CONSERVATION STATION

EDUCATOR COMPANION GUIDE

TOPIC

Smart Cities Virtual Field Trip

KEY LEARNING OBJECTIVES

Students will be able to:

- Explain how smart cities use innovative technologies to solve today's challenges related to conservation and energy.
- Explore how professionals at a water and energy conservation laboratory must be able to identify problems, create solutions, think critically, effectively communicate as part of a team, and apply new technologies and skills.
- Explain the role technology plays in solving real world problems by reconstructing existing, and creating their own, smart city case studies.

OVERVIEW

The Itron Virtual Field Trip takes your students on a tour of the Itron Innovation Center to explore how technology powers sustainable solutions to the challenges of modern life. Students meet the team at the Innovation Center to learn how 'smart cities'—those that use information and communication technologies to increase efficiency, share information, and improve services and citizen welfare—are using innovative technologies to solve today's challenges related to energy, water, and conservation.

The Virtual Field Trip illustrates a variety of interesting, highly-skilled careers related to technology, engineering, city planning, and sustainability. It also showcases how new technologies can solve real-world problems, such as safety, disaster response, and protecting ecosystems and wildlife. Finally, it highlights the relationship between water and energy systems in smart cities. The companion activities help engage students prior to and during the Virtual Field Trip, and they extend the learning from the Virtual Field Trip to the classroom.

MATERIALS

- Copies of the Itron Case Studies, one per case study (each placed in one of five folders marked "Key"): Murfreesboro, North Miami Beach, Wadsworth, Copenhagen, & Parsons
- Copy of *Case Studies: Engage Cards*, cut and shuffled for random distribution
- Pieces of chart paper, posted around the classroom, one per group
- Tape
- Copies of *Careers in Smart City Innovation* capture sheet, one per student
- Internet Access

- Copies of *Career Profile* Research sheet, one per student
- Copies of *Creating Smart City* Solutions capture sheet, one per student

ENGAGE

1. Before class, write the city headings for each of the five case studies, as well as the subheadings: "Problem", "Solution", and "Benefits" on poster paper. Print one copy of *Case Studies: Engage Cards for 30 cards*. Cut along dotted lines and shuffle for random distribution. The Engage activity is designed for five groups—one for each case study—with six students in each. Reduce the number of case studies or give students more than one card for smaller class sizes.
2. Begin class by handing each student a unique section of one of the 5 Itron Case Studies.
3. Prior to beginning the activity, provide some background information on smart cities and technologies that they utilize by showing the following NBC News video: https://www.youtube.com/watch?v=THiQtn9hVB8 (stop at min 2:28).
4. Tell students that they will be reviewing the case studies of particular smart cities as a warm-up to the VFT and later, creating case studies for their own smart cities of the future.
5. Instruct students to read their card and find the heading for the corresponding real-life case study on the poster paper hanging somewhere in the room. (NOTE: Case Study Codes are in the top right corner if students need help with matching.)
6. Once they've located the correct case study, they should work with the other students at that poster (their group) to place their cards in the correct order and tape them under the appropriate headings to complete the case study.
7. Once they think they have the cards in the correct order, direct students to check the full case study in the folder marked "Key" next to the poster. (NOTE: Tell students that the subheadings won't necessarily match what's in the "Key". For example, "Problem" may be the "Overview" section. Also, their case study text on the poster will be shorter than the complete case study, but they should still endeavor to get their text in the same order as it appears in the actual case study.)
8. Engage students in a short de-brief discussion to synthesize key points they learned about smart cities and introduce the VFT. Leave the posters up for Activity #2 (below).

DURING THE VIRTUAL FIELD TRIP

1. Distribute the *Careers in Smart City Innovation* capture sheet to students and review the background information.
2. Direct students to watch the Smart Cities Virtual Field Trip. While they watch, they should brainstorm career skills that would be helpful if working in this field.
3. Then, students should look to match some of their personal background and training opportunities with the careers featured in the presentation and answer the other questions on the last page of the capture sheet.

AFTER THE VIRTUAL FIELD TRIP

Two activity options are available for students to apply and summarize their learning.

