ASHB Research Library – Public Area (Updated: December 2024)

The following reports are available through the ASHB Public Research Library:

(IS-2021-266) Taking the Pandemic Pulse of Healthcare Real Estate

This BOMA International "Deep Dive" from August 2021 highlights that nowhere have COVID's transformational effects been more apparent than in healthcare; namely, the medical office building (MOB) sector. A key factor in MOB growth has been the move to take healthcare off the hospital campus and bring it out to patients. Competition between health systems, cost management and containment and insurance pressures are all drivers of this trend.

(IS-2021-265) The Future of Commercial Facility Management

This September 2021 report by Propmodo Research for Microshare looks at the tools and tech platforms that facility managers can enlist to make their jobs easier. The analysis identifies key challenges facing practitioners in the space and explores facility manager training requirements, providing a closer look at competencies and skill sets modern FM professionals should come to the table with.

(IS-2021-264) Raising Awareness Around IoT Strategy, A Mobile Network Operators Perspective on Approaches and Challenges

This report was prepared by Forrester Research and published in April 2020. The authors provide insight to organizations on how to integrate Internet of Things (IoT) solutions into their business. Fundamentally a customer-centric opportunity, the development of IoT solutions demands a long-term approach during which organizations focus on preparing for the competition ahead and learning the best techniques and processes to achieve full deployment, the authors highlight.

(IS-2021-263) Commercial Office – 7 Keys to a Successful Post-COVID Workplace

In a report from April 2021, Building Engines highlights that while COVID-19 upended the CRE industry, many keys to the property managers success pre-pandemic have been essential in navigating the current moment and will be crucial during what comes next. Timely communications, strong team collaboration and flexible thinking are key to any building portfolio's success. Moreover, as property teams know, many challenges lie ahead, including the fact that buildings now need to provide what home offices can't, including flexible coworking

spaces and attractive amenities.

(IS-2021-262) Low Carbon Multifamily Retrofits: Garden Style 1-3 Stories

This report focusing on a distinct g*arden style, 1-3 stories* building segment is part of a series authored by NYSERDA & Steven Winter Associates for Building Energy Exchange and published in March 2021. The report emphasizes retrofit strategies that maximize occupant comfort and energy savings through a transition from fuel to electricity-based heating, cooling and hot water systems. Aligned with typical capital improvement cycles, the recommendations will prepare buildings for increasingly stringent efficiency and carbon emissions targets through careful phasing of work across all major building components, including upgrades to exterior walls, windows, and ventilation systems. The report describes the primary benefits of a low carbon retrofit with details on the major system upgrades needed to access those benefits.

(IS-2021-261) Low Carbon Multifamily Retrofits: Post 1980 8+ Stories

This report focusing on the "post 1980s, 8+ stories" segment is part of a series authored by NYSERDA & Steven Winter Associates for Building Energy Exchange and published in March 2021. The report emphasizes retrofit strategies that maximize occupant comfort and energy savings through a transition from fuel to electricity-based heating, cooling and hot water systems. Aligned with typical capital improvement cycles, the recommendations will prepare buildings for increasingly stringent efficiency and carbon emissions targets through careful phasing of work across all major building components, including upgrades to exterior walls, windows, and ventilation systems. The report describes the primary benefits of a low carbon retrofit with details on the major system upgrades needed to access those benefits.

(IS-2021-260) Low Carbon Multifamily Retrofits: Post-War 8+ Stories

This report focusing on a segment of buildings — 8+ stories — constructed in the post war period is part of a series authored by NYSERDA & Steven Winter Associates for Building Energy Exchange and published in March 2021. The report emphasizes retrofit strategies that maximize occupant comfort and energy savings through a transition from fuel to electricity-based heating, cooling and hot water systems. Aligned with typical capital improvement cycles, the recommendations will prepare buildings for increasingly stringent efficiency and carbon emissions targets through careful phasing of work across all major building components, including upgrades to exterior walls, windows, and ventilation systems. The report describes the primary benefits of a low carbon retrofit with details on the major system upgrades needed to access those benefits.

(IS-2021-259) Low Carbon Multifamily Retrofits: Post-War 4-7 Stories

This report focusing on a segment of buildings (4-7 stories) constructed in the post war period is part of a series authored by NYSERDA & Steven Winter Associates for Building Energy Exchange and published in March 2021. The post-war building selected by the authors for study is a 7-

story, market-rate residential building in Brooklyn, New York. The building has masonry exterior walls enclosing 83 apartments across 76,113 gross square feet. Typical of a large swath of buildings in New York City (as well as many other regions), the building is thought to be representative of the most common challenges that will be encountered by anyone looking to perform a deep retrofit of an occupied multifamily building.

(IS-2021-258) Low Carbon Multifamily Retrofits: Prewar 4-7 Stories

This report focusing on "prewar, 3-7 story" building was authored by NYSERDA & Steven Winter Associates for Building Energy Exchange and published in March 2021. The report emphasizes retrofit strategies that maximize occupant comfort and energy savings through a transition from fuel to electricity-based heating, cooling and hot water systems. Aligned with typical capital improvement cycles, the recommendations will prepare buildings for increasingly stringent efficiency and carbon emissions targets through careful phasing of work across all major building components, including upgrades to exterior walls, windows, and ventilation systems. The report describes the primary benefits of a low carbon retrofit with details on the major system upgrades needed to access those benefits.

(IS-2021-257) Smart Buildings - A Framework for Assessing the Openness of a Building Management System (BMS)

This April 2021 report from Schneider Electric's Buildings Research Center emphasizes three layers which the authors contend need to be understood in the context of "open" building management systems. These include (1) Data acquisition/sharing, (2) System integration, and (3) Building orchestration. The report proposes a framework, clarifies terminology, and outlines key criteria associated with being "open" — including how these criteria influence the complexity and performance of the BMS. Example use cases for each are presented.

(IS-2021-256) Why Sustainability Should be Your Competitive Edge

This March 2021 report is by Honeywell International. "Executives are increasingly turning to sustainability as a force multiplier for competitive advantage," the authors write. In the past, this was typically not a competitive focus – simply a means of demonstrating responsible corporate citizenship – and so sustainability initiatives often became silo," within the enterprise. Today, with the recognition deep ties between "sustainability" and "profitability, sustainably managed companies have become increasingly attractive to investors and customers. This report provides insight into the right "sustainability path" and how industry stakeholders can begin to identify the strategy that best fits their company by answering three critical questions: *What's my objective?; What are my opportunities?; And What will be my approach?*

(IS-2021-255) A Guide to Building Automation Systems and CMMS Integration

This March 2021 from Eagle Technology looks at how customers can win by integrating their building automation systems (BAS) with their computerized maintenance management system

(CMMS). Maintaining a comfortable and efficient work environment is an important factor for any business, and with BAS integrated with the asset maintenance software, one system environment can be used to control the indoor environment and ensure that building equipment is running efficiently. “Whether they are monitoring the building’s temperature or analyzing how efficiently the air conditioner is running, it can all be done by using the same software,” the authors write. Because everything is completed using the same system, the faster it is to train and bring employees up to speed efficiently.

(IS-2021-254) Transform with Technology - Shaping the Future of Real Estate

This August 2021 report by JLL Research and MIT sets out to identify which real estate technology investments are the most impactful, and how stakeholders can use them to increase the employee health and wellness, maximize value of a property, and drive business forward. The digital transformation underway as the technology ecosystem around the built environment matures and consolidates is examined. The technologies available now or currently in development will radically reshape how people interact with and use buildings, with the potential to delivery much more “human-centric, resilient and responsible built environments.”

(IS-2021-252) Energy Management in the Ontario Mid-Tier Commercial Real Estate Sector

This December 2020 report was authored by CIET and Knowenergy with input from a steering committee and published by the Independent Electric System Operator (IESO) in the province of Ontario. Focusing in particular on organizations that manage mid-tier commercial real estate (CRE) buildings, the report proposes a strategy to engage them in the energy transition. The analysis was based on a survey conducted among 77 building owners and property managers, supplemented by site visits at eight mid- tier buildings. The research indicates that many respondents are lacking in their understanding of metering and lease mechanisms to monetize the value of investments in energy efficiency. The outcomes also highlight the need for education and capacity building in this market, focusing on how building owners can create value from energy efficiency.

(IS-2021-251) Flexible Buildings - Five elements to create buildings ready for the new world of work

This June 2021 report by Schneider Electric in partnership with WORKTECH Academy sets out to define “flexible buildings.” With more flexible work patterns, flexible teams and flexible organizations, the market will naturally come to demand “flexible buildings” more and more as well. How should the term *flexible building* be defined? How should its key attributes be understood? This report provides practical considerations on how to specify and procure a flexible building. Designing for change, developing data science skills within the CRE team and treating flexibility as an office amenity are among the key issues raised.

(IS-2021-249) Corporate sustainability goal setting and measurement

GreenBiz Group presented the results of a survey of sustainability leaders at Fortune 500 companies as the starting point for a discussion around sustainability targets and evaluation criteria. The analysis argues that sustainability targets demand that companies consider operational planning horizons that can extend for decades. It shows that 80% of companies have emissions reduction targets and some of them have started to include “Scope 3” emissions to influence emissions of other companies and activities in their value chains.

(IS-2021-248) LEED building design and construction guidelines

This 2021 report by Gordian was designed to help architects, engineers, construction professionals and facility owners more easily grasp LEED sustainability principles. The resource reviews the highlights from each of the nine LEED guidelines and points out where they might prove valuable. The goal is to bring the main objective of each criterion to the forefront – adding practical recommendations where applicable.

(IS-2021-247) Low Carbon Strategies for Utility End-Use Sectors

This 2021 report by global consulting services company ICF examines the impact of electric infrastructure decarbonization on utilities. It analyzes challenges and opportunities linked to transportation electrification and argues that utilities can play a major role in shaping the uptake of electric vehicles. At the same time, EV charging will impact utilities as it increases the need to consider resilience upgrades and further grid hardening.

(IS-2021-246) Next-Generation Lighting Strategies

This 2020 ebook was prepared by I+S in collaboration with the industry outlet BUILDINGS is a compilation of articles by lighting industry experts. Keeping with the theme that good lighting must be about more than just illuminating a space, the authors provide overviews of technologies and strategies to carry out lighting retrofits in buildings and they explore an array of technical considerations associated with light quality, including lighting controls systems, energy efficiency, and quality metrics. Key Words: Light systems/controls, property management, system monitoring equipment, energy efficiency

(IS-2021-245 10 Predictions for Smart Building Technology in 2021 and Beyond

Verdantix analyzed the major trends that expected to influence the smart building technology market over the next 12 months and beyond in this report from December 2020. What will be the key objectives of building managers? Which technology areas will see strong levels of investment? How will integrated platform solutions fare? The analysis cover topic such as building electrification, smart controls and new applications to facilitate integrated solutions, digital twin applications and other “occupant centric” features.

(IS-2021-243) Automated Demand Response Non-Residential Incentive Structure

This report by Energy Solutions and Lawrence Berkeley National Laboratory, from August 2020, examines factors affecting the calculation of control incentives in the automated demand response (ADR) program within California's investor-owned utilities. The analysis highlights growing customer and industry interest in the program, the importance of incentives, trade ally networks and vendor engagement for program success, and the importance of cloud technologies to lower cost.

(IS-2021-241) iiSBE Frameworks for Performance Targeting and Assessment

This December 2020 report from the International Initiative for a Sustainable Built Environment focuses on development tools for the establishment of sustainability performance targets, with the goal of assessing predicted or actual performance for small urban areas and buildings. Consideration is also given to integrated design process and post-occupancy performance evaluation. With the proposed tools, users have the opportunity insert local context values, performance benchmarks and targets to suit certain building types, leading to a calibrated system that provides meaningful results.

(IS-2021-240) Unlocking Value Across the UK's Digital Twin Ecosystem

TechUK outlines how digital twins can be adopted effectively to cope with unprecedented levels of risk and uncertainty in this report from February 2021. Targeted support for the UK's digital twin ecosystem will unlock value for people, economy, society, and planet, TechUK argues in this report from February 2021. A series ofESG recommendations to level up digital twin innovation and investment to take advantage of UK expertise in this area are proposed for government and innovation bodies. Accelerated adoption of digital twins will drive decarbonization, trigger the reduction of social inequalities, and drive sustainable R&D-led growth, the authors contend.

(IS-2021-239) Work Smarter to Live Better – Understanding the New Expectations of the UK Workforce When it Comes to Hybrid Working

This report by Microsoft, published in February 2021, presents the results of a survey of 4000 UK office workers carried out to understand the habits and new expectations of the UK workforce when it comes to hybrid working. Successful implementation of hybrid working will require people support through good management, ongoing fairness of opportunity, and prioritizing employees' health and wellbeing. Important takeaways include addressing employee resilience and workplace culture, mindfulness and ability to disconnect, and providing high flexibility with devices that can seamlessly integrate from the desktop to a mobile platform.

(IS-2021-238) A Scalable approach to residential EV management

This January 2021 report from EnergyHub presents a three phase EV management strategy that will ensure a safe and reliable grid. It is predicted that by 2030 more than 80% of the charging infrastructure will be residential and the strategy outlined here relies on smart charging stations that have the ability to capture charging behavior and provide load management capabilities.

The components of the strategy include time-of-use (TOU) rates, an active event-based peak management, and automated managed charging that takes into account real-time grid and market constraints.

(IS-2021-237) New Era of Workplace Data & Analytics

This report was prepared by Comfy and published in February 18. The report provides insights to business owners for informed decision-making in a time of workplace transformation. Flexible working models, data and analytics for effective space utilization, workplace design, and strategies to maximize real estate savings are discussed. Through analysis of key metrics, businesses can better understand workspace usage patterns to support business continuity while reducing overall costs.

(IS-2021-236) A Feature Selection-Based Predictive-Learning Framework for Optimal Actuator Control in Smart Homes

This report appeared in the academic journal *Actuators* (April 2021). The authors propose a predictive- learning framework based on contextual feature selection and an optimal actuator control mechanism, with the goal of minimizing energy consumption in smart homes. The analysis also addresses how optimal control can reduce energy cost and improve performance resulting from lesser learning cycles and decreased error rates.

(IS-2021-235) A Novel Robust Smart Energy Management and Demand Reduction for Smart Homes Based on Internet of Energy

This academic paper published in the *Sensors Journal* (July 2021) presents a residential energy management (REM) technique capable of monitoring and controlling residential loads within a smart home. A new distributed multi-agent framework, which is based on the cloud layer computing architecture, is developed for real-time microgrid economic dispatch and monitoring. A system based on the Raspberry Pi microcontroller is implemented to test the proposed framework, which is shown to be capable of effectively tracking load (demand) changes.

(IS-2021-234) Latency-Optimal Computational Offloading Strategy for Sensitive Tasks in Smart Homes

This March 2021 report in *Sensors Journal* discusses a computational offloading strategy for processing large amounts of data generated by smart devices. The technique focuses on minimizing delay by applying the back-pressure algorithm (BMDCO) to determine an offloading decision and the number of tasks that can be offloaded. Simulation results show that BMDCO is stable and can reduce computational delay.

(IS-2021-233) LSTM Networks Using Smartphone Data for Sensor-Based Human Activity Recognition in Smart Homes

This February 2021 report in the *Sensors Journal* deals with human activity recognition (HAR) using smartphone sensor data. To explore this strategy, a generic framework is proposed based Convolutional Neural Network (CNN) and Long Short-Term Memory (LSTM) networks. The experimental results indicate that the proposed CNN-LSTM network performs well in activity recognition, enhancing the average accuracy by up to 2.24% as compared to prior state-of-the-art approaches.

(IS-2021-232) Multimodal Approaches for Indoor Localization for Ambient Assisted Living in Smart Homes

This report appeared in the *Information Journal*, a scholarly publication, in March 2021. The report deals with indoor localization for ambient-assisted living in smart homes. The localization strategy relies on Bluetooth low energy (BLE) beacons, BLE scanners, activity zones, and accelerometer and gyroscope data gathered from diverse behavioral patterns. Experimental results show system accuracy of 81% to track user's indoor position.

(IS-2021-231) Being Blind to Water Use

This July 2021 report by HydroPoint found that the biggest obstacle to eliminating water waste wasn't broken pipes — it was people and "institutional water blindness." The report covers many of the areas in buildings and outside that are wasting water and can be improved.

(IS-2021-230) Energy Management Information Systems Technical Resources Report

This technical resource report from July 2021 provides information and best practices for understanding, designing, and implementing Energy Management Information Systems (EMIS). Its authors are with the U.S. Department of Energy, Energy Efficiency Renewable Energy Office and the National Renewable Energy Laboratory. An EMIS can help agencies improve energy performance, reduce operational cost, and for federal staff, can serve as a valuable component of an agency's portfolio-level energy and water metering strategy, the author highlight. EMIS functions and capabilities are discussed along with their applicability and benefits to federal agencies. These include information that can be used throughout the EMIS life cycle, ranging from system design to implementation and ongoing maintenance.

(IS-2021-229) HVAC Summer Edition

This Consulting-Specifying Engineer eBook was published by CFE Media in June 2021. The lead article covers four steps for designing a VRF system and how variable refrigerant flow offers an alternative HVAC solution, and it is followed by a case study focused on designing VRF for an office. This issue also has articles on what ASHRAE 90.4 does for data center energy efficiency; delivery and maintaining modular pumping systems for HVAC; and pumping controls methods and their impact on system efficiency.

(IS-2021-228) Improving Building Design with Division 25 Specifications

This e-book from Schneider Electric (first published in August 2020 and modified in February 2021) was designed to provide consulting engineers with the key trends driving smart building specifications. One of the biggest smart building hurdles for engineers is the fact that key "controls" conversations are not taking place among electrical, mechanical, IT, OT, and other divisions before design. As a result, engineers are forced to integrate systems that haven't been vetted in an iBMS atmosphere. This, in turn, causes data integration roadblocks, endangering the entire smart building project. Division 25 specifications help building owners and managers get what they want in terms of increased value and a platform that can be expanded with future technology.

(IS-2021-227) Smart Products - Building the Modern Home

This June 2021 white paper was developed for GE Appliances by Parks Associates. The authors describe new smart home applications and their market penetration. As consumers become familiar with market offerings, new smart product categories emerge, offering added benefits that address different pain points. New categories include solutions that monitor indoor air quality and facilitate independent living, safe package delivery, and energy resilience in the home.

(IS-2021-226) A Research Paper on Internet of Things Based Upon Smart Homes with Security Risk Assessment Using OCTAVE Allegro

This paper appeared in the International Journal of Engineering Research & Technology in June 2020. The paper provides an overview of the Frugal Labs IoT Platform (FLIP), based on the Raspberry Pi, for building an IoT-enabled smart home. OCTAVE Allegro methodology is applied to the system to assess security risks and reveals that the system is vulnerable to both internal and external security threats.

(IS-2021-225) 67 An IoT-Based Smart Home Automation System

This paper appeared in MDPI's Sensors Journal in May 2021. The authors present Toggle, a system for interconnecting sensors, actuators, and other data sources for multiple home automation. The approach leverages application programming interface (API) for communication. A smartphone application is also introduced that allows users to control various home appliances and sensors.

(IS-2021-224) The Future of Smart Home Design

This report was published by Silicon Labs in June 2020. It examines what Original Equipment Manufacturers (OEMs) should know about the future of smart home design to develop compelling smart devices. By considering the ways that smart devices will improve ease of use, the report describes the role that artificial intelligence and machine learning will have in enabling new capabilities, and the security that will be needed to be implemented to protect users, devices, and OEMs.

(IS-2021-223) Stepping Up Europe's 2030 Climate Ambition

Subtitled “Investing in a Climate-Neutral Future for the Benefit of our People,” this September 2020 report by the European Commission deals with the EU economy-wide 2030 greenhouse gas emissions reduction target. Actions that will be required across all sectors of the economy are discussed. Consideration is also given to launching revisions of the key legislative instruments to support this goal, as well as hosting a public debate to increase the EU’s contribution to the Paris Agreement.

(IS-2021-222) An Economic Approach to Neutral Host Network Deployments

This report was prepared by Microlab and published in June 2021. The report describes Neutral Host Networks (NHNs), as a solution for addressing a demand for more capacity and connectivity in wireless networks, and provides a brief comparison between NHN ownership models. Benefits and challenges that affect the Total Cost of Ownership (TCO) for NHNs are outlined. The analysis provides insights into how NHN owners can lower the TCO by minimizing the deployment complexity while providing an “economical” path to leverage future spectrum allocations to improve capacity per user or monetize new use cases.

(IS-2021-221) High-Impact Programs Targeting Regional Multifamily Energy Savings Opportunities This July report was prepared by ACEEE reviews four multifamily utility efficiency programs and their

success in achieving high savings in regions throughout the U.S. Criteria considered in the review include spending, savings, and participation data. The programs address regional energy-saving opportunities and include strategies to reach deeper savings by encouraging more-comprehensive energy-saving measures. Providing free or low-cost energy assessments and offering performance-based incentives or higher rebates for whole-building approaches are some of the most successful tactics.

(IS-2021-220) ICS Cybersecurity Year in Review 2020

This February 2021 report is the latest installment in a yearly analysis of cyber threats, vulnerabilities, assessments, and incident response insights pertaining to Industrial Control System (ICS) / Operational Technology (OT) by Dracos. The recommendations offered to improve ICS/OT cybersecurity include increased network monitoring, prioritization of assets, improved incidence response capability, continuous monitoring of network segmentation, and securing management of credentials.

(IS-2021-219) Lighting the Patient Room of the Future

Subtitled “Evaluating Different Lighting Conditions for Performing Typical Nursing Tasks,” this study was published in the academic journal Health Environments Research & Design in November 2020. The paper explains how aspects of lighting in patient rooms are experienced

and evaluated by nurses while performing simulated work under various lighting conditions. Insights are provided regarding lighting to support circadian synchronization, lighting at night, the distribution of light in the patient room, use of multiple lighting zones, and the use of colored lighting.

(IS-2021-218) SmartCitiesWorld City Profile – London

This report by SmartCitiesWorld (March 2021) explores how the London, U.K. uses technology and smarter approaches to deliver better services and improve citizens' quality of life. In 2010, the city created the London Data Store, an open data platform, to inform its infrastructure growth. In 2018, London launched the smart city roadmap (Smarter London Together) and the Emerging Technology Charter regarding use 5G and artificial intelligence (AI) to support the needs of Londoners. By demonstrating an ability to listen, adapt, evolve, and crucially collaborate, London has positioning itself well to continue evolving as a smart city.

(IS-2021-217) How Network Testing Ensures High-Quality In-Building LTE and 5G Deployments

This report was by the technology group Rohde & Schwarz and published in May 2021. The analysis deals with the entire indoor deployment cycle of mobile networks, such as distributed antenna systems (DAS) and small cells. It highlights the characteristics of these systems, the planning phase, installation and verification of the deployed system. Mobile network testing solutions to verify successful mobile network deployments indoors are discussed.

(IS-2021-216) OPC UA Users and Experts Conveying Knowledge and Experience

This report was published by the OPC Foundation in December 2020. Expert content from market leaders in communication, automation and industrial IT is brought together in an analysis highlighting the benefits and the potential of the Open Platform Communications Unified Architecture (OPC UA) technology for end users, system integrators, operators in the world of industrial IoT. Key areas covered include open process automation, a deep dive into OPC UA, field level communication, insights to the mechanical engineering industry association (VDMA), open serialization communication, Microsoft's role in OPC, and the smart factory web.

(IS-2021-215) SmartCitiesWorld City Profile – Sydney

This report was authored by Jon Glasco from SmartCitiesWorld and published in January 2021. The report profiles the city of Sydney, Australia as a smart city. With a global ranking of 14 in the Digital Capitals Index, and 18 out of 109 in the Smart City Index, Sydney boasts a high level of resiliency and particular strengths in areas like finance, education, manufacturing, technology, trading and tourism. To improve its current smart-city standing, Sydney focused on post-COVID economic recovery planning, investment in digital technology and infrastructure, recalibration of jobs, community wellbeing, remote work, and investment in transport and public spaces. Emerging technologies, combined with strategic use of digital technology to connect remote and disadvantaged communities, will be influential in ensuring Sidney's continued "smart city"

growth.

(IS-2021-214) 2021 Industry Insights

This report was prepared by Electrical Construction & Maintenance (EC&M) and published in April 2021. The authors present an “inside look” at key technologies markets, technologies, and trends expected to shape electrical construction and building activity in 2021. The construction industry will face a hiring boom. Growth is expected in residential, commercial, and industrial projects, as well as economically charged regions and tech hubs. Material shortages in the electrical industry are likely to occur. Alternative materials are proposed, such as fiberglass, for conduits traditionally made from polyvinyl chloride or galvanized rigid steel. Maximizing revenues and increasing process efficiencies will be important keys to success this year.

(IS-2021-213) Profitably Decarbonizing Heavy Transport and Industrial Heat

This July 2021 report was authored by RMI, a non-profit organization focused on accelerating the clean energy transformation. The paper discusses how to transform by 2030 heavy transport such as trucking, aviation, and shipping to decrease impact on greenhouse emissions. Furthermore, consideration is also given to reducing industrial heat from production of materials such as steel, aluminum, cement, and plastics to lower the impact on climate change. Emphasis is placed on clean electricity as the key enabler for transformation hoped for.

(IS-2021-212) Brave New World - Leveraging the Private Networking Opportunity

This report was prepared by Sierra Wireless and published in May 2021. It examines why private Long Term Evolution (LTE) and 5th Generation mobile (5G) networks have emerged as an option for many organizations. Operational basics for each network are presented, along with discussion of the differences between these options and Wi-Fi networks, public LTE and 5G networks. Use cases are featured to assist professionals to determine if a private LTE or 5G network might help organizations create more value for customers, employees, and other stakeholders.

(IS-2021-211) The Built Environment Investment Thesis

This report was prepared by Shadow Ventures, an Atlanta-based venture capital investment firm, and published in March 2021. It provides an assessment of the built world markets, challenges and technology solutions, and investment opportunities. Markets considered include real estate, architecture, engineering, construction, infrastructure and capital projects, security, utilities an energy, logistics, transportation, and distribution. Key challenges highlighted are labor shortage, fragmented communication, environment concerns, thinning profit margins, and climate change. Technology based remedies proposed include robotics, automation software, collaborative project management software, interoperable data models, and innovative building methods and materials. Significant opportunities exist for venture capital firms to invest in startups to bring those innovations to the built environment.

(IS-2021-210) ESG, SRI, and Building Energy - An Economic Imperative for Chief Executives

This report was prepared by ENTOUCH Controls and published in late 2020. The authors focus on Environmental, Social, and Governance (ESG) and Socially Responsible Investing (SRI) as it relates to the building sector. Market trends indicate that they have gradually become a standard for investing in real estate due to the multiple benefits in terms of costs savings, productivity, profitability and regulatory risk minimization. The report illustrates how commercial buildings can be a potential solution to the unsustainable buildup of atmospheric carbon by implementing energy efficiency measures and energy management systems to reduce consumption. It explains a seven-step process for smart retrofits developed by the sponsor of this report.

(IS-2021-209) America's Zero Carbon Action Plan

This report was prepared by the Sustainable Development Solutions Network (SDSN) and published in late 2020. This 347-page paper examines many aspects of moving to a zero-carbon economy. There is a chapter dedicated to the decarbonization of buildings, underlining how this sector accounts for almost half of the country´s greenhouse gas (GHG) emissions.

(IS-2021-207) Demand Response with Variable-Capacity Light Commercial HVAC Systems

This report was prepared by the Electric Power Research Institute (ERPI) and published in September 2020. The authors evaluate of the electrical demand response (DR) potential of variable capacity (VC) heating, ventilation, and air conditioning (HVAC) equipment in light commercial building applications through demonstrations at two field sites in Southern California. Variable refrigerant flow (VRF) systems and packaged rooftop units (RTUs) were considered. The findings for the VRF system suggest that capacity limit control can reduce electrical demand with minimal impact on indoor temperatures. For the RTU system, it was not possible to implement advanced demand-response controls.

(IS-2021-206) Demand-Side Solutions to Winter Peaks and Constraints

This report from the American Council for an Energy-Efficient Economy came out in April 2021. The report describes the opportunity for electrical demand-side resources to address potential winter peaks and constraints. Examples of remedial strategies for utilities and market participants are provided. Some of the key strategies: using existing programs that target winter peak demand reductions through energy efficiency and demand response; applying demand-side measures that reduce heating load; residential weatherization measures; applying intelligent operation of heating equipment through residential smart devices; and energy storage and managed electric vehicle charging.

(IS-2021-205) Assessment of Occupational and Skills Needs for Energy Efficient Buildings

This report by ECO Canada was released in February 2021. The authors outline the capacity and challenges of today’s building sector workforce in Canada to achieve energy efficiency within

new and existing commercial, institutional, and multi-unit residential buildings. The key finding is that Canada's building sector workforce does not have the widespread experience or skills required to perform their roles in a manner that achieves energy efficiency goals. Seven recommendations are made regarding how stakeholders can address such skills gaps.

(IS-2021-204) Energy Smart Buildings Readiness Guide - How to Make a Building Energy Ready

This report from Iconics published in September 2020 describes building operational data can be used to optimize its performance. The key components considered include networking technology, protocols, system interoperability standards, documentation, and key performance indicators. A detailed example is provided summarizing typical properties monitored for HVAC equipment.

(IS-2021-203) Engineering Net Zero - Canadian Technical Report

This report by SNC Lavalin from March 2021 recommends key actions necessary for Canada to achieve a "net zero" greenhouse gas (GHG) emissions by 2050. Emphasis is placed on design, engineering, construction, operations, and maintenance, combined with a fundamental transformation of societal behaviours and lifestyles, to reduce carbon emissions. An overview of emerging technologies to achieve the "net zero" goal is presented.

(IS-2021-202) Future Energy Scenarios

This July 2020 report comes from Britain's National Grid Electricity System Operator (ESO). The analysis explores the assumptions and conclusions from the extensive modelling, research, and stakeholder engagement undertaken by the National Grid ESO on how energy system must evolve while safely and reliably delivering low carbon energy to end consumers to meet the net zero goal by 2050. Taking into consumer and energy system perspectives, the key requirements include availability of open accessible data, consumer incentives, use of hydrogen and carbon capture and storage, immediate action across all key technologies and policies, and full engagement across society and end-consumers.

(IS-2021-201) Green and Equitable Economic Recovery

This April 2021 report was prepared by Climate Mayors. It highlights key policy priorities and local success stories contributing to a green and equitable recovery and demonstrating job creation and resilience. The areas to watch include sustainable infrastructure, a better coordinated government role (city, state, federal), emphasis on electric transit and citizen mobility, zero carbon buildings, transition to renewable energy, urban greening, and the necessity for federal funding.

(IS-2021-200) Improving the Customer Experience in the Utilities Industry

This report by Harvard Business Review from February 2021 offers a snapshot of the customer

experience (CX) evolution in the electric, gas, and water utility industries. Key takeaways include that CX will be utilities' top business priority and that the existing siloed operating structure within utilities will need to change to align with demands of digital age. The customer experience overall will shape utilities' brand and determine whether customers see it as the provider of choice.

(IS-2021-199) Keeping the Lights On - How to Ensure Connected Lighting Systems are and Remain Secure Throughout Their Lifecycle

This report produced by SmartCitiesWorld in association with Signify was published in April 2021. The report describes how to ensure robust, end-to-end cybersecurity in connected lighting deployments. It contends that a model of "shared responsibility" is the best approach and highlights why cloud-based systems are better suited to the demands and rigors of today's connected world when compared to on-premise IT infrastructure. Best practices are presented and myths are discussed that can cloud an organization's decision-making.

(IS-2021-198) Net Zero by 2050 - A Roadmap for the Global Energy Sector

This report from International Energy Agency (May 2021) maps out the energy sector's path to global energy sector by 2050. Milestones to achieve the goal are provided spanning all sectors and technologies – for what needs to happen, and when, to transform the global economy from one dominated by fossil fuels into one powered predominantly by renewable energy sources Emphasis is placed on investment, innovation, fairness, inclusivity, skillful policy, design and implementation, technology deployment, infrastructure building, and international co-operation.

(IS-2021-195) Proving the Business Case for Building Analytics

This October 2020 report by the Lawrence Berkeley National Laboratory presents the results of the Smart Energy Analytics Campaign. From 2016-2020, the public-private sector partnership assessed the costs, benefits, and common practices of Energy Management Information Systems (EMIS). With support for 104 organizations and 6,500 buildings covering over a half a billion square feet of combined floor space, the initiative produced the largest-ever dataset on EMIS costs and benefits and revealed a 2-year simple payback. Key outcomes included median annual energy savings of 3% (energy information systems) and 9% (fault detection and diagnosis). The report discusses, among other aspects, monitoring-based commissioning practices (MBCx) that use EMIS tools.

(IS-2021-194) U.S. Department of Energy Progress Report 2021 - Partnering for the Future - Leadership, Innovation, and Proven Solutions

U.S. Better Buildings Initiative partners have been contributing energy, water, and waste solutions designed to support an accelerated transition towards clean energy. This progress report from May 2021 underlines that building owners and plant managers faced significant new barriers to energy efficiency caused by the COVID-19 pandemic: lower occupancy levels, the

need to upgrade ventilation systems quickly, budget shortfalls, and layoffs/staffing disruptions. Despite these difficulties, new strategies and solutions have moved forward in four key areas essential to building a more efficient and cost-effective energy future.

(IS-2021-193) Buildings of the Future - Creating Safer, Healthier and more Responsive Environments This 2020 report from Schneider Electric sets out a vision to create “resilient, sustainable, hyper- efficient and human-centric buildings” — transforming today’s buildings to meet tomorrow’s needs. The importance of these foundational aspects has come to the forefront in the year of the pandemic, the author highlight. The report focuses on the potential for (1) Maximizing space efficiency (2) Enhancing occupant well-being (3) Improved employee experience, and (4) Reducing operating costs.

(IS-2021-192) Creating Truly Open Cities - The Importance of Building Interoperable Smart Cities from the Ground Up

This report by Smart Cities for Paradox Engineering came out in September 2020. It discussed 6LoWPAN’s value in creating “open and interoperable smart cities” and Paradox Engineering’s platform that uses 6LoWPAN. The Swiss company’s PE Smart Urban Network is a connectivity platform and applications ecosystem that allows cities to manage a range of urban services. The authors also examine other developments in the open standards movement that will be “key to helping city authorities ensure future smart projects reach full maturity.”

(IS-2021-191) The Evolving Importance of Effective HVAC Management

To understand how tenant expectations for HVAC systems have changed during COVID-19, Building Engines conducted a national survey of nearly 300 CRE building managers and engineers. Reporting on the results in late 2020, the company highlighted the increased importance property managers give to HVAC systems — their capabilities as well as maintenance issues — and discussed how HVAC management should be handled to meet new air quality standards while maintaining tenants’ trust throughout re-occupancy. The report focuses on the company’s new Prism solution, designed to provide “transparent HVAC management” for buildings owners/tenants. The solution tracks, among other aspects, routine (and important) tasks such as filter changes demonstrating proficiency and responsibility.

