

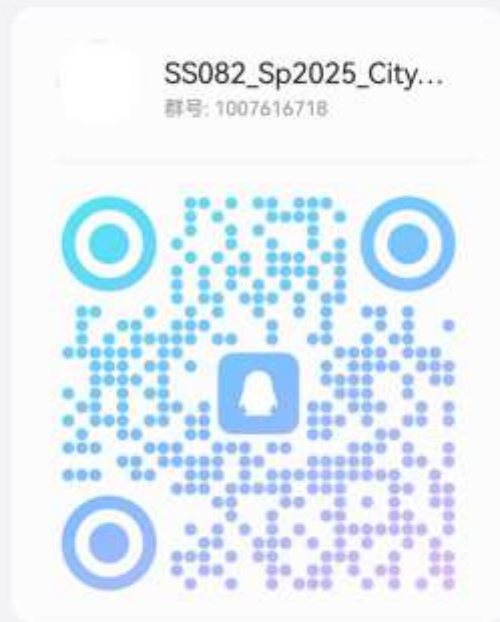


SUSTech, Spring 2025

THE CITY AND TECHNOLOGY

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Center for Social Sciences





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Humanities and Social
Sciences

Email:

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Office hours: 7:30 – 9:30 pm,
Wednesdays, or, by
appointment

CONTENT OF TODAY'S CLASS

1. Review of last class
2. Urban utilities: Definition
3. Essential utilities in modern cities: Water and sewage
4. Essential utilities in modern cities: Electricity and electric light



1.

REVIEW OF LAST CLASS

What did we do last week?



Contents

1. COURSE RATIOANLITY



**A thought
experiment**

2. COURSE INTRODUCTION

Course objectives

Course approaches and learning materials

Assessment

Class involvement

Communication

Course space on Blackboard

Academic integrity

Course structure

3. SOME USEFUL TOOLS

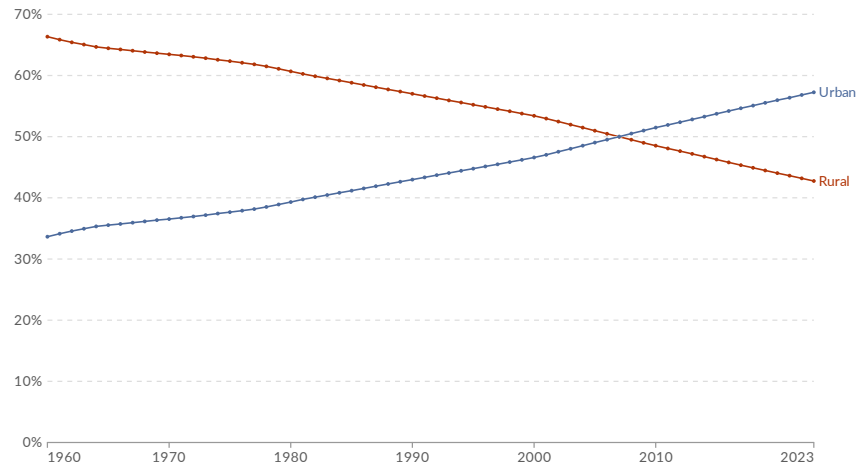
How to search and cite resources?

How to use AI tools?

