



Energy and environment 2020

Conversations on energy and the environment center on the three Cs—connect, collaborate, and coexist. Smarter devices result in smarter energy choices, while networks of sensors, drones, citizen regulators, and conscious consumers work together to monitor and protect the environment. Rapid urbanization fuels innovation and the quest for sustainable and resilient cities. Entire markets emerge around sustainable solutions such as reducing food waste. Government regulation is less blunt—and heavily influenced by sensor-produced data.

Smarter data and devices lead to smarter choices

An application layer for the smart grid

The combination of remote sensing, metering, and real-time pricing connected to applications that give businesses and consumers greater control over how they use energy—or automatically make the best decisions for them—leads to innovative new services. This “application layer” becomes the locus of innovation and profits in the energy space; on it, organizations build everything from sustainability apps and interactive electricity bills to distributed micro-power grids. Integration with smart grid systems gives utilities greater flexibility to “surgically” balance demand and load, providing more opportunities for consumers to participate in demand-side management programs. This requires education and coordination with state regulatory bodies that approve energy efficiency programs.

Energy-saving learning devices

Smart, networked devices like the Nest Learning Thermostat are increasingly the norm for everything from household appliances to handheld electronics. These gadgets know you better than you know yourself, studying your habits and patterns to find the most optimal ways to use

Nest is designed to learn based on users’ schedules, and optimize energy use and savings. The thermostat can be programmed remotely by mobile phone and can reduce heating and cooling bills by up to 20 percent.

energy. By 2020, most consumers buy Nest-style devices as part of bundled “home energy management” offerings. Governments work to balance the inequality between citizens who can afford to generate or negate their energy use via solar and smart devices and those who cannot.

Gamifying sustainability

Utilities and developers leverage the data of the smart grid to drive end-user behavior. In particular, “gamifying sustainability,” using games and game mechanisms to encourage energy conservation. Companies work with consumers and utility companies to track and analyze home energy consumption and present the data to consumers in ways that encourage them to save power.

Opower’s online scoreboard allows users to compare and discuss their household electricity use, and gamifies the experience through challenges, group participation, and points and badges tied to real-world data. Using the gamification route Opower has enabled energy savings of 2–4 percent, translating into hundreds of millions of KW hours saved.

Environmental data go hyperlocal

Government employs sophisticated geospatial analytics to improve land management, using analytical tools and techniques to examine the relationships between a number of factors, including highly localized data on rainfall, surface elevation, soils, geology, drainage, and historical flood patterns. Such data equip agencies to identify at-risk areas and improve their defenses against natural disasters. The data also better inform infrastructural requirements and help government target investment.

Environmental monitoring at your fingertips

Embedded environmental sensors

Embedded sensors of various types are used for everything from pollution monitoring to land management, supplementing or replacing on-site inspections. Energy agencies rely on these sensors for continuous environmental monitoring and automatic intervention. These technologies help agencies execute their missions, but also raise issues concerning the definition and resolution of violations in a real-time monitoring environment. Embedded sensors in “smart cities” enable continuous monitoring of weather conditions, air quality, and home energy consumption.

BCC research estimates that the global environmental sensor and monitoring business grows from \$13.2 billion in 2014 to nearly \$17.6 billion in 2019, at a compound annual growth rate (CAGR) of 5.9 percent.

Drone environmental monitoring

Drones are commonly used for land monitoring, pollution control, and related activities such as “smart” agriculture. Hurdles are encountered, in particular the regulation required to quell privacy and security concerns around non-military drones. Agencies such as the Coast Guard struggle to maintain adequate presence and domain awareness over their vast areas of responsibility; drones act as a substantial force multiplier.

The US Department of Interior acquired two drones, Raven and T-Hawk, from DOD to conduct proof-of-concept projects and test the drones for environmental monitoring.

Hyper-localized environmental enforcement

Aided by embedded sensor networks and intelligent algorithms that provide only important data to human analysts, governments gain the capability to enforce regulations at a hyper-local level, driving greater compliance with environmental laws. They also leverage predictive models as a kind of force multiplier, using data to profile regulated organizations and identify which are most likely to be negligent. Third parties also get into environmental monitoring. Efforts are made to integrate data from environmental advocates and third parties with government data to create a more holistic view of the current state of the environment.

New York City’s fire department inspectors used predictive analytics to discover that landlords behind on their property taxes are also likely to maintain substandard and fire-prone buildings.

Citizen regulators for environment

Niche groups of citizens with increasingly powerful tools, social and otherwise, become formidable civic and environmental crusaders. These “activists by night” undertake distributed monitoring and protection of the environment, organizing through websites such as witness.org. They also participate indirectly, opening up the sensors in their mobile devices and homes for use in large-scale monitoring programs. Citizen regulators play an increasingly important role in building or breaking a project’s social license to operate.

Witness.org trains and equips citizens to use video to draw attention to human rights issues. Their “See it, film it, change it” approach helps provide a voice for human rights activists.

Connect, collaborate, and co-exist

Food sharing

“Food sharing” transforms our interaction with the environment by localizing food production and consumption. In the process, our food systems become more resilient, decreasing the incidence of mass recalls and food-borne disease. Governments rethink how they inspect and regulate food quality as food sharing grows.

Ron Finley’s Guerilla Gardening movement encourages people to grow their own food. To combat the issue of food deserts in South Central Los Angeles, Finley and his group, L.A. Green Grounds started growing food on vacant lots in the area. What started as an illegal activity earned citizen support and endorsements from public officials.

Everyone is a utility

A new class of citizen power producers uses homes and offices to generate electricity and sell extra capacity back to the grid. Buildings are increasingly covered with solar material and paper batteries, transforming the construction industry and creating millions of new micro-sources of power. One potential roadblock is the role of regulatory agencies, which may limit who can legally “sell” power.