Activity #1 (Career Investigation)

1. Remind students that this field offers many different career paths in STEM, business, marketing, environmental conservation, and more that are all dedicated to ensuring the production of sustainable energy production and usage solutions, safe water treatment, and delivery technologies for smart cities. From city planners and engineers, to field technicians, research and development managers, and sustainability experts, each career plays a unique role in addressing consumers' needs by identifying problems, creating solutions, thinking critically, effectively communicating as part of a team, and applying new technologies and skills.
2. Using the careers highlighted in the VFT as a starting point, ask students what they know about these related careers:
    - Product marketing
    - City planner
    - Sustainability expert
    - Engineer
3. Then, challenge students to learn more about one of the two careers they listed on the back of their *Careers in Smart City Innovation* capture sheet. Pass out the *Career Profile*, direct them to conduct a web search, and invite them to record their research.
4. Once research is completed, invite students to identify a gap in their school's course offerings and write a persuasive letter to the principal asking that the school offer more opportunities in this area, either directly or through partnership with outside groups.

Activity #2 (Design Your Own Smart City)

1. Distribute copies of the *Creating Smart City Solutions* capture sheet to each student.
2. Explain that they will get into groups of three (half of their group from the Engage activity) to brainstorm ideas for their own smart city of the future.
3. Instruct students to engage in a Gallery Walk around the classroom to use the real case studies posted from the Engage Activity for inspiration. They can also draw upon solutions they learned about during the VFT.
4. Individually, they should complete the capture sheet, using their group's collective ideas.

HS NATIONAL STANDARDS

Next Generation Science Standards

ESS3.A: Natural Resources

Humans depend on Earth's land, ocean, atmosphere, and biosphere for many different resources. Minerals, fresh water, and biosphere resources are limited, and many are not renewable or replaceable over human lifetimes. These resources are distributed unevenly around the planet as a result of past geologic processes.

ESS3.C: Human Impacts on Earth Systems

Typically, as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise.

ETS1.B: Developing Possible Solutions

There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem.

CASE STUDIES: ENGAGE CARDS PAGE 1

Case Study Code KEY: M—Murfreesboro, C—Copenhagen, N—North Miami, W—Wadsworth, P—Parsons

M The City of Murfreesboro Water & Sewer Department (MWSD) was looking to modernize its meter reading process to more efficiently manage the delivery and use of water to, and by, its customers.	**C** Copenhagen, one of the world's most sustainable and smartest cities, has set the ambitious goal of becoming carbon neutral by the year 2025.
M Itron's Advanced Metering Infrastructure (AMI) solution with acoustic leak detection and analytics software project began in August 2015 and finished ahead of schedule in May 2017.	**C** Goals: 1) Save energy and create a city-wide wireless network; 2) Develop next-generation smart city lighting solutions that improve citizens' quality of life; 3) Improve safety for the city's large and growing population of commuter cyclists.
M Itron's AMI solution with leak detection and analytics has increased operational efficiencies at MWSD and saved millions of gallons per year.	**C** Copenhagen deploys an enhanced city lighting system designed to improve energy efficiency, lower operational costs, enable remote lighting management and control and improve citizen safety.
M A leak was detected. "The Itron technology alerted us about the leak and allowed us to monitor the situation … The result minimized the impact on Murfreesboro citizens, as well as the local environment."	**C** • More than 20,000 networked LEDs • Dynamic lighting via motion and occupancy sensors • Advanced controls for remote dimming and scheduling
M • 64 leaks located • 28 repaired • 104 million gallons saved per year	**C** • 55% energy savings • 50% reduction in operations and maintenance costs
M • 385 thousand gallons saved per day • Estimated production cost saving per year of $105,000 • Improved customer service • Greater operational efficiencies	**C** One application uses a fusion of intersection-based occupancy sensors and light controls to sense an approaching bicyclist and provide extra light as they cross vehicle intersections.

Case Study Code KEY: M—Murfreesboro, C—Copenhagen, N—North Miami, W—Wadsworth, P—Parsons

N

Until recently, the City of North Miami Beach relied on traditional walk-up, manual meter reading, and a leak detection service, going from one end of the 550-mile pipeline system to the other in one-mile sections—it took one and a half years to get through the city's 25-square-mile service territory.

W

In 2009, Wadsworth Electric received a federal Recovery Act Smart Grid Investment Grant Award to deploy smart meters.

N

The process was labor intensive, and the city understood that automating meter reading and leak detection would save precious time, staff resources, money—and most importantly, water.

W

With those funds, they initiated a Connected Grid Project, which involved system-wide deployment of advanced metering infrastructure (AMI) and the targeted installation of in-home technology.

N

Advanced Metering Infrastructure (AMI) solution, equipped with leak detection technology and cloud-based analytics, includes 38,000 communication modules along with 11,000 acoustic leak sensors. Instead of potentially taking more than a year to identify leaks, the city now knows within three days if a leak occurs.