(IS-2021-190) 2021 Multifamily Amenities Survey, Multifamily Design and Construction Magazine

Multifamily Design+Construction magazine surveyed respondents on how their amenities were affected by the pandemic and presented the results in June 2021. There were, not surprisingly, numerous examples of property managers closing fitness centers, pools, playgrounds, and game rooms, at least temporarily; other respondents removed amenities, pushed activities outdoors, or made modifications, such as using plexiglass separators in fitness areas. However, more than half said they had not made changes, either because a given construction/installation project was already far along, or because they believed the best course of action was to “weather the storm.” The pandemic era will continue to raise difficult questions about how multifamily

housing—including the amenities—should be designed in ways that best support occupant health and wellness.

(IS-2021-189) 2020 Luminaire Level Lighting Controls Incremental Cost Study

This NEEA report by Energy Solutions (January 2021) estimates the incremental cost of Luminaire Level Lighting Controls (LLLC). The analysis grouped these products/systems into “smart” and “clever” based on their differing features and price points. It showed that the average price for more complex, smart systems has oscillated but shows an overall decrease in costs over time. The variation was thought to be due to the continued addition of incremental feature packages and capabilities that the smart systems can enable. Smart systems remain more expensive than their clever-hybrid counterparts, and their value proposition tends to be linked to increasing value from nonenergy benefits.

(IS-2021-188) 048 Atlas of Energy Efficiency - Brazil 2020 Indicators Report

This February 2021 report was authored by members of the International Energy Agency technical team and the *Empresa de Pesquisa Energetica* (Brazil’s federal public agency focused on energy sector research). The research explores the impacts of the COVID-19 pandemic crisis and measures related to energy consumption and efficiency in different economic sectors in Brazil.

(IS-2021-187) Broadband Insights Report - 4th Quarter, 2020

This February 2021 report by OpenVault breaks new ground by exploring the cumulative impact of pandemic growth on broadband networks. Broadband service providers have experienced across-the- board growth in consumption and speeds, testing networks as never before due to COVID-19, the analysis shows. Data on two distinct categories is provided: subscribers on flat-rate billing (FRB) plans that offer unlimited data usage and those on usage-based billing (UBB) plans, which bill subscribers based on their broadband consumption. The average monthly bandwidth usage at the end of 2020 approached one- half of a terabyte (TB) of data, or close to 483 GB. Subscribers on unlimited usage plans, or FRB plans, were closer to 497 GB.

(IS-2021-186) Maintenance Key Performance Indicators

This report from Eagle Technology (November 2020) discusses Key Performance Indicators (KPI’s), their benefits and key examples for maintenance managers. Computerized Maintenance Management System (CMMS) KPIs are used to track performance in several areas over time and indicate when an organization is operating inside or outside of acceptable levels. An enhanced KPI reporting would include analysis of data collected by assets, work orders, labour and material history, and costs. Details on major maintenance KPIs are provided.

(IS-2021-185) NLPIP Lighting Answers UV Disinfection Products

This report by the Lighting Research Center from December 2020 was published by Lighting Answers. Guidance on use of ultraviolet (UV) light for disinfection of surfaces and air in buildings is provided; the authors report on the results of a recent survey and testing that was undertaken to look at issues of effectiveness, safety and energy expenditure. While there are no clear UV specific regulations, the report references the many associations and organizations that have articles and books on the topic of UV lighting applications.

(IS-2021-184) 5 Ways to Lower Energy Use Intensity on Your Building Project

This report by Cove.tool (June 2021) discusses why engineers should be calculating the EUI of buildings, to better predict their projects' yearly utility costs — useful in understanding the impact of each design decision. EUI or Energy Use Intensity is a building's annual energy consumption relative to its gross area and broadly, it can be divided into heating, cooling, lighting, equipment, fans, pumps, and hot water. Building design that responds sensitively to the local climate conditions can improve occupant comfort and significantly reduce energy consumption, the report highlights. As an example, "solar heat radiation can work against or in favor of whole-building energy consumption, depending on the building location."

(IS-2021-183) 7 Must-Have Capabilities for Your Next Building Operations Platform

This March 2021 report from Building Engines underlines that in a competitive CRE climate, having an outdated building operations platform makes it much harder to become more efficient, generate more revenue, and provide a top-notch tenant experience. Armed with the right building operations software, build owners can complete all their tasks more efficiently, and this e-book sets out 7 "must-have" capabilities in a modern building operations platform. They include, among other aspects: 1. Scalable cloud infrastructure, 2. Automation of slow workflows, 3. Mobile capabilities, 4. Tenant experience functionality, 5. Robust analytics and reporting, 6. Ability to capture all revenue.

(IS-2021-182) 2020 - Our Air in Review

This January 2021 report was by AirRated, which provides a certification for Indoor Air Quality (IAQ). Just 22% of customers stated that they are knowledgeable about air quality and only 40% and 45% of customers said they understood the sources of indoor and outdoor air quality respectively, in a recent AirRated survey. Furthermore, 62% of business owners said that the reason why they hadn't made changes to the air quality in their buildings was due to a lack of information. When building, renovating and occupying spaces, it is important to prioritize the need for to establish standards that outline improvements for ventilation, filtration and air cleaning for new offices and commercial properties, while maintaining a sustainable approach to building design, the report argues.

(IS-2021-181) Best Practices Guide - Predictive Maintenance Using Automatic Fault Detection and Diagnostics

This October 2020 guide from the International Institute for Sustainable Laboratories was authored by Cimetrics. The report examines the opportunity represented by predictive maintenance to save money and increase facility reliability. The risk of equipment failure can be reduced by continuous, automated analysis of equipment performance to identify faults before they become critical. A successful predictive maintenance program requires investment in a data-rich building automation system, configuration of that system to perform analytics, development of a process and workflow to manage the automatic fault detection and diagnostics (AFDD) results, and training of facilities personnel on the program. The result is a leaner, more efficient lab facility operation, helping to eliminate energy-wasting faults while freeing up funds and labor for other types of sustainability improvements.

(IS-2021-180) Connected & Protected - The Vulnerabilities and Opportunities of IoT Security

ABI Research identifies three distinct IoT markets based on low, moderate, and high security requirements in this report from April 2021. The “low security” requirements category included buildings, home appliances, home monitoring, home security & automation. The “moderate” category included commercial building automation, condition-based monitoring, gas meters, video surveillance, smart meters, and water meters. “High security” category in buildings could include Automated Teller Machines (ATMs), healthcare equipment monitoring, patient monitoring, OEM telematics, and usage- based insurance. The amount of IoT security revenue available does not always correlate with the amount of IoT connections, and “disproportional” allocations of revenue can be seen in some markets.

(IS-2021-178) The State of Demand-Side Energy Management in North America

The third volume of CPower's State of Demand-Side Energy Management in North America (June 2021) provides a breakdown of the most important issues, trends, and regulations designed to help commercial and industrial organizations make better decisions about their energy use and spend. The report takes up questions such as: FERC 2222 is poised to usher DERs into the wholesale energy markets in the US. How are the markets responding? How will California rebound after suffering its first blackouts in nearly 20 years?; What has Texas learned from the devastating grid failure this past February?; What will New England and PJM do to appease states that are angered at the policies they feel affect their desired fuel mixes?; and How is New York tracking toward its climate goals and what market designs might it employ to help achieve them?

(IS-2021-177) Decarbonizing the Built Environment

This JLL Global Research report was released in June 2021. A survey of senior executives representing 647 occupiers and investors was conducted in the first quarter of 2021, with results showing a clearer, stronger understanding of how organizations across the globe are progressing in their journey toward net zero carbon via their investment in more responsible real estate, and to what level sustainability ambitions are being translated into actions. “Occupiers, investors and city leaders each have a role to play in meeting demand for greener, more sustainable spaces.”

(IS-2021-176) How to Make Smart Buildings Even Smarter

This report from Siemens Industry was published in April 2021. Buildings and facilities could still benefit from even greater measures of openness to ease integration challenges, some quite costly. The authors report that 82 percent of decision-makers confirm that building automation is important or very important, and 64 percent plan investments in integration solutions in the next year. But 30 percent of system integrators estimate they lose up to $1 million a year due to integration-related issues, resulting in them turning to open-source data-integration tools. This report describes the Desigo Optic program for better optimization of a structure's performance without making its operation too complex to manage. The program also helps in the management of the data that must be stored in a BMS and most importantly, in deriving insights that can drive greater operational efficiencies.

(IS-2021-175) The 2021 Buyer's Guide to CRE Building Operations Technology

This report was published by Building Engines (July 2021). CRE tenant expectations are rising, budgets have tightened, and competition is increasing. “Amid this change, one theme is clear: Assembling the right technology stack can be the difference between cementing your portfolio’s long-term growth or falling behind competitor buildings”. Modern software platforms and point solutions hit the market each day and can help a team work smarter, faster, and more cost effectively. But choosing the right solutions—and avoiding clunky, overpriced, and difficult-to-deploy options—takes research. The authors list “must-have capabilities” and support features for choosing a building operations platform.

(IS-2021-174) The Future of Building Design, Construction and Operations

This eHandbook from the Global Wellness Institute was published by Buildings in November 2020. COVID-19 has impacted the design and operation of commercial buildings in myriad ways— from shutting facilities down for months on end at the start of the pandemic to rethinking the way we view physical space and how it can help keep occupants safe as businesses reopen. Given the challenges, this resource sets out to highlight opportunities that can be found in best practices that support health and wellness efforts. It provides a breakdown of different building components that can have a positive impact on occupants; guidelines for incorporating wellness strategies in commercial facilities; as well as case studies.

(IS-2021-173) 2021 Pandemic Guide

BOMA Canada sets out a blueprint to manage pandemic-specific challenges for employees, tenants, and other stakeholders in this guidebook from July 2021.

(IS-2021-172) Engineering an Intelligent Building

This report by Newcomb & Boyd (July 2021) discusses the state of the market for Intelligent Building Technologies, the market forces driving strategies, and the implications for operations

and occupants. Highlighting that engineering an intelligent building requires "putting people at the center," the authors provide case examples from the operations and user experience realms and shows the paramountcy of having a dedicated strategic planning process & team.

(IS-2021-171) Smart Buildings: Spring Edition

This e-book was produced by Consulting-Specifying Engineer magazine and ABB (April 2021). Among other topics, this e-book discussed: integrating buildings systems through controls; selecting a building automation system, getting started in designing a smart building; and smart building consulting: integrating people and systems.

(IS-2021-170) The City of Toronto's Net Zero Existing Building Strategy

The City of Toronto has set a goal of reducing city-wide emissions to net zero emissions by 2050 or sooner, relative to 1990 levels. Achieving this goal requires a significant reduction in the emissions derived from energy use in buildings, as they represent over half (55%) of Toronto's GHG emissions, highlights this report by the city's energy and environment division from May 2021. The authors discuss the bigger challenge of achieving the net zero goal with the large number of existing buildings. It reports on a concerted and coordinated market shift involving multiple actors, including federal, provincial and municipal governments, as well as industry associations, financial institutions, trade unions, the real estate sector, and of course – home and building owners.

(IS-2021-169) IoT at the Edge - How AI will Transform IoT Architecture

This report by wireless provider Kajeet (April 2021) underlines that the vast amounts of information gathered by IoT devices can be a serious challenge. But thanks to advancements in AI and machine learning, the authors argue, AI can be used to lower costs and improve productivity through data-driven decision-making and smart automation. Smart devices and sensors are rapidly changing the ways in which all industries and buildings operate – from healthcare and telecommunications to industrial maintenance and utilities management. Sensors and devices that can automatically generate or capture real-world data for analysis are now available, making it possible to shorten product and service delivery times, better understand the consumer, track assets, plan resource allocations, predict machine breakdowns, lower costs, and streamline production and service delivery processes.

(IS-2021-168) Canada's Climate Retrofit Mission

This report by think tank Efficiency Canada (June 2021) defines the contours of a climate retrofit mission for Canada. It quantifies the retrofit potential and demonstrates the scale required to confront the climate emergency. The authors set out a "mission-oriented" policy framework to the building retrofit challenge and then proposes a way to organize the public sector to achieve it.

(IS-2021-167) DroneDeploy Deep Dive - Transforming Facility & Property Inspections with Drone Solutions

This eBook by DroneDeploy came out in May 2021. It discusses the benefits of drone technology for inspections and takes a closer look at how drone software transforms facilities and property management inspections. Through drone inspections, decision makers become more strategic: managing more effectively, lowering costs, determining measurable outcomes, optimizing assets, and driving unparalleled ROI, the authors argue. To start, drone solutions help companies collect an accurate baseline view of their assets. Creating a pavement condition index (PCI) empowers users to see pavement conditions down to the foot-by-foot level. Low-cost drone flights over roofs and walls provide thermal imaging and empowers clients to understand where problem areas are and can often detect leaks or water erosion invisible to the naked eye. More importantly, customers save time for their employees, take preventative action before problems get more costly, and spend millions less on annual maintenance.

(IS-2021-166) Unlocking the Queue with Grid-Enhancing Technologies

This February 2021 report by the Brattle Group was prepared for the WATT (Working for Advanced Transmission Technologies) Coalition. The analysis discusses how Grid-Enhancing Technologies (GETs) can resolve the transmission issue hindering the deployment of renewable generation and the analysis focuses on three GETs, in particular: Advanced Power Flow Control, Dynamic Line Ratings, and Topology Optimization. The authors provide a case study illustrating how the Southwest Power Pool use of 3 GETs enabled more than twice the amount of additional new renewables or 2,600 MW to be integrated for annual cost savings of $175 million and annual carbon emission reductions of over 3 million tons.

(IS-2021-165) Planning for the Future - FERC's Opportunity to Spur More Cost-Effective Transmission Infrastructure

This January 2021 report by Americans for a Clean Energy Grid describes the need to update and replace a now 50-year-old electricity transmission infrastructure with a more regionally connected one to better accommodate shifting demand and a changing resource mix. The report calls on FERC (Federal Energy Regulatory Commission) to establish guidelines to ensure proactive planning for future needs; require planners to employ the best available data and forecasting methodologies; require planning authorities to consider the diverse benefits of transmission holistically; require planners to evaluate all available solutions, including new physical infrastructure options and grid-enhancing technologies; and direct planners to select a portfolio of solutions that is likely to maximize aggregate net benefits.

(IS-2021-164) Unrealized Potential - Expanding Energy Efficiency Opportunities for Utility Customers in Florida

This report was authored from ACEEE and published in January 2021. The authors take the measure of Florida's underperformance in energy-efficiency programs and provide the following recommendations: setting utility energy saving targets; requiring EE programs for underserved

customers; moving from “ratepayer impact measure” approaches to better utility cost test measurement approaches; and eliminating the two-year payback screen. Such measures would incentivize utilities to invest in cost- effective energy efficiency programs, the report argues.

(IS-2021-163) A Case Study on Integrating Customer DER - Moving the Needle on Utility DERMS Innovation in Australia

This report by Peter Asmus and Michael Kelly from Guidehouse Insights was published in January 2021. The authors discuss a successful Distributed Energy Resources Management System in Onslow, Western Australia. Utilizing a single DERM platform and behind the meter applications, a standalone microgrid was optimized to successfully integrate and instantaneously manage solar PV/diesel/natural gas generation, storage batteries and energy demand. An advanced DERMS algorithm combines real-time data with historical patterns to make real-time decisions. The combined microgrid helped reduce costs and the carbon footprint while providing sustainable energy.

(IS-2021-162) Accelerating Decarbonization of the U.S. Energy System

This February 2021 report from the National Academies of Sciences, Engineering and Medicine and provides a technical blueprint and policy manual for the U.S. energy system over the first critical 10 years of a 30-year effort to transform to net-zero GHG emissions. The report identifies federal policies to advance five technological and four socioeconomic goals and to how to achieve quantitative milestones along this path. Upwards of $2 trillion in costs would be funded through federal appropriations and carbon pricing. The benefits would be significant, including a more competitive and inclusive U.S. economy. Extensive policy summary tables with cost benefit analysis are provided.

(IS-2021-161) Annual Energy Outlook 2021 with Projections to 2050

This report was authored by the U.S. Energy Information Administration and published in February 2021. Utilizing the National Energy Modeling System, various energy projections to 2050 are provided. Energy consumption fell faster that GDP in 2020 and “will take years” to return to 2019 levels, the analysis concludes. Demand for transportation fuels will return to 2019 levels in 2025. Petroleum will remain the most consumed fuel, while coal and nuclear generating capacity will gradually be replaced by natural gas and renewable technologies. High natural gas production will support exports and industrial use. The report sets out a variety of projections related to energy consumption, GDP, carbon dioxide emissions by fuel type, and electricity use by end-use sector projections based on different assumptions.

(IS-2021-160) Blueprint for State Action: NARUC-NASEO Task Force on Comprehensive Electricity Planning

A joint task force involving NARUC (National Association of Regulatory Utility commissioners) and NASEO (National Association of Energy Service Companies) set out two years ago to examine

how electricity system planning processes can achieve greater alignment “after being siloed for decades.” The result report, from February 2021 summarizes the work and offers practical ways to accelerate state actions in aligning electricity system planning approaches, building upon the experience of the 15 Task Force member states. The recommendations were driven by a desire to: improve grid reliability and resilience; optimize use of new and existing resources; avoid unnecessary costs to rate papers; support state policy priorities; and increase the transparency of grid-related investment decisions.

(IS-2021-159) AMI Survey January 2021

This report was authored by Maravedis and published in January 2021. A smart metering survey, conducted in the fourth quarter of 2029, reviewed: meter and WAN requirements, top use cases for Automated Metering Infrastructure (AMI), and key challenges requiring resolution. The top identified AMI use cases include measuring, detecting leaks and improving operational efficiency, and the authors underscore that AMI must incorporate data security and network availability. LoRaWAN and LPWAN options are compared, including applicability for Smart Cities and Home Energy Management Systems. Private networks are preferred 2:1 over public networks. Challenges with AMI include interoperability issues and validation of business models.

(IS-2021-158) Determining Utility System Value of Demand Flexibility from Grid-Interactive Efficient Buildings

This report was authored by Johanna Zetterberg and Monica Neukomm from SEE Action and published in April 2020. The authors focus on methods and practices for determining the economic value of grid- interactive buildings, and how to design market-based programs to optimize demand flexibility, costs and efficiency of the energy network. Data requirements for the economic valuation modeling of demand flexibility grid services are outlined. The analysis includes a summary of valuation enhancements and an extensive list of implementation resources and offers illustrative utility examples.

(IS-2021-157) Powering Our Net Zero Future

This report from the UK Secretary of State for Business, Energy and Industrial Strategy focuses on initiatives under way to drive the country toward net zero. This white paper presents a vision of how the UK makes the transition to clean energy by 2050 and what this will mean for consumers of energy in homes and places of work, and for how businesses use energy to produce goods and services. The way energy is produced and used will rest on a decisive shift away from fossil fuels to using clean energy for heat and industrial processes, as much as for electricity generation.

(IS-2021-156) The Intelligent Automation Global Market Report

This January 2021 report by Shared Services & Outsourcing Network (SSON) presents 5 case studies by 5 authors illustrating where intelligent automation can impact performance and aims to help readers better understand the ROI. Intelligent automation has proven its efficacy when it

comes to improving customer experience, driving new revenue opportunities, supporting digitization across an enterprise, improving data's value add, and finally, offering greater transparency.

(IS-2021-155) Demand Side Energy Management in the Time of COVID

This report by CPower published in January 2021 focuses on the energy challenges major industries faced in 2020 and continue to face in 2021. The analysis presents demand-side energy strategies each industry should consider to offset pandemic year losses and/ or to optimize energy use and expenditure by monetizing existing energy assets in U.S. energy markets. The authors also provide an explanation of the deregulated U.S. energy markets and discuss demand-side energy management opportunities available in each market for commercial organizations.

(IS-2021-154) How smart is your office?

This report from SmartCitiesWorld (February 2021) examines the current state of the smart office movement and identify not only the most in-demand applications and technologies, but what approaches organizations are taking and what the main barriers are to creating more intelligent workspaces. A smart office benefits from being built on a common connected infrastructure capable of accommodating different applications and devices and gathering data from these applications and devices. Responses show that most companies are not taking this integrated approach. Moreover, in practice, a connected lighting infrastructure often serves as an ideal entry point for businesses who want to distribute IoT capabilities throughout their workspaces. However, as the survey revealed, many are not maximizing the use of connected lighting as a cost-effective starting point for smarter indoor spaces.

(IS-2021-153) How the Smart Office Acts as a Team Player in Crisis Management

This report from Siemens Industry was published in May 2020. The role of the smart office in contributing to a crisis management response is examined, with discussion of some of the digital technologies available and how they support the operation of office buildings while keeping the occupants healthy and safe. With the use of workplace applications, it is possible to deliver timely and local communication, showing how density management can be facilitated through sensors and booking software and how risk mitigation can be achieved with data and access control. "The lines are becoming increasingly blurred between buildings, technology and community as new workplace solutions are introduced based on intelligent building infrastructure." The analysis concludes that it is crucial to acknowledge the different layers within an office building which generate data points – from infrastructure to spaces to people – and the ability to connect them. The building itself has an ever- increasing role to play throughout the lifecycle of the crisis – and beyond.

(IS-2021-152) Building Better Places

This report was from SmartCitiesWorld was published in March 2019. Smart, connected

technologies are helping to make buildings more efficient, productive, healthy, comfortable and personalized for the people who work in them. And because commercial buildings make up a significant percentage of the built environment, smart buildings have a significant role to play in creating a sustainable future for cities and the planet.

(IS-2021-151) Air Conditioning and COVID-19: Slowing the Spread

This report from Carrier (May 2020) explains the various systems for indoor air quality and the ways to improve and monitor them. A generation of research and experience has proven that when properly maintained and operated, heating, ventilation, and air-conditioning systems (HVAC) can reduce the spread of viruses. HVAC systems work in a built environment to supply comfortable, clean, recaptured air, mix in healthy levels of fresh air, and contain or exhaust contaminants. Air delivery systems can reduce the transmission of viruses through inline filtration and are also critical in maintaining healthy humidity levels between 40% and 60% indoors which may help to limit the spread and survival of SARS- CoV-2 within the building, while minimizing the risk of mold growth and maintaining hydrated and intact mucosal barriers of human occupants.

(IS-2021-150) Leading Better than Normal

This January 2021 report from JLL highlights that COVID-19 exposed the social and economic inequities and vulnerabilities across healthcare, education and social systems. As a result, the importance of environmental, social and governance (ESG) goals has increased, and it is with this momentum that stakeholders can increase these commitments for a better future. The report provides specific recommendations from JLL's leaders on the improvements that can be made—across industries, property types and regions—in the year ahead. In 2021, the real estate industry has the opportunity for transformative change in the areas of emissions, climate change, social justice and equality. Smart building technology, machine learning and predictive analytics can be powerful tools to enable greater building efficiency, predict maintenance needs and optimize performance for a reduced environmental impact, a healthier human experience and reduced operating expenses.

(IS-2021-149) Buildings are Getting Smarter - Are They Also Getting Healthier

This report was published by SmartCitiesWorld in June 2020. This report examines how connected lighting can lead to a more efficient workplace and healthier workforce. A flexible approach to managing the indoor environment and workspace is vital because each building is unique, and each building occupant has unique preferences. Research confirms that indoor air quality (IAQ) affects the well-being of building occupants and that poor IAQ is linked to lower productivity levels and "sick building syndrome." A connected lighting system can serve as a platform to host sensors and enable facility managers to leverage the value of a building's lighting infrastructure by monitoring workspace parameters such as occupancy, temperature, light, noise, air quality, relative humidity, volatile organic compounds, CO_2 levels, dust and pollution.

(IS-2021-148) Smart Buildings and Carbon Neutrality – A Race Against Time

This report was authored by Jon Glasco for SmartCitiesWorld was published in June 2020. This report examines the potential for policy interventions and innovative technologies to mitigate building emissions, support carbon neutrality measures and facilitate green initiatives. Examples of innovation in energy efficiency include e energy-saving retrofits and upgrades (reducing energy loss and emissions by modernizing the building envelope); and microgrids combined with renewable energy sources, providing capabilities to achieve a more balanced energy supply. Other types of innovations include energy storage solutions combined with on-site renewables; use of intelligent platforms, sensors and user-centric communications to support energy-efficient behavior and reduce energy use; and AI and machine learning to provide notification about energy waste or loss.

(IS-2021-147) Impact of Glazing Properties on Energy Use Intensity and Daylight Quality

This report from building performance platform COVE.TOOL was published in March 2021. The analysis focuses on the energy and daylight impact of selecting different types of glass products based on their performance properties. The author highlights the impact of changes in glass properties on the energy use intensity and daylight quality of this office project. With energy regulations becoming stringent around the world, and glazing leading to a significant impact on performance, using iterative testing can be a cost-effective way to design a higher-performing building.

(IS-2021-146) Microgrids Find Their Business Case with Climate Resilient Internet

This December 2021 report by David Theodore of Climate Resilient Internet (CRi) highlights that microgrids remain the future for resilient, sustainable energy, but cost is a stumbling block. This paper confronts that challenge with a stronger value proposition; one that taps a new revenue stream and maximizes client resilience. In this new vision, microgrids extend resilience to mission critical Internet and cloud data, where extreme weather is causing blackouts so consequential, they must be avoided at all cost. Internet resilience isn't so simple, because data—even from a user's Wi-Fi or their smartphone—relies on untold miles of fiber optic infrastructure, all of which is vulnerable to weather, and dependent on the electric grid. However, a new solution has emerged, called "Climate Resilient Internet"— based on a new certification for climate change and operating on the same "resilience is local" principle as the microgrid. One of the compelling facts put forward is that the savings from a single prolonged internet outage could fund an entire microgrid deployment (typically $2-$4 million/MW).

(IS-2021-145) Charting a Path to the Future of the Office

This report published by BOMA International Deep Dive was published in March 2021. This report provides a reflection on the how the COVID-19 has changed commercial real estate. In "stage one," tenants and property managers established hastily constructed work-from-home (WFH) protocols and the placement of plexiglass and hand sanitizer stations. The office space

industry “normalized” under new—but often changing—rules of engagement in “stage two,” as employees grew accustomed to wearing masks and adjusted to working in a more solitary context. “Stage three” centered on planning for a return to work, albeit in fits and starts and in numbers still greatly reduced from the days of full occupancy. Stage four is still taking shape, and it will require decisions on how the office of the mid- term future looks both in physical appearance and in the protocols that will ensure tenant confidence.

(IS-2021-144) Architects vs Contractors vs Owners - Who Can Most Impact Climate Change in the Built Environment?

This report was authored by building performance platform Cove.tool and published in April 2021. The challenges of reducing carbon emissions in the building industry requires a multi-pronged effort on the part of owners to drive demand, architects to design for the demand, and contractors to execute design in a climate-conscious manner. But today data-driven workflows and analytical tools make it easier for buildings to account for sustainability concerns, with powerful digital tools that provide in-depth analyses of a project for its entire lifecycle, and tools that provide quick metrics and graphical representations of information to drive client discussions and design decision-making. External stakeholders like global organizations, advocacy groups, and governments can push for greater efforts and collaboration between owners, contractors and architects to create a sustainable and carbon- conscious building industry in the future.

(IS-2021-143) Designing Electricity Rates for An Equitable Energy Transition

This February 2021 report was produced by California non-profit Next 10 in collaboration with the Energy Institute at UC Berkeley’s Haas School of Business. The groundwork for the transition to renewable energy has been laid, but changes to how the California and its residents pay for electricity will be needed to ensure equitable outcomes as the state pursues a carbon-neutral path, the report concludes. In particular, the current system of recovering system costs through high volumetric prices is not only inefficient; it imposes a relatively large burden on lower- and average-income households while it recovers a shrinking fraction of system costs from higher-income households because of the diffusion of rooftop solar. A variety of potential approaches to ensure utility revenues can be kept stable without relying on the current rate model are described.

(IS-2021-142) 2020 Construction Technology Report

JBKnowledge reviewed construction industry technology trends in this report from December 2020. Challenges faced by construction companies — and their adaptation strategies — are presented. The analysis covers top software and mobile apps for the construction industry with innovation forecasts and budget benchmarking. A comparative analysis is provided between current and prior year data to highlight important trends.

(IS-2021-141) 2020 Year-End Data Center Trends

JLL Research focused on data center trends and projections for 2021 in this January 2021 report. Demand for data centers, and creation of new capacity, continued to increase with millions of people working from home, attending online schooling, shopping online, and gaming. That growth is likely to continue based on strong investment, demand for 5G, and need for sustainability.

(IS-2021-140) Building Digital Twins

This report by Ken Dooley and José Carlos Camposano from Granlund was published in December 2020. The report explores digital twins through a user-centric approach to determine user needs and the benefits that could be created by connecting data to a digital twin. Different digital twin categories exist, with varying degrees of complexity and timelines for adoption, and less complex solutions are likely to achieve a better balance between the customer value and the resources needed for their implementation and maintenance.

(IS-2021-139) The Advent of Private LTE and 5G

This April 2020 report by Harbor Research offers recommendations for organizations to develop new business opportunities by leveraging smart systems and the Internet of Things. The key enabler includes high performance networks such as Long-Term Evolution (LTE/4G) and next generation 5G. Use of private network services is proposed to act as an abstraction and orchestration layer to link existing networks and optimize data flow and operational efficiency. Successful deployment of new technologies will strongly depend on organizations being able to engage different channels and deploy new technical and business models.

(IS-2021-138) Global Economic Value of Wi-Fi

This February 2021 report from the Wi-Fi Alliance forecasts that the value of Wi-Fi globally will rise from $3.3 trillion in 2021 to $4.9 trillion in 2025 and highlights the importance of ensuring sufficient spectrum for Wi-Fi use to continue the benefits of this technology. Updating results from an earlier study (2018), the analysis presents economic value results for 14 countries and the EU that were developed by economists at Telecom Advisory Services. The data on Wi-Fi's economic value was developed by assessing several key factors and global developments impacting the Wi-Fi industry that contribute to the value of Wi-Fi for 2021 and beyond.

(IS-2021-137) Momenta Prediction Report | 2021: A Look Ahead

This report was authored by digital industry venture capital firm Momenta and published in January 2021. The report discusses how evolving technologies will impact consumers' lives and transform how they communicate, collaborate and do business. Technologies discussed include artificial intelligence, the Internet of Things, cloud computing, 5G, and blockchain. Factors impacting how people work are presented and include social responsibility, wellness, distributed work, and automation. The report also highlights advances in clean energy, electric vehicles, and space technology as indicators of where the market is heading.

(IS-2021-136) Foundations for a Science-Based Net-Zero Target Setting in the Corporate Sector

This report by CDP, the global environmental reporting non-profit, was published in September 2020. The paper describes how companies can apply a science-based targets initiative to achieve net-zero global CO2 emissions by mid-century. Key items discussed include the importance of public awareness regarding C02 emissions, common understanding on what net-zero means for companies, and the development of a science-based framework for the formulation and assessment of net-zero targets.

(IS-2021-135) COVID-19 and the Economic Value of Wi-Fi

This report by Telecom Advisory Services, from December 2020, demonstrates the economic importance of Wi-Fi under pandemic conditions. “Critical contributions” of Wi-Fi include provision of Internet through free access points, efficient and concurrent access to the Internet by multiple devices, reduction in wireless expenditure, support of unserved communities through wireless Internet service providers (WISPs), and virtualization of business processes.

(IS-2021-134) Broadband Myths - Are High Broadband Prices Holding Back Adoption?

This report from the Information Technology & Innovation Foundation published in February 2021 deals with factors impacting broadband accessibility in the U.S. Key takeaways are that while U.S. broadband prices are competitive with other nations, wider broadband access can be achieved through government subsidies for low-income users, improved user literacy and device cost, and user access to private ISP providers.

(IS-2021-133) The Future of Enterprise Networking and Security - Are You Ready for the Next Leap?

CATO Networks presents the results of a global survey that polled 2,376 IT executives on the impact of the COVID pandemic and secure access service edge (SASE) technology on IT purchasing and strategies. The key findings in this January 2021 report reveal that IT enterprise budgets and priorities will focus on remote access performance and security. SASE presents important benefits to organizations such as increased security, time savings in management and maintenance, overall cost savings, and greater agility in adapting to new challenges. CATO's SASE solution is promoted as the first SASE platform to help organizations reap such benefits.

(IS-2021-132) A National Roadmap for Grid-Interactivity Efficient Buildings

This report from the Office of Energy Efficiency & Renewable Energy was released in May 2021. The Building Technologies Office, with industry support, put together a roadmap that outlined how to achieve, by 2030, triple the deployment of Grid-interactive Efficient Buildings (GEBs) over 2020 levels. A GEBs are defined as industrial, commercial or residential facilities which can provide both energy efficiency and optimization of grid services through control and automation. Grid services include resource adequacy, capacity firming, frequency and voltage regulation,

ramping reserves, resiliency, black start, etc. The paper highlights both the barriers preventing — and pillars that support — GEB adoption.

(IS-2021-131) The State Transportation Electrification Scorecard

This report from the American Council for an Energy-Efficient Economy (ACEEE) was published in February 2021. This comprehensive report evaluates and provides a scorecard of states' policy activities and efforts to electrify transportation. While transportation accounts for 28% of GHG, EVs currently represent only 2% of the American vehicle market. California led in five of six categories, including: planning & goal setting; incentives; efficiency; grid optimization; and equity. Recommendations pertaining to benchmarking, data collection, investment and establishing clear policy direction are provided, with policy guidelines for transportation electrification.

(IS-2021-130) Anatomy of a Healthy Building

This September 2020 report by Honeywell provides a technical guide to improving air quality and health safety with regards to COVID, with detailed references. Specific information is provided for: temperature & relative humidity; air filtration; cleaning & disinfection; ventilation; pressurization; and surface cleaning & disinfection. Information on the effectiveness of various air-filtration devices is provided.

(IS-2021-129) The Building Electrification Technology Roadmap (BETR)

This report from the New Buildings Institute was published in January 2021 and provides a guide to developing, implementing and supporting electrification programs. Extensive qualitative research drawing from California efficiency programs of 38 technologies across four end-use areas (Space Heating, Water Heating, Cooking and Clothes Drying & Laundry) is provided. A Technology Assessment Graphic Tool is provided. As an example, heat pumps use 36% less energy, produce 71% less GHG and are 300% - 400% efficient compared with high-efficiency condensing gas furnaces. Electrifying the four main gas-using technologies of space and water heating, cooking and clothes drying cuts energy use by over 40% and GHG emissions by over 75%. The analysis discusses key roadblocks and recommendations.

(IS-2021-128) Building a Successful Smart Home Strategy

This report was authored by Plume Design and published in December 2020. Consumers will require fast, ubiquitous and reliable connectivity from their communications service providers (CSPs) as smart home ecosystems evolve. By 2023, the consumer segment will be three times as large as the business segment, with the global smart home market reaching $317 billion by 2026. This report discusses the current market state, business models, challenges and solutions. Plume's integrated CSP solution is said to reduce customer churn by 30%, truck roll rates and service deployment timelines by 67% and support calls by 50%, resulting in net promoter scores increasing by 60 points.

