

***America 3.0:* A Pathway to the Next Generation, Interconnected Infrastructure**

November 18, 2021

Rob Wilhite

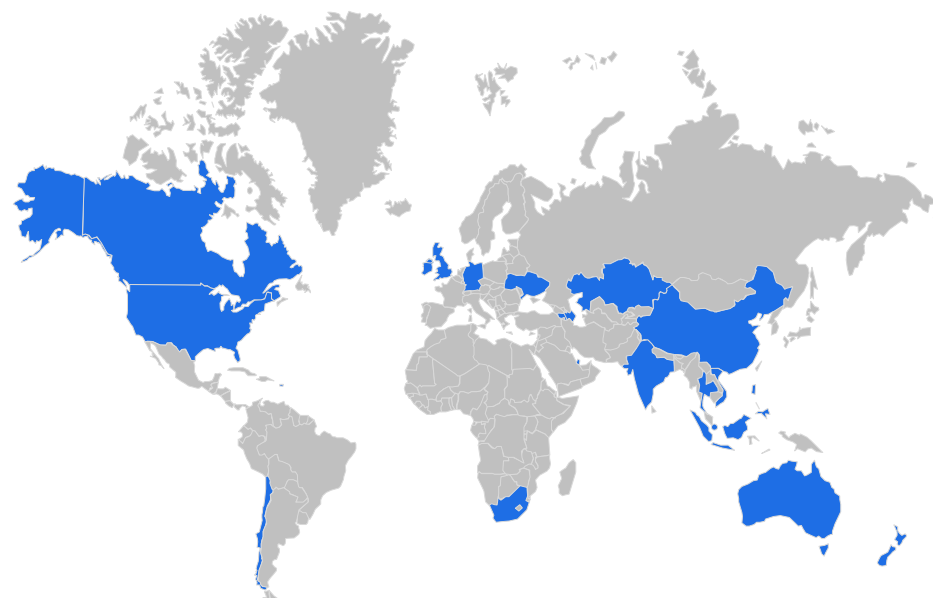
Senior Vice President and Managing Director
Global Distributed Energy
Black & Veatch



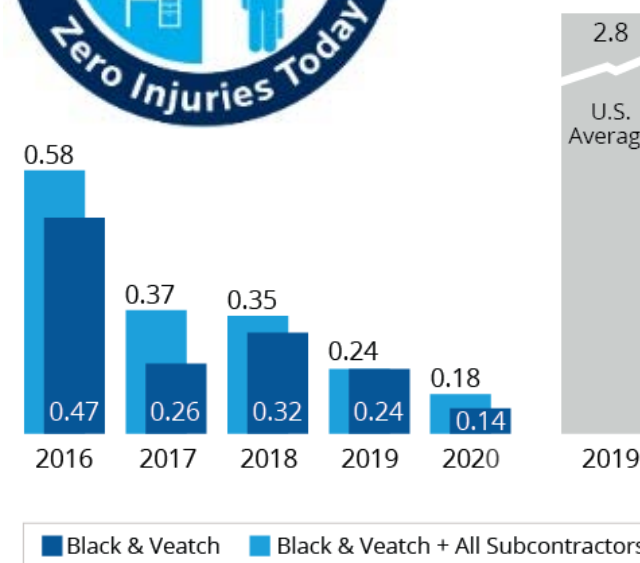
Since 1915, We Provide Clean, Reliable, and Resilient Infrastructure to Utility, Telecom, and Commercial Customers Worldwide



CEO **ACT!ON** FOR
 DIVERSITY & INCLUSION



- 8,300+ professionals
- \$3.0 billion in 2020 revenue
- Work in 100+ countries on six continents
- Consistently high industry rankings in Power, Telecom, Water, and more



Everybody returns home safely each day

Black & Veatch – Experience Highlights

- 1,500+ Electric Vehicle Charging Sites Deployed
- 105 MWh+ Behind-the-Meter Battery Energy Storage Installations
- 1,000+ Rooftop Installations, 19,000 MW of Solar PV experience
- 8,000 MW+ of CHP Experience
- 75+ Microgrids from 200 kW to > 25 MW