1. Course rationale

Share of people living in urban and rural areas, World

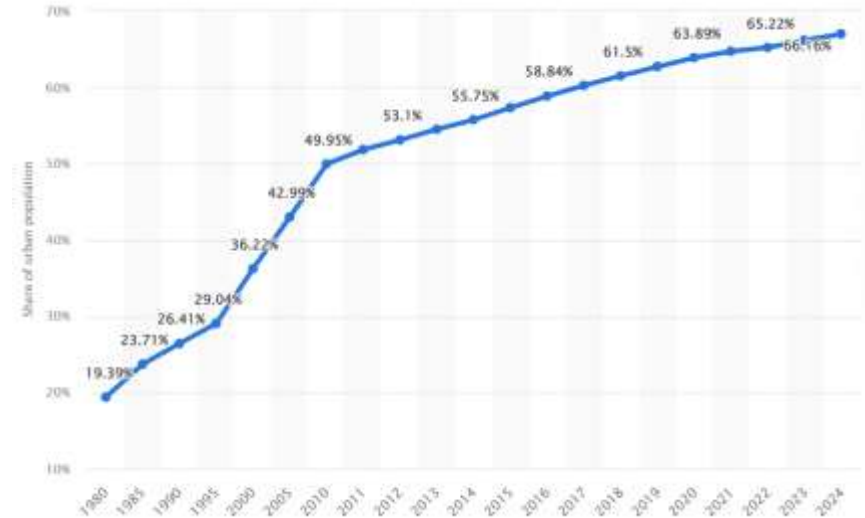
Our World
in Data

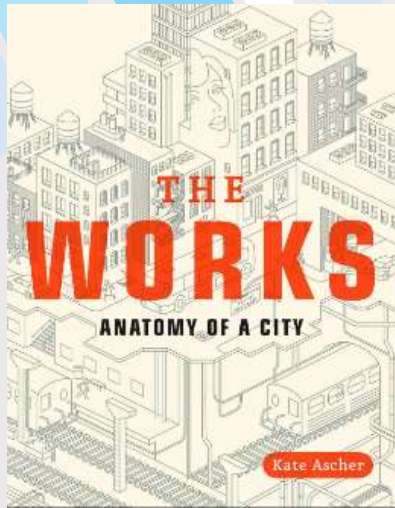


Data source: UN Population Division (via World Bank) (2025); World Bank based on data from the UN Population Division (2025)

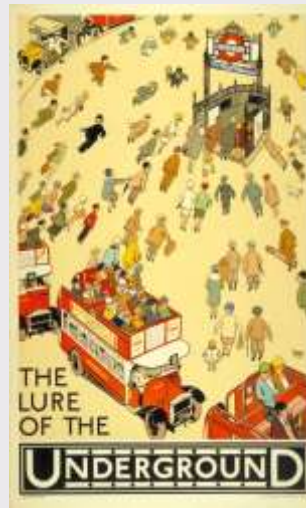
Note: Because the estimates of city and metropolitan areas are based on national definitions of what constitutes a city or metropolitan area, cross-country comparisons should be made with caution.

OurWorldinData.org/urbanization | CC BY





Louis Wirth (1938)
**Urbanism as
a way of life**



THE
SKY-
SCRAPER
TALL
IS A
WONDER
TO ALL
A THING
TO ADMIRE
BEYOND
QUESTION

But oh! down below where pedestrians go
it certainly adds to congestion



2. Course structure

- » Course objectives
- » Course approaches and learning materials
- » Assessment
- » Class involvement
- » Communication
- » Course space on Blackboard
- » Academic integrity
- » Course structure

COURSE ASSESSMENT

IN-CLASS EXERCISES

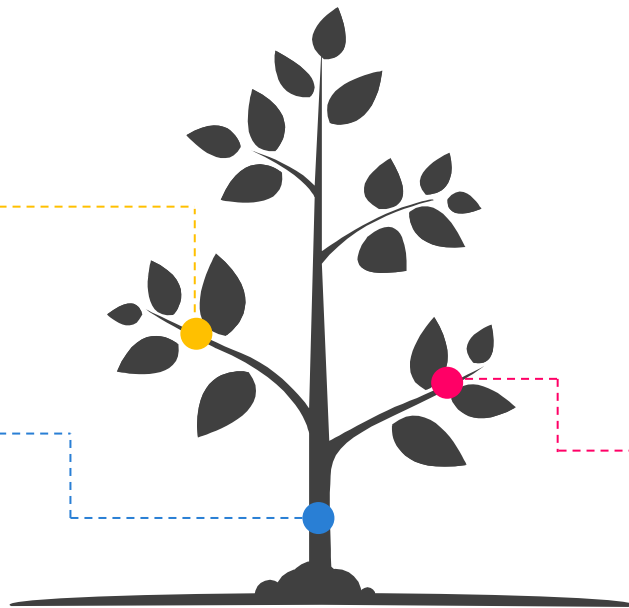
31% of final grade

12 in-class exercises in total
Given randomly

ATTENDANCE

13% of final grade

Missing more than three classes
will lead to a course failure.