(IS-2021-127) Building Automation Opportunities to Meet NYC Emission Laws in Existing Buildings

This 2021 paper from EnOcean Alliance highlights that New York City now requires that large (over 25,000 square feet) existing buildings (residential and non-residential) reduce their carbon emissions by 40% by 2030 and by 80% by 2050. As an ambitious climate regulation for buildings, the new law invites discussion about the opportunities available for carbon reduction for buildings which involve building automation, intelligent control Systems and widespread sensor implementation and provides examples of projects where EnOcean-based systems have been installed. The authors provide real-world cases where the EnOcean's resource-saving energy harvesting technology has been adopted in NYC to enable buildings there to be sustainably digitalized for a reduced carbon footprint.

(IS-2021-126) Better than Normal

JLL explores long-term opportunities for improvement in residential, commercial and industrial real estate in the wake of COVID-19 in this 2021 report. Demand for more space and flexibility and use of technology solutions for operations and maintenance have become essential for residential users. Given the shift, trends involving the distribution of office spaces in urban and suburban areas and the continuity of working from home model are discussed. The implications of the new focus on wellness and sustainability in many sectors like work offices, industrial and hotels are also examined. The authors conclude that the real estate industry has the opportunity for transformative change in the areas of emissions, climate change, social justice and equality — and grounds for optimism about large cities' long-term resiliency.

(IS-2021-125) Energy Efficiency Snapshot 2020

This report was prepared by Northeast Energy Efficiency Partnerships (NEEP) and published in 2020. It provides an overview and jurisdictional scan regarding public policy advancements in energy efficiency policies and performance metrics for twelve U.S. states located in the Northeast and Mid-Atlantic region. Figures indicate that energy efficiency is the fastest-growing jobs sector in the energy industry and most of the investments are directed towards electric programs followed by natural gas efficiency programs. A correlation to the reduction of regional carbon emissions in the region for the period 2014- 2018 is also given.

(IS-2021-123) Energy Storage - Impacts of Electrochemical Utility-Scale Battery Energy Storage Systems on the Bulk Power System

This report was authored by the North American Electric Reliability Corporation and published on February 2021. This report confirms Battery Energy Storage Systems (BESS) will grow exponentially with utility-scale storage increasing from 899 MW in 2019 to 3,500 MW by 2023. BESS provides system reliability through frequency regulation, voltage support, and peaking capacity. However battery storage is an emerging technology and lags in integration with renewable resources. North American market development information is provided. California

leads with 1,300 facilities in operation or under construction. Lithium-ion and flow battery applications and market potentials are discussed. Recommendations for modifications of NERC standards to address specific issues are provided.

(IS-2021-122) Property Owners Guide to Private Networks

This report was authored by the Connectivity Wireless Solutions and published in April 2020. This report provides an understanding of Citizens Broadband Radio Systems (CBRS) designed to enhance mobile broadband, open connectivity to cable operators, and extend broadband service through a private network. Real-use cases discussed include airports, stadiums, hospitals, convention centres, universities and commercial buildings. Results of a successful Times Square NYC pilot included enhanced Wi-Fi, mobile and monitoring device connectivity in one of the most densely populated tourist spots in the world.

(IS-2021-121) Leading by Example - How Multifamily Real Estate Companies Approach Energy Management and Savings

This report from the American Council for an Energy-Efficient Economy (February 2021) reports on the results of a comparative study of energy and carbon emission reduction programs for three multi-family real estate companies. An Urban American initiative in NYC achieved a 30% reduction in energy consumption through equipment upgrades and additional weather sealing. A 439-unit apartment in Union City, California achieved an ROI of 42% with a simple payback of 2.4 years on a $1.44 million project. The third program was a Joint Ownership Equity NYC project involving 386 units and $14.3 million in upgrades. Over all, energy efficiency is prioritized in capital planning and ongoing operations in each of these programs, leading to tangible energy savings and better energy management.

(IS-2021-120) The Modern Energy Minimum - The Case for a New Global Electricity Consumption Threshold

This report by the Energy For Growth Hub was published in January 2021. The authors link energy poverty with economic poverty. The sectors that account for energy consumption include industrial (44%), residential (28%), commercial (23%), agriculture (3%) and transportation (2%). The energy poverty line is assessed at 100 kWh, corresponding to an annual income of $208 per year. By comparison, the median for high-income countries is 6,270 kWh and $20,000 per year. The authors propose establishing a two-threshold global energy minimum consumption of 1,000 kWh per person per year (300 kWh residential, 700 kWh non-residential), which would correlate to an average income of $2,500 per year.

(IS-2021-119) State of Construction Tech

JLL looks at the current state and key trends in construction technology in this report from December 2020. The analysis proposes a “construction technology hierarchy,” growth trends, and the data on current venture capital investment. The technology hierarchy includes details on

different construction tech categories which are ranked as foundational tools, a “primary impact” technologies, or “secondary impact” technologies. Most of growth due to the pandemic have been digital collaboration platforms, virtual scanning tools, and safety focused wearables. Venture funding was on par with prior years and with new funding being concentrated in categories that have grown because of the pandemic.

(IS-2021-118) Connected Complexity | The Padi Platform: Open-Source Tools For Open Data

This white paper by Harbor Research and published in March 2021. The paper deals with a software tool, Padi, that enables simple, durable and context-sensitive integration between complex systems without wasteful custom development. It is argued that by using open-source connection profile mechanism, Padi addresses integration issues and enables system developers work more collaboratively by integrating data flows in a reusable way with generalized and extensible concepts.

(IS-2021-117) The Dematerialization Path to Profitability and Sustainability

This report was prepared by Ericsson Consumer & Industry Lab and published in February 2021. Based on a survey involving 5,059 online respondents, the report examines the future of enterprises, white- collar work, and the role of ICT in the next 10 years. Key findings focus on the importance of dematerialization for increased profitability, the remote-work trend for white-collar jobs, the growing adoption of extended reality (XR) and the increased use of renewable electricity for enterprises.

(IS-2021-116) The global economic impact of 5G

This report was authored by Wilson Chow from PWC and published in January 2021. By considering use- cases in health care, smart utilities, consumer and media, industrial manufacturing, and financial services, the analysis highlights that the adoption of 5G will add US$1.3 trillion to global GDP by 2030. To achieve such gains, companies will need to factor 5G into their technology road maps and strategically apply use-cases that will deliver the greatest value. Policy makers and governments, for their part, will need to regard 5G as fundamental component of societal infrastructure.

(IS-2021-115) The Future Telco-Connected Home

This report by Omdia Research for the Broadband Forum was published in January 2021. Opportunities for broadband providers to differentiate their products by offering new services and deriving additional revenue from the connected home are explored. Standards are needed to avoid fragmentation, for open platforms to encourage third-party developers, and "to maintain customer trust," the analysis shows. The security of the router and home network, and customer privacy, remain top challenges.

(IS-2021-114) The 2020 State Energy Efficiency Scorecard

The 14th edition of the American Council for an Energy-Efficient Economy's ranking of U.S. states on their policy and program efforts to save energy; and their progress in pursuing efficiency as a cost- effective tool to achieve state clean energy goals. Score cards covering utility policy, transportation, building energy efficiency policies, state initiatives, and appliance efficiency standards are provided in this report, from December 2020. California leads and sets standards which are adopted by other states, particularly regarding low- emission and zero-emission vehicle programs. Regionally, the northeast leads the way.

(IS-2021-113) Sustainable Recovery - World Energy Outlook Special Report

This report from the International Energy Agency (July 2020) provides a three-year sustainable recovery plan for the electricity, transport, industry, building, fuel and emerging low-carbon technology sectors. A $USD1 trillion investment would yield a 1.1% increase in global GDP, create 9 million jobs, and reduce GHG emissions by 4.5 billion tonnes. New policies and regulatory frameworks would be required to support this plan, which would help achieve the long-term climate goals of the Paris Agreement.

(IS-2021-112) Side Effects: How Renewable Energy Policies Drive Innovation in Complementary Grid Technologies

This January 2021 report from the Information Technology & Innovation Foundation evaluates the impact of seven renewable policies in OECD countries on patenting rates of technologies that complement renewable energy; in particular, solar and wind. Modeling shows the impact that strong renewable policies, market-based demand policies and R&D investment have on innovation. Renewable policy scores by country (Denmark leads) are provided. The analysis shows how the U.S. compares against the global mean over the past 20 years, across 7 metrics.

(IS-2021-111) Responding to Automation Technology Adoption in Canadian Industries

This report Conference Board of Canada report, which came out in January 2021, covers industry- specific trends and attitudes that shape how Canadian organizations adopt automation, using surveys and interviews of managers and frontline workers. Key findings indicate the importance of integrating digital applications and mobile devices, workforce preparedness, understanding the pressure placed on employees to 'up-skill,' and compatibility of automation with existing systems. Barriers to embracing automation are also discussed and include labor shortages, reactive response by employees, insufficient system testing, and inconsistent regulations.

(IS-2021-110 IoT Spotlight Report 2020

This report was authored by Erik Brenneis from Vodaphone and published in September 2020. Based on a survey of 1,639 businesses globally, the report describes how business leaders are using IoT, how the technology is helping them become 'future ready,' and the next steps forecast for IoT. Business adoption of IoT remains strong, with IoT at the core of digitalization enabling

business to seize new business opportunities. Many businesses are also turning to it to help them grow stronger and adapt in the face of unforeseen events such as COVID-19.

(IS-2021-109) Canada Real Estate Market Outlook 2021

This 2021 report by CBRE Limited takes a closer look impacts of the COVID-19 pandemic on the commercial real estate market across Canada. It explains how different market sectors (e.g., industrial, logistics) will continue growing as e-commerce demand remains strong, while the rebound in other sectors (e.g., office, retail, hotel) will depend on how vaccination roll-out evolves. The authors go on to provide a long-term outlook linked to demographic trends and the evolving digital economy. They provide a regional market analysis of Canadian urban centers using statistical information and underline that it is probably too soon to say exactly how remote working will impact demand for office space until workers return safely to office.

(IS-2021-108) Meeting the dual challenges of Covid-19 and climate change

This report was authored by Nils Larsson from ISSBE and published in November 2020. It aims to establish a business case for responding to the dual challenge of climate change and COVID-19 impacts. The analysis explores actions needed in buildings to comply with anticipated health requirements for the post-pandemic period, as well to tackle climate related impacts. It is argued that an integrated action framework that incorporates a variety of strategies for the building industry is urgently needed. As examples, decision-makers should prioritize measures such as focusing on building renovations and retrofits, improving ventilation rates and strengthening energy performance and housing programs for low income populations.

(IS-2021-107) IoT Signals

This October 2020 report by the Hypothesis Group was commissioned by Microsoft. Part of a series of reports on the Internet of Things (IoT), the analysis offers "new learning and insights around the current and future state of IoT." A survey was undertaken involving decision makers in large companies (1000+ employees), where 91% of these companies worldwide (94% in Germany) are involved in IoT adoption in some form. Most projects have moved from “learning” and “trial” to “purchase” and “use” stages. Adoption is highest in retail and energy. IoT is being adopted to enhance productivity and security. Barriers to IoT adoption include complexity and cost. Companies adopting IoT are also developing their familiarity with artificial intelligence (AI) and edge computing, and 70% are using digital twins for simulation with IoT.

(IS-2021-106) Functional Requirements for Broadband Residential Gateway Devices

This technical report by the Broadband Forum, titled "TR-124," was published in December 2020. It contains requirements for a residential gateway between a broadband network such as DSL (digital data over analog telephone wires) or GPON (gigabit passive optical network using fiber optics) and a home network. Applications include voice, data, broadcast video, video-on-demand and two-way video using broadband networks. Among the requirements is support for IPv6

(Internet Protocol version 6), which extends the address space of IPv4 from 32 bits to 128 bits, in that way making it possible to accommodate billions more devices.

(IS-2021-105) Artificial Intelligence: The Future of Coworking

This report was prepared by Yardi company and published in October 2020. The ways in which artificial intelligence (AI) and the Internet of Things (IoT) impact the shared workspace industry today–and how they will shape coworking as a whole in the near future–are the focus of the report. The authors argue that growth and adoption of AI will be influenced primarily by user trust. As AI and IoT become more powerful, refined, and accepted, operators will ultimately free up more time from manual tasks, gaining the ability to focus on the community-driven aspects of coworking.

(IS-2021-104) A U.S. Grand Strategy for the Global Digital Economy

This report was authored by Robert D. Atkinson from the Information Technology & Innovation Foundation and published January 2021. This paper presents a stark view of world competition in information technology: "Today's era is one of nationalization, mercantilism, increased authoritarianism, and tension." The author urges the U.S. to focus on developing hardware and networks to support communications necessary for "the digital economy." Moreover, the U.S. faces a risk where much of the world, including the EU, could align against U.S. IT and digital interests, leading to a many-against-one environment, with detrimental consequences. Various scenarios are present for how the U.S. might ally with countries outside of China and Russia or might be thwarted by these allies.

(IS-2021-103) 2021 State of Disruptions

Avant Communications released this report in January 2021. The results of a survey of 500 US U.S. executives in IT, security and finance were presented, pointing to business transformation as a key business driver that enterprises need to understand well in to stay ahead of the competition and sustain growth. The main trends and takeaways include the use of software-defined networks, multi-protocol label switching, growth in as-a-service models (contact centers, infrastructure, unified communication), co-location, inclusion of trusted advisors, and cybersecurity preparedness.

(IS-2021-102) Intelligent Buildings and COVID-19 | Executive Summary & Module 1

In this CABA Landmark Research project, Frost & Sullivan evaluated the key issues and challenges presented by the pandemic for the intelligent buildings industry, assessed the implications for current and future technology evolution, and outlined measures that will help build future resiliency for the sector. The Executive Summary report and Module 1 of 3 are available as a free download.

(IS-2021-101) Energy Technology Perspectives 2020

This International Energy Agency report from January 2021 offers detailed analysis and advice on the clean energy technologies the world needs to meet net-zero emissions objectives. The analysis maps out the technologies that will be required to tackle emissions in all parts of the energy sector, including areas where technology progress is still lacking, such as long-distance transport and heavy industries. The authors show the amount of emissions reductions that are required from electrification, hydrogen, bioenergy and carbon capture, utilization and storage. An assessment of emissions from existing infrastructure and the recommended countermeasures is also provided.

(IS-2021-100) Dissecting IoT for the Rural Broadband Ecosystem

Finley Engineering released this report (December 2020) focusing on six to ten-year planning for the potential growth of connected devices, informally called Internet of Things (IoT). The estimated 30 billion connected devices in 2020 are expected to reach 50 billion by 2025. Business and industrial applications are expected to outpace home applications. Use cases in rural America are described for agriculture, healthcare, town operations, and education. The role of fiber optics and fixed wireless networks for a data infrastructure is presented in summary form. Public funding programs are discussed.

(IS-2021-99) Automation 2020: OT/ICS Cybersecurity

This December 2020 eBook was published by Automation.com, a subsidiary of the International Society of Automation. It examines emerging cyberthreats—in particular, the misuse of DNS protocols—and sets out a "zero-trust" cybersecurity approach that should work within Operational Technology (OT), industrial control systems (ICS), and supervisory control and data acquisition (SCADA). There are key takeaways on the value of open and secure SCADA systems, safety best practices for improving OT cybersecurity, and how to strategically communicate cybersecurity information to corporate board members.

(IS-2021-98) 5G Standalone Architecture

This January 2021 report by Samsung examines the advantages of 5G networks over 4G networks (LTE) in terms of throughput, latency and reliability. 5G allows operators to provide unprecedented communication services for end-users and to explore innovative business use-cases that can generate new revenue streams by using 5G-specific services. Migration strategies from 4G to 5G are presented, including standalone (SA) and non-standalone (NSA). Over all, NSA can be an attractive option for customers who have interest in quickly deploying 5G by utilizing legacy network and minimizing upfront investments. "However, the SA architecture is the best choice for operators that want to tap new 5G opportunities, as 5G-specific services are available only in SA architecture."

(IS-2021-97) Zero Carbon London

This November 2020 report by New London Architecture in the UK reports on a survey of

challenges and solutions to help industry support the path to carbon neutrality in the city of London. Over 100 businesses involved in the whole-building industry were surveyed. According to the respondents, lack of policies and green funding are the two major obstacles to achieve zero carbon emissions. The resulting proposals emphasize the importance of retrofits of existing buildings, the adoption of a circular economy approach for design and construction as well as a complete transition to clean sources of energy. Lastly, the annex provides a list of existing projects in London that set the bar for environmental design.

(IS-2021-96) Energy Efficiency 2020

This December 2020 report from the International Energy Agency (IEA) reviews energy efficiency (EE) trends with a special emphasis on the impact of the COVID-19 crisis on EE technology adoption and global energy markets. Facts showing how the pandemic influences the energy demand and energy intensity in the building sector, appliances, manufacturing industry as well as transportation (urban and long distance) are illustrated and discussed in depth. In light of government funding on energy efficiency and COVID-19- related stimulus measures, the report provides analysis of the role of the energy efficiency industry as a driver for economic recovery and job creation.

(IS-2021-95) Global Renewables Outlook: Energy Transformation 2050

This 2020 report published by International Renewable Energy Agency (IRENA) examines energy transformation with closer a look at needs and impacts at the regional level, in both energy and socio-economic terms. This study also outlines a vision of transformative energy policies as the path to decarbonization. On the innovation and technology side, carbon dioxide (CO_2) emission reductions in shipping, aviation and heavy industry remains the most difficult obstacle. Addressing such challenges soon will be crucial to achieve net-zero emissions in the second half of the century.

(IS-2021-94) Canada's Net Zero Future: Finding Our Way in the Global Transition

This February 2021 report from The Canadian Institute for Climate Choices proposes credible pathways for Canada to reach its goal of net zero greenhouse gas (GHG) emissions by 2050. Policy options across sections are evaluated and discussed as “safe bets” and “wild cards.” The report highlights the need for government action to implement and enforce strong policy, manage the risk linked to "wild-card" solutions, implement an accountability framework, and ensure the transition to a net zero economy is fair and inclusive. References to supporting studies are provided.

(IS-2021-93) Building the 22nd-Century Utility

This January 2021 report by Val Jensen of consulting giant ICF is subtitled “How a utility CEO remakes her business to survive—and even thrive—into the future.” Instead of providing a future model based on incremental improvement of past practices, this paper provides a fresh

approach based on what the future consumer is likely to need in the coming years—and how these needs could be monetized. A two-tier structure involving network capabilities and energy-as-a-service provides a utility with a more responsive, resilient and consumer-friendly business model, one better structured to respond to changing future demands. Illustrations of how this model would work in practice are provided.

(IS-2021-92) Automated Facial Recognition - A Guide to Ethical and Legal Use

This January 2021 report from the British Security Industry Association proposes terms of reference and frameworks for governance and compliance for the legal and ethical use of AFR. The report provides verification and identification decision trees and discusses how AFR storage and data privacy should be approached. This report helps frame the discussion around AFR, and the inherent rights individuals should retain as the technology continues to progress.

(IS-2021-91) 2021 Strategic Directions: Megatrends Report

This February 2021 report from Black and Veatch looks to inform the 2021 decision-making process that will drive capital spending and help utilities position for the future. Supported by survey results from 1,000+ power, water, telecommunication and natural gas professionals, the report identifies three significant trends: Customers Driving Sustainability in the C-Suite; Next-Level Reliability Through Resilience; and Turning Data into Action. Results suggest that 83% of utilities are pushing capital towards clean energy with 70% leading innovation in this area; 73% are focused on improving reliability; 85% have a water/drought management plan; and 60% identify regulatory changes as a risk.

(IS-2021-90) Affordability and Resilience: The Challenge of Tower Renewal in Private Rental Apartment Buildings

This December 2020 report by the Urban Land Institute presented the conclusions of a special panel tasked with proposing creative renovation and redevelopment solutions for tower clusters in the Greater Toronto Area (GTA). Based on analysis of the challenges facing these sites, the panel developed recommendations on selected sites that could be applied more broadly. The panel underscored that Toronto's apartment towers remain critical landing points for new immigrants and housing strivers constrained by the "missing middle." Refocusing on tower renewal is crucial, as no alternative housing currently exists for much of the city's residents.

(IS-2021-89) Combined Heat and Power and a Changing Climate: Reducing Emissions and Improving Resilience

This January 2021 report by the Combined Heat and Power Alliance looked back on the national three-day summit it held in the fall on the role of combined heat and power in a low-carbon future. This report is based on the presentations and discussion by those who attended the event, as well as on previous research and analysis undertaken by the alliance. Key benefits of combined heat and power systems are examined. CHP is a climate change solution because it

can both reduce emissions and be a resilient energy resource, reliably providing electric and thermal energy even during severe weather events, the authors write.

(IS-2021-88) Data Automation is the New Battleground in the Mortgage Industry

This report by Barbara Hodge, Principal Analyst and Global Digital Editor, Shared Services and Outsourcing Network (SSON) was released in September 2020. It is argued that the mortgage industry is in desperate need of a "digital overhaul." Automating data ingestion will underpin operational resilience, reduce costs and deliver new revenue streams as mortgage providers tap into customer and property data currently trapped in applications, contracts and valuations. The author predicts that swift, seamless workflows combined with reliable data analytics will become "game-changing" for the mortgage industry, and the extent to which the opportunity is taken up will greatly influence the success of different industry players.

(IS-2021-87) Guide to Building a Connected Workplace with a Remote Workforce

This COVEO report released in April 2020 discusses the need for today's employees to be equipped with up-to-date tools and information resources in order to work effectively from any location. There are currently several organizational challenges preventing a unified digital workforce, including siloed and disconnected systems which lead to inaccurate and inconsistent data, the authors write. The report describes the key measures companies can undertake to build an intelligent and connected digital workplace—one that creates trust and confidence among employees, while allowing them to adjust to the new realities of remote work.

(IS-2021-86) OpenBlue Healthy Buildings | Pulse Survey

Johnson Controls surveyed more than 400 firms in the U.S. and Canada on their approach to supporting healthier buildings and a successful return to work in 2021. The resulting report, published in January 2021, revealed a keen interest in healthy buildings initiatives and valuable insights on what that means to companies today. A universal spending pattern across industries also became clear. In particular, while some industries spend slightly more on clean air initiatives (commercial real estate) and others on disaster response and healthy workspace (healthcare), overall, the need and desire for healthy buildings and safe workspaces transcends vertical markets.

(IS-2021-85) Lessons from a Heat Pump Retrofit at Walpole Ave: A TAF Case Study

This report prepared by The Atmospheric Fund (TAF) was released in November 2020. To advance climate action and reduce carbon emissions in the Greater Toronto and Hamilton Area (GTHA), The Atmospheric Fund (TAF) is focused on scaling up the adoption of deep energy retrofits (defined here as savings of 40 per cent or more) in multi-family buildings. Deep retrofits offer multiple benefits to communities including carbon reduction, cost savings, and health and comfort improvements. The report describes the results of installing heat pumps at a nine townhouse blocks having 120 suites in total, ranging in size from one- to three-bedrooms. To

demonstrate the viability of retrofits focused on electric heat pumps, TAF installed and monitored eight cold climate air-source heat pumps (CC- ASHPs) as a pilot project. The results and lessons of the pilot project are summarized here. The heat pump pilot demonstrated that the multi-split systems can effectively maintain comfortable conditions through a cold Toronto winter.

(IS-2021-84) Most Innovative Projects of 2020

This report by Enel X (January 2021) shows how some of its leading commercial, industrial, institutional, and utility clients meet their energy challenges. While 2020 will be remembered as a pandemic year, it also marked a major, positive shift in the way energy is consumed, the authors write. Fossil fuel companies continued to lose market share as deployments of renewable energy projects accelerated. Even in oil- and gas-rich Texas, solar, wind, and energy storage projects dominated the queue to connect with the grid. The report highlights the effectiveness of: 1) Highly coordinated demand-response programs that protect the grid and local communities in hours of need; 2) Innovative solar-plus-storage initiatives that are replacing grid instability with energy resiliency, while also reducing GHG emissions; and 3) Ingenious fleet and infrastructure electrification efforts that are making carbon-free travel possible.

(IS-2021-83) Adoption of Light-Emitting Diodes in Common Lighting Applications

This report by the U.S. Department of Energy (August 2020) examined the effects of LED for lighting in terms of energy saved for markets where non-LED technologies were traditionally installed (incandescent, halogen, etc.). Estimates for energy savings if there were 100% penetration of LEDs are presented. As of 2018, indoor penetration of LEDs was about 30% and outdoors was 51%. Indoor penetration was slower than outdoors because of LED light quality aesthetics. About 4 quadrillion BTUs could be saved with 100% LED installation, the analysis projected.

(IS-2021-82) Why Local Solar for All Costs Less: A New Roadmap for the Lowest Cost Grid

This report was authored by Vibrant Clean Energy, LLC and published in December 2020. Using software modeling, the researchers analyze the potential impact of local solar power generation on total emissions of carbon dioxide. Fossil fuel generation accounts for 32% of all energy-related carbon dioxide emissions, the report notes. The current mix of fuels is about 20% coal and almost 50% natural gas. Coal for electricity generation is expected to end by 2040. The modeling compared business-as-usual with government mandates to reduce emissions. With clean energy mandates in the U.S., potential savings of $473 billion by 2050 are projected.

(IS-2021-81) Sector Coupling: Creating an Interconnected Decarbonized Energy System Benefiting Industry, the Power Sector and Society

This December 2020 report from DNV GL investigates the relationship between power sources for various industries as they move toward electricity and hydrogen as the primary fuel source.

He analysis describes coupling between different economic sectors (e.g., industry, services, households and transport) as they transition towards the use of electricity and hydrogen as the dominant energy carriers. Traditionally, economic sectors have been tied to specific energy carriers and energy carriers are tied to specific uses. Electrification is a main enabler of the energy transition and a main aspect of sector coupling. Sectors that previously used various energy carriers will now compete for the same source: electricity. Sector coupling will lead to "market coupling", meaning that prices of energy will depend on its use in different markets. Market coupling may well have a positive effect on the business case for renewable electricity generation and lead to promising new opportunities for industry.

(IS-2021-80) How Technology Can Save Traditional Retail

This report was authored by Juniper Research Ltd and published in September 2020. A review of technologies to improve the operations of a retail store to be more competitive with online sales was undertaken. The technologies included: smart checkout (faster checkout), smart mirrors [not explained], beacons using Bluetooth (to help the customer find a specific product in the store), RFID (electronic tags with product data read wirelessly at a short range for inventory management), and robotics. The use of AI (artificial intelligence) is discussed for improving the customer experience. Smart checkout technology was a $2-billion market in 2020 and is expected to reach $387 billion by 2025.

(IS-2021-79) Vision for Driving a Clean Energy Transformation

This November 2020 report was authored by the American Wind Energy Association. The authors set out recommendations for driving renewable energy to meet climate and economic-expansion targets, delivering renewables to consumers at the least cost, expediting federal permitting or renewables, and removing competitive barriers for renewable energy to reduce the costs of decarbonization. Recommendations for specific executive orders, laws, regulations, and tax policies are listed.

(IS-2021-78) The Italian Superbonus 110 Percent Economic Recovery Program - A Golden Opportunity for Energy Efficient Technology

This November 2020 report is by EnOcean Alliance. A new Italian law aims to boost the economy by providing financial incentives promoting sustainability and improving energy efficiency, especially in older residential properties. COVID-19 economic recovery programs will strongly support a shift towards energy-efficient solutions by allowing for the tax deduction of up to 110% of the costs incurred over several years. Italian law already provides an "ecobonus" that has made it possible for building owners to offset the cost of installing remote monitoring/control systems for heating, air conditioning and hot water supply in a property. Enhanced legislation that took effect in July 2020 extends fiscal detraction to 110% when building automation systems are installed in conjunction with other, more extensive works aiming to reduce energy consumption within the same building.

(IS-2021-77) The Smart Home Opportunity: Room-by-Room

Parks Associates prepared this June 2020 report for ESA Research, with support from Resideo. The authors examine the challenge of marketing professionally-installed home automation equipment, especially security and safety systems, versus selling do-it-yourself (DIY) equipment. The analysis provides three choices around DIY: DIY as a fallback if the customer refuses professional installation, DIY as an alternative to professional installation, and DIY as the only option built around voice recognition. Companies are advised to tailor their product offerings to specific rooms in the house according to customer needs. Moreover, security companies should position their offerings in smart home devices as appropriate for specific locations in the house. These companies should be sensitive to consumer's privacy concerns.

(IS-2021-76) Advancing Deep Retrofits in the UAE

This report was authored by Majd Fayyad and Jason John from the Emirates Green Building Council and published in October 2020. The analysis aims to help industry and government explore solutions, approaches and incentives to retrofitting buildings—measures that must go beyond current renovation programs to achieve greater energy and financial savings. Moreover, this study presents the views of key stakeholders in the UAE retrofit market and seeks to establish roadmaps for deep retrofits and decarbonization of the existing building stock.

(IS-2021-75) A Powerful Priority: How Appliance Standards Can Help Meet U.S. Climate Goals and Save Consumers Money

This paper published in the last quarter of 2020 by the American Council for Energy Efficiency Economy shows how updates to national appliance standards could mean significant carbon reductions, utility-bill savings, and better management of peak electricity demand. Estimates are provided to quantify the savings if 47 products are subject to upgraded efficiency standards. Water heaters, commercial and industrial fans, and furnaces for space heating and lighting offer the greatest carbon reductions opportunities, the analysis shows. Improving test procedures can also help ensure that standards deliver the expected savings.

(IS-2021-74) Decarbonizing Public Sector Buildings

This NEEP report (November 2020) is an update to a 2012 report entitled *Greening the Public Sector, Maximizing Energy Efficiency*. The original report provided recommendations and exemplars for how public sector buildings could achieve higher levels of energy efficiency. Some of the recommendations that remain relevant include reducing cost barriers for constructing energy-efficient buildings and schools, increasing workforce training and education, and establishing the goal of zero energy for all public buildings. However, while zero energy was considered a long-term goal for public sector buildings in 2012, it is now a proven performance target for many buildings today, the authors write. Their analysis sets out updated recommendations to help states implement strategies to rapidly decarbonize public sector buildings and demonstrate how building decarbonization can drive market transformations in the overall building sector.

(IS-2021-73) Smart Home, Healthy Home

This report published in 2020 by Park Associates provides an overview of how the healthy home concept was developed as an extension of the green building movement and the type of goods and services found in the market. “Healthy home” is a powerful new value proposition for builders. Second, the report illustrates the results of a recent consumer study which found that interest in health- related use cases increased due to COVID-19 concerns. Topics such as safety, clean air, clean water, energy management and senior care technology have emerged as top concerns in consumers’ minds. The report also analyzes the implications for dealers in the security industry as potential suppliers of integrated solutions linked to their security platforms.

(IS-2021-72) State of Operations and Maintenance Software

James Dice, Founder, Nexus Labs, and Raj Subramanian, Co-Founder and CPO, Facilio analyze the current state of software in building O&M and the barriers for technology adoption. They examine the possibilities that can be unlocked with modern software and suggest a viable strategy for real estate owners and operators to unlock that potential. The paper presents insights and observations based on the changing real estate technology landscape and backed by learnings from working closely with the industry.

(IS-2021-71) Energy Efficiency Program Financing: Size of the Markets

This ACEEE policy brief from November 2020 estimates the volume of residential and commercial energy efficiency financing from five programmatic sources. Energy-efficiency financing programs typically aim to increase the scale of investment in energy efficiency, as grants, rebates, and other incentives alone will not be enough to reach efficiency goals and targets, the authors. Due to the decentralized nature of energy efficiency financing programs and the dearth of publicly available data, there has been a lack of sufficient information on the volume of recent annual lending to energy efficiency from programmatic sources. This brief aims to fill this knowledge gap and provide a baseline for future research.

(IS-2021-70) Energy Impact of Human Health and Wellness Lighting Recommendations for Office and Classroom Applications

Researchers from the Pacific Northwest National Laboratory evaluated the potential energy impacts of circadian lighting designs. Specifically, this research from August 2020 investigated the potential energy impacts of circadian lighting design recommendations that are gaining attention in a variety of common applications such as offices and classrooms. Within the two applications considered, parameters like surface reflectance distribution and desk orientation were also evaluated to explore the magnitude of potential effects. Using results from 45 unique simulation conditions, the analysis estimates that energy use may increase between 10% and 100% because of increased luminaire light levels used to meet circadian lighting design recommendations listed in current building standards (WELL v2 Q2 2019, UL Design Guideline 24480, and CHPS Core Criteria 3.0.)

(IS-2021-69) WBA Annual Industry Report 2021

This November 2020 report by the Wireless Broadband Alliance examines how new levels of Wi-Fi speed, security and reliability have become available through innovations such as multi-access point mesh, Wi-Fi 6, very high throughput, and ultra-low latency. As industry turns to enhanced Wi-Fi, the latest Wi-Fi standards (Wi-Fi 6 and 6E, based on IEEE 802.11ax standards) will deliver a sea change in Wi-Fi capabilities and performance on 1200 MHz of additional spectrum. The Wi-Fi community has worked to turn an impressive core standard into a fully deployable, monetizable platform, the authors, write. With publications like the Wi-Fi 6 Deployment Guidelines and Scenarios, the WBA seeks to aid service providers in deploying networks that are optimized for many different markets and applications, and that consequently have far greater commercial potential than previous platforms.

(IS-2021-68) Fire Safety Challenges of Green Buildings and Attributes

This October 2020 report was published by the Fire Protection Research Foundation. Specifically, the goal was to examine fire events involving green / sustainable building materials, features and technologies, and to assess the current state of research, regulatory changes, engineering approaches, risk mitigation strategies, and firefighting tactics associated with fire challenges with green / sustainable building materials, features and technologies, which have emerged since 2012, when the group previously examined this issue. The analysis recommends integration of sustainable buildings attributes into fire incident reporting systems. It calls for more robust and appropriate test methods for assessment of materials, components, and systems performance. The importance of having better tools for holistic design and performance assessment, taking advantage of BIM and other technologies that are defining the future of the construction market, is also discussed.

(IS-2021-67) Fit For Future: The Impact of COVID-19 on Workplace and Portfolio Strategies

This December 2020 survey was conducted by Fit for Future with support from the Royal Institution of Chartered Surveyors. The pandemic brought a radical transformation to the world of work. Supply chains are being reconfigured, consumer preferences have changed and working practices and expectations have adapted, influenced by technology use. There will also be longer-term impacts that greatly affect the way workplaces and real estate strategies are planned and managed. Looking ahead to those changes, collaborative research team sought to canvas opinions from those at the forefront of the decision-making process. A questionnaire survey was conducted with the support of more than 100 organizations spanning governmental bodies and private sector companies. Approximately 20% of the survey participants were interviewed and their views are captured in this report, which is aimed at real estate occupiers, the supply chain and policymakers.