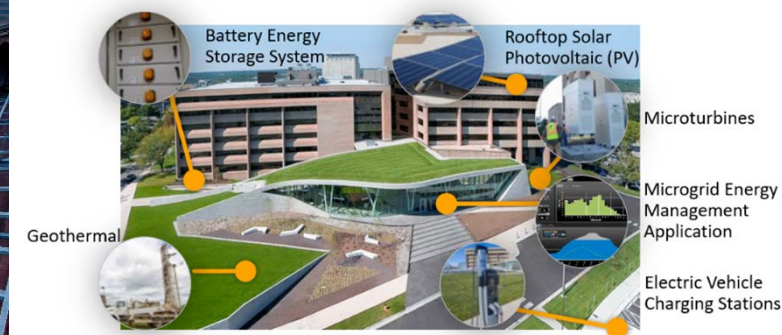
High-Powered Vehicle Charging



Battery Energy Storage Systems



Rooftop Solar Installations

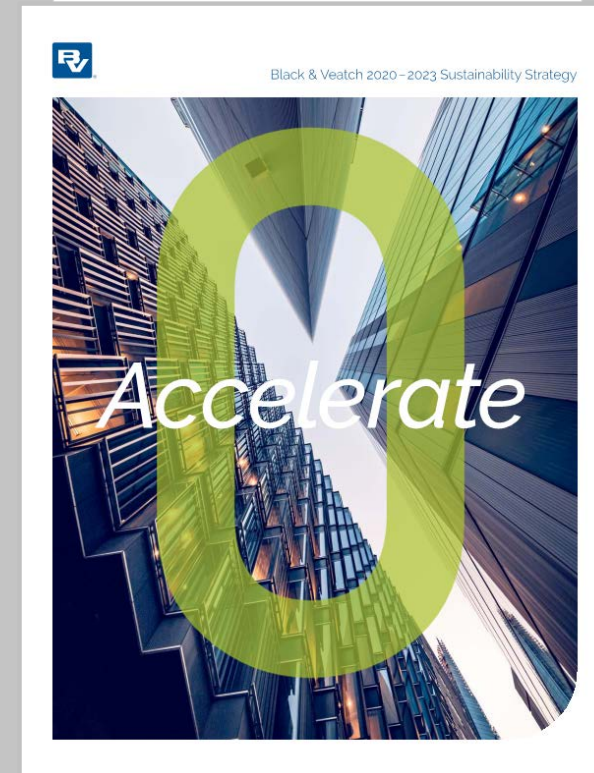


Resilient Microgrids

Advancing Sustainability

Black & Veatch Announces 2025 Net Zero Goal as Part of Sustainability Pledges

- Managing the company's carbon footprint and achieving net zero emissions for overall greenhouse gas emissions by 2025
- Gauging the company's water footprint and helping clients meet their own sustainable water use objectives
- Incorporating sustainability principles into all project execution manuals



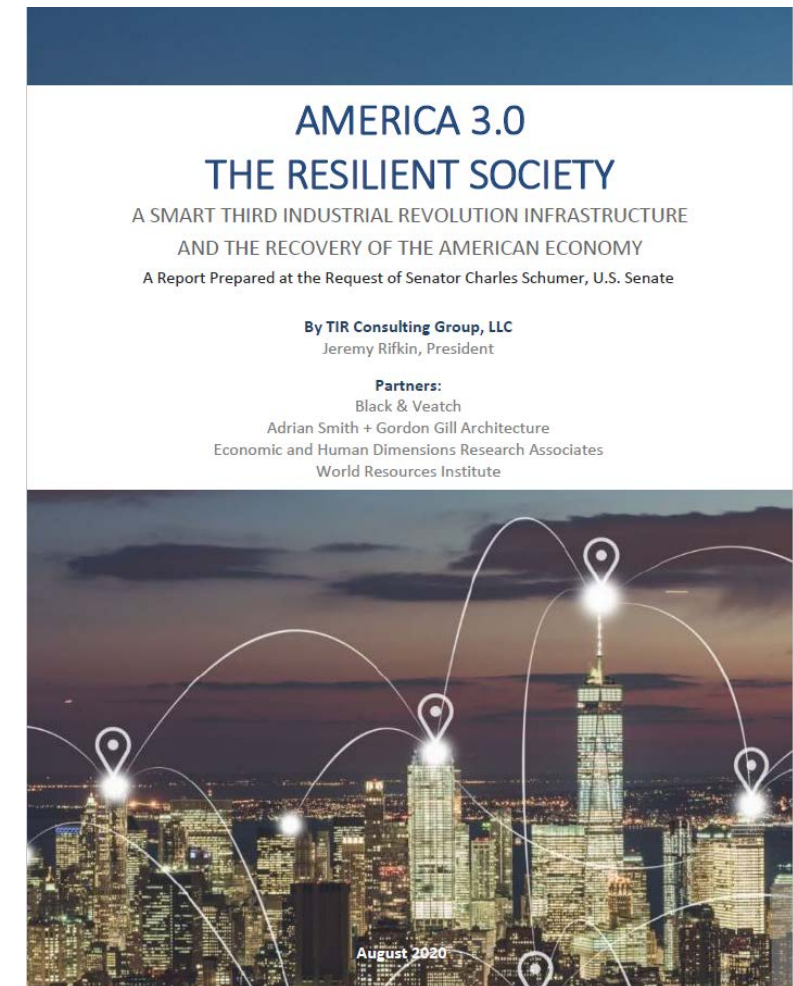
Black & Veatch's commitment to sustainability is embedded throughout our company and underpinned by our 2020 - 2023 Sustainability Strategy.

