Sustainable and Inclusive Cities

June 2025
Instructor: Janice Levenhagen, Katja Legisa

LINKÖPING UNIVERSITY

UNIVERSITY OF THESSALY

STIMMULI for social change

NTNU
Norwegian University of Science and Technology

WOMEN STEM UP

Who am I?

- Computer engineer turned gender equity in STEM and entrepreneurship

- Left tech due to harassment and bias–very passionate about changing that for other women

- Launched and ran a nonprofit for girls and women in tech in the US for 8 years. 20+ cities, serving 8,000 people per year with 1,500 volunteers

- Now I do consulting for organizations serving women and girls, work on EU projects like this, and run a nonprofit called Wevise (wevise.org) around mentorship in tech

[Photo by Todd Kulesza, ChickTech, Flickr](), used with permission

WOMEN STEM UP

Women STEM Up Project

✔️ EU-funded project to support young women in STEM majors to improve their confidence, passion, and creativity, with the end goal of encouraging them to stay in STEM.

✔️ Also, to help universities do a better job of supporting women in STEM majors

✔️ This course is part of 'Women STEM Up for Good', which focuses on boosting women's (your) passion for STEM using ESTEAM for social good

✔️ By attending all 5 sessions, you will receive a certificate of participation, which you can add to your CV and LinkedIn

✔️ If you're in one of the project countries (Belgium, Sweden, Norway, or Greece), you could be chosen to attend a 3-day hackathon in Greece!

WOMEN STEM UP

Sessions

1: Introduction to Sustainable and Inclusive Cities

2: Inclusive Urban Design

3: Smart Cities

4: Environmental Sustainability and the Circular Economy in Urban Design

5: Resilient Cities

Focus is on exploration, discussion, critical thinking, and problem solving. Participation is critical!

Agenda: Session 1 (Introduction)

10 min	Introduce instructor and course
5 min	Student intros and ice breaker
10 min	*Discussion:* What issues do cities currently have?
5 min	*Quiz:* Why is this important?
7 min	*Discussion+video:* What is a sustainable city?
7 min	*Discussion:* What is an inclusive city?
5 min	*Definition:* Smart and cognitive cities
8 min	*Overview:* SDG 11
10 min	*Video:* 7 principles for building better cities
5 min	BREAK

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Ice breaker

- Name

- School

- Major and year

- If you could solve one problem in the world today, what would it be and why?
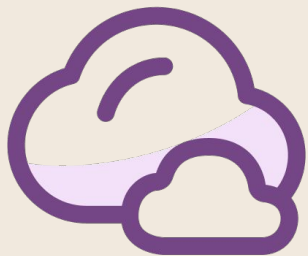
What issues do cities struggle with?

ⓘ Presenting with animations, GIFs or speaker notes? Enable our Chrome extension

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Context
Know better. Do better.

Journalism from the Thomson Reuters Foundation

World's slum populations set to surge as housing crisis bites

Nita Bhalla
Updated: June 08, 2023

Share

Women wash laundry at a water puddle within the Kibera slums in Nairobi, Kenya, July 21, 2020. REUTERS/Monicah Mwangi

https://www.context.news/socioeconomic-inclusion/worlds-slum-populations-set-to-surge-as-housing-crisis-bites | Screenshot taken May 11, 2025

Informal settlements

Air pollution

https://time.com/9802/beijing-air-pollution-nuclear-winter/ | Screenshot taken May 11, 2025

TIME
SUBSCRIBE

WORLD • AIR POLLUTION

China's Smog Is So Bad They're Now Calling It a 'Nuclear Winter'

3 MINUTE READ

Good morning, Beijing: The view from Beech's 16th-floor apartment on Feb. 26 in Beijing's Central Business District. The building in the background is the tallest in the city Hannah Beech

BY **HANNAH BEECH**

FEBRUARY 26, 2014 1:10 AM EST

THE FREE PRESS JOURNAL

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Home › Mumbai › Mumbai: Traffic congestion on Western and Eastern Express Highway amid backlogs and breakdown of buses

Mumbai: Traffic congestion on Western and East Highway amid backlogs and breakdown of buse

Vehicular movement was reported to be slow on Eastern Express Highway and to backlog upto BKC, BEST Bus breakdown reported near Aarey in Goregaon an

Aishwarya Iyer | Updated: Monday, September 19, 2022, 07:59 PM IST

Traffic Jam in Mumbai | Photo: PTI

https://www.freepressjournal.in/mumbai/mumbai-traffic-jams-hit-city-roads | Screenshot taken May 11, 2025

Traffic congestion

Keep it Inclusive – The Lack of Accessibility within Community Spaces

Kori Velasco, Staff Writer | January 25, 2023

Over the past few decades, monumental technological advances have been made in the field of medicine and disabilities. However, despite this progress,

https://thedublinshield.com/uncategorized/2023/01/25/keep-it-inclusive-the-lack-of-accessibility-within-community-spaces/

Inaccessible public spaces

Poor waste management

https://climate.gov.ph/news/923 | Screenshot taken May 11, 2025

Office of the President of the Philippines
CLIMATE CHANGE COMMISSION

Ridge to Reef: The Fight Against Mismanaged Waste

September 09, 2024 Monday

Photo by: Albert Alcain

Kamilia Palu · News Editor
Updated Fri 9 May 2025 at 5:35 am GMT+2 · 6-min read

Monash experts Professor Louise Wright and Associate Professor Catherine Murphy (pictured) say Melbourne's urban sprawl has come at a great cost to habitat and biodiversity. Photo: Nigel Bertram

https://au.news.yahoo.com/photos-show-huge-problem-facing-a
ustralias-fastest-growing-city-such-a-high-price-033547779.html

Urban sprawl

GREENPEACE

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Inequality and transport: who decides where you go?

Nerea Ramírez Piris
20 September 2023 • 3 min read

Transport systems are typically designed for men, and service the journeys they want to make. This is especially true for middle-aged, white, cis-male, able bodied, wealthy men. If you don't fit this description, transport might not serve your daily needs.

Copenhagen, Denmark. In some cities, cycle paths are also accessible for people using wheelchairs or mobility scooters to get around, enabling people living with and without disabilities to join in social rides. © Chris Grodotzki / Greenpeace

https://www.greenpeace.org/international/story/62407/inequality-and-transport-who-decides-where-you-go/

Inequitable transport systems

Heat islands/lack of green space

https://www.scidev.net/global/news/urban-heat-islands-increasing-faster-in-poorer-cities/ | Screenshot taken May 11, 2025

Sci Dev Net — Bringing science & development together through news & analysis

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17/04/25

Urban heat islands 'increasing faster' in poorer cities

A section of Cairo city at sunset. A new study published in the journal Urban Sustainability indicates that urban areas are heating up at an average rate of 0.021 degrees Celsius per year. Copyright: Matt Wan (CC BY-NC-ND 2.0)

South China Morning Post

Indonesia | This Week in Asia / Health & Environment

Jakarta's floods worsen, displacing thousands as extreme weather, poor planning collide

Extreme weather and poor urban planning have exacerbated Jakarta's annual flooding, displacing residents and highlighting critical infrastructure failures

Reading Time: **3 minutes**

Resty Woro Yuniar
Published: 8:27pm, 11 Mar 2025 | Updated: 9:12pm, 11 Mar 2025

https://www.scmp.com/week-asia/health-environment/article/3301976/jakartas-annual-floods-worsen-displacing-thousands-extreme-weather-poor-planning-collide

Flooding due to inadequate infrastructure

Why is this important?

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What percentage of Earth's land do cities occupy?

What percentage of the world's population lives in cities?

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How much energy do cities consume?