W

They provided customers with the ability to monitor and control their own energy use with devices such as in-home displays (IHD), home area networks (HAN), and program-mable communicating thermostats (PCT).

N

The utility's customers now have access to detailed consumption information through a secure customer web portal, so they can better manage their usage, conserve water and save money.

W

Customers were offered incentives to use power at off-peak times and cycle their power usage for appliances such as air conditioners, pool pumps, and hot water heaters.

N

- 23 leaks identified and repaired, saving an estimated 27 million gallons and $38,000 annually
- Improved efficiency of meter reading and billing and enhanced safety of meter readers

W

Itron's project management team enrolled and installed devices between November 2012 and June 2013 in excess of 20% of the city's eligible customer base.

N

- Increased quality of customer service by eliminating estimated bills
- Customers may check own usage via secured website

W

The City's three-year goal was to save 5,300 megawatt hours of electricity.

Case Study Code KEY: M—Murfreesboro, C—Copenhagen, N—North Miami, W—Wadsworth, P—Parsons

P

Parsons provides gas and water resources to a mix of residential and industrial customers across a 3.14-square-mile, primarily rural service territory.

P

Facing accessibility hazards, such as unfriendly dogs and hard-to-reach equipment when attempting to collect meter data throughout the county, the utility aimed to improve operational efficiency and customer service.

P

The automated meter reading system (AMR)—allows the utility to gather reads by driving down the street in a van with a mobile collector.

P

The City of Parsons can take full advantage of the drive-by data collection capabilities, leaving field personnel free to focus on special projects and enhancing customer service.

P

Automation has allowed the utility to read endpoints remotely in a fraction of the time it took to read the old ones, saving time and money.

P

The utility now has a committed GIS Mapping Department dedicated to transforming physical drawings of gas and water lines throughout the county into digital computer records. The map not only serves to help the utility find the exact coordinates for concerning underground pipes or meters, but also serves the community's economic growth.

CAREERS IN SMART CITY INNOVATION

(To be completed during and after the virtual field trip)

The Smart Cities Virtual Field Trip takes you on a tour of the Itron Innovation Center to explore how technology powers sustainable solutions to the challenges of modern life. You will meet the team at the Innovation Center to learn how 'smart cities'—those that use information and communication technologies to increase efficiency, share information, and improve services and citizen welfare—are using innovative technologies to solve today's challenges related to energy, water, and conservation.

This field offers a variety of interesting highly-skilled careers that deal with technology, engineering, city planning, and sustainability. The VFT showcases how new technologies can solve real-world problems, such as safety, disaster response, and protecting ecosystems and wildlife. It also highlights the relationship between energy and water systems in smart cities.

While watching the Smart Cities Conservation Station Virtual Field Trip, complete the table below:

List **two** background experiences/training opportunities that would be influential to each career.		
Engineer	1.	2.
City Planner	1.	2.
Field Technician	1.	2.
Research & Development Manager	1.	2.

Now, match your own background/opportunities to the careers highlighted.

Which background experiences of yours mirror any that you heard during the video? List two or three below.

_____

_____

Have you heard of any of the high school courses or training opportunities mentioned by any of the professionals as being available at your school?

If yes, list them below.

_____

_____

If not, which courses or opportunities would you be interested in exploring further to see if they could be offered at your school or through an extension/partnership program?

_____

_____

List two careers related to conservation and smart cities that are most interesting to you based on your background and the training opportunities available to you.

_____

_____

How do these careers support water and energy sustainability?

_____

_____

_____

_____

_____

_____

CAREER PROFILE RESEARCH

Directions: Conduct internet research to further explore a career that was interesting to you after watching the Virtual Field Trip. Record your notes below.

CAREER NAME	_____
Brief Description	
Training & Skills Required	
Salary Range	
Related Careers	
Current job openings, if available	
Current classes I am taking that impact this career	
How this career matches my interests/skills/strengths	
Training opportunities I would need in the future to pursue this career	

CREATING SMART CITY SOLUTIONS

Directions: Complete a Gallery Walk of the posters around the room and a brainstorm session with your fellow group members. Imagine and name your own smart city of the future and describe the sustainability Problem your city faces, a Solution, and the Benefits of your plan.

Name: City of _____

Problem: _____

_____

_____

_____

_____

Solution: _____

_____

_____

_____

_____

Benefits: _____

_____

_____

_____

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