This guides how we assess our progress towards our many social, environmental, and governance responsibilities and commitments.

Summer 2020: A Team of Industry Thought Leaders Crafted a Vision to Guide Resilient Investments for America's Next Generation

As a Contributing Partner, Black & Veatch Developed Innovative Plans for Four Critical Energy and Telecommunications Infrastructure Components:

- **Continental Electricity Internet** - underground cable, high-voltage direct current (HVDC) nationwide electricity network
- **Microgrids and Distributed Energy Resources** - notion of microgrids as a cleaner and more resilient source of electric power, bringing power generation closer to its point of consumption
- **National Broadband Telecommunications Network** - manage and control the flow of electricity and to support demands for reliability and efficiency
- **Advanced Mobility** - transform from high dependence on fossil fuels to an electricity and, possibly, hydrogen-fueled network of vehicles



Road-mapping the Continental Electricity Internet (CEI) to Support a More Resilient and Clean Energy Power Network

- The 22k mile-long, CEI will be developed in four, five-year phases using underground High-Voltage Direct Current (HVDC) transmission cables
- The 47k miles of Interstate highway system, along with approximately 140k miles of rail corridors, offer ready-made Right-Of-Ways
- Install in parallel with the National Broadband Telecommunications Network to reduce total infrastructure costs and disruptions



U.S. HVDC Continental Grid Full Deployment (2040)

High-Level, Capital and Operational Investments in CEI Infrastructure (\$B, Cumulative)

HVDC	2021-2025	2026-2030	2031-2035	2036-2040	20-YEAR TOTAL
Phase 1	\$50.6	\$0.2	\$0.2	\$0.2	\$51.2
Phase 2	N/A	\$107.7	\$0.3	\$0.4	\$108.4
Phase 3	N/A	N/A	\$98.7	\$0.3	\$99.0
Phase 4	N/A	N/A	N/A	\$118.6	\$118.6
HVDC Total	\$50.6	\$107.9	\$99.2	\$119.5	\$377.2

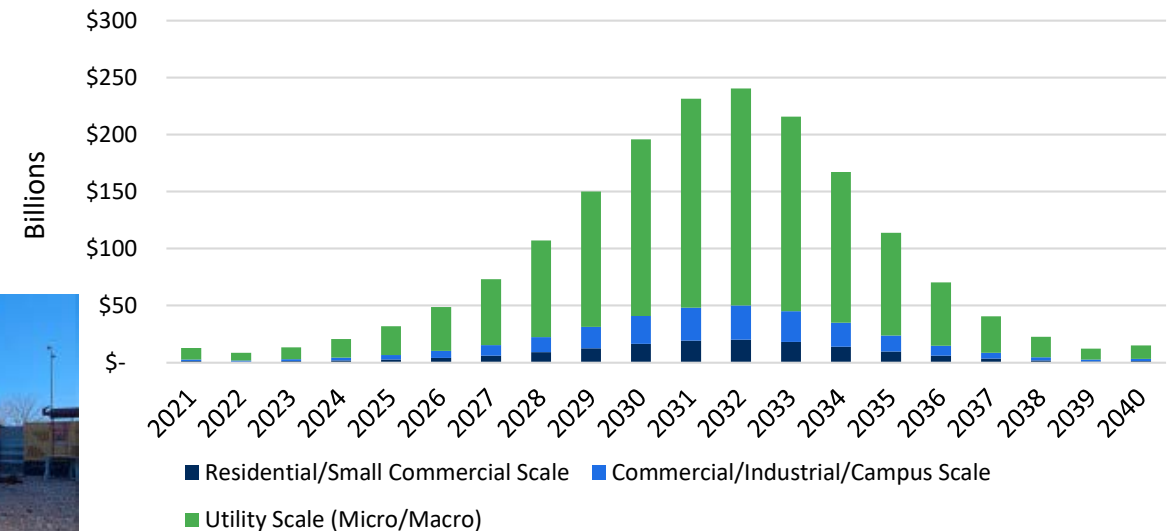
Notes: High-level cost estimates in current 2020 U.S. dollars. Assumes sufficient supply chain availability and continued cost learning curves. No additional assumptions made relative to equipment life expectancy (affecting capital replacement costs), improved designs and construction methods, nor to any increased efficiencies or benefit streams to offset these estimates.