(IS-2021-66) Lead-Free Perovskite-Inspired Absorbers for Indoor Photovoltaics

This report from October 2020 highlights the potential to use indoor photovoltaics (IPV) to

power autonomous devices. Lead-free perovskite-inspired materials (PIMs) have recently attracted significant attention in photovoltaics research, due to the similarity of their electronic structure to high-performance lead-halide perovskites, but without the same toxicity limitations. The capability of PIMs for indoor light harvesting has not yet been considered, however. Calculations around low- toxicity PIMs reveal their considerable potential for IPV, thus encouraging future efforts for their potential to power IoT devices.

(IS-2021-65) Prediction of an OT Attack

This Tenable white paper, published in December 2020, discusses the need to update the current operational technology (OT) security paradigm. Some organizations wanting to be more efficient and cost-conscious buy into IT-OT convergence, while others deploy Industry 4.0 or IoT technology. These two initiatives yield massive benefits but can also open the door to new risks. A newer form of security takes both the network and both IT & OT devices—together—into account. This is called attack vectoring, which redefines how one can address attacks by identifying the high-risk pathways an attack may take if it were introduced to the OT environment. An important aspect to attack vectoring is running simulations that can best determine weak points and where security interventions will be needed before an attack is launched.

(IS-2021-64) Canadian Provincial Energy Efficiency Scorecard

This 2020 report from Efficiency Canada, housed at Carleton University's Sustainable Energy Research Centre, assessed provincial energy efficiency policies and outcomes introduced or implemented between January 2019 and June 2020. Provincial scorecards are provided, covering five policy areas: Energy Efficiency Programs; Enabling Policies; Buildings; Transportation; and Industry. British Columbia and Québec retained the top two spots in the overall rankings. British Columbia continues to lead in both Enabling Policies and Buildings, and Québec again places first in Transportation. Overall, energy efficiency improvement was less than 2% and also less than the 3% target for Canada. The energy efficiency methodology, data on program spend, and recommendations provide helpful reference material for policymakers and energy efficiency sector professionals.

(IS-2021-63) Identified & Authorized: Sneaking Past Edge-Based Access Control Devices

This September 2020 paper from Trend Micro Research September 2020 examines the capabilities and security of new access-control devices based on edge computing architecture. Many popular access control solutions based on biometric technology are more secure and less prone to issues such as credential theft and fraud than traditional security solutions. However, biometric authenticators are usually computationally heavy. Offering an alternative approach is edge computing, a distributed architecture design that places computing nodes at the edge of the network. This brings them much closer to information-gathering sensors and devices, thereby eliminating the need to send large amounts of data to computational services in distant locations. The analysis concludes that many edge-based access-control devices are fully capable of controlling access through facial recognition, but they lack basic security features.

Manufacturers should apply the necessary guidelines and measures to make sure that these devices are as secured and protected as possible.

(IS-2021-62) the Time is Now for a Holistic Approach to Assessing Smart Buildings

This April 2020 position paper from TIA discusses the need to define smart buildings, identify gaps in existing measurement methods, and develop preliminary assessment criteria. Those critera, to support the objective of holistically measuring building technology and performance, should encompass six primary smart building operational categories, the authors write: connectivity, health and wellbeing, life and property safety, power and energy, cybersecurity and sustainability. Buildings are to be scored on a sliding scale and their operators provided with the information and guidance they need to improve scores all building lifecycle stages. The TIA launched the new SPIRE program for smart buildings recently, and are currently running SPIRE pilot buildings.

(IS-2021-61) Transparency, Digitization, Decarbonization: The Imperative for Transparent, Sustainable and Resilient Real Estate

The 11th edition of the Global Real Estate Transparency Index (GRETI), produced jointly by JLL and LaSalle Investment Management, was released in July 2020. With data from 163 cities in 99 countries and territories, the report provides a comprehensive survey of the availability and quality of performance benchmarks and market data, governance structures, regulatory and legal environments, transaction processes and sustainability metrics. GRETI is intended to guide cross- border investors, developers and occupiers of real estate—as well as government and industry bodies looking for international benchmarks. This year's edition was extended to quantify 210 separate elements of "transparency," with additional coverage on sustainability and resilience, health and wellness, proptech and alternatives sectors.

(IS-2021-60) Addressing Subscriber Security Challenges with Comprehensive Gateway Security Controls

This Calix white paper published in May 2020 looks at current and emerging options for home Wi-Fi network security. The analysis describes various security solutions that subscribers can purchase, such as endpoint security software and standalone cybersecurity hubs. These options, however, come with significant limitations, the white paper notes. Given those drawbacks, service providers can integrate best-in-class technologies like PUF, WPA3 and software-based security controls in the residential gateway, it is argued. This approach ensures "complete protection at the network perimeter" while minimizing the impact on performance and maximizing the subscriber experience, the authors write.

(IS-2021-59) Changes in SSL Device Efficiency and Optical Performance Under Accelerated Aging Conditions

This report for the U.S. Department of Energy's solid state lighting technology division came out

in June 2020. Lighting application efficiency (LAE) describes the efficient delivery of light from the light source to the lighted task and is viewed as a new frontier—increasing energy savings with solid-state lighting (SSL) technologies. A LAE framework that takes into account light source efficiency, optical delivery efficiency, spectral efficiency, and intensity effectiveness is discussed. This research focuses on a sampling of the available SSL products that can be broadly defined as having modified spectral output; the method of spectra modification has a significant impact on light source efficiency and long-term optical delivery and spectral efficiencies. Enhanced optical performance came at the cost of reduced light source efficiency for the lamps and light engines examined in this study.

(IS-2021-58) Multi-Tenant Datacenters and Sustainability

This September 2020 study by 451 Research based on primary-research survey data assesses the market dynamics of a key enterprise technology segment. In the coming years, major technology players and their datacenter providers will need to demonstrate they are working aggressively to improve their sustainability practices. IT vendors and cloud service providers are instrumental in achieving a smaller environment footprint by improving efficiencies across industry, including enterprise IT. To gauge how this segment views the importance of sustainability measures in datacenter operations, 451 Research was commissioned by Schneider Electric survey MTDC operators. The resulting study is based on more than 800 datacenter service providers globally.

(IS-2021-57) Data Center Outlook | Outperforming Other Sectors Amid the Pandemic

This September 2020 report by JLL combines forecasts from analysts across the company's regions. According to Nareit, data center REITs outperformed other sectors amid the pandemic in total returns, due to immediate demand for e-commerce and virtual connectivity. While they have challenges with manned operations and increased demand, the report projects that data center REITs will continue to outperform other sectors throughout the year. Operators with diverse tenancy have been largely unscathed from direct COVID-19 impacts. Other operators, such as QTS and CyrusOne, have set record revenue backlogs.

(IS-2021-56) Energy End-Use Data Collection Methodologies and the Emerging Role of Digital Technologies

This publication is authored by the Energy Data Centre (EDC) of the International Energy Agency (IEA) and released in October 2020. The paper explores the role of new and digital technologies for energy end-use data collection. It reviews applications, strengths, and weaknesses of the major existing technologies, dividing them into three broader categories based on whether the purpose is data collection, data management, or data analysis. The case studies and analysis provided may serve as a starting point for energy statisticians and energy efficiency experts in guiding the design, and/or informing the implementation of new technologies for data collection.

(IS-2021-55) Building Analytics Comparison Guide

This December 2020 report by Dennis Krieger of Clockworks Analytics and James Dice of Nexus Labs examines and compares the range of tools available to O&M teams, from building automation system (BAS) alarms to fault detection and diagnostics (FDD). This paper tells the story of that second “D” and why it is so important. To illustrate, the example of a large air handling unit experiencing several issues is examined. The paper concludes by issuing a challenge to the industry: building owners need FDD, not just FD.

(IS-2021-54) The Post-COVID Recovery: An agenda for resilience, development and equality This 2020 report was published by the International Renewable Energy Agency (IRENA). It

makes the case that action on clean energy can be instrumental in the post-pandemic period to strengthen the economic recovery, bolster sustainable development and ensure carbon emission reductions. This report provides practical insights, options and recommendations for governments to consider. It is intended to support informed policy-making as countries devise recovery measures specific to their circumstances.

(IS-2021-53) Sharing Knowledge on Electrical Energy Industry’s First Response to COVID-19

This 2020 report from IEEE’s PES Industry Technical Support Leadership Committee (ITSLC) examines how the electrical power and energy industry has been dealing with emerging challenges resulting from the pandemic. It compiles the results of a survey carried out to identify the type of mitigation measures and practices implemented by some electric utility operators around the globe to keep workforces safe and mitigate technical issues that might occur.

IS-2021-52) Framework Document on a Transformational Plan for the Built Environment

This November 2020 report by Holger Wallbaum and Colin Fudge was presented at the World Sustainable Built Environment online conference Beyond 2020. Its main purpose was to provide clear guidance to the global built environment and interconnected sectors such as urban planning, urban design, urban landscape and green infrastructure to achieve the UN’s Sustainable Development Goals by 2030. All these sectors are critical in capturing life-cycle assessment at the neighbourhood, city and regional level, the analysis show. Specific initiatives with measurable activities and outcomes in nine areas are provided.

(IS-2021-51) Transforming Data into Action

This October 2020 report from Northeast Energy Efficiency Partnerships (NEEP) is subtitled “A report on how benchmarking data can be used to achieve deep energy savings.” It highlights the importance of energy benchmarking to understand energy usage across city and state jurisdictions, which is helpful in developing strategies to achieve climate goals. Interactive energy dashboards and maps, home energy scores, building performance standards, and policy guidelines are discussed.

(IS-2021-50) Interpreting Global Energy Scenarios for Emissions Planning at the Utility Scale

Researchers at the University of Wisconsin-Madison were asked by the primary utility company in Madison to evaluate IPCC scenarios relevant to its operation (Intergovernmental Panel on Climate Change). The resulting report published in November 2020 focuses on the application of IPCC scenarios to the Madison Gas and Electric Company's planning to reduce carbon emissions. The analysis makes clear that when applied to specific goals at the organizational level, electricity demand and carbon intensity of generation affect carbon emissions.

(IS-2021-49) The New Era of Energy Management - How to Reduce you OpEx While Achieving Sustainability

This report by ABB was published in March 2020. It outlines the need to measure and monitor electrical systems to obtain real-time data which, when coupled with robust energy modelling reveals patterns and opportunities to better manage energy waste. The authors discuss energy bill verification; multi-utility validation; load profiling; multi-site comparison; and optimized equipment performance. Implications for the integration of SaaS, AI and machine learning are discussed.

(IS-2021-48) IoT Connectivity Buyer's Guide

This report was released by Aeris in October 2020. The analysis is intended to help organizations to evaluate cellular IoT connectivity providers against the critical dimensions of coverage, support, cost control, and security. The authors focus on the specific capabilities that "make or break" IoT deployment success at scale and their analysis could be of interest to engineers, technologists, system integrators, wireless carriers, and business owners/directors deploying IoT devices and systems.

(IS-2021-47) Lighting Control in Patient Rooms - Understanding Nurses' Perceptions of Hospital Lighting Using Qualitative Methods

This article from Health Environments Research & Design Journal (August 2020) is by Lindsay

McCunn from McCunn & Associates Consulting. Findings underlined that controllability was among the "best" lighting attributes—although more refinement is necessary for optimal staff productivity and patient satisfaction—and daylighting was also considered to be among the best attributes. The study also found that "trespassing" of light is an issue. more attention can be paid to the ways in which window shades, and light sources outside of rooms, penetrate spaces and affect users. Qualitative analysis of four hospitals with results on lighting control is provided.

(IS-2021-46) State of the Ecosystem Report

This July 2020 report by the Z-Wave Alliance focuses on smart home and connected technologies both inside and outside of the home. The authors discuss the current state of smart home technology, current and future trends, opportunities, and the developing role of Z- Wave in smart homes. The report will be of interest to smart home technology distributors and installers, companies providing home accessibility solutions, and system integrators.

(IS-2021-45) Macro Grids in the Mainstream - An International Survey of Plans and Progress

This November 2020 report is by James McCalley and Qian Zhang from Ohio State University. Their analysis identifies the value of developing inter-regional transmission and macro grids in the U.S. An extensive global comparison is presented, along with a cost-benefits analysis, engineering design options/requirements and a discussion of three characteristics said to be essential for successful implementation. The authors lay out a 21st-century vision of macro grids with various possible scenarios.

(IS-2021-44) Smart IoT Applications and Environments: Key Antenna Considerations in Designing Your Smart Ecosystem

This report was prepared by TE Connectivity and published in September 2020. It covers technological challenges, explores specific demands, and shares considerations for selecting the optimal antenna for IoT applications. Highlights of the discussion center on how the growing use cases of IoT are posing challenges for wireless connectivity and insights on smart building and smart tracking applications trends and challenges. The report will be of interest to wireless operators, antenna manufacturers, engineers, technologists, and system integrators.

(IS-2021-43) Facility Services Now: Results from the 2020 CMM In-House Facility Management Benchmarking Survey

This report was authored by Amy Richardson from Cleaning & Maintenance Management and released in March 2020. Results of a survey of in-house service providers and facility managers conducted prior to the pandemic are presented. Top concerns included health and safety; improving facility image; security; improving productivity/efficiency; and staff training. Additional detailed survey information regarding cleaning and maintaining facilities is provided.

(IS-2021-42) Foundational Cybersecurity Activities for IoT Device Manufacturers

This May 2020 report was released by the National Institute of Standards and Technology (NIST). The report describes recommended activities related to cybersecurity that manufacturers should consider performing before their IoT devices are sold to customers. These “foundational cybersecurity activities” can help lessen the cybersecurity-related efforts needed by customers, which in turn can reduce IoT device compromises and attacks carried out using compromised devices. The topics include assessment of customer needs and goals, communication with customers, and device support issues. The report will be useful to manufacturers of IoT devices, engineers, technologists, and IoT system integrators.

(IS-2021-41) Why Digital Twins Are Critical to the Industrial IoT

This June 2020 report from Juniper Research centers on the application of virtual models in Industrial Internet of Things (IIoT) applications to detect issues, advance both learning and understanding, as well as to test and simulate scenarios in the physical model counterpart. The

topics include key drivers, values, and challenges associate with implementation of digital twins (virtual and physical models). The target audience for the report includes engineers, technologists, IT professionals, and system integrators.

(IS-2021-40) Luminaire Level Lighting Controls Replacement vs. Redesign Comparison Study

This September 2020 study by University of Oregon researchers summarizes the results of a field study which compared Luminaire Level Lighting Controls (LLLC) to Networked Lighting Controls (NLC). Specifically, the research set out to determine if LLLC systems, applied as one- for-one (1:1) replacement retrofit solutions, can provide lighting energy savings and lighting quality comparable to more comprehensive networked lighting control (NLC) redesign solutions. The latter also require significant cost investment in design, specification, and install. Cost data indicates LLLC savings of one-third to one-half the cost of more comprehensive NLC solutions. Methodology and detailed analysis are provided.

(IS-2021-39) 2020 Energy Efficiency Indicator Survey

Johnson Controls released the results of its annual Energy Efficiency Survey in December 2020. Half of organizations plan to increase investment in energy efficiency, renewable energy and smart building technology in 2021, the analysis showed. Surprisingly, facility energy usage in 2020 dropped little despite lower occupancy rates. 79% indicate data analytics and machine learning will have a very signifiant impact on buildings. 70% will have one or more net-zero facilities in the next ten years. The authors provide a discussion of current funding mechanisms.

(IS-2021-38) Enable Operational Agility with a Digitally Connected Workforce

This report authored by Peter Bussey, Matthew Littlefield and Vivek Murugesan from LNS Research was released in December 2020. This research focuses on how industrial organizations are implementing “connected worker” initiatives as a core pillar of their industrial transformation programs. Results point to a new focus on increased operational agility; improved safety, productivity; and improved performance and profitability. Actionable recommendations and a solution architecture are provided.

(IS-2021-37) DERMS Fact Versus Fiction - Debunking Six Myths About DER and DERMS

This report by Peter Asmus of Guidehouse Insights was released in December 2020. Distributed energy resource management systems (DERMS) run algorithms frequently and quickly to keep the distribution grid in balance. This report defines six key aspects of enterprise DERMS, and their relationship to Advance Distribution Management Systems (ADMS), Virtual Power Plants (VPP) and Distributed Energy Resources (DER).

(IS-2021-36) Crisis-Tested IT Teams Accelerate Digital Agility Plans

This report from IDG Communications was released in September 2020. A survey of 100 IT

decision-makers revealed that those who were already engaged in some stages of digital transformation believed that their investments left them better prepared and able to cope with widespread disruptions of normal business operations. 74% of companies have elevated IT leadership to the executive team recently. The analysis also projects that nearly half of knowledge workers will work from home after this crisis. 45% will change both their IT priorities and investment levels. Survey results of future infrastructure-oriented technology initiatives are also provided.

(IS-2021-35) Transactive Energy Market for Energy Management in Microgrids

This April 2020 article the academic journal Energies, by researchers from Monash University in Australia presents a transactive energy market (TEM) framework for implementation within microgrids. The TEM facilitates the integration of distributed energy resources (DER) into existing electricity networks and orchestrates energy management and energy trading through appropriate market mechanisms. An efficient solution is required to ensure DER owners are incentivized to participate, especially in countries such as Australia, where there is 21.6% installed grid capacity of roof-top PV systems. The report discusses pricing mechanisms and market scenarios and concludes with a case study for the TEM as it would apply in a real-world example - the Monash University microgrid.

(IS-2021-34) OpenVault Broadband Insights Report

This report from OpenVault was released in September 2020. This report highlights continued growth among “power users” who consume 1 TB or more of data, the steady migration of subscribers to faster speed tiers, and revenue implications for broadband service providers. Average monthly data consumed at 384GB was up 40 percent in the third quarter of 2020 vs. over the same period in 2019. Although flat since the second quarter of 2020, 8.8 percent of subscribers consumed more than 1TB, compared to just 4.2 percent in the third quarter of 2019. Comparisons between flat rate billing and usage base billing, and between North American and European data usage are provided.

(IS-2021-33) Building the Case for Net Zero

This report was authored by Karl Desai, Richard Twinn, and Alexandra Jonca from the UK Green Building Council and published in September 2020. The report presents the findings of a feasibility study that highlights real-world implications for achieving new net zero buildings. It illustrates how new buildings can be designed to reach net zero performance targets and the effect this has on cost. The report is useful to builders, building owners, engineers, architects, and designers.

(IS-2021-32) Network Convergence

This August 2020 report by CommScope, subtitled “Building a smart, simple infrastructure with advanced network capabilities,” sets out a strategic approach for planned and building network

convergence. By embracing such an approach, operators can solve issues of network complexity with “one smart, simple network architecture which provides a common network to handle today’s demand.” Topics include enhanced mobile broadband and the path to convergence, planning and building for convergency, and the many ways convergence transforms an operator’s network. The report will be of interest to engineers, technologists, IT professionals, wireless operators, and network service providers.

(IS-2021-31) Rural Broadband Valuations Remain High as Investors Move Down Market for New Opportunities

This report by economist Jeff Johnston of CoBank ACB was released in September 2020. With the accelerated need due to COVID to improve broadband access to under and unserved rural markets, investor interest is growing. The $80B government commitment to infrastructure spending will contribute to the market support for high valuations of fiber-based operators. Low earth orbiting satellites are not anticipated to have a significant impact on these valuations in the near future. Overall, the abrupt shift in 2020 to working from home and remote learning has significantly increased high-speed data subscriptions, representing a new catalyst for the broadband market.

(IS-2021-30) Rural Broadband – 8 Actions to Ensure Fiber Deployment Success

This report from Black & Veatch was released in November 2020. Twenty three percent of rural Americans do not have access to fixed high-speed broadband. To help close this gap, the U.S. is prioritizing rural broadband, enabled by fiber, to connect rural citizens and foster much-needed innovation across rural services, businesses, and industries such as healthcare, education, and agriculture. Rural electric co-ops can take a leading role in fiber deployment. The authors list eight recommendations designed to remove hurdles, accelerate implementation, and minimize costs. Case studies are provided.

(IS-2021-29) Performance Incentive Mechanisms for Strategic Demand Reduction

This February 2020 report from ACEEE defines performance incentive mechanisms (PIMs) for strategic demand reduction (SDR) as “megawatt reductions comprised of energy efficiency and demand response that aim to minimize system costs by displacing the need for services traditionally provided by the supply side.” A new generation of SDR PIMs is on the rise, driven by a need for flexibility at times of peak demand and a shift toward more variable generation. Thirteen states have an SDR PIM in place for at least one utility. A review of case studies demonstrates that PIMs can be an effective strategy for incentivizing SDR. Key remedies are proposed to unlock SDR, which the analysis indicates is largely untapped, reaching nowhere near the potential cost-effective load flexibility.

(IS-2021-28) Impacts of the E-QUIP Tax Proposal

This report authored by Lowell Ungar, James Barret and Chris Perry from ACEEE was released in

December 2020. This report estimates the cumulative impacts from the Energy Efficient Qualified Improvement Property (E-QUIP) proposal would be: 130,000 net additional job-years; $15B in energy-bill savings (NPV); $11B additional business and federal investment; and 100M tons of CO2 emissions avoided. Detailed analysis including assumptions is provided.

(IS-2021-27) Building Opportunities for the New COVID-19 Reality

This July 2020 report by Impact Infrastructure, Inc. explores HVAC systems and their role in reducing the airborne transmission of COVID-19. Best practices for HVAC usage within the built environment set out by ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) and REHVA (Federation of European Heating, Ventilation and Air Conditioning Association) are discussed. It also discusses Cost Benefit Analysis (CBA) and provides a case study to showcase how to evaluate investments into recommended HVAC strategies.

(IS-2021-26) Tomorrow's Smart Connect Products Require Smarter Connectivity Services Today

This report by James Moss from ABI Research was published in November 2020. It examines the role of Connectivity Management Platforms (CMPs) and global connectivity coverage solutions. The evolving needs of—and challenges faced by—operators and enterprises are discussed. Recommendations, with a case study, for next generation CMPs are provided.

(IS-2021-25) The Smart Home Floor Plan - Three Key Device Strategies

This report authored by Steven Jones and James Moar from Juniper Research was released in November 2020. It provides an overview of the smart home market and discusses aspects such as device forms; smart home value chain and product strategies; disruptive technologies; and portfolio diversification options. The number of global installed smart home devices is forecast to rise to 13.5 billion by 2025. Additional research is available, including related to market trends; five-year forecasts; strategic analysis; and vendor strategies.

(IS-2021-24) Tech Giants Collaborate to Create Digital-Native Smart Building

This report from Microsoft was prepared in July 2020. The discussion outlines the value of creating a digital twin of a building's physical space and operations on a modern platform that allows a safer and more secure integration of sensors and devices as technologies evolve. Energy and maintenance costs are reduced, design is improved, space is optimized and the overall user experience is enhanced. A user case study is provided.

(IS-2021-23) Residential Security Market Trends

This November 2020 Park Associates research report was commissioned by the Electronic Security Association (ESA) and sponsored by Resideo. It provides an analysis of residential security trends related to competition, attach rates and the market impact of COVID-19. Findings

include: home ownership (34%) and professionally monitored security systems (31%) continue to increase; 76% of security system purchasers want interactive services while 63% want a self-installed system; and 35% of broadband households are extremely concerned about their household's safety and security. Resideo and Parks Associates are CABA members.

(IS-2021-22) IoT - The Internet of Transformation 2020

This report was authored by Markus Rothmuller and Sam Barker from Juniper Networks and published in April 2020. The report presents an overview of key factors regarding IoT deployment. The main topics include market challenges, strategic recommendations, IoT industry leaders, and total connected IoT units. Vendors must implement security procedures that are highly scalable and can cope as network architectures become increasingly complex, the author note.

(IS-2021-21) Forecast Outlook for Residential Security and Add-On Devices

This report was authored by Brad Russell from ESA Research and published in October 2020. The report examines new trends regarding residential security monitoring and devices to help security companies grow their business. The main topics include projected growth trends in professionally monitored security subscribers, consumer interest in home control services, and smart home devices. The report will be useful to security company owners, IT professionals, technologists, and system integrators.

(IS-2021-20) Artificial Intelligence in the Field of Building Automation

This report from November 2020 is by Michael Kröder and Graham Martin from Enocean Alliance and the IGT Institute. Their analysis covers the application of cloud-based artificial intelligence (AI) for building automation. The main topics include cognitive buildings, AI learning process, and applications. The report will be of interest to building owners and managers, IT professionals, engineers, and system integrators. EnOcean Alliance is a CABA member.

(IS-2021-19) A Review of Existing Test Methods for Occupancy Sensors

This report was published in August 2020 by the U.S. Department of Energy. It presents the results of a literature review regarding test methods for evaluating occupancy-sensor performance and categorizes those methods according to which spatio-temporal properties they were able to discern. The reviewed articles are representative of research published over the past 20 years.

The authors provide a technical discussion of the methods as well as suggestions for future test-method development.

(IS-2021-18) Financing a Net-Zero Economy

This October 2020 report from Ceres examines the impact of climate risk on loan portfolios of

the largest U.S. banks. Over half the syndicated lending of major U.S. banks is exposed to climate transaction risk due to inadequate preparation for emissions reductions in line with the Paris Climate Agreement, the analysis shows. Banks may face substantial losses from this direct exposure. Incremental climate risk and the financial system's interconnectivity could result in balance-sheet contagion. Detailed analysis, case studies and modelling are provided. Recommendations include actions to assess and disclose risk; improve measurement and decision- making tools and methods; and act to mitigate climate risk and its ultimate impact.

(IS-2021-17) Transforming Smart Building Technology

This white paper from Planon from July 2020 discusses how real-time integration of smart building technology with an Integrated Workplace Management System (IWMS) enables better management of energy costs and improved efficiency. The systems bring together features of building modeling, computer-aided facility management, building management, and fault detection diagnostics within the IoT ecosystem of a Smart Building. A real-time and dynamic integration of a smart building technology platform with an IWMS offers the potential to boost ROby monetizing the combination of the technical building setup and the functional business context.

(IS-2021-16) Wireless Lighting Control – Simple to design, Cost-Effective, and Flexible

This report from Lutron published in July 2020 discusses the merits of wireless lighting control, which removes the need for communication wires and allows for fewer power wires and less conduit. Wireless lighting control makes it possible for cost and complexity to be reduced, while design/ installation flexibility and scalability are enhanced. Another significant feature of wireless systems is that the keypads, sensors, and remotes are often battery powered, further eliminating cost and complexity while expanding the opportunity for installing flexible control wherever it is needed in the space.

(IS-2021-15) LoRa Devices: Smart Home Business Case Overview

This August 2020 report from Semtech discusses the merits of LoRa devices and the LoRaWAN protocol to address the connectivity challenges of traditional platforms. LoRaWAN-based networking is a platform of choice for low-power, wide areas networking (LPWAN)-based IoT solutions, the report notes. Applications and case studies discussed in the report include water leak detection, senior care in the home, precision gardening and antique & art preservation.

(IS-2021-14) Transition Faster Together

Subtitled “Setting the scene: Solutions, strategies and policies for a clean energy future,” this report was authored by Ditlev Engel from DNV GL - Energy and published in September 2020. It outlines the need to transition the energy economy and deliver on sustainable development goals. Ten measures to achieve this transition are discussed, including solar, EV charging, green hydrogen, rail expansion and carbon capture. The technology solutions proposed cut across

three vital areas: renewables, power grids and energy use and efficiency.

(IS-2021-13) Guide for Sustainable Projects

This report was prepared by The American Institute of Architects and published in September 2020. It provides general background information on topics of interest to those pursing sustainable projects, and explanation of new provisions in AIA's recommended approach to sustainable projects. Four main topics include: general background about sustainable projects; Sustainable Projects Exhibit; sustainable considerations in AIA Agreements; and a discussion of an example of a Sustainability Plan. AIA's resources aim to "advance, disseminate and advocate" for design practices that integrate built and natural systems and enhance both the quality and environmental performance of the built environment.

(IS-2021-12) COVID-19 Impact - Offices Will Find a New Purpose

In July 2020, JLL reported on a global survey of 3,000 employees from diverse industries focusing on the importance of physical office space in ensuring organizational success in the post-pandemic world. Tackling this challenge demands a rethinking the office as a social hub, a shift from merely "surviving" to "thriving" in remote-work arrangements, and ensuring that the workplace functions "elastically" but still as a single community. Key findings outlined in this report include: the need for hybrid/elastic models; "tech empowerment" as a significant booster of productivity; the home work environment's crucial role in productivity; offices as "anchors" to corporate culture; and the new imperatives of flexibility and empowerment. This report will be of interest to office planners, building innovators and building occupants.

(IS-2021-11) Characterization and Analysis of the Energy-Reporting Accuracy of Connected Devices

The authors of this June 2020 report, from the Pacific Northwest National Laboratory for the U.S. Department of Energy, Energy Efficiency and Renewable Energy explore the energy-reporting accuracy of market-available connected electrical outlets. The results of the study and subsequent related work may be relevant to stakeholders in industry-specification and standards- development organizations. The research methods employed could inform test- and measurement procedures and performance classifications for connected outlets, lighting products, and other building systems capable of reporting their own energy consumption.

(IS-2021-10) Cable Companies and Municipalities: Natural Smart Community Partners

This report from Connected Communities LLC was published in 2020. It makes the case that cable companies are uniquely well-positioned to help a growing ecosystem of smart community partners advance their objectives. They possess both dense network infrastructure across large service areas, and valuable experience deploying and managing wired and wireless networks designed to solve complex connectivity challenges. The analysis and case studies highlight that rather than approach partners with a one-size fits all approach to smart community

deployments, cable providers are working with organizations to co-create approaches that best achieve common goals.

(IS-2021-9) Guide to Electric Vehicle Charging in Multi-Residential Buildings

This 2020 report from Pollution Probe and The Delphi Group sets out to demystify the process of installing electric vehicle (EV) charging infrastructure in multi-unit residential buildings. Looking at both new and existing buildings, the research explores key technical considerations, potential challenges and opportunities, stakeholder roles and responsibilities, and regulatory instruments. The report should interest building owners and managers, policy makers, as well as condominium boards and others involved in the planning and installation of EV charging stations.

(IS-2021-8) Industry Perspective: Understanding Barriers to Smart Grid Adoption This September 2020 report from the MaRS Discovery District, *Industry Perspective:*

Understanding Barriers to Smart Grid Adoption, was prepared with support from Natural Resources Canada. The research used stakeholder interviews and secondary research to highlight key challenges and barriers facing the smart grid sector. The authors describe changes that will be needed in the areas of policy and regulation; business models and market structure, energy sector culture/customer awareness; and technology and digitization. The report is intended for market players and policy makers focused on energy efficiency and smart grid development.

(IS-2021-7) The State of IoT and Smart Buildings

This report from April 2020 was led by Smart Energy Decisions and sponsored by Siemens. It provides a baseline of where the industry is today and what the current trends in building energy management and control could bring. Respondents were surveyed about current IoT deployments, key drivers, barriers encountered, and rewards realized—both intentional and unintentional—with connected facilities. The gap between legacy systems and new digital connectivity, and lack of internal knowledge to achieve corporate buy-in, are cited as prohibiting factors.

(IS-2021-6) The Case for Deep Retrofits

The size, scale, and condition of multi-residential buildings should make them a key target segment for scaling up deep retrofits, notes this August 2020 report from the Atmospheric Fund. The authors write that current business case evaluation for energy retrofits places an overwhelming emphasis on simple payback based on energy cost savings, at the expense of more robust Life Cycle Cost Analysis (LCCA). It is argued that incorporating financial metrics like Net Present Value and Internal Rate of Return would improve the accuracy of business case evaluation.

(IS-2021-5) National Standard Practice Manual for Benefit-Cost Analysis of Distributed Energy

This report from the National Energy Screening Project, released in August 2020, is intended to help guide the development of "cost-effectiveness tests" for more robust benefit-cost analyses (BCAs) of distributed energy resources (DERs). It sets out a systematic approach for gauging investment cost-effectiveness by consistently and comprehensively comparing the benefits and costs of individual or multiple types of DERs against each other and with alternative energy resources. The research will be of interest to those involved in energy policy, smart grid development, and protocols and standards.

(IS-2021-4) Future Energy: The Technologies Shaping the Energy Transition

This August 2020 report by Wood Mackenzie Limited highlights technologies needed to achieve a decarbonised future. Challenges and opportunities linked to *green hydrogen*, and what might need to change to make this technology a leading decarbonization strategy are discussed. The research goes on to explore the growing potential of *carbon capture and storage* in decarbonization strategies. In reference to *zero-carbon heating*, the report asks if could heat pumps could soon displace gas in homes. Finally, the report discusses *offshore wind* as a zero-carbon technology that continues to attract major capital.

(IS-2021-3) No Capital Needed: Your Guide to No-Cost Energy Projects

This report by Enel X published Sept 2020 notes that as the grid adapts to new realities, utilities and electric grid operators are making changes to their rate structures and market rules. They are imposing new and increasingly complex charges on their customers' bills, and offering financial compensation for large energy consumers that help alleviate some of their most complex challenges. For commercial- and industrial (C & I) energy consumers, this creates incentives to invest in distributed energy resources (DERs) that can manage facility exposure to the high costs of consuming energy from the grid. New opportunities could emerge for flexible financing options to help C&I energy consumers integrate and upgrade DERs to capture that value without taking on the risk of a capital investment.

(IS-2021-2) Three Essential Elements of Next-Generation Building Management Systems

This July 2020 white paper by Schneider Electric notes that building stakeholders face increasing pressure to save more energy, reduce costs, and maintain availability—all while enhancing occupant experience and well-being. "Achieving these varying objectives is best solved by a new type of building management systems (BMS) that goes well beyond HVAC controls." The authors argue that these modern next-generation BMSs benefit stakeholders by being a more open integration platform that uses IoT, cloud computing, data analytics, and artificial intelligence technologies to get more out of available resources and connected systems. The paper will be of interest to building owners, facility managers, and system integrators.

(IS-2021-1) Smart Buildings: A Foundation for Safe, Healthy and Resilient Cities

This blueprint by the Smart Buildings Super Cluster released in August 2020 aims to inform smart

city stakeholders about the design of smart buildings within the broader framework of the smart city. The discussion centers on the smart building, exploring how smart buildings can be deployed to advance diverse smart city objectives. These include accelerating the deployment of smart city, Internet of Things (IoT) enabled, connected infrastructure; infusing robust and adaptive features into the smart city infrastructure through integrated smart building designs; and providing a roadmap to sustainable advantage and ROI for communities that adopt this approach. The report will be of interest to policy makers, municipalities, developers, integrators, property owners, and managers.

(IS-2020-187) 7 Ways Technology Will Transform Buildings in the Next Decade

This June 2020 report is by 75F. It has been roughly 15 years since new technology has been applied to building energy management systems (EMS), and within those years, technology has evolved significantly. Because of this, across the industry EMS systems are being supplanted by additional software layers and complexity to help understand the equipment installed in place and how it can be optimized. In comparison, a predictive solution that leverages cloud-based algorithms can provide a building solution that enables everything within the envelope to function more efficiently, save more energy, and increase occupant comfort. The report will be of interest from the perspective of energy management, building operations, large buildings controls/automation, and analytics.