By 2050, how many people are expected to live in slums?
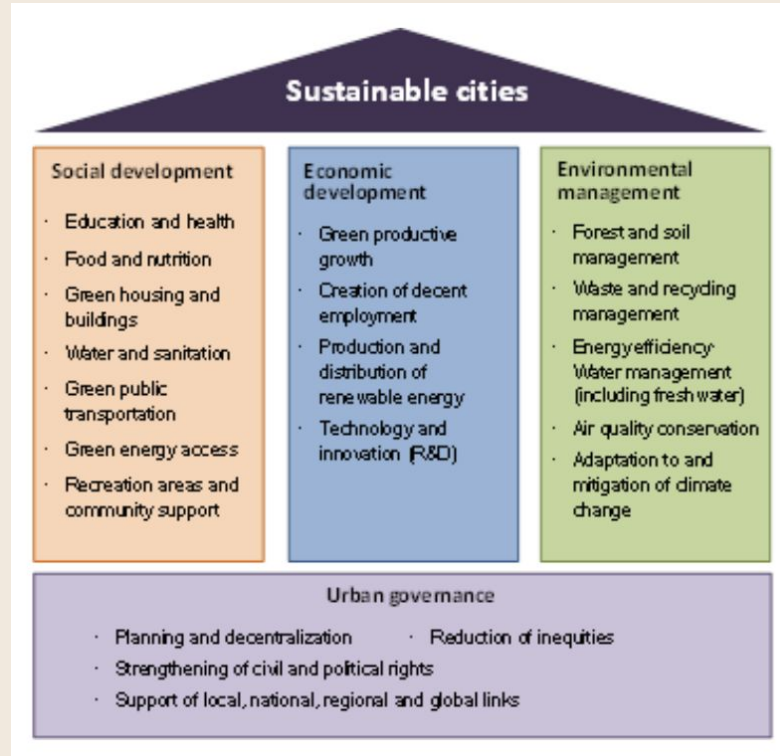
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What is a sustainable city?

What is an inclusive city?

- What could cause different experiences between different people?
- What ARE "different" people? Different from who?
- What might those different experiences look like?

Two more definitions

- **Smart city:**
  Uses data and digital technologies (IoT, sensors, AI) to improve urban services like traffic, energy, and public safety. Focus is on efficiency, connectivity, and innovation.

- **Cognitive city:**
  Goes further by incorporating machine learning and adaptive systems that learn from residents' behaviors and predict needs. Emphasis is on anticipating change and human-centric adaptation.

SDG 11:

Make cities and human settlements inclusive, safe, resilient and sustainable

11 SUSTAINABLE CITIES AND COMMUNITIES

TARGET 11·1 — SAFE AND AFFORDABLE HOUSING

By 2030, ensure access for all to adequate, safe and affordable housing and basic services and upgrade slums

TARGET 11·2 — AFFORDABLE AND SUSTAINABLE TRANSPORT SYSTEMS

By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons

TARGET 11·3 — INCLUSIVE AND SUSTAINABLE URBANIZATION

By 2030, enhance inclusive and sustainable urbanization and capacity for participatory, integrated and sustainable human settlement planning and management in all countries

TARGET 11·4 — PROTECT THE WORLD'S CULTURAL AND NATURAL HERITAGE

Strengthen efforts to protect and safeguard the world's cultural and natural heritage

TARGET 11·5

REDUCE THE ADVERSE EFFECTS OF NATURAL DISASTERS

By 2030, significantly reduce the number of deaths and the number of people affected and substantially decrease the direct economic losses relative to global gross domestic product caused by disasters, including water-related disasters, with a focus on protecting the poor and people in vulnerable situations

TARGET 11·6

REDUCE THE ENVIRONMENTAL IMPACT OF CITIES

By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management

TARGET 11·7

PROVIDE ACCESS TO SAFE AND INCLUSIVE GREEN AND PUBLIC SPACES

By 2030, enhance inclusive and sustainable urbanization and capacity for participatory, integrated and sustainable human settlement planning and management in all countries

TARGET 11·A

STRONG NATIONAL AND REGIONAL DEVELOPMENT PLANNING

Support positive economic, social and environmental links between urban, peri-urban and rural areas by strengthening national and regional development planning

IMPLEMENT POLICIES FOR INCLUSION, RESOURCE EFFICIENCY AND DISASTER RISK REDUCTION

By 2020, substantially increase the number of cities and human settlements adopting and implementing integrated policies and plans towards inclusion, resource efficiency, mitigation and adaptation to climate change, resilience to disasters, and develop and implement, in line with the Sendai Framework for Disaster Risk Reduction 2015-2030, holistic disaster risk management at all levels

Support least developed countries, including through financial and technical assistance, in building sustainable and resilient buildings utilizing local materials

SUPPORT LEAST DEVELOPED COUNTRIES IN SUSTAINABLE AND RESILIENT BUILDING

11 SUSTAINABLE CITIES AND COMMUNITIES

MAKE CITIES AND HUMAN SETTLEMENTS INCLUSIVE, SAFE, RESILIENT AND SUSTAINABLE

SLUMS ON THE RISE

1.1 BILLION URBAN RESIDENTS ARE LIVING IN SLUMS [2020]

2 BILLION MORE ARE EXPECTED IN THE NEXT 30 YEARS

GLOBALLY, ONLY **ONE IN TWO** URBAN RESIDENTS HAVE CONVENIENT ACCESS TO **PUBLIC TRANSPORT** [2022]

AIR POLLUTION IS NO LONGER AN EXCLUSIVELY URBAN PROBLEM

TOWNS EXPERIENCE **POORER AIR QUALITY** THAN CITIES IN EASTERN AND SOUTH-EASTERN ASIA [2019]

IN THE DEVELOPING WORLD **1 BILLION PEOPLE** LACK ACCESS TO **ALL-WEATHER ROADS** [2022]

GLOBALLY, **3 IN 4 CITIES**

HAVE **LESS THAN 20%** OF THEIR AREA DEDICATED TO **PUBLIC SPACES** AND **STREETS**

MUCH LOWER THAN THE TARGET OF 45-50% [2020]

https://unstats.un.org/sdgs/report/2023/

THE SUSTAINABLE DEVELOPMENT GOALS REPORT 2023: SPECIAL EDITION- UNSTATS.UN.ORG/SDGS/REPORT/2023/

ALSO

- SDG 8: Promote sustained, inclusive, and sustainable economic growth
- SGD 16: Promote peaceful and inclusive societies for sustainable development

8 DECENT WORK AND ECONOMIC GROWTH

16 PEACE, JUSTICE AND STRONG INSTITUTIONS

BREAK

Sustainable and Inclusive Cities: Inclusive Urban Design

June 2025
Instructor: Janice Levenhagen, Katja Legisa

Sessions

1: Introduction to Sustainable and Inclusive Cities

2: Inclusive Urban Design

3: Smart Cities

4: Environmental Sustainability and the Circular Economy in Urban Design

5: Resilient Cities and Final Project

Focus is on exploration, discussion, critical thinking, and problem solving. Participation is critical!

Agenda: Session 2 (Inclusive Urban Design)

5 min	Review of ideas from first session
15 min	Overview of inclusivity issues
10 min	*Discussion+case study:* Why is this important?
5 min	UN Women
10 min	Examples
15 min	Small group discussions
10 min	Report out

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What is the goal of inclusive cities, and why is this important?

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[Equiterra](#), a country of equality, as imagined by UN Women

Credit: UN Women/Ruby Taylor
https://un-women.medium.com/welcome-to-equiterra-where-gender-equality-is-real-6fc832c383fe

Who are affected differently by cities?

Gender　　Disability　　Race/Ethnicity　　Age

Socioeconomic Status　　Migrant Status/ Language　　Religion

Sexual Orientation/ Gender Identity

Some facts (the bad)

- Less than 10% of the Paris metro network is wheelchair accessible

- In Dhaka, Bangladesh, a city of over 23 million, less than 2% of roads have proper pedestrian infrastructure, disproportionately affecting children, the elderly, and people with disabilities.

- In LA, wealthier neighborhoods have up to 42% tree canopy coverage, compared to just 10–15% in low-income areas, worsening urban heat for already vulnerable populations.

- According to UN Women, 99.3% of women in Cairo report experiencing sexual harassment in public spaces, a major barrier to gender-inclusive mobility and participation in city life.

- About 70% of Lagos's 20+ million residents live in informal settlements or slums with limited access to water, sanitation, and transport, despite the city's massive economic growth.

- In São Paulo, low-income residents from peripheral areas often spend over 4 hours a day commuting, largely due to poor transit access and urban sprawl — reducing time for education, caregiving, and community life.