Microgrids and Distributed Energy Resources Enable Greater Control and Access to Clean, Reliable, and Resilient Electricity Supply

- Microgrids integrate distributed power generation technologies that can operate in parallel with the electric grid, or as an island apart from the grid
- Microgrids will provide more resilient, directly controllable, clean energy sources for residential and commercial enterprises
- Total microgrid capacity would be distributed as follows:
 - Residential = 20% of total capacity (approx. 74M microgrids)
 - Commercial/Industrial = 30% of total (90k microgrids)
 - Utility-scale = 50% of total (12k micro/macrogrids)



Microgrids - Estimated Capital Buildout Costs



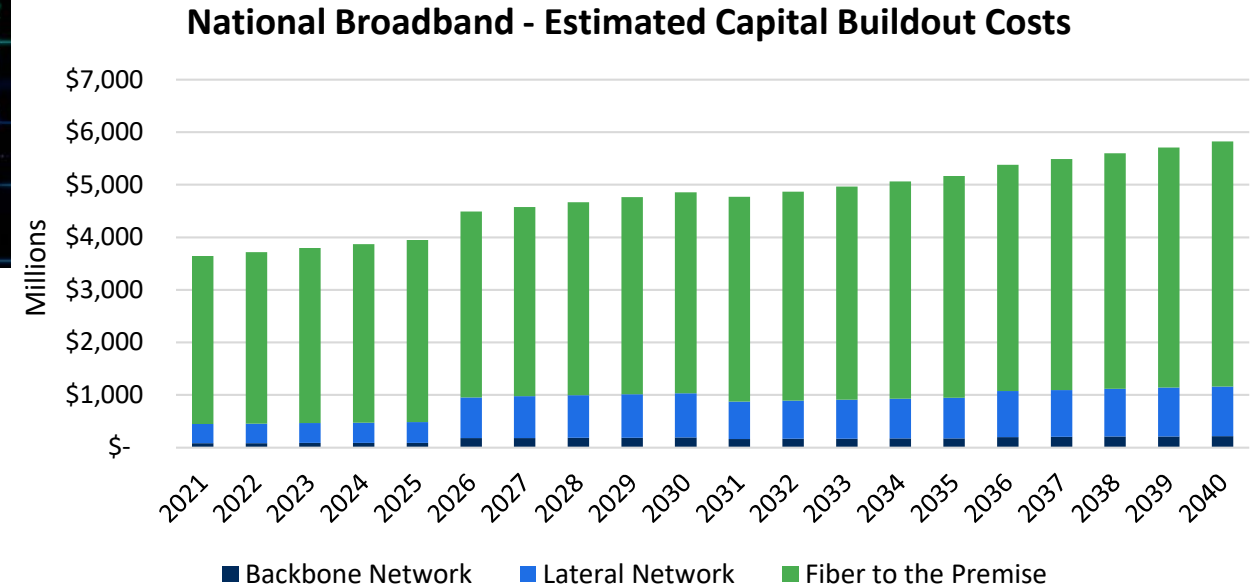
High-Level, Capital and Operational Investments in Microgrid Infrastructure (\$B, Cumulative)

Microgrids	2021-2025	2026-2030	2031-2035	2036-2040	20-YEAR TOTAL
Residential/ Small Commercial Scale	\$7.6	\$51.1	\$92.8	\$29.7	\$181.1
Commercial/ Industrial/ Campus Scale	\$22.2	\$103.3	\$172.2	\$91.0	\$388.7
Utility-Scale (Micro-/Macrogrids)	\$72.2	\$489.6	\$894.0	\$297.5	\$1,753.3
Microgrids Total	\$102.0	\$644.0	\$1,159.0	\$418.2	\$2,323.1

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Deploying a National Broadband Infrastructure and Using an Underground Fiber Optic Network for More Equitable and Reliable Communications

- Build in parallel with the HVDC network, gaining efficiencies in using the same path and trench
- Design/build a fiber optic network to meet today’s requirements, future growth and spares, allowing for sectional replacements with no loss of service
- Includes “jumping off” points so that each community will be served, enabling equal access to high-speed comms