Bernstein’s analysts predict new worldwide solar installations will grow from just 31 GW in 2012 to 300 GW a year by 2020.

Sustainability lessons from the base of the pyramid

The world looks more and more to people at the margin, who often already operate in an energy-lean fashion to save money. These groups, including slum dwellers, refugees, and citizens of developing nations, serve as a source of innovation as well as powerful evidence for the use of personal self-interest to drive sustainability.

Environmental mission convergence

With environmental concerns rising, the missions of various public and private organizations converge, to the point that, in some jurisdictions, nearly everything falls under the umbrella of an energy or environmental organization. New technologies such as “pervious concrete,” which allows storm water to pass through, reducing runoff and the need for costly storm water management, usher in an era in which environmental agencies start thinking like transportation agencies, and vice versa.

Sustainability solution markets

Future impact bonds for sustainability

With the rise of big data and analytics, environmental and sustainability programs can be evaluated holistically, considering both direct and downstream impacts. For example, air quality initiatives that seem costly may actually save significant amounts by reducing pollutants that lead to respiratory illness and thus hospital visits. To fund these kinds of efforts, governments issue “future impact bonds,” allowing them to raise capital to address underlying social and environmental problems in exchange for a share of the downstream rewards.

Collective action on sustainability issues

As the sustainability agenda gathers steam, global firms partner with social organizations. “Collective action” is the new buzzword: The government, private sector, social organizations and innovators come together to build solution ecosystems around environmental issues.

In Tanzania, a unique alliance is working to improve the country’s generally low agricultural productivity. The goal of the Southern Agricultural Growth Corridor of Tanzania (SAGCOT)—whose partners include Unilever, the fertilizer company Yara International, SAB Miller, Monsanto, and the government of Tanzania—is to create an efficient agricultural value chain, with the expectation that it will triple the area’s agricultural output.

Market externalities become market opportunities

The private sector moves away from treating sustainability as part of the CSR/philanthropy portfolio and instead works to create shared value with its customers and community. Firms still strive to meet their profit goals, but pursue sustainable development models, which create greater value for the company and community in the long run. In India, for example, Unilever has created a campaign around washing hands, which increased the sales of its soap while reducing cases of diarrhea due to better hygiene.

By 2020, Unilever wants to bring safe drinking water to half a billion people around the world and help improve the hygiene habits of twice as many.

Credits as currency

As environmental protection laws continue to evolve, so do credit markets. New exchanges emerge in various facets of sustainability, with credits being traded as currency—carbon credits, water quality credits, fishing quotas, and net energy credits, to name a few. This spurs the creation of viable markets that protect both people’s livelihoods and the environment.

To deal with competition, fishermen in Alaska’s Bristol Bay use fish as a currency in the form of individual, transferable quotas. The Alaska Department of Fish and Game maintains the system and each licensed crew receives a quota for tons of fish and can sell it to other fishermen, allowing some to hedge against bad luck while letting others buy enough quota permits to exploit a big haul.

“Aspirational” drive sustainable consumption

Today, more than a third of the US population is classified as “aspirational,” focused on responsible consumption. By 2020, these consumers usher in a tectonic shift in the sustainable marketplace. Armed with better data about corporate practices, they buy products only from companies with green reputations, crowning new industry leaders.

Rebalancing the “green versus growth” equation

Fossil fuels continue to dominate energy markets because 6 billion people living in the developing world want rapid economic growth through proven, scalable methods with very low upfront costs. To tip the scales in favor of green thinking, policymakers create new incentives and mechanisms such as environmental impact accounting and “un-development” policies that price in the true cost of carbon.

The carbon credit market is currently valued at more than €175 billion, and experts project this to grow to €3 trillion by 2020.

Urban environmental innovation

Kickstarting innovation in energy and environment

With no clear path forward in the energy field, investors and government agencies double down on their efforts to uncover promising new technologies and approaches—and help rapidly scale those that show potential. To support this effort, agencies increasingly rely on new tools and methods to identify and support innovators. Crowdsourcing and crowdfunding platforms focused on energy solutions emerge as a promising way ahead.

Sustainable, resilient cities

Early innovations in green building seen in the first decade of the 21st century become the norm, reshaping the construction industry and creating entirely green cities that are not only sustainable, but also resilient, giving rise to advances such as zero-energy home building, rooftop farming, and permeable pavements.

Recycled construction

As the cost of raw materials continues to rise, “taking it out of the ground” is no longer feasible for most construction projects. Instead, developers increasingly source metals and minerals from old buildings, landfills, and junkyards, fueling a surge in the secondhand market.

The global construction and demolition recycling market grows to \$23.85 billion by 2020.

Rise of materials makers

Given high costs and supply constraints for key material resources, companies increasingly turn to labs for “designer molecules” they can use as replacements. These “materials makers” become critical to manufacturing, helping to keep costs low and reducing the negative environmental impacts associated with traditional sourcing. Regulatory agencies have to adapt and widen the scope of their testing, policy, and enforcement efforts to keep up.

Innovation in food production

Climate change and natural calamities disrupt global food production, driving the need for innovation in food production. Widespread urbanization and the degradation of arable land give rise to “vertical farms” inside cities to meet food demands. Globalization of taste and increased consumption of meat put pressure on food and water systems. Conscious consumers push for healthy and organic food, sustainability, and reduced food footprints, while burgeoning ecosystems develop around food waste recycling and the redistribution of unused food. As oceans and rivers deteriorate, aquaculture becomes the primary source of fish for human consumption.

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