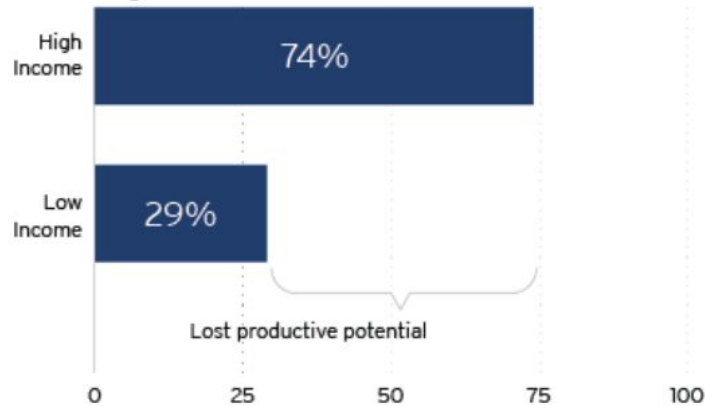WOMEN STEM UP

Some facts (the good)

- Paris plans to expand its bike lane network to over 1,000 km by 2026, prioritizing mobility for non-drivers and reducing transport inequality, particularly for women and young people.

- Over 3,000 cities globally (including New York, Paris, and Porto Alegre) now use participatory budgeting, allowing residents—especially marginalized groups—to directly influence how public funds are spent. In Surabaya, Indonesia, 50% of its annual municipal budget is allocated to local community projects

- Around 60% of Vienna's population lives in city-owned or subsidized housing, helping prevent gentrification and keeping neighborhoods mixed and accessible across income levels.

- The Metrocable system in Medellín reduced commute times for hillside residents by 40%, providing affordable access to jobs, education, and healthcare for low-income communities.

- In Barcelona, car traffic dropped by 25% in areas where superblocks were implemented, giving more space to pedestrians, kids, and disabled residents while reducing air and noise pollution.

- Kigali (Rwanda) implemented a citywide safety code for public transport, including complaint hotlines and driver accountability, contributing to a reported 35% drop in harassment cases on buses within the first year.

- To combat heat and flooding, Freetown launched a "Freetown the Treetown" initiative, planting 500,000 trees by 2023 with resident involvement, improving resilience and equity in informal settlements hit hardest by climate change.

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Case study: the cost of unequal economic opportunity

EDUCATION AND SKILL DEVELOPMENT

Figure 7. **Race and income disparities hinder education and skill development**

The share of 8th graders with top test scores that attain a bachelor's degree

High Income — 74%

Low Income — 29%

Lost productive potential

0   25   50   75   100

Case study: the cost of unequal economic opportunity

INNOVATION

Figure 9. **Inequality of opportunity impairs innovation potential**

Patent rates as adults among 3rd graders with mathematics test scores in top 10 percent, by parental income

High Income (top 20 percent): 7

Lower Income (bottom 80 percent): 3.3

Lost innovation potential

Case study: the cost of unequal economic opportunity

ENTREPRENEURSHIP

Figure 10. **Entrepreneurs rely on personal wealth and social networks to finance new businesses**

INC. 5,000 fastest growing firms, sources of funding

Source	Percent
Personal savings	67%
Bank loans	52%
Credit cards	34%
Family	21%
Business acquaintances	12%
Angel investors	8%
Close friends	8%
Venture capitalists	7%
Government grants	4%
Have not used finance	14%

Case study: the cost of unequal economic opportunity

SPATIAL ACCESS TO OPPORTUNITY

Figure 15. **Jobs are becoming less proximate to low-income neighborhoods**
Change in job proximity by neighborhood, 2000 to 2012

Suburbs
- -7% All neighborhoods
- -17% High-poverty neighborhoods

Cities
- -4% All neighborhoods
- -14% High-poverty neighborhoods
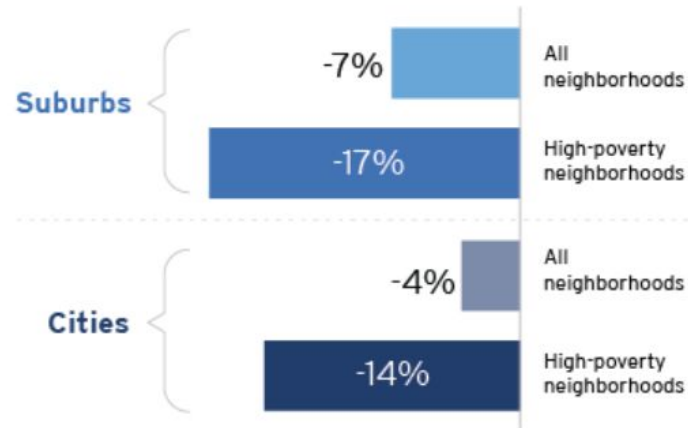
Case study: the cost of unequal economic opportunity (cont'd)

- Childhood poverty (an outcome of insufficiently inclusive growth) costs the US economy ~$500bil per year–4% of GDP, due to lost productivity, higher crime and incarceration, and larger health expenditures

- Hostilities that fray social and political cohesion and good governance (which affects economic growth)

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UN Women

Safe Cities and Safe Public Spaces

Global flagship initiative to prevent sexual harassment in public spaces. Partner cities include Cairo, Quito, Port Moresby, Delhi, and Kigali.

Focus on:

- Ending violence against women

- Economic empowerment

- Leadership and governance

- Gender mainstreaming and institutional development

Example: Women's safety audits

- Women and community members walk through neighborhoods to identify unsafe areas (poor lighting, lack of transport, overgrown areas, etc.)

- Originated in Toronto in the 1980's (METRAC–group of women who came together to fight against sexual assault and murder of women)

- Start close to dusk to see area during day and night

- Shows how participation of the groups affected is critical

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Case Study: Women's safety audits

Delhi, 2013

- 95% of women and girls in Delhi said they felt unsafe in public spaces

- 51% of men reported that they had themselves perpetrated sexual harassment or violence against women and girls in public spaces in Delhi. In the study, 25 per cent said they had done so in the last six months.

- In cases of sexual violence, many men blamed women for their behaviour. In the study, three out of four agreed with the statement 'Women provoke men by the way they dress' and two men out of five fully or partially agreed that 'Women moving around at night deserve to be sexually harassed'.

- Nearly 73 per cent of women said they do not feel safe in their own surroundings as well, and reported feeling unsafe all the time.

https://www.unwomen.org/en/news/stories/2013/2/un-women-supported-survey-in-delhi

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Case Study: Women's safety audits

Findings

- Insensitive attitudes of the police and public transport staff including drivers and conductors

- Gaps in provision and effectiveness of essential services (access to telephone booths, police and 24-hour hospitals)

- Poor lighting near bus stops (and in general a need for more street lighting infrastructure)

- Lack of well-maintained public toilets

- Absence of pavement

- "Never before was violence against women considered an urban planning problem. But now more urban planners and policymakers are reviewing urban design – thanks to our programme," says Sushma Kapoor, Officer-in-Charge, UN Women.

- "The programme has really helped to make women an equal partner in ensuring their safety. Women are now able to speak of their experiences directly to the police, and tell us what is needed to be done," says Suman Nalwa, Additional District Commissioner of Police, Special Police Unit for Women and Children.

- source

Technology: Safetipin

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Technology: Safetipin

- NGO created an app for crowdsourcing information on unsafe areas in towns, sharing that data with the public and governments so they can be addressed
- Launched in Delhi in 2013 but now in 16 countries and 78 cities, almost 600,000 audits
- Data used as inputs to where lighting could be improved, and the Delhi Police used it to reformulate their patrolling routes
- Digital Divide (poverty, gender)--
  - Worked with NGOs to hear the voices of marginalized people
  - Supported women working in groups so those without smartphones could participate (with others who did have them)   Study
  - Provided posters with the information in different areas so residents could see and provide thoughts/feedback in person.

Delhi 2016
7438
Dark Spots

Delhi 2018
2780
Dark Spots

Co-funded by
the European Union

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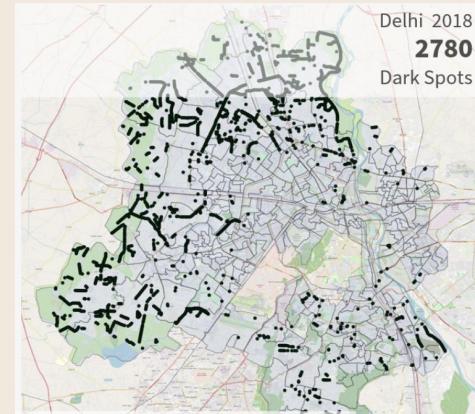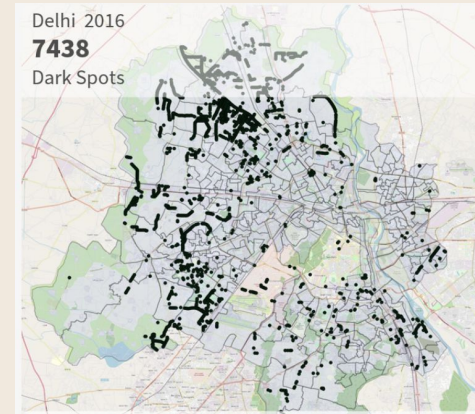
Choose a city from the list for small-group breakouts

You'll be working in these groups for the rest of the sessions!