(IS-2020-186) Customer Preferences Dictate the Future of Smart Home Business Models

This report was authored by SmartEnergy IP™ and published in 2020. The analysis draws on the results of two surveys of 5,000 adults conducted in the U.S. prior to and during the COVID period, with the aim of understanding consumers' smart-home preferences and identifying potential business opportunities for utilities in the connected-home market. Results showed that energy management is a key driver for consumer adoption of smart home technology; thermostats ranked first on a list of home products favored by consumers, followed by security and lighting. The paper concludes with a discussion of the critical role of utilities in rolling out smart home solutions.

(IS-2020-185) Climate & Resilience: Shaping the Future of Cities

This report was authored by Gensler Research Institute in the U.S. and published in 2020. The analysis focus on carbon impact reduction of the built environment which entails both new constructions (embodied carbon) and existing buildings (operating carbon). Five core strategies are proposed for advancing climate resilience, focusing on such concepts as Reuse, Water, Energy, Materials. Specific actions within each of these categories are explained and exemplified by real case studies. Lastly, the report offers an illustration of the energy savings obtained by the building portfolio of the firm.

(IS-2020-184) PIMs for Progress

This report from Rocky Mountain Institute, published in July 2020, reviews select examples of PIMs (performance incentive mechanisms) and provides a simple taxonomy of the results to identify important lessons for future PIM development. By exploring why some PIM proposals are rejected by regulators and others are accepted, as well as what happens to PIMs after acceptance, lessons can be learned about how these regulatory tools can best be leveraged in a shifting electricity landscape. Recommendations are provided regarding the need to leverage data, align incentives, focus on outcome-based PIMs, prioritize flexibility and learning, and support stakeholder participation. Barriers to success are discussed and examples are provided.

(IS-2020-183) Training the Workforce for High-Performance Buildings

This September 2020 report from ACEEE examines how to address the current skills gap related to high performance buildings. Facility managers, building operators, engineers, equipment installers, and other onsite technicians all face new skill and knowledge demands that professionals can prevent high-performance buildings from delivering on their promise, adversely impacting their energy savings, indoor environmental quality, cost effectiveness, and long-term viability. This report has a survey of 111 building owners/managers, operators, tradespeople, technicians, and service providers, five categories of technical skills are essential for the high-performance buildings workforce.

(IS-2020-182) Why Lorawan is the Foundation for Smart Building Success

This May 2020 paper from the LoRa Alliance provides insights on the current evolution of the smart buildings market and compares LoRaWAN technology to legacy approaches. Smart buildings present an obvious sector of the market in which Internet of Things (IoT) enabled services can generate efficiencies, improved user experiences and profits. The early energy focus of IoT applications has now widened to encompass applications that support the new ways that people use the buildings they live and work in. Popular applications include room and desk sharing, individual environmental control, predictive maintenance, and many others.

(IS-2020-181) The Experts' Assessment – The Workplace Post-COVID-19

This IFMA report was prepared by Nordic Foresight and published in September 2020, with support from JLL and EPOS. What are the long-term consequences of the COVID-19 pandemic? To help organizations and its members prepare for a new future state, IFMA conducted a study based on a real-time Delphi methodology, where industry-leading subject matter experts from around the world engaged in a month-long consensus seeking debate, using quantitative and qualitative methods. The results point towards significant shifts in how organizations will operate in the future. These shifts will require complex adaptations within enterprises. Leadership, facilities management, human resources, and information technologies departments will have to develop new ways to organize and collaborate.

(IS-2020-180) Building a Case for Net Zero - A Feasibility Study Into the Design, Delivery, and Cost of Net Zero Carbon Buildings

This report was prepared for Advancing Net Zero by UK Green Building Council and published in September 2020. “Real-world” implications for achieving new net zero buildings are examined in this study that explains how new buildings can be designed to reach new zero-performance targets, and the implications for costs. The analysis discusses both design changes and cost changes for net zero offices and multi- residential buildings. Case examples and their outcomes are provided.

(IS-2020-179) Cimetrics Guidelines for COVID-19 Response

This report was prepared by Cimetrics and published in September 2020. The discussion summarizes current recommendations in the U.S. from ASHRAE and the CDC related to air distribution systems, quantifies the financial impact, and demonstrates how building analytics can be used to facilitate decision- making and operational management. Parameters for shutdowns and re-openings are discussed, along with examples.

(IS-2020-178) Mind the Gap: A Roadmap to IT/OT Alignment

This whitepaper by Tenable from September 2020 highlights that Operational Technologies (OT) are increasingly identified as targets for cyber-security threats in the Industrial Internet of Things (IIToT) ecosystem. To address the problem by aligning Information Technology (IT) and OT environments requires an alignment of different mindsets, technologies and even approaches to the business environment. C-Suite support and oversight, along with regulatory compliance requirements, will help IT and OT to work in tandem at the level of security, technologies and processes.

(IS-2020-177) Power grids solutions, strategies and policies for a clean energy future

This report was authored by DNV-GL and published in June 2020. The analysis presents key drivers for energy transition and the current obstacles. Solutions, strategies and policies needed to achieve energy transition are presented and discussed in detail. Several interviews with electric utilities CEOs about energy transition are also presented.

(IS-2020-176) Programs to Promote Zero-Energy New Homes and Buildings

This report from September 2020 was authored by Steven Nadel from the American Council for an Energy-Efficient Economy (ACEEE). As baseline building energy codes become more stringent, a growing number of program administrators are focusing all or a portion of their new-construction programs on zero-energy buildings. This brief is intended to aid these efforts by providing information on current programs and thereby support program implementers considering zero- energy programs. The analysis discussed 20 programs (13 which are residential-focused and 7 which serve commercial buildings). The report will be of interest from the perspective of energy policy and zero-net energy programs.

(IS-2020-175) Renewable Energy and Jobs

This report was authored by The International Renewable Energy Agency (IRENA) and published in 2020. Global employment opportunities provided by renewable energy are evaluated. Employment opportunities provided by different types of renewable energy (wind energy, solar energy, hydropower, biofuels) in different countries are presented and compared.

(IS-2020-174) Energy Savings from Networked Lighting Control (NLC) Systems with and without LLLC

This report by Northwest Energy Efficiency Alliance (NEEA) was published on November 5, 2020. This report presents data from Networked Lighting Control (NLC) systems, including those with and without Luminaire Level Lighting Control (LLLC), in 194 buildings across a variety of building types in North America, with an average of 13 weeks of monitoring data per building. The study found that the average energy savings from all NLC systems to be 49%.

(IS-2020-173) Five Strategies for Making Your Building Healthy and Safe - Indoor Air Quality and COVID-19

This 2020 report from ENTOUCH presents strategies that can be applied to improve building indoor air quality and help prevent the spread of COVID virus through HVAC systems. In particular, the analysis focuses on: 1) filtering the air, 2) managing air flow and ventilation rates, 3) controlling air humidity, 4) using ultraviolet germicidal irradiation, and 5) continuous monitoring of air quality.

(IS-2020-172) Next Steps for 5G – Survey Report

This report was prepared by Telecoms.com for IEEExplore, Thales and CommScope and published in August 2020. Currently, 5G is on track to achieve 2 billion subscribers by the end of 2024. Yet as this survey of 70 mobile operators across 40 countries revealed, there are mixed results to date regarding performance expectations. High costs and a lack of consumers realizing “gigabit per second” speed were contributing factors. Various 5G technologies designed to address customer concerns, operational challenges, security, different ecosystems and OTT/Cloud solutions are surveyed, and future technologies and likely market implementations are discussed.

(IS-2020-171) Bank of Things White Paper — Next Generation Financial Infrastructure

This report by SPD Bank and Huawei was published in August 2020. The Business of Things (BoT) connects physical entities engaged in financial activities and digital spaces, providing data used in customer profiling, business modelling and risk management. Technological architectural frameworks, infrastructure, 5G connectivity, data storage, security and various technology and business challenges are examined. Supported by BoT, new opportunities for the next generation of financial infrastructure will arise.

(IS-2020-170) How Energy Efficiency Can Help Rebuild North Carolina's Economy - Analysis of

Energy, Cost, and Greenhouse Gas Impacts

This September 2020 report from the American Council for an Energy-Efficient Economy (AEEE) sets forward six recommendations on how investments in clean energy could help mitigate the financial impact of the COVID-19 pandemic on North Carolina's economy. Analysis of energy types and their associated financial and greenhouse gas impacts is provided. The report will be of interest from the perspective of energy management and energy policy.

(IS-2020-169) The Power and Potential of Home Warranty Programs

This September 2020 report by American Water Homeowner Services notes that, from the utility's point of view, home warranty programs help to ensure that customer-owned service lines and appliances are properly maintained and inspected on a regular basis. Having warranty services also ensures higher adoption rates, and in addition, personalized offerings that are based on a customer's unique circumstances have proven to be critical, the report notes.

(IS-2020-168) Putting Customers & Climate First

This blueprint was released by Illinois' Office of the Governor in August 2020. It proposes new measures to accelerate the State's transition to a cleaner energy matrix, with new proposals that include utility reforms, consumer protections, electrification of the transportation sector, and support for clean tech companies. Under the theme of renewable energy growth, the blueprint calls for, among other items, new wind and solar energy development incentives and the deployment of energy storage systems and programs.

(IS-2020-167) Reimaging Grid Resilience

This July 2020 report from the Rocky Mountain Institute illustrates the vulnerabilities, catastrophic risks and technological challenges affecting the grid. A new framework and recommendations for addressing resilience risks are provided. A case study examining resilience options for public safety power shutoffs is also provided. The report will be of interest to industry professionals involved in recommending or monitoring energy policy.

(IS-2020-166) Powering Paradise: How Hawaii Is Leaving Fossil Fuels and Forging a Path to a 100% Clean Energy Economy

This August 2020 report from the Rocky Mountain Institute provides an overview of Hawaii's success to date in achieving its goal of moving to 100% renewable energy. The report is divided into five areas: Leadership, Rooftop Solar, Renewables, Reinventing the Grid and Reimagining the Utility Model. Three lessons emerge: willingness to experiment, clear guidance from leadership and stakeholder engagement. In 2015, Hawaii was the first US state to proclaim a 100% renewable energy target for each of its six separate island electric systems, and many other states, municipalities and utilities have since followed suit. The report will be of interest from the perspective of utilities management and energy regulation.

(IS-2020-165) Programs to electrify space heating in homes and building

This ACEEE report on space heating, published in June 2020, describes current programs designed to foster the uptake of high-efficiency heat pumps as a primary heating system, while gradually reducing the use of fossil fuels in buildings. Findings show that most of these programs in different U.S. regions target the residential sector and smaller commercial buildings. Areas with high use of delivered fuels (fuel oil and propane) are more suitable candidates for these programs since the economics of electrification work better than areas served by natural gas. The report will be of interest to industry professionals in the HVAC sector all those involved in recommending or tracking regulatory policy.

(IS-2020-164) Application of Wireless Power Transfer (WPT) in Smart Home and Building Applications

This CABA White Paper describes the key technologies, standards, implementation aspects, and current opportunities and challenges associated with Wireless Power Transfer (WPT). After decades of research, WPT has now reached the required maturity level to be used widely, but its application in smart homes/buildings will require early-stage cooperation between engineers, architects, building owners and designers.

(IS-2020-163) IES Committee Report Germicidal Ultraviolet: Frequently Asked Questions

This report by the IES Photobiology Committee came out in April 2020 in response to COVID-19. The committee set out to provide objective and current information on germicidal ultraviolet irradiation (UVGI) as a means of disinfecting air and surfaces. Germicidal UV (GUV) refers to using ultraviolet radiant energy to inactivate bacteria, mold spores, fungi or viruses. When the process is applied in a given location, it has generally been referred to as ultraviolet germicidal irradiation (UVGI). Because of the public’s concern about ionizing radiation (e.g., X-rays and gamma rays), the term GUV avoids needless concerns about a link with that type of radiation.

(IS-2020-162) CBRE Expert Perspectives on the Journey Ahead - Reopening the World's Workplaces Real estate services giant CBRE (Coldwell Banker Richard Ellis) published this article in June 2020, based on the panel presentation it held to share insights on the industry as local economies continue to reopen. From public health and mass transit, to individual wellbeing and the global economy,COVID-19 has had far-reaching effects on our society and communities at large. As the industry navigates uncertainties and the evolving pandemic, experts are rethinking, adapting and redefining what it means to reopen the economy and our work environments safely and effectively.

(IS-2020-161) "Smart Building" trends – a comparison of wireless standards for automation and control

This February 2020 report by GT - Institut für Gebäudetechnologie GmbH (The Institute for Building Technology) describes how building automation systems have evolved as more sensor

data are factored into control algorithms. Value-added services using sensors to enhance environmental control, lighting, elevator maintenance, etc. are discussed. Eleven wireless communication protocols to support sensors for these applications are evaluated and scored. The top two were EnOcean (for commercial buildings and professional installation in homes) and Z-Wave (for do-it-yourself home automation).

(IS-2020-160) Potential Opportunities to Reduce HVAC Energy Using Lighting Sensors in Commercial Buildings

This June 2019 paper by the Lighting Research Center in the U.S. reports on a study examining the potential for using occupancy data from lighting systems to reduce HVAC energy use in large commercial buildings, typically buildings 100,000 ft^2 (9,300 m^2) and greater. It reinforces the concept of employing Building Automation Systems using sensor information from one system to control other systems and having a central monitoring and control location. Challenges and energy saving opportunities on taking this approach are discussed.

(IS-2020-159) Beneficial Electrification of Water Heating

This January 2019 report by the Regulatory Assistance Project (RAP) examines electric heater heating opportunities available today and in the near future. It explores technology options for electrification of water heating such as electric resistance (ER) water heaters and air source heat pump (HP) water heaters. Each option is assessed against certain predefined criteria (e.g., saving consumers money, making the grid more flexible and emissions reductions).

(IS-2020-158) The State of IT Operations & Cybersecurity Operations 2020

General IT operations groups and IT cybersecurity teams need to work closely together to accomplish their objectives. However, their goals sometimes conflict with one another. To better understand how businesses are managing those sometimes-conflicting goals and relationships, Dark Reading and InformationWeek surveyed 115 cybersecurity and technology professionals, primarily in North America. Among those surveyed, 85% are concerned about cybersecurity, but 50% devote 2% of their budget and 25% devote 15% of their budget to cybersecurity. About half of respondents noted that cybersecurity issues are being factored into project planning.

(IS-2020-157) The Advent of Private LTE & 5G Networks

This report was authored by Harbor Research and published in April 2020. It examines business opportunities ($200 billion by 2025) for companies deploying 5G cellular technology for a private wide area network (WAN) using licensed, shared, or unlicensed radio bands. The provider could be a 5G operator or the company could buy, install, and operate the equipment. This opens the door to on- premises 5G instead of, or in addition to, Wi-Fi, Ethernet, Bluetooth, and similar technologies. The implications of this shift for strategic decision making are discussed.

(IS-2020-156) Bridging the IT and OT Cybersecurity Divide

While OT shares some similar operating systems, network connections, digital architectures, and cybersecurity risks as IT, there is definitely not a one-to one relationship between the two worlds, writes Peter Vescuso in this article from *Automation 2020* (April 2020). There remain many unique constraints to securing the operational world of industrial control systems (ICSs). Organizations need to open the lines of communication between IT and OT. “Experts from both domains must start to work cohesively to bolster the resiliency of the business no matter which side of the house the cyberthreats target.”

(IS-2020-155) Mercku | Wi-Fi: The Definitive Guide

This report was authored by Mercku and published in June 2020. This report provides a summary of the history and technology of Wi-Fi communications for wireless Internet access. Factors affecting Wi-Fi performance are discussed, such as building materials. Differences among Wi-Fi generations are explained. The report examines advanced Wi-Fi solutions and the future potential of Wi-Fi.

(IS-2020-154) Keeping Customers Connected

This report was authored by Ericsson Consumer & Industry Lab and published in June 2020. Approximately 11,500 consumers were surveyed for their reactions to physical restrictions on movement and gatherings during the 2020 pandemic, and their use of remote connections via fixed and mobile Internet connections. They were questioned about which technology they used and the perceived benefits as a substitute for in-person meetings. The impact of emerging communications and computer- based technologies is discussed.

(IS-2020-153) JLL Seniors Housing & Care Investor Survey & Trends: COVID-19-Update

This JLL report from Spring 2020 notes that across the seniors housing and care sector, owners and operators have faced the unprecedented challenges of the COVID-19 era head-on, and are quickly and increasingly adapting to apply learned best practices that insure the health and wellbeing of their residents. To shed more light on the full impact of COVID-19 on market valuations, current and future, JLL Valuation Advisory updated its Spring 2020 Investor Survey (conducted pre-COVID-19) toreflect the sentiment and underwriting practices of market professionals.

(IS-2020-152) Four Pillars of the Industrial IoT

This report by Siemens Digital Industries Software from 2019 summarizes "Industry 4.0" based on connectivity of physical devices and enterprise systems, control, digitization for data analysis, and smart machines based on AI (artificial intelligence), IoT, (Internet of Things), and augmentation. The key benefits are reduced downtime and lower operating costs.

(IS-2020-151) Enterprises Building Their Future with 5G and Wi-Fi 6

This report from Deloitte was published in May 2020. It reports on a survey of 415 executives in the U.S. who are planning to adopt 5G cellular communications and Wi-Fi 6 in-building wireless networks. These technologies are expected to affect most companies, but not replace existing wireless technologies. Many executives see these technologies as adding innovation and a competitive advantage for their companies, primarily in efficiency, but are concerned about cybersecurity and backward compatibility.

(IS-2020-150) OT Cyber Integrity: You Cannot Secure What You Cannot See

This report was authored by PAS Global, LLC and published in February 2020. It describes the challenges of evaluating on OT (Operational Technology) installation for cybersecurity. The biggest challenge is dealing with so many heterogeneous systems. An in-depth inventory of OT systems is recommended. The paper will be of interest from the perspective of large building controls/automation and cybersecurity.

(IS-2020-149) CaGBC: Accelerating to Zero Carbon Skills Gap Report

This report was authored by the research team at the Canada Green Building Council (CaGBC) with support from Environment and Climate Change Canada, Government of Canada and released in April 2020. This is a study examining the zero carbon building skills gaps and training needs of Canadian engineers, architects and renewable energy specialists. It puts forward solutions to address the existing gaps in the skills required to deliver zero carbon buildings in Canada. It also identifies training requirements and recommends delivery models to drive zero-carbon-building skills training.

(IS-2020-148) Building a Better World of Energy for Tomorrow

This report was authored by SSE (Scottish and Southern Energy) and published in July 2020. This is a progress report on actions taken by SSE in support of the UN Sustainable Development Goals. SSE cut carbon production, increased the production of renewable energy, and developed plans to accommodate 10 million electric vehicles. Data showing progress are presented. The report is of interest from the perspective of energy management, corporate social responsibility and climate-related disclosures.

(IS-2020-147) Smart Buildings Features and Key Performance Indicators

The authors of this 2020 report, from the Polytechnic University of Milan in Italy, write that quantifying building energy performance through the development and use of Key Performance Indicators (KPIs) is an essential step in achieving smart building goals in new and existing buildings. The analysis begins with an explanation of basic smart-building features and technologies and goes to propose a framework of performance indicators organized into nine groups. The research is of interest from the perspective of intelligent buildings performance metrics.

(IS-2020-146) IoT network slicing on virtual layers of homogeneous data for improved algorithm operation in smart buildings

Writing in the journal *Future Generation Computer Systems*, the authors examined temperature Internet of Things (IoT) devices for smart buildings. Their study used an "IoT slicing technique" to improve the ability of an algorithm to self-correct deviations when indoor temperature data is acquired by IoT networks. A case study result is provided to demonstrate the efficacy of the proposed IoT slicing method. This study will be of interest from the perspective of data architectures and IoT systems.

(IS-2020-145) Simplifying IoT at the Edge Overcoming IoT Complexity with Flexible Device Management

This report was prepared for semiconductor and software design company ARM by CIO Dive and published this year. Advances in sensor technologies and dynamic machine learning modeling drive increasing amounts of data to be collected and processed in primary applications right at the edge. IoT edge gateways connect old and new systems, empowering organizations to automate with data collection and management at the endpoints—without ever going to the cloud. Intelligent buildings and smart grids can benefit from this technology.

(IS-2020-144) How Seamless Engagement Can Bridge Silos and Drive Utility Customer Value

Vlocity and Salesforce commissioned Utility Dive's Brand Study to survey 215 retail energy sector professionals to better understand emerging opportunities for residential customer engagement. The resulting report, published in September 2020, provides examples of "seamless, coordinated, consumer- focused" energy efficiency programs most likely to increase customer satisfaction. The benefits and challenges of mapping customer energy journeys across multiple communication platforms using an integrated approach are reviewed. The results of the survey will be particular interest to utilities and industry players involved in energy management.

(IS-2020-143) Energy Efficiency in Real Estate Listings: A Controlled Experiment

ACEEE provided new data in August 2020 showing that home buyers value information on energy efficiency in real-estate listings. It was most valued (in terms of willingness to pay) by relatively wealthy and educated home buyers. Energy information in real estate listings should be presented using an intuitive energy scoring system, the authors propose. The research will be of interest from the point of view of energy management, smart utilities, and energy policy.

(IS-2020-142) How to Design Multi-User Microgrid Tariffs

This August 2020 report from the Smart Electric Power Alliance proposed a framework that may be used to guide the development of a multi-user microgrid tariff for communities and smaller groups of customers. Strategic considerations for regulators, utilities and stakeholder are described, and a detailed microgrid tariff framework is discussed. The report will be of interest to

energy management and energy policy players.

(IS-2020-141) Growing a Greener Economy: Job and Climate Impacts from Energy Efficiency Investments

This September 2020 report from ACEEE was published in September 2020. The report analyzed the impact of various energy efficiency programs across the building-, transportation- and industrial sectors, with estimates for net job creation, carbon emissions reductions and energy savings. A $83.5 USD investment would create 1.3M job-years and reduce CO_2 emissions by 906MMT, the analysis shows. Substantial energy cost savings would result, spurring the development of long-term markets for advanced green technologies/practices and creating additional economic and environmental benefits.

(IS-2020-140) Top 10 Global CRE Trends

This report was authored by Christian Beaudoin from JLL and published in August 2020. The report explores how firms can reinvent their corporate real estate strategies in response to ever-changing business priorities and a challenging operating landscape and economic environment. Top trends identified include the concept of the "augmented workplaces" achieved through digitally-enabled real estate; activation, quality and governance of "fast data" as data production and consumption increase exponentially; and a radical rethink of performance metrics used in corporate real estate. The report's findings will be of interest to business- and building owners, architects, technologists, and IT professionals.

(IS-2020-139) Pandemics and the Built Environment

This report by the International Initiative for a Sustainable Built Environment, released in July 2020, looks at how expectations and opportunities for the built environment have shift with COVID-19. The report explores impacts of changes in personal and household behaviour under pandemic conditions, and their impact on pathways to a sustainable built environment. Aspects of urban systems (e.g., neighourhood features and density) are discussed in relation to pandemic and post-pandemic measures. The authors also look key requirements for multiple building types, from building entries and shared facilities to public washrooms and lifts in high-rise buildings. The report will be of interest to building owners, contractors, business owners, health professionals, and environmentalists.

(IS-2020-138) Virtualizing the Cable Headend

Taking an in-depth look at the company's virtualization platform for broadband and video service delivery, this May 2020 Commscope report begins with an overview of cable access evolution and distributed access architecture (DAA). DAA seeks to alleviate crowding in head ends and hubs by moving some functionality to the edge of the network, typically the access nodes. While that is an important step in modernizing the cable headend, the report notes, to fully unlock the benefits of elasticity and agility, operators need to also migrate over time to a fully virtualized

environment in which “the management plane, video plane and data plane are virtualized.” The report will be of interest to engineers, technologists, video services providers, telecom operators, and IT professionals.

(IS-2020-137) The Hidden Drains & Drivers Impacting Your Asset Recovery

This report by PTC was released in December 2019. The report describes how manufacturers are implementing new technologies and approaches to solve the “hidden drains”—while optimizing the key drivers—behind asset efficiency. The main topics include approaches to address unplanned downtime, workforce productivity, and capital expenditures. The report will be of interest to facility owners and operators, engineers, IT professionals, and system integrators.

(IS-2020-136) Office Outlook: The outbreak of COVID 19 ground office market activity to a halt, with the path to recovery clouded in uncertainty

This report was authored by Scott Homa and Phil Ryan from JLL and published in July 2020. It focuses on the impact of the COVID outbreak on the U.S. ground office market and the uncertainty around future recovery. The main topics include key trends (leasing, sub-leasing, and occupancy losses), an overview of the industry, and market details by state. The report will be of interest to building owners and operators, renters, and investors.

(IS-2020-135) Enabling a Sustained RAN for a Greener Bottom Line

This report by Greenwave Wireless Research from August 2020 underlines that as carriers scaled network capacity and with the rollout of 5G technology, networks became more complex—with power optimization becoming more important than ever. Focusing on energy efficiency strategy for wireless networks, this paper explores aspects that operators and vendors should consider when it comes to managing energy consumption in mobile networks. The report will be of interest to operators and vendors.

(IS-2020-134) Enabling Digital Transformation with IoT Performance and Properties Measurement

This report by Fujitsu was published on May 7, 2020 by the Industrial Internet Consortium. It investigates the need to measure multiple aspects of an industrial digital transformation solution along its lifecycle and essential role of performance tracking and measurement. The analysis shows how metrics serve different purposes on the way to planning, governing and managing a solution. Engineers, technologists, IT professionals, and system integrators may find the report useful.

(IS-2020-133) Achieving a Green Recovery for China: Putting Zero-Carbon Electrification at the Core

This joint Rocky Mountain Institute / Energy Transitions Commission (ETC) report from June 2020

sets out a green stimulus package for short-term recovery and long-term growth. The proposed blueprint discusses the need for new technology-based infrastructure (5G, AI, IoT); green/energy efficient urbanization investment; stronger promotion of green consumption (EV); and accelerating funding for zero-carbon electrification. The anticipated investments and results are compared with the outcomes of previous stimulus program. This report, part of a series focused on "Green Stimulus and Recovery," will be of interest from the perspective of investment/financing, technology development, and public policy.

(IS-2020-132) Adapting to Climate Change | For Facility Management Professionals

This 2020 report from the International Facility Management Association's FM Research & Benchmarking Institute describes strategies that can be undertaken to help reduce the impact of climate change. The report reviews the major topics of risk management, how to conduct a climate change risk assessment, relevant climate change components, and factors that influence mitigation. The report provides models, checklists, matrices, and scorecards, along with successful use cases. This paper is relevant for facility management leaders and practitioners.

(IS-2020-131) Better Buildings: Working in Partnership for a Resilient and Innovative Energy Future | 2020 Progress Report

This 2020 report from the U.S. Department of Energy highlights successes achieved to date in improving energy, water and waste efficiency by 950 member organizations. Progress linked to "market leadership," "better information," "innovation and emerging technologies" and "workforce development" has resulted in savings to date of $5B, the report notes. The report provides an overview of various services, programs and technologies, along with a case studies, tools and additional resources. This paper will be of interest from the point of view of investment/financing, public policy, technology, and energy/water/waste management.

(IS-2020-130) Soft Landings - The Benefits to Commercial Property Owners

Published in June 2020 by the Better Buildings Partnership (BBP) in partnership with BSRIA, this report highlights the significant gap between design expectations and operational building performance of buildings which affects the energy efficiency and environmental expectations of the end user. "Soft landings" describes a proposed six-phase framework for construction professional, covering inception to post-occupancy evaluation. Illustrative examples, benefits and case studies are provided. This paper is relevant for property managers, commercial developers and commercial tenants.

(IS-2020-129) The Future of Global Office Demand

In this June 2020 white paper from JLL, the authors discuss the function and purpose of the office from the perspective of both the corporate occupier and the employee. Four key factors—remote working, office design, technology, and, commuting patterns—are described as key to shaping the future of office design. The report predicts that changing spatial patterns of office

demand—already in motion prior to COVID-19—will accelerate the move toward a diverse office market ecosystem through the riseof hyperconnected major cities, suburbs and smaller cities. This paper is relevant for investment/financing, government, technology, urban planners and business leaders.

(IS-2020-128) The Impact of COVID-19 on Flexible Space

This JLL white paper from July 2020 predicts a continuing trend towards flexible space, with the potential for 30% of all office space to be consumed “flexibly” by 2030. While social distancing requirements negatively impact the profitability of the high seating density co-working model, private office spaces are anticipated to weather the storm, with remote and flexible working arrangements becoming common. The tenant- and investor-related implications of this seismic change are described. This paper is relevant for investment/financing, commercial property manager, commercial property developers, tenants and business leaders.

(IS-2020-127) The Role of Gas in the Energy Transition

The Rocky Mountain Institute highlights the importance of adapting global methane emissions standards and the need for transparent and accessible data in this March 2020 publication. As many investors, regulators and consumers continue to apply pressure for the staggered phase-out of natural gas, novel data-driven approaches to emissions visibility, as well as a robust certification standard, are required to achieve the reductions needed. This paper would be of interest to government regulators, technology business leaders, and the energy-sector.

(IS-2020-126) Power over Ethernet: Basics 2020

This CABA White Paper describes the fundamentals of Power over Ethernet (PoE), with explanations on the technology’s current state and the applicable codes and standards. PoE devices typically support sensors at every end point, and a denser sensor network enables more special customization of indoor environment conditions. It is also conceptually straightforward to make building data available to building occupants through mobile devices, and to enable their input to control decisions. These advantages promise to deliver behavioral and organizational productivity benefits based on occupant well-being.

(IS-2020-125) Overview of ESR - Operating Reserves Qualification & Technical Requirements & ARS Applicability

This report was published by the Alberta Electric System Operator in April 2020 and provides overview of the short-term qualification and technical requirements for energy storage facility participation in the operating reserves market. Applicability of Alberta Reliability Standards to energy storage facilities is also considered. The report is useful for engineers, regulators, and professionalsworking in the energy sector.

(IS-2020-124) One Digital World

This article was prepared in July 2020 by Black & Veatch and deals with the importance of advanced communication networks. The topics include 5G networks, safety, sustainability, mobility, clean technology, grid modernization, and connectivity. The article will be of interest to business owners, engineers, technologists, and IT professionals.

(IS-2020-123) State of Green Business 2020 Report

This report by GreenBiz Group, from June 2020, provides an annual assessment of the corporate sustainability performance of major global companies listed on the S&P Global 1200 index and major U.S. companies listed on the S&P 500® index for the State of Green Business Index. The analysts find businesses moving more quickly to "reduce the business risk that comes with these threats to natural capital and human well-being." The report will be of interest to policy makers and businesses.

(IS-2020-122) Smart Cities Beyond the Hype - How Far Away are Truly Intelligent Cities that Improve Quality of Life for Citizens?

In this SmartCities Report published in January 2020, reports on a survey of 105 city leaders and executives from telecommunications companies, systems integrators and other suppliers. Respondents were asked for their views on how close cities are to achieving these aims and what were the lessons learned so far. The report highlighted "constantly moving" goalposts when it comes to realising smart objectives. The results will be of interest to energy providers, technology vendors, utilities, city planners and policy makers.

(IS-2020-121) 2020 Utility Energy Efficiency Scorecard

Published in February 2020 by AEEE, this report ranked the 52 largest US electric utilities on utility-sector energy efficiency programs and policies in 2018. The report covers 20 metrics that were developed to reflect utility performance and allocates 50 total possible points across three categories. It describes how utilities are innovating to meet changing system needs, but utility business models are slow to change. The report will be of interest to policy makers, utilities, and all those in involved in energy management.

(IS-2020-120) Position Statement on Germicidal UV-C Irradiation

This report released in May 2020 by the Global Lighting Association presents current UV-C safety knowledge. Topics covered include safeguards to avoid human exposure to irradiance hazards/excessive ozone concentrations and compliance criteria. The report will be of interest to technicians, technologists, engineers, lighting professionals, and users of equipment that includes germicidal UV-C technology.

(IS-2020-119) Plan B Global and Regional Strategies for the Built Environment Under Climate

Change

This April 2020 report prepared by the International Initiative for a Sustainable Built Environment discusses how climate change is presenting an existential crisis to all human societies and settlements. Topics covered include buildings, urban areas, excess consumption, inefficiencies, emissions, and a need for resilience. The proposed audience for the report includes urban planners, policymakers, energy professionals, and policy makers.

(IS-2020-118) What's in Store Post COVID for Retail

This 2020 JLL Research white paper examines the long-lasting impacts of the COVID-19 pandemic on retail and consumer behaviour across thirteen retail sectors. Considerable variance is seen across retailers and sectors. Data to March and April, with projections by sector, is provided. A long “road to normalcy” is forecast. This paper is of interest from the perspective of investment/financing, public policy and retail business planning.

(IS-2020-117) Switch Consolidation - Is the Time Right?

This 2020 report from Finley Engineering provides an overview of a telecommunication switch consolidation trend and offers key considerations for carriers who may want to explore this option. Topics include regulatory implications, a need for consultation with appropriate regulatory counsel, potential savings, and types of switch consolidation. The report will be of interest to engineers, integrators, technologists, and professionals involved in standards development.

(IS-2020-116) SSE: A Greenprint for Building a Cleaner, More Resilient Economy

This report published in May 2020 by SSE discusses a number of steps policymakers could now take to develop an innovative, low-carbon infrastructure and drive a green recovery following COVID-19 pandemic. Topics include policy proposals, net zero power systems, electricity transmission networks, electric vehicles, and green jobs.

(IS-2020-115) Smart Gas Metering

This report was published in March 2020 by Sensus and features interviews with utility professionals who have deployed gas Advanced Metering Infrastructure (AMI) to their customers, as well as vendors and consultants. It offers guidance on gas AMI deployment, including the key components of any gas AMI rollout and responds to critical questions to consider for a foundation of a gas AMI program.

(IS-2020-114) Measuring the Impact of COVID-19 on Business Operations & Purchasing Priorities Across the Net-Zero Sector

NetZero Build Summit released this publication just prior to the August 2020 conference. The results of a survey asking industry professionals for their perspectives on the future of the net-

zero sector are presented. The structure of the survey allowed respondents to give their views on the prospects for the industry growth, business continuity and challenges—before, during and post-pandemic.

(IS-2020-113) Mandatory Building Performance Standards - A Key Policy for Achieving Climate Goals

This June 2020 white paper form AEEE explores building performance standards across different national jurisdictions. To date, multiple approaches exist, and different cities are pursuing a variety of different approaches suited to their community needs and requirements. It is argued that complementary policies are required to help cover costs faced by building owners, and that further analysis is needed to determine how performance standards apply in critical markets, such as affordable housing.

