GREEN ELECTRONICS COUNCIL

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A Story of Sustainable Sensors

Institutional Purchasers are Powerful Sustainability Change Agents

When the City of Portland, Oregon, applied for the National Institute of Standards and Technology (NIST) Replicable Smart City Technologies (RSCT) grant, it wanted to push the boundaries of innovation. NIST was looking for cities and communities who could take a lead role in "action cluster" teams working on groundbreaking Internet of Things (IoT) applications. Portland is known for its cutting-edge sustainability initiatives, so it didn't only want to use the grant money to deploy a network of air quality sensors; it also wanted to make those air quality sensors as sustainable as possible.

Enter the Green Electronics Council (GEC), a Portland-based non-profit that leverages the power of institutional purchasers to achieve a world in which only sustainable IT products are designed, manufactured, and purchased. The City of Portland brought GEC onto its team to integrate recycling and reuse requirements into the proposal. GEC's CEO, Nancy Gillis, was thrilled to see a city acknowledge the potential to reduce the electronics waste associated with smart cities. "We are seeing many cities procuring sensors as the core basis for being smart and resilient," said Gillis. "In every single conversation with government entities or the private sector, no one ever questioned whether or not there was a sustainability component for sensors. What does it mean to embed thousands of these sensors into a city and not think about their sustainability?"

Portland was awarded the NIST RSCT grant, and the City of Portland Bureau of Planning and Sustainability launched its Air Quality Sensor Testing and Deployment pilot in September 2016. Dr. Christine Kendrick, the Air Quality Lead and Smart City PDX Coordinator for the City of Portland, studies the intersection of urban air pollution and transportation. This means she has worked extensively with traditional ambient monitoring instruments and lower-cost sensors and knows all their quirks. "Sensors don't work perfectly," said Kendrick, "and they won't last as long as the housing they are installed in, so there can be a lot of waste."

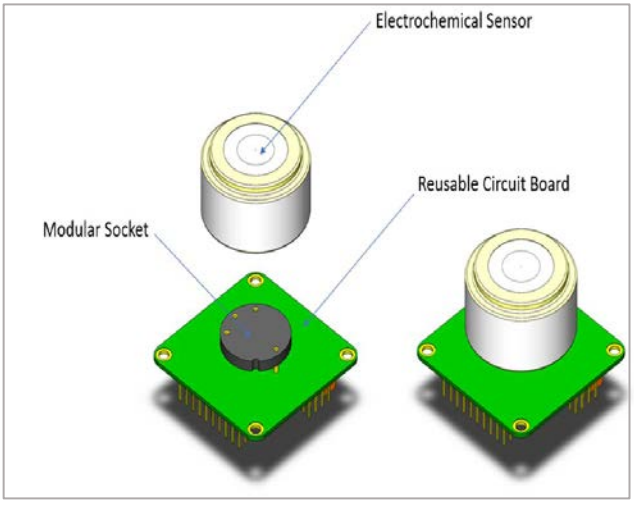
Taking the advice of GEC, Kendrick looked at what Portland has control over – its procurement process. "GEC highlighted that the issue of recyclability for small electronics has not been solved. Part of the criteria we incorporated into our procurement focused not only on maximizing the sensors for our specific needs but also extending their useful life and making them reusable, like specifying pollutant ranges to ensure the sensors can perform as needed, weatherproof housing, and the ability to upgrade the sensors." She noted "we need to think through end of life considerations so that our

procurements aren't just focused on the lowest cost product. Can we modify and upgrade a sensor without throwing the entire device out? Can we at least make sure the components can be reused in a secondary market?"

Simply asking these questions during the acquisition process led to a surprising answer. One pollution monitoring company was already making modular sensor sockets as a cost saving measure, and it had almost started soldering them in thinking its customers would prefer it. Soldering would eliminate the option to reuse the devices, and by the City of Portland asking these questions, they decided against it. "The City of Portland's procurement requirement for a reusable sensor led us to keeping the modular design, and now it's a feature we market with the product." said Robert Beckius, the President and CEO of Apis, Inc. "It was a serendipitous discovery."

Beckius spent many years working on air quality issues and noticed government agencies had a growing interest in sensors as additions to the more expensive monitoring equipment they install and maintain to monitor criteria air pollutants under their Clean Air Act requirements. While the stations cost $200,000 to $300,000 to build and $50,000 to $100,000 per year to maintain, this equipment and monitoring station designed network is successful at capturing ambient air pollution levels using standardized reference methods, but the time, space, and labor involved to maintain these stations means there are limited numbers of them. The monitoring stations cannot provide localized measurements at a high number of locations, important for understanding exposures of rapidly expanding urban populations. Beckius says low cost sensors, like the ones being procured by the City of Portland, work well when they are applied to the Internet of Things (IoT) and connected to the cloud. "They are a more effective, low cost way to collect trustworthy data at higher spatial resolutions."

Apis' solution is driven by a data-as-a-service model, meaning they own the sensors and its customers lease the collected data through a subscription. Apis owns the pollution monitoring equipment and sensors and recirculates them for reuse. "Virtually all of the electronics inside our sensors are reusable. The only waste is a quarter-size unit of electrochemical monitoring cells," says Beckius. "It's just like the batteries in a remote control. You don't throw away the entire remote, you just replace the batteries when they wear out." Apis is even exploring how its electrochemical sensor can be reused.



Apis' reusable circuit board and modular socket design. Credit: Apis.

Today, the City of Portland is continuing the Air Quality Sensor Testing and Deployment pilot with its collaborative partners: GEC, the Portland Bureau of Transportation, Portland State University, and the sensor providers (Apis, SenSevere, and Argonne National Laboratory, and the University of Chicago). They are also expanding their use of sensors with a new pilot that integrates General Electric's CityIQ nodes into light-emitting diode, or LED, street lights. This pilot will collect pedestrian and traffic data with hopes it will lead to solutions that greatly reduce road fatalities and serious injuries. These sensor pilots, along with a variety of policy and data management projects, are a part of the City of Portland's Smart City PDX efforts, and the sustainability of the sensors themselves remains an important aspect.

For GEC, this experience has prompted it to raise the issue of sustainable sensors with other aspiring smart cities and to plan to add a sensors product category to its popular EPEAT ecolabel. "GEC helps identify the sustainability attributes of IT products and services for use in sustainable procurement," said Gillis. "Our work with the City of Portland is a great example of how just asking the question of a supplier can make them rethink and change the way they design IT products. It is a testament to the fact that purchasers are true sustainability champions."

About the City of Portland's Bureau of Planning and Sustainability

The Bureau of Planning and Sustainability (BPS) takes action to shape the future of Portland and advance climate protection for a more prosperous, healthy, equitable and resilient city now and for future generations.

Smart City PDX is a City of Portland program led by the Bureau of Planning and Sustainability. This citywide program will guide the City's use of technology, information, and partnerships to reduce inequities and disparities for people who have been left behind, specifically people of color and people with disabilities.

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About the Green Electronics Council

The Green Electronics Council (GEC) is a mission-driven non-profit that collaborates to achieve a world in which only sustainable IT products are designed, manufactured and purchased. Through its management of EPEAT, the leading global ecolabel for IT products, GEC provides institutional purchasers access to a wide selection of high-performance, sustainable, and cost-competitive IT products. GEC assists organizations in understanding the challenges facing sustainable IT, committing to address those challenges, and acting to change internal operational, manufacturing and procurement behaviors. For more information, please visit http://www.GreenElectronicsCouncil.org

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