- Singapore

- Copenhagen

- New York City

- Amman

- Nairobi

- Bogotá

Steps

- Step 1: Inclusivity issues and potential fixes

- Step 2: Using technology focused on urban design to address one of the issues

- Step 3: Examining the environmental sustainability of the various options to solve the issues, with a final proposal with pros and cons

What are the three biggest inclusivity issues in the city you chose?

Choose one and discuss how that could be fixed (focus on urban design).

https://bit.ly/sustainable-cities-folder

Report out

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Next week:

- Smart cities

- Sustainability and the circular economy

Sessions

1: Introduction to Sustainable and Inclusive Cities

2: Inclusive Urban Design

3: Smart Cities

4: Environmental Sustainability and the Circular Economy in Urban Design

5: Resilient Cities

Focus is on exploration, discussion, critical thinking, and problem solving. Participation is critical!

Agenda: Session 3 (Smart cities)

5 min	Ice breaker
5 min	*Refresher:* What's a smart city?
5 min	*Video:* Overview of smart cities
5 min	*Discussion:* What examples have you seen in your daily lives?
10 min	*Overview:* The tech
10 min	*Discussion:* What issues are there?
5 min	Inclusivity issues
5 min	Different parts of the city that use tech
15 min	Small group discussions
10 min	Report out
5 min	BREAK

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Ice breaker

- Name

- School

- Major and year

- What's your favorite tech product and why?

Review: What's a smart city?

DW

Smart
Cities

SHIFT

What examples have you seen in your daily lives or travels?

SMART CITY

Photo credit:
https://www.datasciencecentral.com/smart-cities-of-the-future-powered-by-iot/
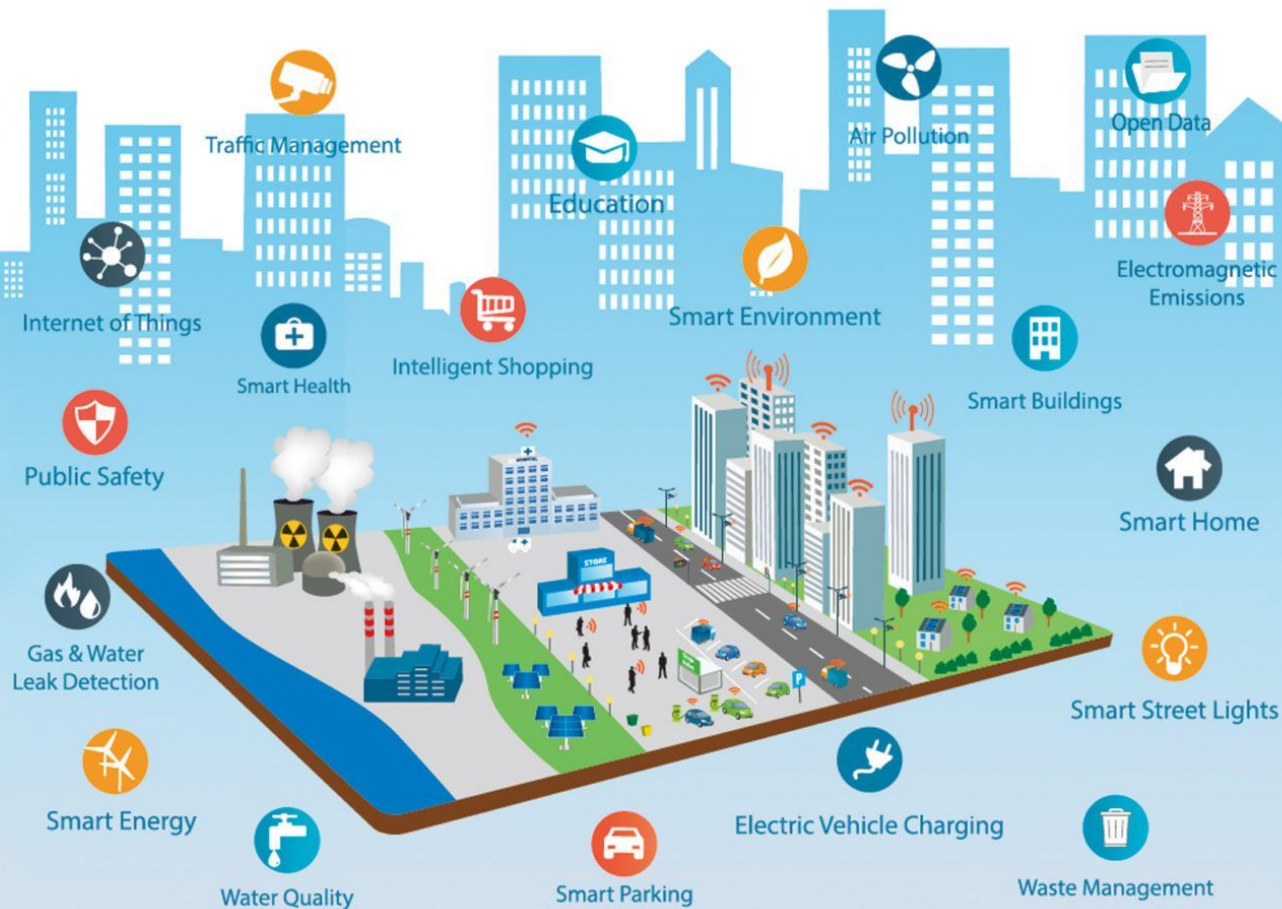
The tech

IoT		network of devices that connect to each other and the cloud
5g		the network that allows a lot more people/devices to send much more data with much higher speed and lower latency (allowing for near real-time)
Big data		all of the data created by sensors, people, weather satellites, etc. Includes structured, semi-structured, not structured
Blockchain		secure, private, and transparent way to transmit data
AI		the ability to "think" about all of this information in a way that allows for predictive analysis
Edge computing		the computing is done in the local area/device so that the data doesn't need to be sent to a central "cloud" for processing

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Example: Traffic Optimization System
To reduce congestion, cut emissions, and improve emergency response times

IoT (Internet of Things)
→ Smart traffic lights, cameras, pollution monitors, and connected vehicles continuously gather real-time data (vehicle counts, speed, weather, air quality, road conditions).

5G
→ Enables real-time data exchange between IoT devices, vehicles, and traffic control centers. Emergency vehicles can instantly communicate with traffic lights to prioritize green signals.

Big Data
→ The system collects and processes data from thousands of sensors and external sources (e.g. weather forecasts, public transport GPS feeds) to understand patterns and predict traffic flows.

AI (Artificial Intelligence)
→ AI models analyze incoming data to adjust traffic lights dynamically, reroute traffic during accidents or construction, and predict congestion before it happens.

Blockchain
→ All data interactions (like vehicle location updates, traffic light changes, or ride-sharing transactions) are stored securely and transparently. Blockchain also helps in managing microtransactions—for example, rewarding citizens with crypto-tokens for using less congested routes or public transport.

Edge Computing
→ Reduces latency and bandwidth usage by processing critical data (like traffic camera feeds) locally rather than sending everything to a central cloud.

WOMEN STEM UP
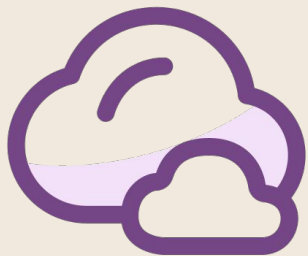
What issues are there with this kind of technology?

