If Boston Were

SMART

By Leslie Friday

Last year, the *Daily Beast* named Boston the country's smartest metropolitan area. The website was referring to the people of Boston, of course, not the city itself. But what if the city itself were smart? What if technology, designed by the smart people who work in Boston, could help us save time and energy and spare us from daily frustrations? We talked to some BU researchers who are studying, designing, and building the technology for a more enlightened city.

Imagining intelligent traffic lights, parking spaces, buildings, and appliances

If Boston Were SMART

SMARTER CENTRAL CONTROL (A)

Imagine a network of sensors that would collect and send data to a centralized processor, which could order a garbage pickup or warn drivers of traffic jams. Christos Cassandras, a College of Engineering professor of electrical and computer engineering and head of the Division of Systems Engineering, Ioannis Paschalidis, an ENG professor of electrical and computer engineering and codirector of the Center for Information & Systems Engineering, and Assaf Kfoury, a College of Arts & Sciences professor of computer science, are testing a miniature version of this network in Cassandras' lab, with help from a $1 million grant from the National Science Foundation (NSF).

SMARTER PARKING (B)

Cassandras, working with research assistant Yanfeng Geng (ENG'13), has also developed the BU Smart Parking application, which can be downloaded to a smartphone from the iPhone App Store by searching "BU smartparking." Drivers tell the app when and where they want to park, prioritizing price and location, and the app searches for available spaces, all of which are networked to the device. When the app identifies a spot that meets the search criteria, it tells the driver where to go. At the same time, a light installed above the spot turns from green to red. When the driver who made the reservations approaches, the light turns yellow. The catch? At the moment the system works only in BU's 730 Commonwealth Avenue garage, but Cassandras hopes to expand it to private parking facilities throughout Boston.

SMARTER TRAFFIC LIGHTS (C)

A smart traffic lighting system would mine GPS information from cars and smartphones and count the number of vehicles waiting at red lights. If there is no approaching traffic, it would switch lights from red to green. Cassandras is testing this system on a model minicity in his lab.

SMARTER HVAC (D)

BU engineers have designed software that, once uploaded to a building's HVAC system, would measure airflow room by room and revise it to meet minimum standards, decreasing energy costs while keeping occupants happy. The invention earned Michael Gevelber, an ENG associate professor of mechanical engineering, Donald Wroblewski, an ENG adjunct research professor, and research assistant Paul Gallagher (ENG'13) first prize and $20,000 in this year's MIT Clean Energy Competition. The team plans to develop and market the software through its newly formed company, Aeolus Building Efficiency.

SMARTER GRID (E)

Because the cost of electricity fluctuates throughout the day, depending on demand, smart meters that are currently available tell homeowners exactly how much energy they use