(IS-2020-112) Machine Learning Explained - The Three Essentials for Video Analytics

This 2020 article by Calipsa and explains the basics of machine learning, breaking down the essential elements that every system needs to get started. Information is also provided on how machine learning is applied to the Calipsa video analytics platform to make it accurate at improving crime prevention. The article will be of interest to IT professionals, computer scientists, and cybersecurity experts.

(IS-2020-111) Is Your Digital Future in the Right Hands?

This report published by KPMG in October 2019 illustrates the result of a survey about digital transformation and technology innovation in the real estate industry around the globe. It explores the drivers for digital investments, the property life-cycle stages that are most likely to see investments in IT initiatives, the current state of integration of internal systems. The report also looks at data strategies and cyber security concerns and concludes with a section on how the industry is opening up to new technology-driven business models, including Property as a Service.

(IS-2020-110) How to Bridge the IT & OT Cybersecurity Divide - Protecting Against Industrial Control Systems Threats & More

This edition of AUTOMATION 2020, published by Automation.com, focuses on how companies can be resilient in the face of cyberthreats and how to protect against threats to industrial control systems. It looks at the latest on USB port intrusion threats and previews the next big step in EtherNet/IP security. The article is intended for a broad audience, including business owners, IT professionals, engineers, and cybersecurity experts.

(IS-2020-109) Wiredscore's Guide on Protecting Your Home Network from Cyber Attacks

This report was published by Wiredscore in April 2020 and explains what types of security

attacks are common among work from home employees during Covid-19. Recommendations are made regarding security measures that can be taken to stay protected. The report aimed at the general public as well as security professionals.

(IS-2020-108) Data Driven Metadata Tagging for Building Automation Systems - A Unified Architecture

This article was prepared in February 2020 by the National Renewable Energy Laboratory and BrainBoxAi. It presents a Unified Architecture (UA) for automated point tagging of Building Automation System (BAS) data, based on a combination of data-driven approaches. The information will be useful for building

(IS-2020-107) How Enterprises Are Managing Endpoint Security Threats

This Dark Reading report, published in April 2020, reports on a survey of 120 IT and cybersecurity professionals on their biggest endpoint security concerns—and their preparedness to deal with them. Topics covered include an overview of endpoint security issues, security polices, security apps, multi- factor authentication, the rise in security issues due to mobile end-point devices, and strategies to mitigate risks. The report may be of interest of business owners and security professionals.

(IS-2020-106) Get to the Point - Why a Point to Multipoint RF Network is Necessary

This report released by Aclara in May 2020 describes why a point-to-multipoint RF network is a necessary foundation to enable distribution automation applications of the future and for grid modernization to succeed. The topics covered include grid modernization, comparison of RF network architecture, distribution automation, and point-to-multipoint networks. The report will be of interest to utility operators, engineers, and technology developers.

(IS-2020-105) Evaluation of a green and sustainable building project

This academic paper looks at environmental assessment schemes for green buildings in China. It proposes an evaluation approach using an algorithm that takes into account the operation stage to ensure the implementation effect of the whole life cycle. A case study of a building in the city of Nanchang to test the methodology is illustrated.

(IS-2020-104) CABA Smart Home as a Service – Executive Summary

Providing a comprehensive examination of all aspects of Smart Home as a Service (SHaaS), this report set out to understand how use cases, customer environments, buying behaviors, and evolving ecosystem interactions all impact and influence the development of the connected home market. The report by Harbor Research, Inc., a CABA member, became available for purchase in the CABA Store in July 2020 at the end of a four-month embargo period. The 27-page Executive Summary of the report is freely available for download here.

(IS-2020-103) An Overview of Security and Privacy in Smart Cities' IoT Communications

This report offers an overview of cyber security and privacy issues involved in the design and implementation of smart cities applications. It explains the characteristics as well as the IoT-based architecture of a smart city. Solutions and challenges are also discussed in the article, published in *Transactions on Emerging Telecommunications Technologies*, an academic journal.

(IS-2020-102) Switch Automation Makes Strides in Digital Facilities Management

This report from Verdantix, published in September 2019, is part of a series which supports real estate and facilities executives' "digitization journey." Digital facilities management software vendor Switch Automation has introduced a solution set that covers the building IoT journey from data availability to asset control, taking real estate customers from initial readiness audits to custom IoT solutions.Firms from across the commercial real estate spectrum may benefit, regardless of the state of their IoT deployments.

(IS-2020-101) Physical and Operational Security for Transfer Switches

This white paper released in March 2020 by ASCO Power Technologies/ Schneider Electric sets out an approach for evaluating device security "from the inside out." When securing transfer switches and other power system devices, a layered security model enables facilities to look from the inside of a device outward to the various system boundaries that impact physical and operational security. The report explains how common-sense security measures such as securing equipment enclosures and rooms and applying password protections mitigate routine threats to reliable operation.

(IS-2020-100) California Power Outages: Mitigating the Effects of Planned Blackouts on Small and Mid- Sized Businesses

In 2019, a large California power provider announced that it would cut power to communities in times of extreme wildfire risk, and the ensuing blackouts caused major business disruptions and economic losses. This document describes outage impacts and presents options for installing backup power equipment at small and mid-sized businesses. While the full economic impacts of California's planned outages may not yet be fully realized, the effects on small and mid-sized businesses demonstrated a consistent pattern. Businesses without access to backup power closed and languished; those that stayed open did so by accessing secondary (sometimes off-site) power sources.

(IS-2020-99) Implications of Sustainable Features

This paper examines key sustainable features and their implications for life-cycle costing in green buildings. The impacts of sustainable features on construction costs, maintenance and operational savings are examined. The research looks at two case studies from Sri Lanka focusing on green industrial manufacturing buildings.

(IS-2020-98) Trends in Sustainable Architecture Design in the United Kingdom: A Delphi Study

This paper published in February 2020 in *Sustainable* Development, an academic journal, looks at the concept of sustainability in contemporary architectural design. It explores the attributes which characterize different approaches to sustainable building design. The research was developed through a consultation process with several sustainable architects in the UK. It seeks to provide an original typology of sustainable practice.

(IS-2020-97) Demystifying LTE and Cellular IoT Technology for Utility Companies

This report was published in April of 2020 by Sierra Wireless. It provides an overview of how LTE cellular networks can help improve grid intelligence, operations and data management; how public cellular networks compare to other communication networks (such as radio mesh, fixed point-to-point, private cellular, etc.) including technical choices for investments; and explores the future evolution of connected IoT for utilities.

(IS-2020-96) A Road Map for Successful Conversation to a Fully Electric Fleet

This Burns & McDonnell white paper provides a road map for electric utilities and transit agencies to complete an efficient conversion to electrified vehicle fleets. The following aspects are examined: operational assessment, market analysis, energy requirements, charging needs, facility need, utility interconnection, on-site power, financial analysis and phasing implementation. The paper will be of interest to government, transportation, utility and business leaders.

(IS-2020-95) Changing the Way the Grid's Future is Planned

The report by Burns & McDonnell deals with the required transformations of the electric grid to meet the needs of current consumers. The topics covered include changes affecting the electric grid, grid planning, holistic distribution planning, grid modernization, and foundation for grid transformation. The report is useful for electric utility owners and operators, electrical engineers, policy makers, and city planners.

(IS-2020-94) Testimony by the ACEEE at Congressional Hearing on Saving Energy: Legislation to Improve Energy Efficiency and Storage

Lowell Unger, Senior Policy Advisor with the American Council for an Energy-Efficient Economy, appeared before the U.S House of Representatives Subcommittee on Energy in February 2020. His presentation examined aspects such as industrial competitiveness, building codes, the importance of saving energy, industrial assessment centers, federal energy management, and water management performance. The report will be of interest to policy makers, engineers, manufacturers, professionals working in the energy sector, and consumers.

(IS-2020-93) AHR Expo 202 Economic + Industry Report

This 2020 survey for the AHR 2020 Expo gauges 1,400 members' prospects for the new year, focusing on: areas of growth, market segments with highest performance, potential threats, challenges and opportunities. In summary, business prospects continue to be good or excellent with 70% expect growth of at least 10%. Light commercial, hospital and residential were viewed as the top segments. Maintenance/replacement, retrofit/reno and new construction are the top market prospects. Also included - eight industry sector leaders including trade associations such as CABA provide their unique views and perspectives in their areas of expertise. This paper is relevant for HVAC technology/service/suppliers and business leaders.

(IS-2020-92) DC Microgrids in Buildings

This report by CSA Group deals with trends in direct current (DC)-based distribution technology, including standards development. The topics covered include background on DC technology, industry drivers, DC microgrid case studies, codes and standards, and microgrid advantages and challenges. The report will be of interest to engineers, technologists, electric utility owners and operators, and system integrators.

(IS-2020-91) User Guide for Local Clean Energy Self-Scoring Tool, Version 4.0

This paper from the American Council for an Energy-Efficient Economy provides a comprehensive guide for using the ACEE's Local Clean Energy Self-Scoring Tool. Policy evaluation covers buildings, energy & water utilities, transportation, government operations and community-wide initiatives. Comparisons and benchmarking tools are provided with respect to the 2019 City Scorecard. This paper is relevant for policy makers, communities, utilities and business leaders.

(IS-2020-90) Lighting Control Application Guide for Open Offices

The report by the Lighting Controls Association describes various control strategies applicable to open office spaces to minimize operating costs, achieve energy code compliance, and promote more productive workspaces. The topics covered include time-based control, manual control, vacancy sensing, daylight-responsive control, combining strategies, open workstations, flexibility and personal control, energy codes, retrofit options, institutional task tuning, demand response, and integration with building management system. The report will be of interest to building owners and operators, engineers, technologists, lighting professionals, and system integrators.

(IS-2020-89) How Utility Companies Can Reduce Operating Costs With Vehicle Area Networks

This white paper from Sierra Wireless describes how consolidating connectivity over a vehicle area network (VAN) reduces high costs for utilities, while increasing field productivity. At the heart of a VAN architecture is a vehicle-based cellular gateway or router that establishes a continuous, reliable and secure internet connection for field personnel, giving workers access to corporate applications and enabling two-way communication that keeps them productive. This

white paper will be of interest to utility companies, technology developers and system integrators.

(IS-2020-88) Lighting & Lighting Controls: Following an OPR to design lighting systems This addition to the Consulting and Specifying Engineers eBook Series describes the many

factors lighting designers must consider when specifying lighting systems and lighting controls for nonresidential buildings, including the owner's project requirements. Following that section in the ebook, the authors examine commissioning light occupancy sensors. Installing lighting occupancy sensors and commissioning the devices have many benefits, including reducing operational and maintenance costs. This resource will be of interest to engineers, builders, building operators, and system integrators.

(IS-2020-87) Electric Vehicles in a Distributed Energy World

This research from Enbala explains why conversations in utility board rooms around electric vehicles are shifting dramatically. Traditionally there has been a focus on EVs as potential grid destabilizing problems. With the burgeoning EV market accompanied by a dramatic change in mindset, EVs are increasingly seen a unique opportunity to achieve heightened levels of positive customer engagement while balancing supply and demand swings and enabling new ways to participate in wholesale energy markets. The research will be of interest to researchers, technology suppliers, utilities, integrators and policy makers.

(IS-2020-86) Features and Benefits of Bluetooth Connectivity

This October 2019 report from Silicon Lab overs a variety of Bluetooth technologies, with discussion on where and why they should be used within smart homes. The topics covered include an overview Bluetooth 5, the highlights of Bluetooth mesh networking technology, multiprotocol Bluetooth and Zigbee connectivity, practical Bluetooth low energy and sub-GHz integration approaches, plug-and- play Bluetooth Xpress module for home automation, and product design. The report will be of interest to engineers, technologists, product designers, IT professionals, and system integrators.

(IS-2020-85) Creating Zero Carbon Communities: The Role of Digital Twins

This paper from Navigant and Integrated Environmental Solutions (IES) explains that a comprehensive reduction in urban emissions requires an increased focus on transforming energy use in buildings and transport, as well as a shift from fossil fuels to renewable energy sources. A holistic approach to the decarbonisation of city operations, infrastructure, and services is proposed. Digital twins have an important role to play in understanding and managing the complex integration of multiple assets and systems that characterize community-scale projects, the paper argues.

(IS-2020-84) Leveraging IoT sensors and analytics to optimize energy efficiency

This white paper from IOTA Communications explains that the energy consumption of a commercial building is continuously changing, based on a number of dynamic conditions— there is no static model of energy use. Better energy management, then, relies on having the right data at the right time, which allows building managers to be flexible and agile in their approach to energy reduction. This whitepaper discusses some of the parameters the IoT monitors and analyzes to uncover energy efficiency solutions, and describes two of the most impactful strategies organizations are implementing today—demand response and demand control. The document will be of interest to building developers, building operators, systems integrators, and technology suppliers.

(IS-2020-83) What is Lif-Fi? The Evolution of Integrating Li-Fi Technology into Smart Lighting and Control Systems for the Intelligent Building

This CABA White Paper explains key differences between LI-FI and Wi-FI, including comparison of RF Wireless and Optical Wireless Technologies; discussion of Li-Fi and Wi-Fi IEEE/ ITU Standards and Link Speed; the benefits and drawbacks of Li-Fi; and Li-Fi applications. As a member benefit, CABA members can get White Papers developed complimentary and you can join CABA White Papers under construction or view other completed White Papers on the CABA web site.

(IS-2020-82) State of CRE Operations 3.0

With the rapid proliferation of technology in the Commercial Real Estate (CRE) industry, building operations and maintenance is poised for disruption. This report from Facilio presents an overview of this phenomenon and presents the results of a survey of CRE leaders and facility management experts from across the US, the Middle-East and India. occupancy sensors. The authors begin by discussing how attitudes towards data-driven operations has fundamentally changed today. The report will be of interest to professionals involved in buildings operations and property management.

(IS-2020-81) Understanding Energy Efficiency as a Dynamic Resource in the Built Environment

This paper from BrainBox AI explains that dynamic modulation systems driven by Artificial Intelligence (AI) engines are the next disruptive innovation in the building industry. The traditional approach to building management has been to add intelligence to the different control systems in a building. However, these existing systems remain isolated and do not work together. By combining thesesystems with the outside environment and occupant behaviors, dynamic modulation representsan important paradigm shift in the world of building management by bringing together the Internet of Everything (IoE) and AI.

(IS-2020-80) Accelerating energy renovation investments in buildings
At today's renovation rate of around 1% of buildings per year, a timely transition of the EU building sector towards climate-neutral levels by 2050 cannot be ensured. This white paper from the European Commission provides a country-by-country overview of the most important public schemes identified across the EU, and investigates new private financial products in place to

stimulate more energy efficiency investments in residential, commercial and public buildings. Good practices are identified based on the criteria of impact, cost effectiveness, ambition level of energy efficiency upgrades, funding sustainability/continuity, scalability and outreach to hard-to reach groups.

(IS-2020-79) Canada Proptech Journey - How Canadian companies are faring in the digital age

KMPG's International's 2019 Global PropTech Survey analyzed responses from real estate companies across the globe. identifying the latest advancements and challenges in digital adoption. This report explores where Canadian companies stand in comparison to their global counterparts. In Canada only 36% have a digital strategy with 8% company wide and 28% only in certain areas.

(IS-2020-78) Protecting Transfer Switches from Water-Related Damages

This paper from ASCO Power Technologies explains that transfer switches provide important functions by transferring loads to alternate sources when power outages occur. Both the functions they provide and the energy they manage require their safe operation. Because contact with water can degrade transfer switch condition and performance, it is important to understand how water-damaged equipment can impact facilities. Water ingress into transfer switches and other critical power equipment can impact operability, reliability and service life. This document summarizes measures for mitigating water-related risks throughout the equipment lifecycle.

(IS-2020-77) State of Demand Side Energy Management: North America 2020

This report from CPower examines what the grid and energy markets of tomorrow will look like, with insights on what organization can do today to position for success when the future arrives. This book seeks to answer those questions with a market by market analysis of the issues, trends, and regulations the experts at CPower feel your organization should understand in 2020 to make better decisions about your energy use and spend.

(IS-2020-76) Transforming Markets for VPPs in Europe

The report was prepared in November 2019 by Navigant Research and describes how Europe is pushing the envelope on the virtual power plant (VPP) concept. The topics covered include European experiments for next generation VPPS, expanding VPP markets beyond country borders, linking energy trading to grid reliability via VPPs, and Europe’s initiative to take VPPsto the next level. The report is useful for electric utility owners and operators, electrical engineers, technologists, government officials, and policy makers.

(IS-2020-75) Over-the-Top: The cloud-based path to video innovation

The report published by Amazon in September 2019 discusses the accelerating growth in over-

the-top (OTT) video markets, compares hardware- and cloud-based approaches to creating live and on-demand OTT video workflows, and gives examples of organizations that architected OTT services with a cloud- centric approach. The topics covered include transformation of the media industry, building a disruptive technology foundation, and OTT content providers on Amazon Web Services (AWS). The report will be of interest to media company owners and operators, IT professionals, and cloud service providers.

(IS-2020-74) Evolving home gateway architecture to enable the smart home

The report published by Calix in April 2019 discussed the importance of Wi-Fi technology in homes to ensure reliable Internet access to all devices connected to the home network. The topics covered include service providers' contractual obligations, signal extenders, the importance of service provider's connection with the users, service upsells, and technical ownership of the smart home. The report is useful for home owners, Internet service providers, engineers, technologists, and system integrators

(IS-2020-73) Insights and strategies for smart home insurance programs

This report from LexisNexis Risk Solutions reports on a consumer study of 2,500 US participants focusing on smart home and the internet of Things (IoT). Results show that smart home insurance programs are still in the beginning stages. Carriers that take strategic steps to better understand their policyholders' appetite and adoption of smart devices can respond appropriately and gain acompetitive advantage.

(IS-2020-72) Where's the ROI?

This report from SmartCitiesWorld discusses how smart cities can deliver social, economic and environmental benefits, providing a three-dimensional return on investment. It examines an emerging or growing trend in smart cities, highlighting progress so far and future potential, as well as spotlighting case studies from cities around the world. Examples from Paris, France and Guangzhou, China are discussed. This paper will be of interest to city planners and public policy makers.

(IS-2020-71) (IS-2020-71) Digital Vision for Mobility

More change is now underway across the transport and logistics industry than at any time since the invention of the combustion engine, begins this opinion paper from Atos. It goes on to discuss how digital technologies such as process automation, analytics and artificial intelligence are critical for transport and logistics providers to improve customer experience while optimising use of assets and reducing emissions. This paper is useful for publicpolicy makers and transport authorities.

(IS-2020-70) Unsettled Future: Trends and Opportunities Impacting Energy Networks

This report discusses the U.K.'s strategy to achieve net zero carbon emissions. It comments on options currently being evaluated such as the renationalisation of the power industry, increased use of renewables, vehicle electrification, power storage technologies, incorporation of hydrogen-based technology for space cooling and heating, blockchain-based technologies for energy trading. The paper concludes by providing a summary of what is needed to remove the existing barriers and drive investments.

(IS-2020-69) Moving Forward in a Complex Environment

This paper from JLL talks about the impacts coming from the expanded role of facilities management. And just like the tides of technology moving it along, this transformation has brought greater demands, higher stakes, and a workforce that expects more. Organizations are tasked with creating people- focused environments powered by streamlined services and datadriven solutions. The paper goes on to discuss three main drivers behind the transformation. The document will be of interest to technology innovators and facility managers.

(IS-2020-68) Key Factors for Successful Solar Construction

This 2019 Burns and McDonnell whiter paper examines the key factors required in the current marketplace, specifically contractor knowledge and experience, to ensure successful completion. Thirteen factors are reviewed, including: site selection, geotechnical investigation, pile design & installation, underground cable sizing, SCADA requirements and module installation & wire management. This paper is relevant for firms considering solar power installations.

(IS-2020-67) Energy poverty through the lens of EU research and innovation projects

This 2019 EU Commission Joint Research Centre white paper studied 31 innovation projects in 30 countries grouped into the following categories: Digital Technologies, Behavioural Change,

Financing, and Sharing of Best Practices. Key findings, consumer insights and emerging trends are highlighted, contributing to the knowledge and best practices to help eliminate energy poverty experienced by more than 50 million Europeans, This paper is relevant for regulators, government, utility and business leaders.

(IS-2020-66) Energy Needs for Sustainable Buildings

Buildings and transportation account for the lion's share of primary energy consumption globally. This article from the Indian Institute of Technology explains in plain language core theoretical concepts associated with energy building performance such as building orientation, solar energy gains, HVAC systems. It also discusses how alternative sources of energy (biofuels, batteries, geothermal and solar energy) are slowly making their way into the energy demand for building and transport.

(IS-2020-65) Energy Infrastructure Update

This December 2019 Office of Energy Project reports highlights the key project in the following areas: natural gas authorizations, hydropower requests for applications, electric generation online, and electric transmission completions. Metrics provided include number of projects, capacity.

(IS-2020-64) 2020 State of Commercial & Industrial Power Reliability Report

This 2020 S&C Electric survey, in collaboration with Frost & Sullivan, of 255 C&I USA companies representing $4B in revenues provides a market assessment of power reliability issues, the impact of poor reliability and considerations of alternative energy options. Analysis includes: an audit of outages, the impact of outages, and mitigating strategies to improve reliability. One-third of companies surveyed would pay more for reliable power and quick restoration of outages, and two-thirds are investing in options to ensure reliability. This paper is relevant for utility and business leaders.

(IS-2020-63) International Journal of Energy Management, February 2020

This journal was published in February 2020 by the Association of Energy Engineers and deals with current topics in energy management. The topics covered include movable solar shades, energy performance targets for a crude producing facility, utility rate design, roles of combined heat and power in a commercial near-zero net energy demonstration, and integrating solar power with thermal storage. The report is useful for professionals working in the energy sector, engineers, technologists, and system integrators.

(IS-2020-62) 2019 Residential Lighting

This 2019 Residential Lighting Guide is designed to serve as a resource for industry professionals involved in the design, construction or retrofit of California's buildings. The guides include compliance requirements and recommendations for implementing the Energy Code in New Construction, Addition or Alteration projects and covers: the compliance process; concepts and principles; technologies, systems and control strategies; compliance requirements; and, requirements and recommendations in practice. This paper is relevant for anyone involved in the California commercial building industry.

(IS-2020-61) Making the case for energy storage

This report provides an overview of energy storage solutions. A cost-benefit analysis is illustrated for three scenarios with different technology configurations. Then, an analysis on congestion relief at transmission facilities is also performed. Finally, an investment evaluation for reliability upgrades in the transmission and distribution system is carried out using two battery configurations.

(IS-2020-60) Imagining an electric world

This paper is a theoretical dissertation about a future electrified world which in view of the author is inevitable. Challenges and opportunities are discussed along with industry sectors being impacted by that change, such as transportation, heating & cooling, infrastructure and other. The author concludes that this transition will signify that a lot of jobs will be created and a lot more lost in every facet of the economy.

(IS-2020-59) REAL-TIME WATER DATA: THE KEY TO AMERICA'S SMART CITIES

This report exemplifies the application of real time data using remote sensonrs in the Great Lakes region (US & Cananda) for the purpose of monitoring water quality in water bodies. It is discussed how the concept of smart infrastructure is evolving as cities and utilities rely on this type technologies to better design and maintain public infrastructure.

(IS-2020-58) Achieving 100% Renewable Energy

This report analyzes Florida´s renewable energy plan. It provides a market and policy context. Then, using an estimated load it discusses the mix of energy sources that could potentially be used to supply this electric demand, with a special emphasis on solar sources and some considerations about cost of investment. Lastly, the author lists some tips that utilities and regulators should consider when starting down a path that leads to 100% renewable energy.

(IS-2020-57) The State of Industrial Internet of Things 2019

This paper discusses the application of Internet of Things (IoT) in manufacturing settings where the drivers are operational effectiveness and productivity. It begins by exploring typical environments where IoT is found, how value is achieved (e.g. IoT analytics measuring the interaction between multiple assets), followed by providing cases to show the impacts and benefits across different functions in organizations. Lastly, it emphasizes the importance of data sourcing as a crucial component of IoT and gives some insights about how early adopters might quickly make the transition from ad- hoc trial test cases to full-scale production.

(IS-2020-56) Resistors Play a Vital Role in Smart Grid Sensors

This EBG Resistors white paper highlights the need for power sensors to be as smart as the grid they monitor. A series of FAQs are provided to help designers and technology managers understand the new requirements being place on power sensors used in SmartGrid applications, and how those requirements affect the selection of their voltage sensing components. A conceptual model is provided. This paper is relevant for SmartGrid designers and technology managers.

(IS-2020-55) Digitization and the Future of Energy Management

This 2019 DNV GL - Energy white paper highlights the important role energy efficiency plays in reducing total energy demand in transportation, buildings and manufacturing. A global survey of

2,000 energy professionals indicates digitization can improve operational efficiency by 55% and cost efficiency by 40%. Six technologies were identified as important for investment. Digital skills training, creativity andemployees with sufficient combined data and domain expertise were skillsets identified as key future workforce priorities. This paper is relevant for C-Suite and business leaders in the technology and energy sectors.

(IS-2020-54) Optimized energy system design based on active energy-saving technologies in very low- energy smart buildings

This article explores ways to minimize energy consumption for existing commercial buildings so that it can be turned into a very low-energy building. A case study of an office building in Pakistan is used as a pilot. Three-layer of measures are proposed to achieve energy savings (building simulation, energy- efficient technologies, monitoring and measurement). Each type of measure is described and a financial analysis is also performed.

(IS-2020-53) Future trends and main concepts of adaptive facade systems

This academic paper in *Energy Science & Engineering* identifies the most promising adaptive facade technologies and suggests an analytical framework for future trends and technological classification of adaptive facade systems in buildings such as dynamic solar shading, chromogenic facades, solar active facades, and active ventilated facades. It was developed in consultation with subject matter experts with a focus on the European context.

(IS-2020-52) Why Australia Is a DER Innovation Hot Spot

The report was prepared in September 2019 by Navigant Research and deals with factors that have contributed to making Australia a global leader for distributed energy resources (DERs). The topics covered include the evolving DER market in Australia, supporting technology for DERs and virtual power plants, and leveraging Australia as a test bed for global DER adoption. The report is useful for electric utility owners and operators, engineers, technologists, system integrators, government officials, and policy makers.

(IS-2020-51) The Wi-Fi Evolution

This report was prepared in August 2019 by Qorvo and deals with the evolution of the IEEE 802.11 standard commonly referred to as Wi-Fi. The topics covered include a description of the following protocols: 802.11-1997, 802.11-a,b,g,n, ac, and ax. The report is useful for engineers, technologists, system integrators, and IT professionals.

(IS-2020-50) IoT Design & Development

This report was prepared in September 2019 by EEWorld and deals with industrial IoT (IIoT). It describes the commercial dynamics and market trends that are defining this particular sector. In addition, the report provides details of the various design issues being faced by engineers as they

look to develop and implement IIoT systems, and then explains how these challenges may be overcome. The report is useful for engineers, technologist, and IT professionals.

(IS-2020-49) Super-B for IoT: Improving QoS in LoRa Networks

The report was prepared in May 2019 by Longview and deals with the new Super-B protocol for LoRa wireless technology. The topics covered include inherent benefits of LoRa, improved quality of service (QoS), description of Super-B protocol, implications for the enterprise, and an introduction to the Longview organization. The report will be of interest to engineers, technologists, system integrators, and IT professionals.

(IS-2020-47) How Blockchain Will Disrupt Business

This report published in November 2019 by CBS Interactive (ZDNet) provides an overview of blockchain technology and its impact on business. The topics covered include blockchain adoption challenges, implementation, promise of electronic voting, content consumption, benefits, feedback from healthcare industry, predictions on future industry impact, and automotive application. The report is useful for business owners, investors, software developers, and IT professionals.

(IS-2020-46) Overcoming the Smart Home Market's Top Challenges

The report was prepared in December 2019 by IoT World Today and provided recommendations for improving growth in the smart home market which is currently fragmented and unsecure. The topics covered include steps to unleash the smart home market and better-informed smart home consumers. The report is useful for smart home equipment designers and manufacturers, system integrators, technologists, engineers, and IT professionals.

(IS-2020-45) IoT: Putting the "smart" into smart cities

This report from June 2019 by Ingram Micro provides a primer on the Internet of Things (IoT) as applied to smart cities. The topics covered include a definition of a smart city, IoT deployments in smart cities, use cases (traffic flow, security, efficiency of utilities, municipal services, sustainability), and how IoT can address challenges such as infrastructure, integration, privacy, and security. The report is useful for city planners, policy makers, government officials, engineers, system integrators, and IT professionals.

(IS-2020-44) The Modern Workplace

The report from Condeco deals with trends driving workplace change and business readiness to respond to these challenges. The topics covered include digital transformation and the workspace, adapting the physical workspace for efficiency, meeting room trends, and flexible working. The report is useful for business owners, architects, builders, and interior designers.

(IS-2020-43) Optical Fiber and the Future Electric Utility

The report is from AFL Global and examines deployment of fiber optic cabling in electric utility networks as part of smart grid modernization efforts. The topics covered include the evolution of fiber in electric utilities, future fiber uses in electric utilities, and best practices for building fiber network for electric utilities. The report is useful for owners and operators of electric utilities, electrical engineers, technologists, and system integrators.

(IS-2020-42) Advancing Automation Sensors & Instruments

The report was prepared in November 2019 by Automation.com and deals with new instruments and sensors for today's process and industrial automation industries. The topics covered include smart transmitters, smart sensors, powering of wireless instruments and sensors, and sensors and systems for computer-controlled production of automobiles. The report is useful for technologist, engineers, IT professionals, system integrators, and automation equipment manufacturers.

(IS-2020-41) Artificial Intelligence for Energy: How Smart Algorithms Can Improve Planning

This report was released in December 2019 by Miner & Kasch and discusses how electric utilities can gain new efficiencies, capabilities, and opportunities by leveraging cloud computing, artificial intelligence (AI), and machine learning tools. The topics covered include utility use cases for AI, national grid's investment in AI for utilities, overcoming barriers to AI adoption, and initial steps toward an AI- enabled utility future. The report is useful for electric utility owners and operators, IT professionals, engineers, and software developers.

(IS-2020-40) White Paper on Connected Lighting and the Integrated Home

This report by the Consortium for Energy Efficiency (CEE) describes how the emergence of connected lighting presents opportunities for the integrated home. The topics covered include lighting of tomorrow, integrated home framework, characterization of connected residential lighting as part of the integrated home, barriers to connected lighting, commercial applications, next generation lighting systems, and leverage the strengths of the lighting for tomorrow competition model. The report may be useful for lighting professionals, technologists, engineers, and system integrators.

(IS-2020-39) 2019 State of Green Business

This report from May 2019 by the GreenBiz Group deals with world of sustainability and the ten trends sustainability professionals should be tracking in the year ahead. The topics covered include corporate sustainability, value of reuse, the importance of soil for climate action, deforestation, electric buses and trucks, energy productivity, green loans, super pollutants, greenhouse gas emission disclosure by companies, and science-based targets for environmental impacts on water, land use, biodiversity and oceans. The report is useful for environmentalists, business owners, government officials, scientists, engineers, and policy makers.

(IS-2020-38) Shaping Autonomous Vehicle Deployment to Meet Climate and Energy Goals: A Policy Toolkit for Cities

This report released in December 2019 by the American Council for an Energy-Efficient Economy presents the outcomes that cities should strive for when incorporating autonomous vehicles (AVs) into their transportation systems and describes major challenges that may arise as AV deployment proceeds. The topics covered include desired outcomes such as low emission, efficiency, and space optimization, and the recommendations for transportation policies to achieve the outcomes. The report is useful for city planners, government officials, AV manufacturers, policy makers, and engineers.

(IS-2020-37) Video Surveillance in the Smart Era: Unlocking the Potential through Cloud Sponsored

The report was prepared in September 2019 by the International Data Corporation (IDC) and deals with the transformation of video surveillance technology; how it has evolved beyond being an integral component of safety/security processes to new use cases. The topics covered include surveillance ecosystem in the smart era, use cases (district / building security, operations management, sales in retail stores), implementation challenges, benefits of cloud- based solutions, and the NXN'S smart video surveillance service. The report is useful for video surveillance professionals, engineers, technologists, IT professionals, system integrators, and business owners.

(IS-2020-36) NIST Cybersecurity Framework and BAS

This January 2020 paper by Anto Budiardjo wasamong a series of articles published to coincide with the second annual New Deal for Buildings Cybersecurity Summit at AHR Expo 2020. Budiardjo and the panelists merge their voices to tell the story of how cybersecurity touches buildings, from identifying components, all the way to responding and recovering following an attack. Budiardjo examines on the NIST Cybersecurity Framework, with particular reference to its five core functions: identify, protect, detect, respond, and recover. The article will be of interest to technology developers and cybersecurity professionals.

(IS-2020-35) Estimating Office and Mutifamily Building Energy Retrofit Hurdle Rates and Risk Arbitrage in Energy Efficient Investments

This research paper develops a substantial, large-scale database of building energy use, energy audit reports, land use, and financial characteristics in New York City to empirically model the hurdle rate for energy retrofit investments, using actual audit data per permitted renovation work. The model considers different property types and building characteristics. Median IRRs of 20% for Multifamily and 24% for Office are consistent with the estimated return of a bundle of NPV-positive energy conservation measures. This paper would be of interest to investment/financing, government, regulatory, construction, property management and business leaders.

(IS-2020-34) A Different Look at Commercial Real Estate Performance Insights into Energy Efficiency Improvements

This April 2019 paper discusses the environmental performance dynamics of commercial buildings and examines the efficacy of green labels like LEED to bring about reductions in energy consumption. A dataset of 26,000 buildings in the US was used for the analysis. The results indicate that the commercial real estate sector is gradually obtaining reductions in energy consumption. The types of upgrades linked to the most significant improvements in energy efficiency for commercial buildings are also discussed.

(IS-2020-33) Effect of Energy Benchmarking and Disclosure on Office Building Marketability

This paper examines the effect of energy benchmarking on the marketability of commercial buildings in a selection of U.S. cities (New York City, San Francisco, Chicago, Washington DC). The analysis suggests that it is difficult to determine if the policy impacts on energy efficient buildings are more positive than less energy-efficient buildings since there are other multiple factors influencing real estate performance. Further research is needed to ascertain if disclosed energy performance has an impact on marketability.

(IS-2020-32) Connected Thermostats and Low-Income Energy Programs

Although smart thermostats have been proven to drive substantial HVAC savings, they lag behind with respect to other energy efficiency technologies used by utilities in the US, in particular for low-income programs. To foster the adoption of smart thermostats, a program called Nest Power Project has been rolled out in partnership with utilities countrywide and the benefits for weatherization programs in houses are explained.

(IS-2020-31) Estimates of Building Component Energy Savings for Use in a Property Condition Assessment This paper presents the results of a study carried out in the US to estimate energy savings data obtained from efficiency upgrades of key building components using parametric energy simulations. The method used is aligned with the ASTM Standard Guide for Building Energy Performance and Improvement Evaluation in the Assessment of Property Condition. The percentage savings metrics can be applied to the actual energy use of a building to estimate the savings for a given building. Energy efficiency metrics for office and retail buildings -pre 1980/post 1980/post 2004- are illustrated in graphs for different climate zones in the US.