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People/Inclusivity

- Technocentrism over human-centered design

- Digital divide

- Surveillance and privacy (& social engineering)

- Algorithmic bias

- Public participation gaps

- Gentrification and displacement

- Labor and human rights issues in tech supply chains

Environment

- Greenhouse gas emissions

- E-waste and resource extraction

- Energy consumption of smart infrastructure

- Greenwashing and token sustainability

- Climate resilience gaps

- Water use and pollution from tech infrastructure

- Greenhouse gas emissions from tech operations and supply chains

Technology

- Bugs and inaccuracy of algorithms

- Data accuracy (and "overfitting")

- Security vulnerabilities

- Interoperability challenges

- Over-reliance on technology

- Cost and vendor lock-in

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Case studies

Potholes and smartphones (Boston)

- Smartphone app to discover potholes on public roads through automated recognition by the phone's accelerometer

- However, lower income (and particularly older) residents, had fewer smartphones (16%)

- Therefore, lower income areas that may have more potholes would get fewer resources to fix them.

https://www.sciencedirect.com/science/article/pii/S2515856220300067

Predictive policing (UK)

- Smart Information System (SIS): AI+Big Data

- 2023: 24.5 stops and searches for every 1,000 Black people, 5.9 for every 1,000 white people

- This biased data is then fed into the algorithms, which is in turn fed back to police

https://www.researchgate.net/publication/304746305_Privacy_concerns_in_smart_cities
https://www.amnesty.org.uk/press-releases/uk-police-forces-supercharging-racism-crime-predicting-tech-new-report

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"Racism has always been about predicting, about making certain racial groups seem as if they are predisposed to do bad things and therefore justify controlling them."

Dorothy Roberts, writer and academic, University of Pennsylvania

Video: "Policing without the police: race, technology and the new Jim Code"

AGAIN: must be people-centric and participatory!

Image from: Bellini, Pierfrancesco & Nesi, Paolo & Pantaleo, Gianni. (2022). IoT-Enabled Smart Cities: A Review of Concepts, Frameworks and Key Technologies. Applied Sciences. 12. 1607. 10.3390/app12031607.
License: CC BY 4.0

https://bit.ly/sustainable-cities-folder

Group work:

How could you use technology to (partially) fix the inclusivity issue(s) you chose? Be specific!

What are the drawbacks? Is anyone left out?

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Report out

BREAK

Sustainable and Inclusive Cities:
Environmental Sustainability and the Circular Economy in Urban Design

June 2025
Instructor: Janice Levenhagen

Sessions

1: Introduction to Sustainable and Inclusive Cities

2: Inclusive Urban Design

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Agenda: Session 4 (Environmental sustainability and circular economy)

15 min	Introduction
5 min	*Video:* What is a circular economy/circular city?
10 min	Circular city case studies
10 min	*Quiz:* Critical thinking around environmental sustainability
10 min	Green cities + green spaces = healthier people
15 min	Small group discussions
5 min	Report out

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Review:What's a green city?

An environmentally sustainable city (eco-city/green city), is an urban area designed and managed to meet the needs of its present inhabitants **without compromising the ability of future generations to meet their own needs** — with a specific emphasis on minimizing its environmental footprint.

Environmental sustainability in cities means ensuring that urban development:

- Reduces emissions and pollution (air, water, noise, and soil),
- Protects and regenerates ecosystems and biodiversity,
- Manages natural resources responsibly, especially energy, water, and land,
- Adapts to climate risks like floods, heatwaves, and droughts.

Cities are both the problem and the solution…most of the issues come from cities, but they are also where most of the innovation is coming from as well!

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CREATING
SUSTAINABLE
CITIES

Core environmental priorities for cities

- **Urban Decarbonization**: Transitioning to renewable energy, improving building efficiency, and reducing transport-related emissions.
- **Circular Urban Systems**: Designing out waste, reusing materials, and recovering resources (especially in construction and food).
- **Green Infrastructure**: Integrating natural systems into city planning (green roofs, urban forests, rain gardens).
- **Low-impact Urban Design**: Compact, mixed-use planning that reduces car dependency and preserves surrounding natural areas.
- **Climate Adaptation and Resilience**: Building infrastructure and governance systems that can anticipate and respond to climate shocks.

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Key challenges

- **Urban sprawl** and land-use pressure on ecosystems
- **Overburdened infrastructure** that increases emissions and waste
- **Inequitable environmental burdens** (e.g. pollution in marginalized neighborhoods)
- **Short-term political cycles** vs long-term sustainability investments

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Example: Curitiba, Brazil

- Green space:
  - 52 square meters of green space per person
  - Vs Buenos Aires: 2 square meters per person
- Public transport:
  - Bus Rapid Transport (BRT). 1974. Basis for BRT systems in 300+ cities
  - 70-80% of daily trips for 85% of the population
  - Sometimes every 90 seconds!
  - 2 million per day (compared to London tube system with 3 million)
- Waste:
  - Waste-for-cash program
  - 90% of people take part
  - 4lbs of waste for tokens that can be traded for 1lb of produce.
  - 70% of the waste is recycled.
- Poverty reduction:
  - 30-year economic growth rate is 3.1 percent higher than the national average
  - Per-capita income is 66 percent higher.
  - Over the last 60 years, the population increased by 1,000% to 2 million people

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END OF LIFE

RAW MATERIALS

CIRCULAR ECONOMY

USE

MANUFACTURING
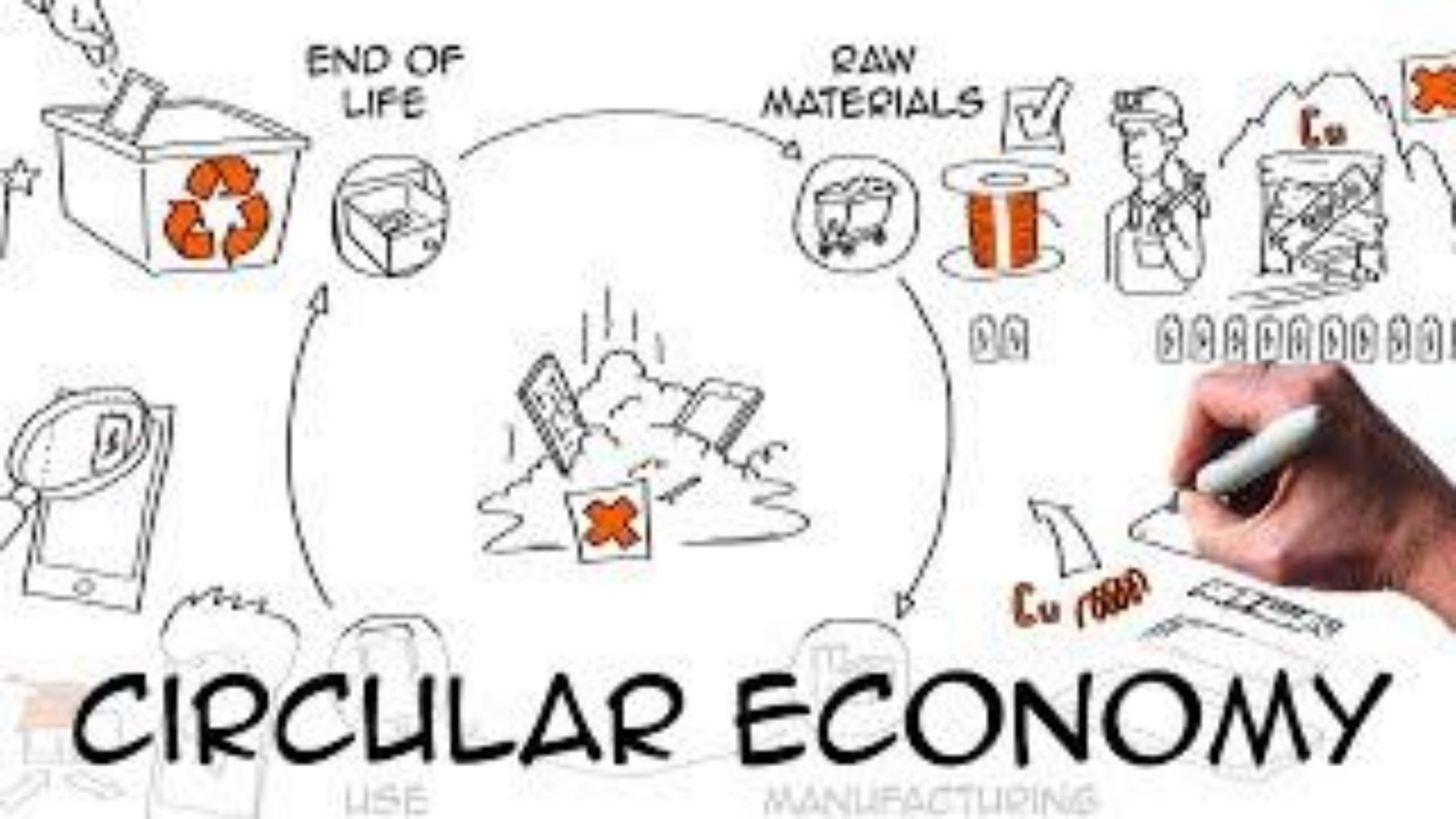
Circular cities: Case studies

Beijing Chaoyang Circular Economy Industrial Park

Clustering industries to reuse each other's byproducts

Electric Vehicle Charging and Battery Swap Station:

Serves sanitation vehicles, electric cars and Dongdong buses. Serves up to 400 vehicles daily.