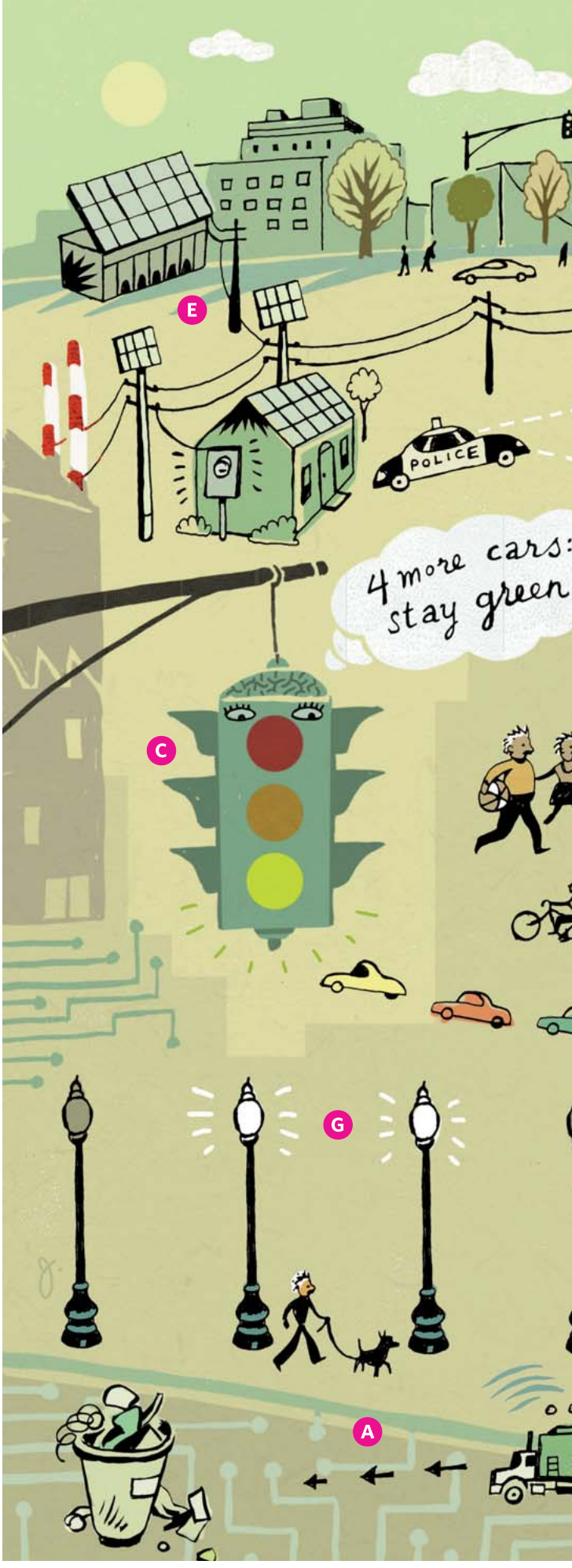

ILLUSTRATION BY JOHN S. DYKES

and at what cost, encouraging them to delay energy-intensive activities until a time of day when demand and costs are low. Supported by a $2 million NSF grant, Michael Caramanis, an ENG professor of mechanical and systems engineering, John Baillieul, an ENG professor of mechanical engineering, and two MIT faculty members are collaborating on a study of how these and larger-scale measures could result in a smarter electricity grid. In the United States, we lose about 8 percent of energy because it travels long distances between points of generation to use. Caramanis thinks the loss could be greatly reduced if we got our energy from closer and cleaner sources. A smarter grid could help us do that.

(F) SMARTER TIMING

Refrigerators and hot water heaters are duty-cycle appliances, meaning they need to run only two to three times each hour. Caramanis thinks they could be designed to communicate with the electricity grid and run when electrical demand is lowest during that time period. Alternatively, if either of these appliances is connected to a home photovoltaic unit, it could be programmed to detect when a passing cloud blocks the sun and choose to cycle at a later time. Caramanis says this technology is mostly being tested in pilot settings. A New Jersey–based company called FirstEnergy has installed temperature sensors and communication controllers that turn on and off the hot water heaters of thousands of consumers in relation to low or high energy costs in the Pennsylvania, New Jersey, and Maryland region.

(G) SMARTER LIGHTING

The next-generation lightbulb could enhance sleep quality, send data like a Wi-Fi hotspot does, or help visitors navigate large buildings through a network of visible cues, while operating more efficiently. This technology is made possible by combining LEDs, sensors, and other control systems within a single hybrid bulb that needs 40 to 70 percent less energy than existing compact fluorescent lights or LED lightbulbs. It is being developed by Thomas Little, an ENG professor of electrical and computer engineering and associate director of the Smart Lighting Engineering Research Center, working with researchers at the center under an $18.5 million NSF grant. Little is collaborating with colleagues from Rensselaer Polytechnic Institute and the University of New Mexico.

(H) SMARTER SECURITY

Security officers could sort through billions of hours of video footage and spot unusual events, such as someone attempting to enter a building in the middle of the night, using specially designed cameras with embedded algorithms. Janusz Konrad and Venkatesh Saligrama, both ENG professors of electrical and computer engineering, have developed the technology, supported by more than $800,000 in funding from the NSF, the Department of Homeland Security, and other agencies. ■