(IS-2020-30) How a Fully-Digitalized Grid Improves Utility Planning and Operations and Empowers New Business Models

This paper explores the transformation currently underway in the electric utilities sector. Among several factors, the emerging trend of Distributed Energy Resources (DER) is at the heart of this pace of change. The drivers and barriers for this transformation are discussed. It argues that traditional tools are obsolete, thus making a case for software solutions to be deployed to

facilitate the integrated planning process and accelerating the conversion of utility's operations, business models and customer engagement.

(IS-2020-29) Mobility as a Service: Cities on the Move

This SmartCitiesWorld trend report examines the emerging trend of Mobility-as-a-Service which brings together various transportation options in a city and allows citizens to plan their route, choose their preferred mode of travel, and book and pay for everything via one app.

This network effect will reduce the use of personal automobiles, encourage more sustainable forms of transportation and save the equivalent of 90 hours travel time per annum per MaaS user. Pilot trial results are provided. This paper is relevant for urban planners, transportation, technology and business leaders.

(IS-2020-28) Beyond Environmental Building Certification: The Impact of Environmental Interventions on Commercial Real Estate Operations

The report was prepared in April 2019 by York University and the University of Guelph and deals with the impact of monitoring and tenant engagement on building energy efficiency. The topics covered include research methodology, data sources, results, summary, and implications which show that monitoring and tenant engagement can impact decreased energy consumption. The report is useful for building owners and operators, engineers, environmentalists, and energy professionals.

(IS-2020-27) Next-Generation PoE: IEEE® 802.3bt White Paper

The report was prepared in March 2019 by Microchip Technology and deals with the IEEE Power over the Ethernet (PoE) standard 802.3bt. The topics covered include future proofing PoE, prior standards, and new features of 802.3bt. The report is useful for engineers, technologists, IT and telecom professionals, and system integrators.

(IS-2020-26) The Future of Carbon Capture and Storage is Looking Up

This 2020 Burns & McDonnell white paper examines carbon capture utilization and storage technologies, which can capture 90% of a power plant's carbon dioxide emissions. Both amine-based conventional absorber processes and membrane technologies are reviewed. DOE funding through 45Q tax credits for sequestration is examined. Opportunities and challenges are analyzed. This paper is relevant for investment/financing, government, technology, utility and business leaders.

(IS-2020-25) 12 strategies to step up global energy efficiency

The report was prepared in November 2019 by ACEEE, AEEE and ECEEE and deals with general principles to serve as the foundation for energy efficiency policies and recommended strategies

to enable the change. The topics covered include principles that support efficiency, energy demand by sector, and 12 strategies for global urgent action on energy efficiency. The report is useful for government officials, policy makers, engineers, technologists, energy professionals, and environmentalists.

(IS-2020-24) Commercial & Industrial Lighting Lifetime and Peak Demand Savings Analysis The report was released in November 2019 by the Alliance to Save Energy and deals with the

lifetime and peak demand savings potential from commercial and industrial lighting efficiency measures. The topics covered include technical reference manual (TRM) research, lifetime saving potential, peak demand savings, and cost effectiveness. The report will be of interest to building owners and operators, engineers, technologists, lighting experts, and energy professionals.

(IS-2020-23) Large Supply Pipeline Sets Stage for Market Growth in 2019: North American Data Centre Report

The report was prepared in August 2019 by CBRE Research and deals with the growth of wholesale data centre supply pipelines and strategies to meet demand. The topics covered include national (U.S.) data centre overview, state of the market, supply and demand insights, market pricing trends, capital market trends, and outlook for the second half of 2019. The report is useful for data centre operators, electrical engineers, and energy suppliers.

(IS-2020-22) The Standard Issue 002 U.S. Public Research Report

The report was prepared in September 2019 by the U.S. Green Building Council and deals with actions that can be taken to address climate change and create healthier living environments. The topics covered include environmental threats, turning anxiety into action, solving environmental problems, importance of family, green buildings, and carbon footprints. The report is useful for environmentalists, the general public, policy makers, and city planners.

(IS-2020-21) Building Rural Broadband Success

The report was prepared in October 2018 by Finley Engineering and deals with broadband

access across rural America. A case study of partnership with Pinnacle Telecom and Barry Electric Cooperative is presented. The topics covered include the importance of partnering, smart grid opportunities, key lessons learned, and future outlook. The report is useful for telcom and electric utility owners and operators, electrical engineers, city planners, and government officials. Topics covered include the importance of partnering, smart grid opportunities, key lessons learned, and future outlook. The report is useful for telcom and electric utility owners and operators, electrical engineers, city planners, and government officials.

(IS-2020-20) 2020 Cybersecurity Report

The report released in January 2020 by Check Point Research offers a review of recent major

cyber incidents, adds predictions for the year ahead, and recommends best practices for organization to be safe from cyber attacks. The topics covered include a timeline of 2019's major cyber events, Check Point's cyber security predictions, cyber security trends, global malware statistics, high-profile global vulnerabilities, review of 2019 cyber threat predictions, recommendations to prevent the next cyberattack, and zero trust networks best practices. The report will be of interest to business owners and managers, IT professionals, cybersecurity experts, and the general public.

(IS-2020-19) Digital facilities management: Leveraging the power of people, data and technology

This report explains how facilities management relies on data and technology to overcome the challenges posed by today's traditionally managed buildings. It makes an analogy based on the theory of Maslow's Hierarchy of needs to create the Building Management Hierarchy of Needs which covers all the way from OPEX reduction to brand reputation. It identifies the obstacles and set of solutions available to navigate the hierarchy of needs and how to implement an effective smart building program while investing in the right technology.

(IS-2020-18) Harmonized Data Collection From The Field

This Solar United white paper describes the value of a quality infrastructure (QI) system, comprising the total institutional network and legal framework that formulates and implements standards, testing, certification, metrology and accreditation. A comprehensive QI reduces costs throughout the PV life cycle, with examples provided. The impacts of IoT, AI/machine learning, and simulation modeling are discussed. This paper is relevant for those utilizing PV technology.

(IS-2020-17) Extending the Benefits of Nonresidential Energy Efficiency to Low-Income Communities

This 2019 research study from the American Council for an Energy-Efficient Economy illustrates the challenges community-serving institutions face participating in energy efficiency programs. Additional outreach efforts and incentives to existing programs, rather than program redesigns, positively impact participation rates. Changes to public policy are discussed. This paper is relevant for government, utility and business leaders.

(IS-2020-16) Dispatchable Renewable Energy for a Lower-Carbon Utility Future

This Utility Dive report prepared for Mitsubishi Hitachi Power Systems provides an overview and merits for adding renewable hydrogen capacity to power systems. Green hydrogen, produced using off peak renewable energy, can be effective for energy storage, the report notes. Dual-fuel natural gas / hydrogen gas turbine technology is discussed as a proven and reliable power source. This paper is relevant for technology and business leaders.

(IS-2020-15) How to Collect Data from Legacy Systems to Improve Operations

This paper from Machine Design, developed together with Siemens Digital Industries Software, sets out to respond to two questions: How, specifically, can organizations connect existing systems— some which are several decades old and use an array of outdated and incompatible communication protocols and methods—to next-generation systems so they can maximize the industrial IoT's promised competitive advantages? Just as important: how do organizations achieve such integration quickly, cost- effectively and with little to no downtime?

(IS-2020-14) Remote Working

This paper by Condeco Software Inc. studies the business benefits of telework for organizations. The evidence to date suggests that allowing people the freedom to manage how, where and when they work from seems to have a significant impact on employee engagement. It also discusses how this trend raises questions about how corporations should administer workspaces to reduce underused office space and re-invest in remote working solutions. The analysis presents a 10-step process intended to guide facilities managers into becoming "corporate placemakers."

(IS-2020-13) 2019 Grid Integration Highlights

This 2019 Smart Electric Power Alliance survey provides a technology market gap and trend analysis in the following areas: electric vehicle market; battery storage market; customer engagement; and, challenges to utility business models. Each section includes the key challenges and corresponding opportunities. This paper is relevant for investment/financing, government, technology, utility and business leaders.

(IS-2020-12) Smart Cities: A Business Leader's Guide

This TechRepublic CBS Interactive white paper provides a leader's guide to understanding and transforming cities into smart cities. With $135 billion in technologies projected to be spent on cities by 2021, smart cities will evolve from discrete flagship projects to sizable market opportunities which will improve the quality of life for citizens and visitors. Examples of smart cities are provided. Links to additional resources including on planning, lessons learned and spending projections are provided. This paper is relevant for technology, urban planning, and government business leaders.

(IS-2020-11) The State of Physical Access Control: Impact on the Enterprise

This HID Global paper provides the results of a November 2016 survey on physical access control systems and technologies. The pros and cons of various technologies are discussed. A comparative summary of common physical access control system features is provided, and includes market sizing for planned upgrades. A new framework of access controls as a component of an integrated building management approach is provided.

(IS-2020-10) Big Questions = Big Questions for the Engineering and Construction Industry This

2019 FMI white paper examines the challenges of big data usage, and provides opportunities for the engineering and construction (E&C) industry to use data analytics and its benefits as a business tool. Currently, 95.5% of the 2.5 quintillion bytes of data produced daily in the E&C industry is not used. Examples include: predictive modeling used to create customized visualization tools to better manage design costs; better work flow management processes; and, improved business performance management. The report is particularly relevant for engineering and construction businessleaders.

(IS-2020-9) BuiltWorlds 2019 European Market Annual Report

Key findings are distilled from BuiltWorld's Global Summit in Paris, which brought together industry leaders, innovators, and disruptors from all corners of the European market. Examples of significant infrastructure projects are provided. The report also provides takeaways from visits to some of France’s biggest construction companies. Insights are provided on the increased role of robotics on jobsites; trends in offsite construction; waste elimination through technology; vertical integration in design, development and fabrication; and, the importance of data in the IoT and digital twin solutions.

(IS-2020-8) Building a Hyperconnected City

The report was prepared in November 2019 by ESI ThoughtLab and deals with business case, best practices, challenges, and performance metrics around becoming a hyperconnected city—one that drives huge benefits to stakeholders by interlinking its assets through the latest technology. The topics covered include hyperconnected city index, city maturity classification, the value of hyeperconnected cities, the path to a hyperconnected future, overcoming roadblocks, return on investment, and case

studies. The report is useful for city planners, government officials, policy makers, engineers, and IT professionals.

(IS-2020-7) 2019 Utility Demand Response Market Snapshot

This report covers utility demand response (DR) programs in the U.S. Using the results of a survey representing 64% of total U.S. customer accounts, the report analysez demand respond data from mass market (residential + small businesses) as well as commercial and industrial markets. The analysis describes policy work being developed countrywide and DR market trends related to each type of existing DR programs. Challenges and opportunities for utilities such as energy storage, electric vehicles and demand flexibilty for smart homes are discussed.

(IS-2020-6) Wireless charging: the key to workplace mobility, productivity & engagement

This report illustrates the results of a survey of 2,000 employees to measure impact on workplace mobility. Mobility contributes in maximizing utilization of employees' workspace. Some studies indicate that assigned desks in the workplace are only occupied about 20% to 40% of the time. Thus, a strategy combined with technology like wireless charging become vital to

reach that goal. Benefits like real estate saving and higher employee engagement are also discussed.

(IS-2020-5) Clean-Energy-Based Economic Development: Parallel Tracks for State and Local Policy

This paper debates how local and federal policymakers could foster clean energy technologies as an engine of economic development strategy in the US. It discusses five complementary paths (local incentives, funding for R&D and start-up firms, cluster deepening, substitution of energy imports, stimulating local demand as a complementary component) and provides specific examples from similar approaches taken by other industries in the past.

(IS-2020-4) Corporate Energy & Sustainability Progress Report

This 2019 GreenBiz Research / Schneider Electric reports reports on the results of a survey of 309 industry leaders. It provides guidance to help organizations align how energy purchase/usage can reduce environmental impacts and build sustainable operations. Findings include: CapEx may be a misleading barrier, data quality/usage is still a struggle, setting public targets strengthens speed of execution, smarter energy purchasing remains a key unresolved challenge, and technology continues to gain traction. Examples are provided. This paper is relevant for investment/financing, government, technology, utility and business leaders.

(IS-2020-3) The Speed of the Energy Transition

This white paper by the World Economic Forum from September 2019 compares two transition scenarios - gradual and rapid, how they differ and the signposts to observe indicating which narrative will dominate. Considerations include: clean technologies, new regulatory policies, changing business models, and differing consumption patterns. This paper would be of interest to clean energy industry professionals and policy makers.

(IS-2020-2) Fixed-Mobile Network Convergence: The Key Role of Fibre

A quantitative study on the value of fixed-mobile network convergence was prepared by the FTTH (Fibre to the Home) Council Global Alliance. This white paper reports on the results of the study, providing detail on the assumptions, technologies and network architectures required to provide seamless service through the convergence of 5G and fixed asset networks. To reduce the cost of deploying fibre, operators can take advantage of the fact that there will be significant overlap between the coverage and footprint requirements of 5G and fixed access networks – and thus the fibre deployment requirements of both will be similar.

(IS-2020-1) Building to Grid

This Navigant white paper, published in Q4 of 2019, examines the core requirements of industry transformation for "flexible, integrated, value-generating energy resources." The research focuses on the market shift currently underway as intelligent buildings interact with the grid

creating a more fluid, dynamic energy ecosystem. Five core market components are reviewed, including: customers, policy & regulation, technology, business models and operations. Recommendations and pathways to success are provided. The report is of interest to anyone involved in the future of energy management, the grid and energy usage in buildings.

(IS-2019-138) Breakthrough Batteries Powering the Era of Clean Electrification

This report by the Rocky Mountain Institute frp, October 2019 describes how the exploding investment in battery technologies is revolutionizing the sector much faster than anticipated, increasing the demand for EVs, grid-tied storage, and other emerging applications. The report examines implications for natural gas and internal combustion engine vehicle markets are examined and weighs the merits of various battery technologies. This paper is relevant for anyone interested in energy storage technologies and their market impact.

(IS-2019-137) 2019 Utility Demand Response Market Snapshot

This survey by the Smart Electric Power Alliance from September 2019 covers utility demand response (DR) programs throughout the U.S., and represents 64% of total U.S. customer accounts (or 93 million customers). Program capacity for mass market and commercial & industrial customers totals 20.8 GW. Policy updates and demand market trends are provided. This report is relevant for utility, investment/financing, government, technology and business leaders.

(IS-2019-136) Revving the Community Broadband Economic Engine

The adoption and expansion of broadband has brought about derived economic value and services to communities. This report illustrates the results of a survey carried out in the US to analyze deployment of broadband technology as economic engine. The topics covered include state of broadband and impact in local economies, broadband-driven education and healthcare initiatives as well as community broadband funding. Both urban and rural communities have favoured network ownership through municipalities or partnerships.

(IS-2019-135) Why Space Utilization Matters

Underutilized office space continues to translate into unnecessary costs and reduced profits. This report describes an analysis of private office and cubicle utilization. The study found that most companies space utilization is typically in the 60% – 70% range due mainly to an increasing mobile work force.

Smart-building initiatives could help address this issue, the report underlines.

(IS-2019-134) Analysis and Key Findings from EPA's Review of the ENERGY STAR Model for U.S. Office Properties

This report from July 2019 by the Environmental Protection Agency (EPA) presents key findings

from EPA’s review of the ENERGY STAR model for U.S. office properties. The topics covered include industry data, changes in U.S. buildings, adjustments to the office model, average office scores, and ENERGY STAR scores. The report would be useful for business owners, building owners and energy professionals.

(IS-2019-133) Hydro One 2018 Sustainability Report: Partnering for a brighter future

This report by Hydro One from August 2019 describes the utility's successes and challenges in advancing its sustainability performance throughout the year. The topics covered include the importance of customers, environmental management, people and potential, community support, and building a grid for the future. The report is useful for policy makers, regulators, engineers, environmentalists, and consumers.

(IS-2019-132) World Energy Investment 2019

The report from May 2019 by IEA emphasizes the opportunities for the energy system to attract the scale and types of investment that would align with a more secure and sustainable energy system. The topics covered include energy end-use and efficiency, power sector overview, fuel supply, financing and funding trends, research and development, and new technologies. The report is useful for governments, industry, and the financial community.

(IS-2019-131) Canada's Go Solar Guide and Directory

This report was published in April 2019 by CanSIA and helps consumers to understand how to benefit from generating electricity from solar energy and to become familiar with the installation process from start-to-finish. The topics covered include a description of how solar works, solar photovoltaics, solar thermal, energy storage, solar potential, investment, lease to own, power purchase agreements, community generation, pricing, and choosing a contractor. The report will o be of interest to consumers, electricians, electrical engineers, contractors, and suppliers of solar technology.

Voice Assistant Platforms: Pursuing an Improved Utility Customer Experience

(IS-2019-130) Dominion launches electric school bus initiative, aims for 100% electric fleet in Virginia territory by 2030 Transportation is the number one source of carbon emissions in the US. This report illustrates the strategy that a utility company in Virginia (US) is using to replace diesel school buses fleet with electric powered vehicles. Although it does not explain how EV charging technology can be integrated into building infrastructure, this case constitutes a good example of early adoption of electric vehicle technology.

(IS-2019-129) Advanced Energy Now - 2019 Market Report

The advanced energy industry has experienced explosive growth over the last decade in the US and internationally. Evidence suggests that its revenue equals to the global tourism industry. This

report is the sixth report of market size by revenue of this industry. This industry consists of seven segments (Building efficiency, electricity delivery & management, advanced transportation, advanced fuel production, advance industry, fuel delivery and electric generation) and 41 subsegments. Globally, in accordance to 2018 data, advanced transportation (US$495billion) remained for the second year in a row, the largest advanced energy segment worldwide.

(IS-2019-128) Fairhair Specification enables IoT in commercial buildings via a common, building-wide IT infrastructure

This report focuses on the Internet of Things (IoT) in commercial buildings. It describes an Internet Protocol (IP) developed to facilitate the information exchange between various building-automation systems, for example lighting or HVAC. It is anticipated that this specification will support the work of standards development organizations.

(IS-2019-127) Deregulation Drives Virtual Power Plant Expansion in Japan

This paper explores Japan as an Emerging Market for Virtual Power Plans (VPP) and Distribured Energy Resource management systems. After the 2011 Fukushima nuclear reactor accident in 2011, the country has experienced significant reforms of the electricity sector resulting in market deregulation that enables the introduction of efficiencies from new technologies and business models. This makes it one of the more interesting candidates for VPP markets in the Asia Pacific region because of its robust grid infrastructure. Several modelled scenarios for VPPs and a path moving forward are discussed.

(IS-2019-126) A Modern Data Ownership Framework

This July 2019 Microshare white paper outlines the need to embrace a modern scalable data ownership framework, and provides an approach for how to recognize who/what owns the data, who sets the rules for accessing, editing, sharing, and monetizing data, rules enforcement and conflict resolution. The concept of digital ombudsman is discussed. This paper is relevant for those involved in any aspect of data initiation, ownership, use and management.

(IS-2019-125) Unlock the Promise of 5G: Three Imperatives to Guide Your Journey

This 2019 white paper by F5 Networks describes key stages necessary for development of 5G journey, specifically: network optimization; monetizing new 5G Solutions; and ensuring best- in-class security. 5G connections are expected to approach 280 million by 2021. Market trends, benefits and opportunities are provided, along with business cases and examples. This paper is relevant for those involved in any aspect of network communications.

(IS-2019-124) The Key to Unlocking Smart Home Ecosystems

This Harbour Research white paper from January 2019 reviews the smart-home market and

suggests four solutions to unlock its full potential. In particular, network protocols need to be standardized, software interoperability needs to improve, more of an emphasis on localized ecosystem architecture needs to occur, and distributed edge computing needs to increase to improve reliability and user experience satisfaction. A current list of industry participants and case studies is provided. This paper is relevant for companies involved in smart home technology and the residential consumer.

(IS-2019-123) The 2019 State Energy Efficiency Scorecard

This scorecard from the American Council for an Energy-Efficient Economy, from October 2019, ranks all 50 US states and the District of Columbia are ranked according to policies and progress. It highlights best practices of leading states and captures the latest updates in a year that has seen a particularly strong surge in state-level activity. The analysis would be relevant for those involved or interested in energyefficiency.

(IS-2019-122) Advancing Automation: Cybersecurity

This 2019 eBook from Automation.com examines various aspects of automated industrial cybersecurity. 5 industry leading organizations contributed ten articles, including: A History of Automation; Automation Techniques to Improve Cybersecurity; Industrial Cybersecurity Journey; Implementing ISA/IEC-62443; Cybersecurity Implications of IIoT; Industrial Cybersecurity; Deep Packet Inspection; and, 4 Ways to Tackle Cybersecurity on the Industrial Edge. This paper is relevant for those involved in technology, automation andcybersecurity.

(IS-2019-121) Zero Energy Buildings in MA; Saving Money from the Start

This September 2019 report from the US Green Building Council assesses zero energy (ZE)upfront building costs, model performance and life-cycle costs in Massachusetts. Many types of ZE buildings can be built with no additional upfront costs and some can see return on investment in as little as one year. Recommendations on how to further advance ZE building policy are provided. This paper is relevant for investment/financing, government, commercial/multi-familyconstruction and business leaders.

(IS-2019-120) 2019 Corporate Energy & Sustainability Progress Report

This 2019 GreenBiz Research / Schneider Electric reports highlights the survey results from 309 industry leaders providing guidance to help organizations align how energy purchase/usage can reduce environmental impacts and build sustainable operations. Findings include: CapEx may be a misleading barrier, data quality/usage is still a struggle, setting public targets enables speed of execution, smarter energy purchasing is important, and technology continues to gain traction. Examples are provided. This paper is relevant for investment/financing, government, technology, utility and business leaders.

(IS-2019-119) Consultation on a Definition for Net Zero Carbon Buildings in the UK

This 2019 UK Green Building Council survey request for consultation on net zero carbon buildings in the UK. While the survey deadline has passed, it provides a framework, hierarchy, recommended principles disclosure / energy efficiency / renewables / offsets / whole life principles, and verification. UK policy opportunities are provided. This energy policy paper is relevant for asset managers, developers, government planning authorities, property managers, technology, utility and business leaders.

(IS-2019-118) Barriers to maximizing the Value of Behind-the-Meter Distributed Energy Resources

This 2019 California Solar + Storage Association white paper identifies five barriers to enable behind-the- meter distributed energy resources in the California market, including: utility exclusions, lack of clarity regarding DER adoption forecasts, dual participation limits in DR programs, capacity credit limitations / availability requirements, and prohibitions on participating in multiple utility programs. The current regulatory status of each barrier and suggested resolutions for each are discussed. This paper is relevant for those interested in utility regulations and utility business development in California.

(IS-2019-117) Electric Vehicle Sales Forecast and the Charging Infrastructure Required Through 2030

Electric Vehicle Sales Forecast and the Charging Infrastructure Required Through 2030 This November 2018 Edison Electric Institute / Institute for Electric Innovation report provides an EV sales forecast through 2030 and an estimate for the associated charging infrastructure needs, based on five independent forecasts. EVs are expected to reach 18.7 million or 7% of cars and light trucks. Approximately 9.6 million charge ports will be required. Sales projections by manufacturer are provided. This paper is relevant for automotive, investment/financing, government, technology, utility and business leaders.

(IS-2019-116) Improving the Estimated Cost of Sustained Power Interruptions to Electricity Customers

This June 2018 Lawrence Berkeley National Laboratory report provides improvements, including Monte Carlo uncertainty analysis, to previous studies and models. Commercial and Industrial sectors are estimated to lose $43B due to power interruptions, while residential losses total $1B. Reliability data and reference reports are provided. This paper is relevant for regulators, government, technology, utility and business leaders and the general public.

(2019-2019-115) 7 Hot Tech Trends for Office Transformation

This report was prepared in January 2019 by Future Offices and deals with top seven tech trends impacting the future offices market. The topics covered include open space floor plans, teleconferencing, smart technology, nontraditional illumination, next generation acoustics, sustainable design, and ergonomic seating. The report is useful for business owners, managers,

IT professionals, and interior designers.

(IS-2019-114) Build, Operate and Monetize 5G Networks Together

Build, Operate and Monetize 5G Networks Togther This 2019 Altran white paper provides a background on 5G, and how it can be installed, operated and monetized. The advantages of 5G over 4G are reviewed as are the merits of the three different band spectrums. Altran provides examples of its 5G solutions. This paper is relevant for technology and business leaders.

(IS-2019-113) Global Energy Innovation Index

This white paper from the the Information Technology & Innovation Foundation, released in August 2019, indicates faster implementation of clean energy innovation is required to meet global emissions goals. Norway and Finland are the only countries investing at recommended levels. Innovation index results including social legitimation indicators with country rankings are provided. Survey methodology is provided. This report is relevant for government and business leaders and the general public.

(IS-2019-112) Critical Infrastructure Cyber Security: How to Actively Secure Your Industrial Environment in the New Era of Distrust

This 2019 Indegy white paper illustrates the need to integrate siloed operations technologyutilizing an integrated industrial control system environment which provides a more robust defense against industrial cyber security threats. Key aspects are discussed including visibility, security and control. References to case studies are provided. This paper is relevant for IT leaders.

(IS-2019-111) BRIDGE Index™ - Industry in Transformation – The Technology

This survey was created to provide objective, research-driven insights to current and future priorities across a broad cross-section of North American utility decision-makers. Over 20,000 North American Utility Employees were reached. The utility industry continues to be at a crossroad – but transformation is accelerating. While industry participants are at different stages of the transformation maturity model, many have moved beyond just contemplating changes to taking action supported by substantive investments in capability, infrastructure and talent. This report describes the technology issues.

(IS-2019-110) Wi-Fi Onboarding Technologies for Connected Products

Wi-Fi onboarding is the first thing most people do with connected products. Unfortunately, the process is not always easy. 39% of negative reviews of connected products are related to initial setup and connectivity. Improving this process is critical to the success of the industry, and to the success of each individual product. This guide characterizes the different Wi-Fi onboarding solutions available to developers of connected products, and compares the different approaches

to make actionable recommendations.

(IS-2019-109) Next-Generation Energy Efficiency Resource Standards

This report published in August 2019 by the American Council for an Energy-Efficient Economy found that the 27 U.S. states that have adopted the EERS accounted for 80% of utility-sector electricity savings in 2017. Three approaches for realizing greater efficiencies are proposed, including the adoption of resource-specific targets, fuel-neutral targets and multiple-goal approaches. Seven specific tools are discussed. This paper is relevant for investment/financing, public policy makers, technology, utility and business leaders.

(IS-2019-108) Planning for a Distributed Energy Future

This report from West Monroe Partners surveyed 1,700 customers, 140 utilities and 24 regulators across North America to assess the impact of customer demand for distributed energy resources (DERS) from strategy through technological needs and system integration. Among utilities, 92% have DERs on their system and 40% view DERs as an opportunity. Approximately 28% of aggregated communities are adding DERs to their systems. In addition, 40% of regulators are looking at performance-based ratemaking. This paper is relevant for utilities, regulators, energy customers, investment/financing, technology and business leaders.

(IS-2019-107) IoT Signals

This report was published by Microsoft in July 2019. A survey of 2,500 global businesses and IoT decision makers revealed that over 80% of large companies are adopting IoT solutions - providing a 25% ROI, on average. Interconnectivity provides additional data sources, yielding further opportunities for improvements. The report is relevant for internet technology and business leaders and anyone following the IoT market.

(IS-2019-106) Planning For Safer, Better, Bigger, Battery Energy Storage

This white paper from Utility Dive Brand Study DNV GL provides a background and market projections for large Battery Energy Storage Systems (BESSs). Resource adequacy, grid resilience and fast response are discussed. Examples of cost savings as a result of behind-the- meter deployment are provided. Safety issues are discussed, as well as tips for planning safer and better BESS. This paper is relevant for utility players, energy marketers, system operators, battery manufacturers, technology and business leaders.

(IS-2019-105) Solid-State Lighting R&D Opportunities

This is an annual report by the U.S. Department of Energy on the current state of SSL. This report from January 2019 looking back on the year 2018 examines how a new understanding of lighting science opens up possibilities to further reduce energy consumption and improve lighting performance in new ways. LED and OLED applications are discussed, along with associated R&D

challenges and funding activities. This paper is relevant for academic, investment/financing, government, technology, and utility and business leaders.

(IS-2019-104) Hotel Sustainability Report

This report published in July 2019 by the Urban Land Institute assesses the current stage of sustainability in the hotel sector. Energy efficiency, water conservation and waste-reduction best practices are discussed. The report provides insights on industry rends, solutions to sustainability challenges, operational/technical best practices, and case studies. This paper is relevant for property managers and technologyand C&I business leaders.

(IS-2019-103) Annual Energy Outlook 2019

This annual report from the US Energy Information Administration assesses how US and world energy marketswill operate through 2050, based on many key assumptions. Modeled projections are provided, as are comparative side cases (i.e., high/low oil & gas) when important model assumptions are changed. The US is projected to become a net energy exporter starting in 2020. Energy efficiency will keep US energy consumption relatively flat even as the economy continues to expand. This paper is relevant for anyone monitoring the energy sector.

(IS-2019-99) Virtual Power Plants Go Global

This report was published in June 2019 by Navigant and discussed the need for Virtual Power Plants (VPP) to keep electric grids in a "constant, delicate and reliable" balance. VPPs set the stage for future Distributed Energy Resources Management Systems (DERMS). Insights on market trends, the impact of EVs and emerging technologies, and the convergence of VPPS and DERMS are provided. The paper is relevant for specialists in the following sectors: policy/regulatory, conservation, technology, utilities.

(IS-2019-98) Flowing Investment to Scale Clean Technology

This report published by Globe Capital in June 2019 focuses on the clean-tech investment landscape in Canada, which currently lags the U.S. both growth and proportional levels of capital raised. Trends and funding strategies are reviewed. Tools to address gaps and challenges are provied along with a list of venture capital and Canadian government funding sources. This paper is of interest to investment/financing, government, technology and business leaders.

(IS-2019-97) Solar PV and Energy Efficiency in Residential Building Codes

This 2019 study from the American Council for an Energy-Efficient Economy shows that energy efficiency upgrades in new homes are more cost-effective than installing rooftop solar photovoltaic panels in U.S. climate zones 2-6, generating monthly savings of $4 to $32. Cost comparisons are provided. This paper is relevant for specialist working in numerous sectors, including investment/financing, government, technology, and utilities.

(IS-2019-96) 5G in Europe: More than a Wireless Upgrade

This report was published in March 2018 by Sensa Fili and describe how the transition to 5G affects wireline backhaul, fronthaul, and the emerging coverged-haul variations. The topics covered include the impact of those changes on how mobile operators transport traffic across their networks, how they can plan for them as they transition to 5G, and the implications for European mobile operators. The report is useful for telecom operators, engineers, technologies, IT professionals, and system integrators.

(IS-2019-95) Missing the Bigger Picture

This report was published in May 2019 by Clean Energy Canada. It examines Canada's clean energy sector, seeking to better understand its economic contribution and job creation.

The topics covered include growth trends, employment statistics, energy storage, electric vehicles, building controls systems, and the a snapshot of the sector by province. This report would be of interest to investors, public policy makers, engineers, business owners, and entrepreneurs.

(IS-2019-94) Energy as a Service

This report was published in February 2019 by the American Council for an Energy Efficient Economy and describes how Energy as a Service (EaaS) can help commercial building customers with limited access to capital achieve higher energy, operation and maintenance (O&M) savings. The topics covered include what it means to be an "efficiency-as-a-service" provider, the EaaS model, cost savings opportunities, program approaches, challenges and recommendations for the future. The report would be useful for commercial building customers.

(IS-2019-93) Navigating the Smart Building Landscape

The report was prepared in June 2019 by Locatee and Memoori and examines how smart building concepts and strategies that can be applied to commercial buildings. The topics covered include attributes of a smart building, trends shaping the future of smart buildings, current use cases, and key steps to consider when creating a smart building. The report will be useful for corporate real estate and facility management teams.

(IS-2019-92) Get Connected: Smart Buildings and the Internet of Things

This report was published in March 2019 by Schneider Electric and describes how smart buildings leverage the Internet of Things (IoT) to create new opportunities for information gathering and sharing, and the impact this has on buildings management and operations. The topics covered include evolution of buildings management; smart buildings and the IoT, a real- world examples showcasing the future of buildings and smart building IoT best practices. The report is useful for engineers, architects, developers, investors, and ITprofessionals.

(IS-209-91) Industry Focused Patenting Trends

This report was prepared in May 2019 by Kilpatrick and Townsend / Grey B Services and deals with the impact and significance of patenting trends in the United States. Topics include patentingtrends in the followingindustries: artificial intelligence (AI), automotive, block chain, building materials, cleantech and greentech, computational biology and bioinformatics, financial tech, industrial design, Internet of Things, medical devices, therapeutic & diagnostic molecules, and wireless phones. The report is useful for business leaders, public policy makers, innovators, inventors and investors.

(IS-2019-89) Revolutionizing Building Management with Cloud-Native Solutions

The report was prepared in April 2019 by Harbor Research and deals with data management tools, such as cloud- native solutions, which provide OEMs and service providers an advantage to remain competitive in the future of smart buildings. The topics covered include machine intelligence, smart services, current building management challenges, smart technologies, the evolving role of suppliers to meet customer needs, a cloud native digital BMS solution (RIPTIDE), and its future valuepotential. The report is useful for building owners, service providers, equipment manufacturers, system integrators, and IT professionals.

(IS-2019-88) Improving the Estimated Cost of Sustained Power Interruptions to Electricity Customers

This June 2018 Lawrence Berkeley National Laboratory report provides improvements, including Monte Carlo uncertainty analysis, to previous studies and models. Commercial and Industrial sectors are estimated to lose $43B due to power interruptions, while residential losses total $1B. Reliability data and reference reports are provided. This paper is relevant for regulators, government, technology, utility and business leaders and the generalpublic.

(IS-2019-87) The case for utility consumer engagement platforms

The report was prepared in May 2019 by the McDonnell Group and describes how online engagement platforms and choice engines can be used by utilities to offer meaningful choices to their consumers. The topics covered include consumers' choice and digital expectations, utilities and social media, building brand trust, consumer self-service requirement, distributed energy resources, and non-wire alternatives. The report is useful for electric utility executives, managers, marketers, IT professionals, and consumers.

(IS-2019-86) Using Artificial Intelligence to Optimize the Flow of Energy through the Built Environment

The report was prepared in May 2019 by Brainbox AI and deals with management of thermal equilibrium in a building by applying principles of dynamic modulation and artificial intelligence (AI). The topics covered include a description of a dynamic thermal equilibrium process, energy

characterization, predicting energy flow with deep learning (AI), and cost effectiveness. The report is useful for building owners and operators, electrical and mechanical engineers, and IT professionals.