Restaurant Kitchen Waste Treatment Plant:

Note: food waste is a huge issue in China (70% of waste is food waste, as compared to around 24% in US/Europe)

Largest kitchen waste treatment plant in China. Can process 400 tons of kitchen waste per day. A biochemical treatment technology with high-temperature aerobic fermentation allows to produce 'microbial inoculant' for organic agriculture.

Medical Waste Treatment Plant:

Daily treatment capacity of 30 tons.

Waste Incineration Power Plant:

First modern large-scale domestic waste incineration project in Beijing, and also the largest single-line treatment plant in Asia.

Designed daily capacity is 1,600 tons. Annual rated power generation is of 220,000 MWh (about 73,000 houses in Beijing)

Sanitary Landfill:

First large-scale fully-enclosed domestic waste landfill in Beijing.

Total storage capacity of 8.92 million cubic meters and a daily waste disposal capacity of 1,000 tons.

Beijing Chaoyang Circular Economy Industrial Park
北京朝阳循环经济产业园
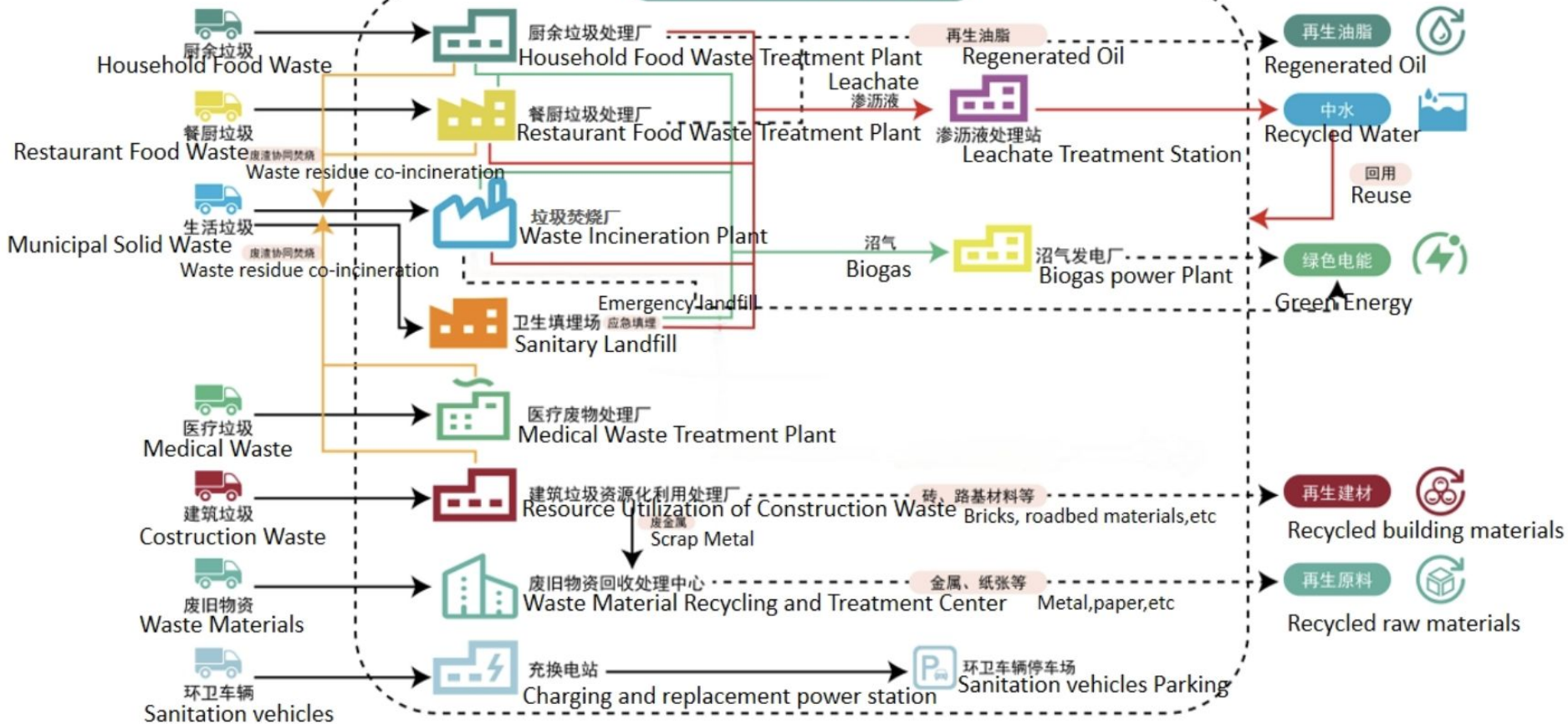
Benefits

Producing capacity of green power of 600 million kWh/year

Crude grease of 5,000 tons/year

Renewable resources and renewable products of more than 4,000 tons/day, reducing CO_2 emissions by nearly 1.6 million tons per year

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Circular cities: Case studies

Cape Town, South Africa

WISP: Western Cape Industrial Symbiosis Programme

Connects businesses with each other to exchange resources!

231 synergies facilitated to date

- Diverted over 143,000 tons of waste from landfill and created over 400 jobs.
- Saved over 435,000 tons CO_2 emissions (equivalent to 117,840 homes in South Africa)
- Generated $8mil in additional revenue, cost savings, and private investments

Some examples

Waste wood -> wooden pallets

- Waste management company, wooden pallet company
- Diverted 79 tons of wood waste from landfill, saves the companies money, and keeps virgin wood from being used

Waste egg whites -> confections (sweets)

- Ice cream manufacturer, confectionary company
- Saved on waste disposal costs for the first and made add'l revenue for the second

Organic waste -> insect feed

- Waste management company, insect farming company
- 3,360 tons of organic waste is being sold to feed insects instead of going to a landfill

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Which of the following urban policies align with circular economy goals...while also minimizing unintended environmental harm?

Why?

B. Local material reuse hubs support the circular economy by facilitating the reuse of construction materials, reducing the demand for virgin resources.

D. Take-back programs for electronics encourage recycling and proper disposal, aligning with circular economy principles.

A. While promoting electric vehicles can reduce emissions, it doesn't directly address material reuse or waste reduction.

C. Waste-to-energy incineration can reduce landfill use but may discourage recycling and doesn't promote material reuse.

TechUK

According to recent data, which sector is most frequently underestimated in urban sustainability plans despite having a high impact on emissions and resource consumption?

slido

Why?

The construction sector, including building operations, significantly contributes to urban emissions and resource consumption. However, its impact is often underestimated in sustainability planning.

[ScienceDirect](#)

A city introduces green roofs across all municipal buildings. Which of the following should be considered to assess whether this contributes meaningfully to long-term environmental sustainability?

Why?

Evaluating the sustainability of green roofs involves considering maintenance capabilities, the environmental impact of construction materials, and ecological benefits like biodiversity enhancement and stormwater management.

[US EPA](#)

[ScienceDirect](#)

A city council is debating between two proposals: (1) subsidize compost bins for every household, or (2) invest in a large-scale anaerobic digestion facility. Both address organic waste. What trade-off most accurately describes their difference in long-term sustainability strategy?

ⓘ Presenting with animations, GIFs or speaker notes? Enable our Chrome extension

slido

Why?

Household composting encourages individual behavior change and community engagement, while anaerobic digestion offers a scalable solution for organic waste management but may involve less direct public participation.

ScienceDirect

Which of these challenges often arises when applying circular economy frameworks in cities in the Global South?

Why?

