994.

“The needs keep growing and the funding is not increasing,” Jansen says. “It is a challenge for elected officials and decision-makers to help people see that what we’re doing is not enough, and we’re going to have to make some hard choices.”



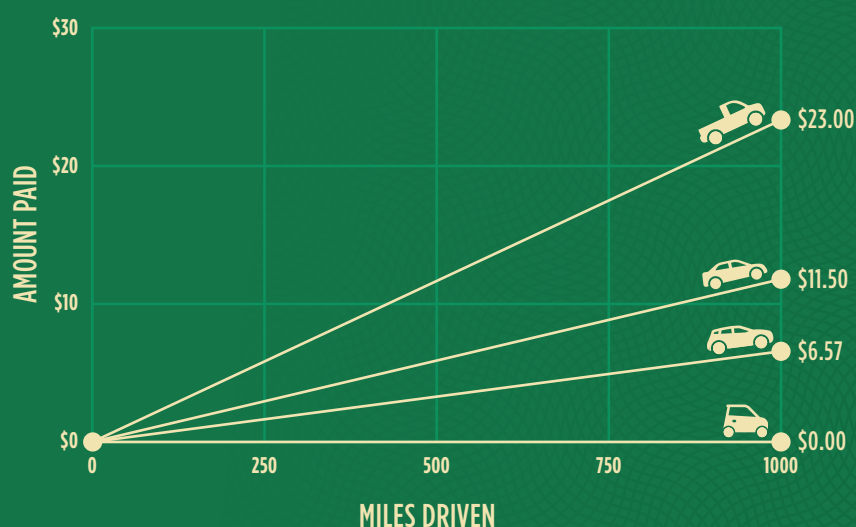
**\$836
billion**

*Backlog of highway
and bridge
capital needs*

*Source: ASCE 2017 Infrastructure
Report Card*



FUEL TAX PAID (AVERAGE MONTHLY)



LOW EFFICIENCY
5-15 MPG



AVERAGE EFFICIENCY
15-25 MPG



HIGH-EFFICIENCY HYBRID
25-45 MPG



ELECTRIC >45 MPG
EQUIVALENT
(GASOLINE NOT NEEDED)

Source: U.S. Environmental Protection Agency, Fuel Economy Trends Report

The introduction of autonomous vehicles (AVs) and rapidly expanding use of electric vehicles (EVs) are forcing reconsideration of some of the basic assumptions behind paying for transportation work, says Bobby Cottam, an industry leader and doctoral candidate focused on vehicle technologies at Burns & McDonnell.

“Back when everyone’s car was roughly the same fuel efficiency, a gas tax was a pretty direct measure of how much you use the road,” Cottam says. But fuel efficiencies are now wildly varied amid increasing efficiency standards. Meanwhile, the use of electric vehicles is surging.

“Some people think the gas tax isn’t so bad if we had just been updating it more,” Cottam says. “Maybe if we charged a tax on the electricity used to power EVs, there would be no paradigm shift. That’s one idea that’s been thrown around.”

AVs pose different challenges, depending to some degree on how they are deployed. Cottam

says the industry is generally working under the assumption that the federal government is not going to mandate specific vehicle or infrastructure improvements. However, the potential for many advanced safety and traffic efficiencies might depend upon significant infrastructure upgrades in terms of roadway configuration, connectivity and superfast wireless networks.

“Fundamentally, the most valuable resource departments of transportation have is their right-of-way,” Cottam says. “If somebody needs to put power lines along that road, that’s probably going to be in the right-of-way, and that offers the potential for some funding sources. Say you want 5G internet to support connected vehicles, but you need to put a tower up every so often; the DOT might consider putting that technology on its streetlights for a fee.

“Without a lot of direct funding outside of taxes, you can think about interesting ways to incorporate those right-of-way assets. They don’t want to just sell off the right-of-way because the roads are still a public good

that needs to be maintained, but they also might like to monetize it to fund upgrades so that taxpayers don't have to bear all of the costs directly."

Finding new ways to measure road usage is going to be essential for better connecting the impact that individuals are having on the transportation system with how they pay for the benefit.

Along the East Coast of the U.S., the I-95 Corridor Coalition is conducting the second phase of a study of mileage-based user fees (MBUFs). Burns & McDonnell is helping the coalition perform this study, which involves putting a piece of technology into vehicles to track the miles driven.

"In addition to having a device and recording mileage, the folks we're engaging through this pilot every month receive a sample invoice that explains what you would have paid in gas, based on the current gas tax, and what you would have paid under a mileage-based user fee," Jansen says. "Throughout this process, we are surveying the pilot users and having conversations around their perceptions of the MBUF and what challenges and benefits they see."

The primary purposes of the MBUF study are to test feasibility and identify drawbacks and challenges. One of the clearest challenges to date is public education.

"We expect to turn on the faucet and have clean drinking water, or that when we drive over a bridge it's going to be safe and in good condition, or that if I flip a switch, my light's going to come on," Jansen says.

"A lot goes on before it reaches the end user, who just wants it to work. I think where we're talking about funding mechanisms that would affect the end user who pays them — such as the gas tax paying into infrastructure — the user perception becomes an important piece in determining which funding solutions are going to be effective and implementable." ●