CONSERVATION STATION

ITRON VIRTUAL FIELD TRIP

Educator Companion Guide Conservation Station

KEY LEARNING OBJECTIVES

Students will:

- Explain how smart cities use innovative technologies to solve today's challenges related to conservation and energy.
- Explore how professionals at an energy and water 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 Demo Center (a.k.a. "Tomorrowland") to explore how technology powers sustainable solutions to the challenges of modern life. Students meet the team at the Demo 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 conservation and energy.

The Virtual Field Trip illustrates a variety of interesting highly-skilled careers that deal with technology, engineering, city planning, and sustainability. It also showcases how new technologies solve real-world problems, such as protecting ecosystems and wildlife. Finally, it highlights the relationship between energy and water 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"): Chicago, North Miami Beach, Glasgow, Copenhagen, & Sacramento
- Copy of *Case Studies: Engage Card*s, 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 have located the correct case study, they should work with the other students at that poster (their group) to place their cards under the correct headings to complete the case study.
7. Once they think they have the cards in the right place, direct students to check the full case study in the folder marked "Key" next to the poster.
   Note: *Tell students that the subheadings will not necessarily match what is in the Key. For example, "Problem" may be the "Overview" section. In one instance (Chicago), the case study is actually a city press release, so there are no headings, and the order will not match exactly. Also, the case study text on their poster will be shorter than the complete case study. The Keys should just be a general guide.*
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 Itron Conservation Station Virtual Field Trip. While they watch, they should list two background experiences/training opportunities each professional highlighted as influential or helpful in their current career.
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 during the VFT, they met many professionals who are dedicated to ensuring the production of sustainable energy production and usage solutions and 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. The VFT highlighted several of these careers. Ask students to share what they remember about these jobs:
    - Engineer
    - City Planner
    - Field Technician
    - Research & Development Manager
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 Study Code KEY: Ch—Chicago, Co—Copenhagen, N—North Miami, G—Glasgow, S—Sacramento

CH

In 2019, Chicago's streetlight modernization program reached a major milestone, with the installation of more than 100,000 new LED streetlights, making the project 37% complete and on-track to reach completion in four years.

CO

Copenhagen, one of the world's most sustainable and smartest cities, has set the ambitious goal of becoming carbon neutral by the year 2025.

CH

- Improving nighttime visibility
- Making Chicago a greener, more efficient City

CO

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

CH

Chicago is replacing 270,000 of its street, alley and viaduct lights (85 percent of the City's streetlights) with high-quality LED fixtures and installing a citywide lighting management system for the new LED lights.

CO

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.

CH

The system will consume 50–75% less electricity, and the new LED fixtures also last 2–3 times longer. LED lights provide better nighttime visibility by projecting light downward where it is needed on streets and sidewalks, not into the night sky.

CO

- More than 20,000 networked LEDs
- Dynamic lighting via motion and occupancy sensors
- Advanced controls for remote dimming and scheduling

CH

When it becomes operational, the system will alert the City when lights need service, eliminating the need for residents to report outages.

CO

- 55% energy savings
- 50% reduction in operations and maintenance costs

CH

- Creating new jobs
- Saving taxpayers more than $100 million over the next decade, including energy efficiency rebates from ComEd

CO

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: Ch—Chicago, Co—Copenhagen, N—North Miami, G—Glasgow, S—Sacramento

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.

G

Glasgow is integrating multiple city services on a common platform and gathering new data to help empower its citizens to improve the city.

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.

G

- Reduce energy costs
- Increase road safety
- Promote cycling to help drive health benefits

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.

G

Itron is streaming lighting, traffic, noise and air quality data to the city's Open Data platform. Developers can use this data to build new solutions to address city challenges.

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.

G

While monitoring vehicle, bicycle and pedestrian traffic, the streetlights are programmed to automatically brighten and dim depending on ambient light levels as well as how many people are in a given area.

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

G

Social media connects city leaders to its citizens more than ever. Many cities are looking to share data sets from across the city with individuals, businesses and research facilities to help improve quality of life and foster innovation.

N

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

G

- 60% energy savings
- More than 2,900 datasets available through the city's open data platform

Case Study Code KEY: Ch—Chicago, Co—Copenhagen, N—North Miami, G—Glasgow, S—Sacramento

S

Sacramento wanted to replace physical inspections of electricity meters with data analytics in order to:

- Protect the customer and SMUD employees from potentially unsafe conditions due to someone tampering with the meter, and
- Reduce revenue loss from theft.

S

- Improves employee safety
- Prioritizes leads based on ones with the highest probability of theft
- Provides efficient use of SMUD resources (labor, fuel, investigation costs, and software)

S

The revenue protection software compiles datasets from the advanced metering infrastructure (kWh, voltage, register, alarm, event, and other alert data), the customer information system (customer, premises, billing, and service notifications) and from the GIS (geospatial information system) to look for evidence of theft.

S

Using statistical analyses to make inferences of the data and identify possible theft, SMUD has benefited from the technology and reduced revenue loss.

S

Though it is hard to know precisely how much theft has been detected, SMUD is seeing benefits to the software, such as increases in kWh billed and dollars collected.

S

- Improves customer safety by better identifying meter tampering
- Reduces revenue loss that would negatively impact customers by contributing to future rate increases

CAREERS IN SMART CITY INNOVATION

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

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All the professionals you will hear from during the Virtual Field Trip will mention the background required for their careers, as well as high school courses/training opportunities that were valuable in preparing them for their field.

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 from the Virtual Field Trip 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	

Name_____ Date_____

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: _____

_____

_____

_____

_____