In many Global South cities, the informal sector plays a crucial role in waste management. However, circular economy initiatives often overlook integrating these informal systems, leading to challenges in implementation.

circle-economy.com

Green spaces = healthier people

How do they help?

- Cooler temperatures
- More (and hopefully safer) exercise
- Nature decreases stress and depression
- Place for children to play
- Decreased air pollution
  - Fewer cars
  - Plants produce oxygen and filter out air pollutants for better air quality
- Less isolation and more social inclusivity
- Less noise pollution
- Opportunities for urban gardens

**Participatory planning is important!

3 GOOD HEALTH AND WELL-BEING

TARGET 11·7

PROVIDE ACCESS TO SAFE AND INCLUSIVE GREEN AND PUBLIC SPACES

Co-funded by the European Union

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Who benefits more from these?

Studies have shown…

Housewives–and women in general
- Shown to have less stress
- However, may worry more about safety if not designed well–BUT better than exercising on streets, where harassment is more often.
- Pregnant women (reduced blood pressure, reduced depressed, especially for women from disadvantaged groups)

Older people at risk of isolation and less exercise–social ties and community.

Children, who otherwise may not have the option to socialize in a safe space–and with different cultures.

Adolescents
Important to think about the use of space: if all the "play" space is focused on sports that are more traditionally focused on boys (basketball, football), then girls won't feel like it's a space for them.

"Deprived subpopulations and minority groups"
Reduced psychological distress in a deprived urban population in the US
Socioeconomic inequality in mental-wellbeing was 40% narrower among respondents reporting good access to green space
Often have lack of access to cooling systems, so the role of vegetation on cooling urban areas is more important for the urban poor

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https://bit.ly/sustainable-cities-folder

Group work:

What is your city doing particularly well around sustainability/circular systems/green space?

What is something they should do better? What would have the most impact, particularly for more vulnerable groups?

Report out

Next week:

- Resilience in urban design

Thank you and see you soon!

Sessions

1: Introduction to Sustainable and Inclusive Cities

2: Inclusive Urban Design

3: Smart Cities

4: Environmental Sustainability and the Circular Economy in Urban Design

5: Resilient Cities

Focus is on exploration, discussion, critical thinking, and problem solving. Participation is critical!

Agenda: Session 5 (Resilience + Final Project)

5 min	Ice breaker
15 min	*Discussion:* What is a resilient city?
5 min	The effects of climate change on cities
10 min	Case studies
15 min	Guest speaker
5 min	STEM careers in sustainable and inclusive cities
20 min	Small group discussions
10 min	Report out
5 min	Post-survey

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Ice breaker

- Name

- School

- Major and year

- What would be your dream job and why?

What's a resilient city?

Ability to bounce back from and adapt to various shocks and stresses, such as natural disasters, economic downturns, and social challenges (https://www.e-zigurat.com/en/blog/urban-resilience-sustainable-cities/)

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The effects of climate change on cities

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Cities: Key impacts

URBAN HEAT ISLAND PROFILE
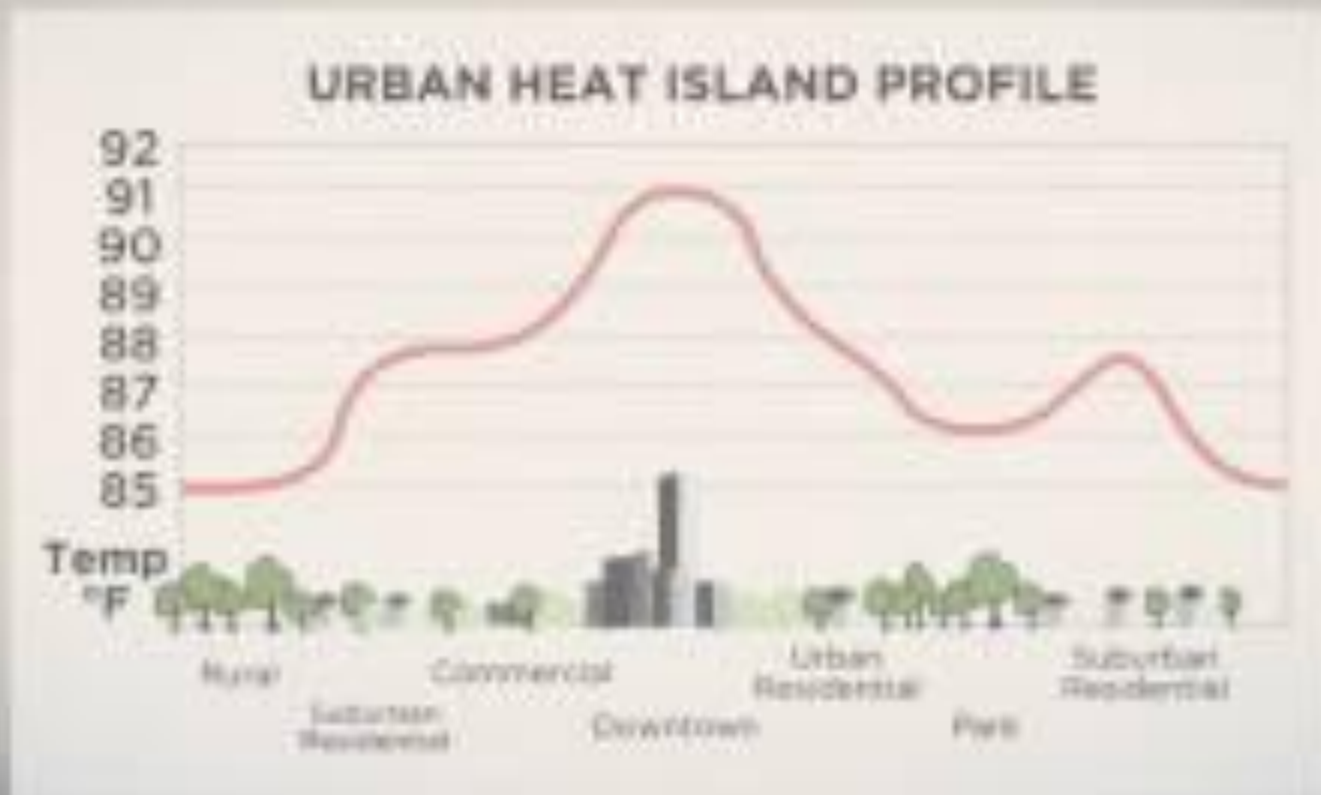
Pathways to resilient cities

1. **Integrate Mitigation and Adaptation:** actions that reduce greenhouse gas emissions while increasing resilience are a win-win.

2. **Coordinate Disaster Risk Reduction and Climate Change Adaptation:** Disaster risk reduction and climate change adaptation are the cornerstones of resilient cities.

3. **Co-generate Risk Information:** Risk assessments and climate action plans co-generated with a full range of stakeholders and scientists are most effective.

4. **Focus on Disadvantaged Populations:** Needs of disadvantaged and vulnerable citizens should be addressed in climate change planning and action.

5. **Advance Governance, Finance, and Knowledge Networks:** Developing robust city institutions, advancing city creditworthiness, and participating in city research and action networks enable climate action.

From: https://www.uccrn.education/what-is-the-meaning-of-resilient-city/

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Development Funds

Network Infrastructure for Energy Grid

Tree Plantation

Insurance Schemes

Temporary Relocation

Resettlement

Insurance Mechanisms

Retrofitting

Risk Mapping

DRR Land Regulation Planning

Community

City

Modifications on Physical Environment

Disaster Risk Management

Land Tenure

Building Repair

Household

Mutual Help Associations

Security Assets

Retrofitting Housing Designs

Diversifying Incomes

Energy Efficiency

Legalization of Property

Informal and Formal Credits

● Coping Strategies
● Adaptation Strategies
● Mitigation Strategies

Earthquake readiness in Wellington, New Zealand

Problems addressed:

On top of a fault line (earthquakes, tidal flooding, storm surge)

Effects of those on buildings, electricity, and drinkable water

- Empowered residents through a participatory planning and budgeting process (not just focused on climate resilience!)