(IS-2019-85) Why an Integrated Platform is Essential to Your Video Business Quality

The report was prepared in April 2019 by Verizon and deals with the integrated platform approach for delivering TV- quality streaming video. The topics covered include video platform features such as quality, simplicity, scale, streaming, delivery, security, service, and support. Verizon's Digital Media Services platform is presented as a benchmark of video platform excellence. The report is useful for video content creators and broadcasters.

(IS-2019-84) Voice Assistant Platforms: Pursuing an Improved Utility Customer Experience

The report was prepared in 2019 by Google and describes how the Google Assistant can be applied by utilities to improve customer experience. The topics covered include smart homes, Google's utility program for energy providers, and case studies including Tendril and Xcel Energy. The report isuseful for system designers and integrators, home owners, and utility company operators.

(IS-2019-83) 5G consumer potential: Busting the myths around the value of 5G for consumers

The report was prepared in May 2019 by Ericsson and clarifies consumer myths regarding 5G. The topics covered include near-term consumer benefits of 5G, use cases for 5G, price premiums, smartphones as the only solution for 5G, and future demand for 5G. The report is useful for telecom providers, communication technology vendors, IT professionals, and the general public.

(IS-2019-82) Shaping Cradles of Innovation

The report was prepared in December 2018 by Cyviz and deals with how organizations can navigate digital upheavals and drive disruption through innovation centers. The topics covered include the rise of digital transformation, incubating innovation, understanding the innovation landscape, challenges to innovation maturity, building a successful innovation center, innovation labs, and the Cyviz turnkey solution for establishing an innovation center. The report is useful for business leaders, entrepreneurs, innovators, architects, interior designers, and IT professionals.

(IS-2019-81) The Future of Open Data in Smart Cities

The report was prepared in May 2019 by Harbor Research and deals with key factors affecting data access and management in smart cities. The topics covered include business verticals in smart cities, value creation, synergistic ecosystems, distributed data challenge, IoT architecture, new applications, and business opportunities. The report is useful for city planners, regulators, entrepreneurs, business owners, IT professionals, system architects and integrators.

(IS-2019-80) Future Perfect: Thematic Research and Trends for 2019

The report was prepared in January 2019 by Harbor Research and deals with critical core technologies and their enablers in the context of broader business and market forces. The topics covered include critical core technology developments, the promise of combinatorial technologies, "new" technologies which are really not new, new market roles and business modes, new relationships and ecosystems, new rules for a new economy, and new players driving new innovations. The report is useful for business owners, executives, managers, entrepreneurs, and IT professionals.

(IS-2019-79) The Challenges and Pitfalls of Digital Transformation

The report was prepared in August 2018 by Harbor Research and deals with alternative innovation modes and ventures that original equipment manufacturers (OEMs) should consider to drive customer solutions and value creation. The topics covered include OEM growth challenges, digital pitfalls, evolving growth themes, digital development ventures, and catalytic growth strategies. The report isuseful for OEM company owners, executives, and manages.

(IS-2019-78) New Approaches to Energy Hardware Innovation and Incubation

The report was prepared in 2019 by the Joint Institute for Strategic Energy Analysis and provides a general landscape of cleantech innovation and incubation programs in the U.S. to identify metrics of success and quantify the impact of these various approaches. The topics covered include examples of nine innovation organizations and their success metrics. The report is useful for investors, entrepreneurs, government officials, and professionals working in the energy sector.

(IS-2019-77) A Policymaker's Guide to Blockchain

The report was prepared in April 2019 by the Information Technology & Innovation Foundation and deals with the ten principles that governments can apply to support legitimate blockchain innovation and adoption. The topics covered include a description of blockchain and problems that it can solve, blockchain applications and case studies, regulation, and principles to advance blockchain. The report is useful for policy makers, government officials, regulators, computer scientists, software developers, IT professionals, and the general public.

(IS-2019-75) Net Zero: The UK’s contribution to stopping global warming

The report was prepared in May 2019 by the Committee on Climate Change and deals with its recommendation for net-zero greenhouse gases in the UK by 2050. The topics covered include principles behind the recommendation, climate science, international circumstances, UK's contribution, supporting global ambition, reaching net zero emissions, delivering a net-zero target, costs, and benefits. The report is useful for government officials, policy makers, business leaders, technology professionals, and the general public.

(IS-2019-74) Report on the implementation of the open internet access provisions - Reg. 2015/2120

The report was prepared in April 2019 by the European Commission and deals with the open internet as per Regulation (EU) 2015/2120. The topics include the assessment of the implementation of the regulation since it entered into force. Also included is a comparison of the state of play regarding access to the open internet in the European Union today against the situation that existed before the regulation became applicable. The report is useful for regulators, policy makers, business owners, and IT professionals.

(IS-2019-73) New York Getting to Net-Zero Status Report

This brief was prepared in April 2019 by the Getting to Zero Forum and provides an update on the construction of net zero Solara apartments and New York State's leadership in net zero buildings. The topics covered include details about the Solara apartments and comments from New York State leaders about advances in net zero development. The report is useful for builders, contractors, investors, and professionals working in the energy sector.

(IS-2019-72) Energy efficiency 2O18: Analysis and outlooks to 2O4O

The report was prepared in October 2018 by the International Energy Agency and deals with global of energy efficiency trends and indicators. The topics covered include global trends and outlook, investments, energy efficiency in transport, buildings, appliances, industry, and emerging economies. The report is useful for policy makers, government officials, engineers, technologists, and professionals working in the energy sectors.

(IS-2019-71) The 2019 U.S. Energy and Employment Report

The report was prepared in March 2019 by the Energy Futures Initiative and the National Association of State Energy Officials and provides information for state officials in the U.S. to advance effective, informed, and robust energy policies and programs. The topics covered include fuels, electric power generation, energy transmission / distribution / storage, energy efficiency, motor vehicles, and vehicle component parts. The report is useful for governments officials, policy makers, and professionals working in the energy sector.

(IS-2019-70) Understanding the Business Value of Re-architecting Core Applications on the Public Cloud

The report was prepared in February 2019 by Ovum and deals with opportunities that the public cloud strategy presents for telecommunication companies. The topics covered include making a business case for a public cloud strategy, importance of having a public cloud to operate in a digital economy, benefits of public cloud, and the Optiva revenue management suite. The report is useful for telecommunication company owners and operators.

(IS-2019-69) Features and Performance of Energy Management Programs

The report was prepared in January 2019 by the American Council for an Energy-Efficient Economy and deals with two emerging energy efficiency programs, strategic energy management (SEM) and energy management information systems (EMISs). The topics covered include program prevalence, features, reported savings, challenges, and recommendations for program promotion. The report is useful for program stakeholders—utilities, third-party administrators, evaluators, and policymakers.

(IS-2019-68) UCRC 2018 State of the Customer Survey Findings Utility Customer Service at a Crossroads

The report was prepared in November 2018 by Russell Research and deals with the customer's perspective on the current state of utility customer service and offerings. The topics covered include customer satisfaction, service value, information access, pricing and payment options, service reliability, power restoration, solar power, and electric vehicles. The report is useful for electrical power utility owners and operators.

(IS-2019-67) The Energy Web Chain – Accelerating the Energy Transition with an Open-Source Decentralized Blockchain Platform

The Energy Web Foundation has built an ecosystem of 70 companies planning to grow it to 200 to help build out an open-source, blockchain-based, digital infrastructure for the energy sector.

(IS-2019-66) Opening the Door to the Smart City

Itron took a close look at selected smart cities around the globe that are demonstrating key priorities and proven best practices that make them successful.

(IS-2019-65) Powering Forward – Publicly Owned Utilities are Critical to California's Energy Efficiency Progress The Natural Resources Defense Council (NRDC) working with Publicly Owned Utilities in California and the California Energy Commission built this report to quantify the value realized by the state of California by energy efficiency programs employed by Publicly Owned Utilities.

(IS-2019-64) Smart Meter Benefits Cost Savings Households Could Make Within A Smart Energy Future

This report was prepared in February 2019 by Delta Energy and Environment and deals with how smart meters are a central part for the energy system of the future and their benefits to households. The topics covered include energy usage, conservation, purchasing strategy, importance of smart meters for energy savings, and benefits of flexible systems. The report is useful for homeowners, electrical utility operators, and IT professionals.

(IS-2019-63) Want to Drive Business Benefits? Improve Customer Experience

This report was prepared in November 2018 by TM Forum and deals with the importance of customer experience as a driver of business benefits. The topics covered include why customer experience is important, challenges communications services providers (CSPs) face in developing digital customer experiences, steps CSPs must take to overcome the challenges, and what CSPs can learn from digital natives and their peers who have succeeded in improving customer centricity. The report is useful for executives, managers, and employees of CSPs.

(IS-2019-62) Real Estate Market Outlook 2019

This report was prepared in February 2019 by CBRE Research and provides an overview of Canada's real estate market. Regional and national perspectives are provided with a focus on growth trends, demand for commercial property, vacancy rates, construction growth, housing imbalance, the impact of coworking providers / technology companies / logistics and distribution firms, future trends, and second tier markets. The report is useful for city planners, policy makers, builders, contractors, real estate owners, and tenants.

(IS-2019-61) The flexible workspace boom in London and beyond

This report was prepared in February 2019 by OfficeFreedom and deals with the analysis and insight of Office Freedom’s internal data collected between 2014 and 2018. The topics covered include central London's average work station rates by area, transactions by area and year, workstation sales by area, decision makers by gender, business centre groups vs independents, enquiry to transaction time, transactions by industry type, business centres, new serviced office operators, and also an overview of global business centres. The report is useful for business owners, managers, and owners of flexible workspaces.

(IS-2019-60) Achieving Deeper Energy Savings through Integrated Building Systems This report was prepared in July 2018 by the American Council for an Energy Efficient

Economy and deals with the savings potential of integrated systems for energy management in buildings along with the barriers to adoption. The topics covered include project economics and savings potential, challenges, program approaches, and a case study from New York State Energy Research and Development Authority. The report is useful for building owners and managers, electrical and mechanical engineers, IT professionals, and system integrators.

(IS-2019-59) 2017 Green Venue Report: The State of Convention & Exhibition Center Sustainability

This report was prepared in August 2017 by Greenview and provides insight and content to best practices showing trends across the facets of event and venue sustainability. The topics covered include space and events, location, energy, water, waste, business case for sustainability, communications, staffing, community involvement, indoor air quality, facility certifications, and

green cleaning. The report is useful for owners and managers of event and exhibition centers, energy professionals, engineers, and architects.

(IS-2019-58) Making the Case for Building to Zero Carbon

This report was prepared in February 2019 by the Canada Green Building Council and advocates for applying the Zero Carbon Build (ZCB) approach for simultaneously lowering energy use and carbon emissions from buildings. The topics covered include unlocking the potential of zero carbon buildings, accelerating to zero, the business case for ZCB, the broader benefits of ZCB, and financial benefits of carbon reduction. The report is useful for building owner- operators, design teams and policydecision- makers.

(IS-2019-57) Energy Efficiency Over Time: Measuring and Valuing Lifetime Energy Savings in Policy and Planning

This report was prepared in February 2019 by the American Council for an Energy-Efficient Economy and discusses measuring and valuing energy savings over a lifetime. The topics covered include short-term versus long-term measures of energy savings, estimating measure lifetimes, applications of lifetime savings estimates, and recommendations to shift toward lifetime savings. The report is useful for energy efficiency program administrators and policy makers.

(IS-2019-56) Building a Lean, Mean, Digital Machine

This report was prepared in January 2019 by SoftwareONE and discusses how businesses can truly make the most of the growing digital workspace. The topics covered include a consideration if a true digital force is fact or fiction, flexible work, benefits and challenges of adopting technology, and management of software and devices across the enterprise. The report is useful for business leaders, managers, and IT professionals.

(IS-2019-55) DGS Sustainability Roadmap 2018-19

This report was prepared in August 2018 by the Department of General Services and deals with an update and plan for meeting the Governor's sustainability goals for California state agencies. The topics covered include climate change adaptation, zero-emission vehicles, energy, water efficiency and conservation, and green options. The report is useful for government officials, policy makers, professional working in water and energy sectors, environmentalists, and leaders of technology companies.

(IS-2019-54) Virtual Power Plants & the Road to DERMS: It's a Distributed Energy World

Our energy grids were not designed to handle two-way power flows (renewables, etc.), nor were they setup to store energy (new batteries are in the pipeline). ln the coming days our grids will require new systems to cover both of these potentialities. This series of articles explores ways to incorporate "Virtual Power Plants" (demand response/capacity; frequency regulation;

operational reserves; energy arbitrage and peak demand management) and "Distributed Energy Resource Management Systems".

(IS-2019-53) Making the Grid Smarter Primer on Adopting the New IEEE 1547TM-2018 Standard for Distributed Energy Resources

The report was prepared in January 2019 by the Interstate Renewable Energy Council and provides an overview and explanation of the major revisions in IEEE Standard 1547TM-2018 and the issues that regulators, utilities, and other stakeholders will need to consider as they work through adopting and implementing the standard. The topics covered include key requirements and implications of the standard, anticipated rollout timelines, distributed energy resource (DER) performance categories, voltage regulation functions, compliant communications, updates to power quality requirements, grounding practices, DER testing and verification, and policy issues. The report is useful for regulators, utility operators, and electrical engineers.

(IS-2019-52) How to Leverage Smart Meter Opportunities with Future-Proof Designs

The report was prepared in November 2018 by Telit and deals with how the advances in technology are changing the role of electricity metering. The topics covered include connectivity standards, communication modules, anticipation of future changes, and Telit's cellular modules for smart metering. The report is useful for electrical utility operators, electrical engineers and technologists, system integrators, and IT professionals.

(IS-2019-51) CRETECH: 2018 Year End Report

The report was prepared in February 2019 by CRETECH and deals with global real estate technology investments for 2018. The topics covered include the state of commercial real estate technology (CREtech) investing in 2018, notable transactions, CREtech landscape, and CREtech company data. The report is useful for commercial real estate owners, real estate company executives, and leaders of technology startup companies.

(IS-2019-50) 2019 Corporate Energy & Sustainability Progress Report

The report was prepared in January 2019 by Schneider Electric and deals with the findings and supporting data from a survey of top global companies to provide guidance to help organizations align how they buy and use energy, reduce environmental impact, and build sustainable operations in 2019 and beyond. The topics covered include capital expenditure for energy projects, use of data to foster collaboration, the importance of setting public targets, strategic energy purchasing, and the importance of technology for achieving efficiency. The report is useful for company executives, operations managers, engineers, and IT professionals.

(IS-2019-49) Electric Report

The report was prepared in August 2018 by Black & Veatch and deals with the progress made by

the electric industry as it continues to evolve. The topics covered include the rapidly changing customer base, commercial defection from the grid, advanced technologies, changing regulatory landscape, importance of renewable energy to drive change, evolution of distributed energy, the changing face of power, and global perspectives. The report is useful for electric utility owners and operators, electrical engineers, electric equipment manufacturers and integrators, and policymakers.

(IS-2019-48) Wi-Fi and 5G redefine wireless Convergence creates a pervasive connectivity fabric

The report was prepared in January 2019 by Senza Fili and provides an overview of the evolution of Wi- Fi and how it addresses the new connectivity requirements driven by increased data volumes, latency- sensitive traffic, and IoT applications – and how it will meet the IMT-2020 vision together with 5G. The topics covered include an overview of WiFi technology, continuity and innovation, Wi-Fi 6 (IEEE 802.11ax), the evolution of Wi-Fi, convergence of WiFi and 5G, and implications. The report is useful for electrical and electronics engineers, system integrators, and IT professionals.

(IS-2019-47) The Modern Family Bringing Families Together: The Digital Connection

The report was prepared in January 2019 by Trusted Media Brands and deals with the impact of digital technology on families. The topics include the impact of technology on family relationships, fun and time saving attributes of technology, role of technology in family connectedness, and a recommendation on how the marketplace should respond to the digital connection. The report is useful for digital technology designers, marketers, and the general public.

(IS-2019-46) The Key to Unlocking Smart Home Ecosystems

This report was prepared in January 2019 by Harbor Research and deals with the status of the current smart home market and the required strategies for it to reach full potential. The topics covered include strategy recommendations such as network protocol standardization, software interoperability, movement of architectures from dictator to a localized ecosystem, and increased distributed edge computing. The report is useful for smart home system developers, system integrators, and IT professionals.

(IS-2019-45) Executing a partner strategy to monetize 5G and IoT

This report was prepared in January 2019 by Netcracker and provides guidance to help communications service providers (CSPs) succeed with partner-based B2B strategies by describing the key characteristics and capabilities that their partner experiences will need to offer. The topics covered include groundwork for a strong partner experience, creating a digital partner experience, a smart city use case, and how to deliver on a digital partnering strategy. The report is useful for CSP owners, operators, and IT professionals.

(IS-2019-44) Broken buildings: Leveraging the power of people, data and technology

This report was prepared in December 2018 by Switch Automation and deals with strategies for building managers to determine their portfolio's unique needs and how to choose the right vendors to achieve smart building goals. The topics covered include how to leverage the power of building data to lower OPEX costs while maintaining occupant satisfaction across the entire portfolio. The report is useful for building owners, building operators, and system integrators.

(IS-2019-43) Smart Systems, and Strategic Services Innovation

This report was prepared in August 2018 by Harbor Research and deals with the productivity impacts and customer responsiveness gains by original equipment manufacturers (OEMs) from the implementation of new asset management solution platforms. The topics covered include smart systems, strategic role of service, legacy asset management, building value for users and customers, strategic opportunities, new OEM business models, data and analytics, IoT, and partnerships. The report is useful for OEM company owners and operators.

(IS-2019-42) The Challenges and Pitfalls of Digital Transformation

This report was prepared in August 2018 by Harbor Research and deals with the development of digital and smart systems strategy for original equipment manufacturers (OEMs). The topics covered include OEMs' growth challenges, digital pitfalls, evolving growth themes, digital development ventures, and catalytic growth strategies. The report is useful for OEM company owners and operators.

(IS-2019-41) The Advent of Hybrid Networks

This report was prepared in December 2018 by Harbor Research and deals with the impact of smart systems on computer networks. The topics covered include how smart systems are driving a need for hybrid networks, impact of complex applications, connected environments, impact of 5G technology, role of satellite, customer environments, post-hybrid developments, wireless industrial connectivity, and distributed systems. The report is useful for network engineers and technologists, IT professionals, system integrators, telco operators, and business owners.

(IS-2019-40) Ecosystems Design in the Age of Smart Systems

This report was prepared in November 2018 by Harbor Research and deals with a new generation of pervasive computing and information architectures known as smart systems which include artificial intelligence, machine learning and the Internet of Things. The topics covered include data driven economy, privacy, business culture, platforms, collaboration, and open source models. The report is useful for IT professionals, system integrators, and business owners.

(IS-2019-39) India's Energy Storage Mission - A Make-In-India Opportunity for Globally Competitive Battery Manufacturing

his paper was completed by the NITI Aayog and the Rocky Mountain Institute. The paper outlines the economic rational to develop battery manufacturing capabilities for India's domestic market. Shifting to electric vehicles and batteries allows India to become its own supplier of energy for transportation (electricity produced in India) and a leading manufacturer of the batteries used to store and transport that energy. Various challenges and solutions are provided.

(IS-2019-38) Five Ways Congress Can Improve the Electric Power System

This survey was completed in August 2018 by the Advanced Energy Economy and CRES forum. This paper suggests five initiatives Congress could undertake to improve the electric power system. Included are: 1) streamline federal permitting; 2) encourage grid planners to consider transmission alternatives;

3) encourage competition between energy storage, efficiency and generation; 4) allow large consumers to choose among electricity sources; and 5) allow utilities and consumers to benefit from cloud computing.

(IS-2019-37) Staff Report to the Secretary on Electricity Markets and Reliability

This survey was completed in August 2017 by the U.S. Department of Energy. This study examines the electricity markets with regards to reliability, affordability, resilience and fuel diversity - both in present state and projected future state based on trend analysis. A summary of the findings is provided along with the analytical framework, relevant data and research.

(IS-2019-36) 2019 Black & Veatch Strategic Directions Smart Utilities Report

This report was prepared in January 2019 by Black & Veatch and deals with the evolution of electrical utilities toward a smarter infrastructure. The topics covered include topics such as distribution modernization and automation, field area networks (FAN), security, network management services, asset management, and DER market enablement. The report is useful for utility owners, operators, electrical engineers, and IT professionals.

(IS-2019-35) Capitalizing on Enterprise Video Convergence: Tips for Building Business Value from the Integration of Streaming and Web Collaboration Solutions

This report was prepared in 2019 by Wainhouse Research and deals with convergence of video technologies used in the workplace such as streaming and web collaboration. The topics covered include the blurring lines of business communication, building a bridge to streaming video, identifying opportunities for video convergence, and how to maximize an organization’s convergence potential. The report is useful for business leaders, technology integrators, IT professionals, and Audio / Video managers.

(IS-2019-34) Predictions for 2019 and Beyond: The Internet of Things

This report was prepared in December 2018 by CCS Insight and presents 57 predictions for 2019

and beyond as they relate to the Internet of things. Topics covered include a broad view including wearables, virtual and augmented reality, smart home, industrial Internet of Things, automotive and transport, as well as smart cities. The report is useful for innovators, engineers, technologists, system integrators, investors, and leaders of technology start-ups.

(IS-2019-33) Planning for a Distributed Energy Future

This report was prepared in January 2019 by West Monroe Partners and presents the survey results of utilities which indicate an increase in deployment of distributed energy resources (DERs). The topics covered include where DERs are making the biggest impact for regulators and utilities, the customer experience side of DERs, and the opportunities and threats if utilities don't quicken the pace of DER integration. The report is useful forutility owners, operators, and energyregulators.

(IS-2019-32) IP Protection in the Data Economy: Getting the Balance Right on 13 Critical Issues

This report was prepared in January 2019 by the Information Technology and Innovation Foundation and deals with key policy issues related to intellectual property (IP). The topics covered include an analysis of 13 policy issues some which include a balance between data collection and its widespread use, non-rivalrous nature of data, who has rights to data, individual ownership of data, forced sharing, competition policy, forced access, text and data mining, database protection, government access to data, conflicts between international regimes, and political economy of IP and data. The report is useful for organizations, individuals, policy makers, lawyers, and government officials.

(IS-2019-31) The Autonomous Grid: In the Age of the Artificial Intelligence of Things

This report was prepared in January 2019 by SAS and Zpryme and explores how AI and IoT work together to deliver everything from improved threat detection to better customer engagement for utilities. The topics covered include digital transformation, the components of AI and status of utility adoption, today's connected grid, how utilities are using AI and IoT, integration of AI an IoT (AIOT), blockchain, and recommendations for utilities. The report is useful for electrical utility executives, managers, electrical engineers, and IT professionals.

(IS-2019-30) 2018 California Renewables Portfolio Standard Annual Report

This report was prepared in November 2018 by the Public Utilities Commission and describes the progress of California's electricity retail sellers in complying with the Renewable Portfolio Standard (RPS) program. The topics covered include RPS progress, statues, activities, workforce development and diversity, challenges, and policy recommendations. The report is useful for policy makers, government officials, and electrical utility operators.

(IS-2019-29) The difference between cCSAus Certified and cULus Listed? There is none.

This report was prepared in April 2018 by Emerson and deals with a comparison of "CSA-us" and "UL Listwith" markings. The topics covered include the role of Sections 90.7 and 110.3 of the National Electric Code (NEC), variations and meanings of CSA and UL certification marks, and the importance of CSA Group being a Nationally Recognized Test Lab. The report is useful for electricalcontractors and electrical engineers.

(IS-2019-28) Creating a Smart City Roadmap for Public Power Utilities

This report was prepared in 2018 by SmartEnergyIP and provides guidelines and recommendations for public power utilities regarding their digital transformation process to serve smart cities of the future. The topics covered include the role of a public power utilities in a smart city, how utilities can become part of the smart city conversation, security planning, building the roadmap, and the characteristics of a public power “utility of the future”. The report is useful for public utility leaders and managers.

(IS-2019-27) Design and Implementation of Community Solar Programs for Low- and Moderate-Income Customers

This report was prepared in 2018 by the National Renewable Energy Laboratory and provides insights on design and implementation of low- and moderate-income (LMI) community solar programs. The topics covered include existing and emerging LMI community solar programs, key questions related to program design, how states can leverage incentives and finance structures to lower the cost of LMI community solar, and the marketing and outreach considerations. The report is useful for policy makers, regulators, electrical engineers, solar equipment manufacturers and distributors, and consumers.

(IS-2019-26) Facilities Technology Trends & Buying Best Practices

This report was prepared in December 2018 by ARC and explains why some facilities leaders are proving to be far more successful at buying technology than others. The topics covered include specific types of technology considered high-value, increase in importance for tech adoption and use, tech purchase success variability, and the top five success factors for buying technology. The report is useful for facilities teams and leaders.

(IS-2019-25) AJourney Across The 51st State: Highlightsand Insights from SPEA's Initiative on the Future of the Electric Power Sector

This report was prepared in January 2019 by the Smart Electric Power Alliance (SEPA) and provides key takeaways from SEPA's three-part study to understand the future of electric power in the U.S. The topics covered include a summary of visions for the future of energy systems, plans to achieve the visions, defining the role of the electric utility, and recommendations for a process to achieve the goals. The report is useful for electric utility operators, regulators, and policymakers.

(IS-2019-24) KNX and OMS position paper: Cross-functional systems for home and building automation as well as smart metering

This report was prepared in September 2016 by KNX / OMS and deals with systems for home and building automation. The topics covered include an overview of cross-functional systems, role of OMS and KNX in smart metering protection, the interplay of OMS and KNX in energy optimisation and information, web services, and Internet of Things. The report is useful for electrical engineers, technologists, IT professionals, system integrators, and building operators.

(IS-2019-23) World Green Building Council annual report 2017/18

This report was prepared in December 2018 by the World Green Building Council and summarizes the Council's achievements from 2017/2018. The topics covered include new partnerships to reduce global carbon emissions, inspiring action toward net zero carbon emissions, access to green mortgages, update on green certified space, and the global promotion of the "green building week". The report is useful for policy makers, builders, architects, contractors, and cityplanners.

(IS-2019-22) Minnesota Energy Efficiency Potential Study: 2020–2029

This report was prepared in December 2018 by the Center for Energy and Environment and deals with the best practices that could be applied by the state of Minnesota to achieve a statewide energy efficiency potential. The topics covered include potential savings from electricity and natural gas, segment analysis, tool to estimate individual utility potential, program findings, and policy considerations. The report is useful for government officials, policy makers, utility operators, and professionals working in the energy sector.

(IS-2019-21) Improving Productivity in the Workplace

This report was prepared in November 2018 by the British Council for Offices (BCO) and summarizes the Whole Life Performance Plus (WLP+) project findings with an interpretation of what the findings mean for improving workplace productivity. The topics covered include an overview of the WLP project, U.K.'s productivity problem, productivity and buildings, case studies, lessons learnt, and insights. The report is useful for business executives, better manage their fuel, operational and price risks. A case study from Microsoft is presented to illustrate the benefits.

(IS-2019-20) Methods for Comparing Visual Illumination Between HID and LED Luminaires to Optimize Visual Performance in Low Light Environments

This report was prepared in May 2018 by Emerson and deals with methods for comparing visual illumination between HID and LED luminaires. The topics covered include the mechanisms of human visual response, methods for empirical estimation of equivalent illuminance and luminance between sources of disparate spectral energy, and differences in optical characteristics of luminaires. The report is useful for lighting professionals, architects, interior

designers, and electrical engineers.

(IS-2019-19) Navigating Content Chaos A roadmap for pay-TV operators

This report was prepared in November 2018 by Ampere Analysis and presents the key factors impacting the engagement of Pay-TV customers. The topics covered include content choice, content navigation, content access on demand from various devices, and navigation complexity. The report is useful for Pay- TV operators.

(IS-2019-18) Overall Residential Wireline Customer Satisfaction Increases Across the Board

This press release was prepared in September 2018 by J.D. Power and presents the results of a residential survey indicating that residential wireline companies that focus on finding newer, more effective ways of communicating with their customers have driven the increase of customer satisfaction. The topics covered include a ranking of wireline companies according to customer satisfaction and the survey results by question. The report is useful for owners, operators, and managers of wireline companies.

(IS-2019-17) Realizing Value for Investments in FM Technology

This benchmark study from Veolia present the findings from interviews with energy and facilities executives, exploring aspects related to the benefits they are receiving from their technology investments. The report indicates wide adoption of advanced lighting controls with 63% of respondents indicating deployment to most of their sites, and highlights a movement towards software solutions to help reduce energy and maintenance costs, but many are struggling to achieve their desired value, with only 30% being fully satisfied.

(IS-2019-16) Proxy Generation PPAs

This paper presents an adaptation of the power purchase agreement (PPA) which is more appropriate for renewable energy power generation assets such as wind and solar. It explores the issues with the current PPA contracts for renewables.

(IS-2019-15) IoT and Privacy By Design in the Smart Home

This report was prepared in February 2018 by ESET and deals with the privacy concerns relating to the creation of a basic smart home. The topics covered include an overview of the Internet of Things (IoT) and the smart home, privacy policy and data capture, and IoT devices and their security vulnerability. The report is useful for electrical engineers, system integrators, device manufacturers, and cyber security professionals.

(IS-2019-14) Smart Factory Case Study

This report was prepared in 2017 by Smart Plants and discusses the application of Internet of

Things (IoT) technologies to establish a connected factory with a cloud-based network. The topics covered include the challenges, objectives, the main features and advantages of the IoT solution, and the results. The report is useful for IoT solution providers and businessowners.

(IS-2019-13) Smarter QA for Smart Homes

This report was prepared in January 2018 by Cognizant and considers the smart home as the point of reference to elaborate on the concept of connected ecosystems, and addresses the challenges and opportunities inherent in the testing of such ecosystems. The topics covered include smart home elements, complexities and challenges with smart home systems, a smarter approach to quality assurance, a UK energy utility case study, and a future outlook. The report is useful for companies deploying smart home systems, smart home owners, and quality assurance professionals.

(IS-2019-12) The Connected Home: Smart Home with Batteryless Wireless Technology

This report was prepared by Enocean Alliance and deals with the batteryless wireless technology from EnOcean. The topics covered include energy harvesting, secure data transmission, product range, cost reduction, energy savings, applications, and a future outlook for smart homes. The report is useful for home builders, home owners, electrical engineers, and systemintegrators.

(IS-2019-11) Resilient Cities Plug In to Technology for Response and Recovery

This report was prepared in December 2018 by the Consumer Technology Association and the Smart City Council and presents a call to action and recommendations for making cities more resilient to disasters with the use of technology. The topics covered include natural disasters in the U.S. 2017, creating a culture of responsiveness and resiliency, how rapidly advancing technology is responding to crisis mode, and the ten essentials for making cities resilient. The report is useful for city planners and operators, government officials, policy makers, engineers, and IT professionals.

(IS-2019-10) Frequency Sharing for Radio Local Area Networks in the 6 GHz Band

This report was prepared in January 2018 by RKF Engineering Solutions and deals with the evaluation of sharing possibilities of Radio Area Networks (RLANs) with existing services in the 6 GHz band. The topics covered include RLAN deployment and operating assumptions, propagation models, and spectrum sharing. The report is useful for electrical and electronics engineers, technologists, IT professionals, and technology company executives.

(IS-2019-09) Next generation Wi-Fi®: The future of connectivity

This report was prepared in December 2018 by Wi-Fi Alliance and presents an overview of Wi- Fi technology. The topics covered include inherent strengths of Wi-FI, Wi-Fi 6 and Wi-Gig technology, mission critical connectivity for 5G networks, performance, cost effectiveness, next

generation of Wi-Fi CERTIFIED technologies, frequency range, integration, and societal/financial benefits. The report is useful for technologist, engineers, system integrators, and IT professionals.

(IS-2019-08) MIT Tests New Energy Valve Technology at Charles Hayden Library And Reaps the Rewards of Higher Delta-T!

This report was prepared in November 2014 by Belimo and deals with new valve technology from Belimo that was applied to MIT's Charles Hayden Library to achieve acceptable difference between entering and exiting chilled water temperatures. The topics covered include an overview of the Belimo valve technology and a case study at MIT's facilities department. The report is useful for college and university facilities managers and operators.

(IS-2019-07) Building a Data Lake to Drive Digital Transformation

This report was prepared in November 2018 by TMForum and explores why common data models and a standardized approach to setting up data lakes is of benefit to communications service providers (CSPs) and the telecoms industry. The topics covered include data models, input from operators such as Verizon and Telia, the importance of event data, application program interfaces, and standards for virtualizing data. The report is useful for telecom and CSP executives, managers, and IT professionals.

(IS-2019-06) Cost-Effectiveness Tests: Overview of State Approaches to Account for Health and Environmental Benefits of Energy Efficiency

This report was prepared in December 2018 by the American Council for an Energy Efficient Economy and deals with health and environmental benefits of energy efficiency across the United States. The topics covered include benefits related to health, society, environment, avoidance of compliance costs, and a summary of State approaches. The report is useful for policy makers, health professionals, environmentalists, and the general public.

(IS-2019-05) Home Energy Management System Savings Validation Pilot - Final Report

This report was prepared in 2018 by Lockheed Martin Energy and deals with the validation of the Base- Load Simulation testing methods and a simulation of potential home energy management system (HEMS) savingsin New York State. The topics covered include a HEMS pilot study of 50 homes, equipment selection, system integration, data management, overall results, and a summary of findings regarding installation, data management, and technology. The report is useful for system integrators, electrical engineers, and professionals working in the energy sector.

(IS-2019-04) Reducing Energy Waste through Municipally Led Behavior Change Programs This report was prepared in November 2018 by the American Council for an Energy-Efficient Economy

and provides a large-scale review of municipally led energy-saving behavior change programs in terms of their design, motivations, goals, and impacts. The report also provides recommendations for designing and implementing a successful locally led behavior change program. The report is useful for policy makers, municipality managers and executives, professionals working in the energy sector, and the general public.

(IS-2019-03) Delivering an Autonomous Customer Experience Through Business Intelligence and Analytics

This report was prepared in November 2017 by Aricent and deals with customer experience management (CXM). The topics covered include a review the current maturity level of CXM for communications service providers (CSPs), the latest CXM technology drivers, and detail Aricent's CXM offerings including a few case studies. The report is useful for business owners and IT professionals.

(IS-2019-02) KNX Demand Side Management

This report was prepared in October 2018 by KNX and discusses compliance issues with European Standard for Home and Building Electronics Systems (EN50090) as it pertains with demand side management of electrical power. The topics covered include demand side management, control strategies and algorithms for load adaptions, and KNX solutions for providing flexibility. The report is useful for electrical engineers, system integrators, and smart gridoperators.

(IS-2019-01) Energy Management

Energy management is a growing trend globally. This paper provides an overview of how this topic and the market for performance contracting of buildings has evolved in signatory nations of the Gulf Cooperation Council. It analyzes projected energy demand, existing models for performance contracting, typical cost breakdown and risk distribution amongst stakeholders (end user, financial institution and energy service companies).