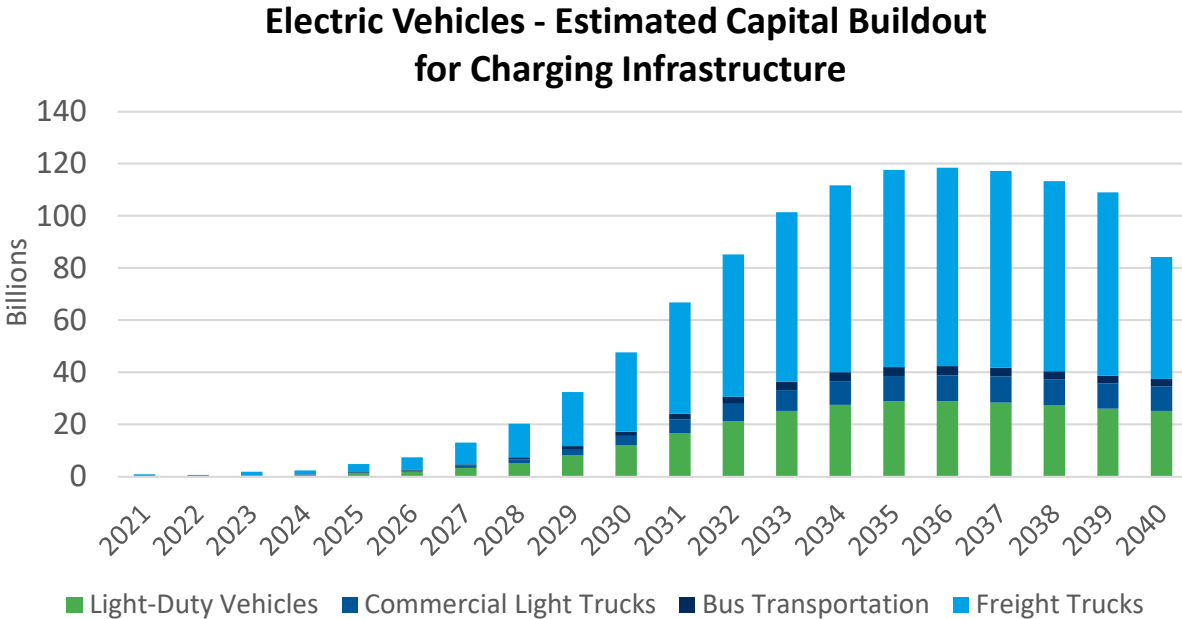
High-Level, Capital and Operational Investments in Broadband Infrastructure (\$B, Cumulative)

BROADBAND	2021-2025	2026-2030	2031-2035	2036-2040	20-YEAR TOTAL
Backbone Network	\$0.4	\$0.9	\$0.9	\$1.1	\$3.3
Lateral Network	\$1.9	\$4.1	\$3.8	\$4.6	\$14.4
Fiber to Premise	\$16.9	\$18.7	\$20.7	\$2.9	\$79.2
Broadband Total	\$19.2	\$23.7	\$25.4	\$28.6	\$96.9

Notes: High-level cost estimates in current 2020 U.S. dollars. Assumes sufficient supply chain availability and continued cost learning curves. No additional assumptions made relative to equipment life expectancy (affecting capital replacement costs), improved designs and construction methods, nor to any increased efficiencies or benefit streams to offset these estimates.

Advanced Mobility Requires a Nationwide Network of Electric Vehicle Charging Infrastructure

- The total cost to develop and maintain sufficient charging infrastructure to support growth of electric transportation totals \$1.4 trillion over the next decade
- This includes Level 2 and Level 3, high-powered charging to accommodate consumer and business needs for convenience and speed
- Also includes adjustments for declining rates of passenger vehicle ownership



High-Level, Capital and Operational Investments in EV Charging Infrastructure (\$B, Cumulative)

Transport Category	2021-2025	2026-2030	2031-2035	2036-2040	20-Year Total
Light-Duty Vehicles	\$3.1	\$34.1	\$136.0	\$158.1	\$331.3
Commercial Light Trucks	\$0.8	\$9.8	\$42.6	\$54.6	\$107.8
Bus Transportation	\$0.6	\$6.3	\$23.6	\$25.2	\$55.7
Freight Trucks	\$8.3	\$95.0	\$389.8	\$443.2	\$936.3
Total	\$12.8	\$145.2	\$592.0	\$681.1	\$1,431.1

Notes: High-level cost estimates in current 2020 U.S. dollars. Assumes sufficient supply chain availability and continued cost learning curves. No additional assumptions made relative to equipment life expectancy (affecting capital replacement costs), improved designs and construction methods, nor to any increased efficiencies or benefit streams to offset these estimates.

Discussion.



Contact Us

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