- Retrofitted 113 buildings and upgrading another 600

- Surcharge to pay for upgrading their power network to withstand disasters

- Constructed 22 river-fed emergency drinking water locations (if an earthquake ruptures underground pipes–will provide more than 200,000 people with a secure water supply and ensure that residents will not have to walk more than 1 kilometer to get access to drinking water.

https://resilientcitiesnetwork.org/downloadable_resources/UR/100-Resilient-Cities-Midterm-Evaluation-Report-Case-Studies.pdf

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Green bus stops in Poland

Problems addressed:

Urban heat island effect

Excess of rainwater runoff

Livability (green space!)

https://stateofgreen.com/en
/news/12-examples-of-climat
e-resilient-city-solutions/

Other case studies

Bangkok, Thailand

Key resilience themes

- Flood management
- Informal settlements
- Green infrastructure

Resilience strategies

- Bangkok Resilience Strategy focuses on aging infrastructure, floods, and social fragmentation
- Urban Flood Resilience Project combines green infrastructure and drainage upgrades
- Community Resilience Networks enable grassroots capacity-building and early warning systems

Impact: Blends infrastructure with social systems to address chronic shocks and stresses

Medellín, Colombia

Key resilience themes

- Social inclusion
- Mobility
- Climate adaptation

Resilience strategies

- Metrocable public transit system connects marginalized hillside neighborhoods to the city center
- Green Corridors program adds green space and reduces the urban heat island effect
- Participatory urban planning involves residents in decisions on land use and infrastructure

Impact: Transformed from a violent city into a model of urban innovation and resilience

STEM careers in sustainable and inclusive cities

Document

Guest speaker

[name]

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https://bit.ly/sustainable-cities-folder

Group work:

Using your previous solution(s) and what you know now, pull it all together in an environmentally sustainable (and resilient) way to create a proposal that you feel hits all the main points.

- What is your final solution?
- What are the pros and cons of your solution?
  - What positive/negative effects does it have on the environment?
  - Is it resilient?
  - Who might be left behind?
  - How can you keep them from being left behind?

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Report out

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https://bit.ly/designing-sustainable-cities-wsu-survey

Survey

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Thank you!

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Session 1 — Introduction to sustainable and inclusive cities

	Time	Duration	Activity	Slides	Sustainable and I
10	8:30-8:40	10 min	Introduce instructor and course	1-5	slide on instructor, slide on agenda, slide on WSU for good
15	8:40-8:45	5 min	Have students introduce themselves (in small groups or in large group, depending on number, with ice breaker question)	6	slide with instructions and ice breaker question
25	8:45-8:55	10 min	What issues do cities currently have? (Word cloud, slides with news articles)	7-10	slide with question. slide with answer
30	8:55-9:00	5 min	Why is this important? 5 quiz questions (including number of people who are expected to be living in slums by 2055: 2.1 billion)	11-15	slide with question QR code to join quiz. then quiz screen. slide with: important for people, economy, etc
37	9:00-9:07	7 min	What is a sustainable city? (discussion, then 5 min video)	16-18	Creating Sustain potential other intro video ~5 min
44	9:07-9:14	7 min	An inclusive city...what could cause different experiences between different people? (what are "different" people? why are they different? different from who??) What might those different experiences look like?	19	
49	9:14-9:19	5 min	Two other terms: smart city, cognitive city (adaptive but predicting/changing preemptively). Biggest point: cities should be for people. cognitive cities serve people better.	20	
57	9:19-9:27	8 min	Goal 11	21-25	
67	9:27-9:37	10 min	video about China. what principle resonated the most?	24	
72		5 min	BREAK	25	

Session 2 — Inclusive urban design

	Time	Duration	Activity	Slides	Sustainable and I
	9:45-9:46	1 min	Agenda	1-3	
5	9:46-9:51	5 min	Quick reminder of what came up earlier for inclusive cities. Quality of life for everyone. [removed]	4	who are cities made for? (nonmarginalized, able-bodied) man who is traveling to and from work, with a car
20	9:51-10:06	15 min	Goal of inclusive cities. Video. Intersectionality. Facts	5-10	https://www.unwomen.org/sites/default/files/Headquarters/Attachments/Sections/Library/Publications/2020/Welcome-to-Equiterra-where-gender-equality-is-real-Brochure-en.pdf
35	10:06-10:16	10 min	Why is this important? (Discussion) Case study on the US: unequal economic opportunity	11-14	
40	10:16-10:21	5 min	UN Women: 4 parts (ending violence against women, economic empowerment, leadership and governance, gender mainstreaming and institutional development)	16	participation is critical people, environment, economy oriented
50	10:21-10:31	10 min	Example: "women's safety audits"	17-20	
			Example: ??		
52	10:31-10:33	2 min	Choose a city from list		Singapore, Copenhagen, Amsterdam, Oslo, NYC,
67	10:33-10:48	15 min	Small group discussion--what are the 3 biggest inclusivity issues in the city you chose? choose one and choose an idea that could be implemented to fix this		Create ppts for each city for them to edit?
77	10:48-10:58	10 min	Report out		
	10:58-11:00	2 min	Feedback? Survey. See you next week!		
			Give access to slides with various resources		

Session 3 — Smart (and cognitive) cities--the tech

	Time	Duration	Activity	Slides	Sustainable and I
5	8:30-8:35	5 min	Agenda + Meet 2 new people! (with ice breaker question)		Smart (tech)--is it focused on improving the quality of life? for everyone? is it sustainable? is it safe? is it affordable?
10	8:35-8:40	5 min	Remind them what came up before. Note differences and overlaps: 'smart' = tech, 'resilient' = disaster preparedness, 'green' = environmental sustainability.		How comfortable is everyone with tech?
	8:40-8:46	6 min	Video overview of smart cities		
15	8:46-8:52	6 min	Have you seen any of these in your daily lives or travels?		balance of sustainability vs tech (water, energy, electronic waste, greenhouse gas emissions)
25	8:52-8:58	6 min	Underlying tech review with examples--do you know any of these?		
	8:58-9:08	10 min	What issues have you heard of or do you foresee? Then review of different examples of issues		lots of good...but also need to understand the tradeoffs
30	9:08-9:14	6 min	Issues around inclusivity: potholes, policing		
			Needs to not be tech for the sake of tech (or efficiency). Needs to still place people at the center		
40	9:14-9:19	5 min	Different parts of the city that can use tech. (transportation, building, energy, etc)		
55	9:19-9:34	15 min	How could you use technology to fix the inclusivity issues you chose? Choose one specific example (it doesn't have to solve the entire issue). What are the drawbacks? Is anyone left out? (intersectionality)		
70	9:34-9:40	6 min	Report out		
	9:40-9:45	5 min	BREAK		

Session 4 — Sustainability and the circular economy in urban design

Sustainable and I — https://www.youtube.com/watch?v=WYo4oqMrl_k&ab_channel=MegaBuilds

	Time	Duration	Activity	Slides	Notes
	9:45-9:55	10 min	Introduction. Discussion: what's a green city? Video	1-9	https://www.youtube.com/watch?v=o3ByrTTtx9M
	9:55-10:00	5 min	Example: Curitiba, Brazil	9-11	
	10:00-10:05	5 min	What is a circular economy/circular city? 5.5 min video	12	Circular Econom
	10:05-10:15	10 min	Examples of circular city. Most important parts. Mimic nature?	13-17	Amsterdam, Glas Circular City - Yo
	10:15-10:25	10 min	Quiz: Critical thinking around environmental sustainability	18-27	Findhorn, Scotland https://www.youtube.com/watch?v=ZMn-bCdThEg&ab_channel=CrashCourse
	10:25-10:35	10 min	Green spaces = healthier people. Who might benefit more? (discussion)	28	Vishaan Chakrab
	10:35-10:50	15 min	Small group discussions		
	10:50-10:55	5 min	Report out		
	10:55-11:00	5 min	Feedback and survey		

Session 5 — Resilience in urban design

Sustainable and I

	Time	Duration	Activity	Slides	Notes
5	8:30-8:35	5 min	Ice breaker		
10	8:35-8:40	5 min	What is a resilient city?		
	8:40-8:50	10 min	How do we make cities more resilient?		
	8:50-9:00	10 min	Climate change--how it is affecting cities? Video and examples		7.4 Climate Chan
45	9:00-9:15	15 min	Guest speaker		
	9:15-9:20	5 min	Jobs in this field (how it connects to STEM)		
65	9:20-9:40	20 min	Final project		
75	9:40-9:50	10 min	Report out		
75	9:50-9:55	5 min	Post-survey		
			Who is impacted more? Why?		