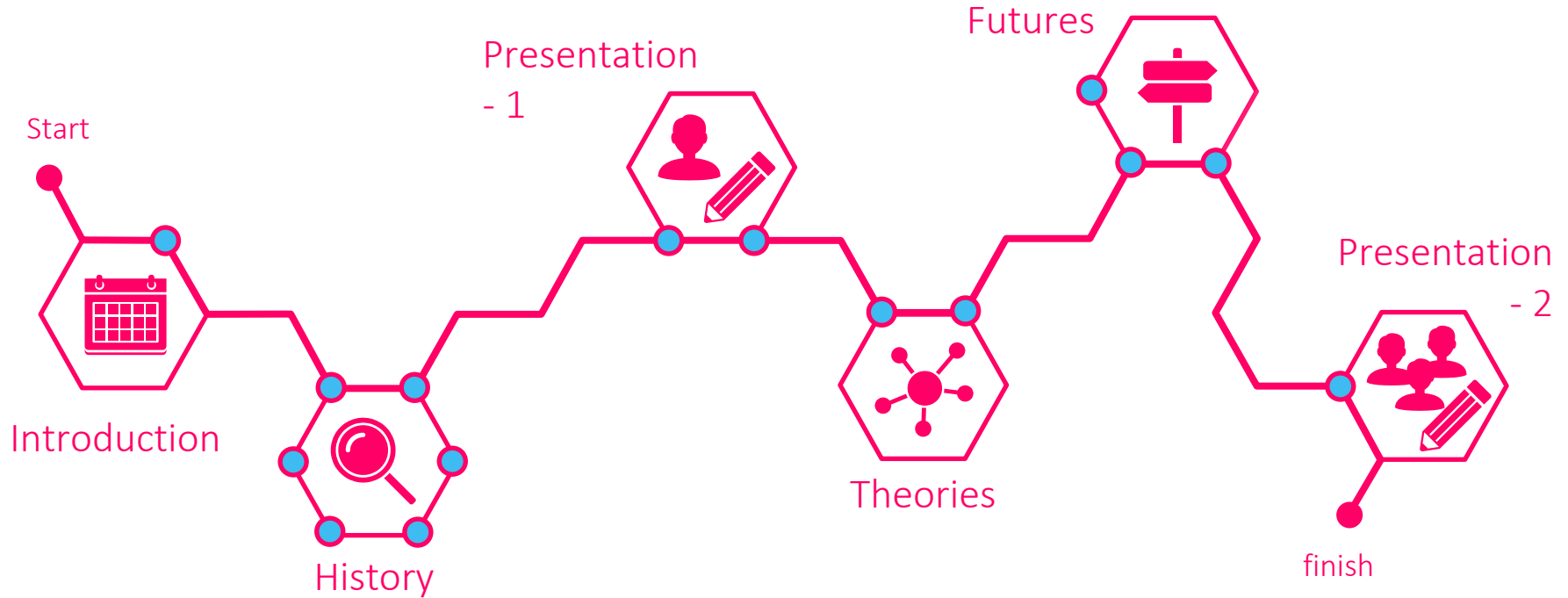
INDIVIDUAL PROJECT

56% of final grade

Stage 1	Topic statement	4%
	Presentation – poster	20%
	Feedback	4%

Stage 2	Topic statement	4%
	Presentation – slides	20%
	Feedback	4%

COURSE STRUCTURE



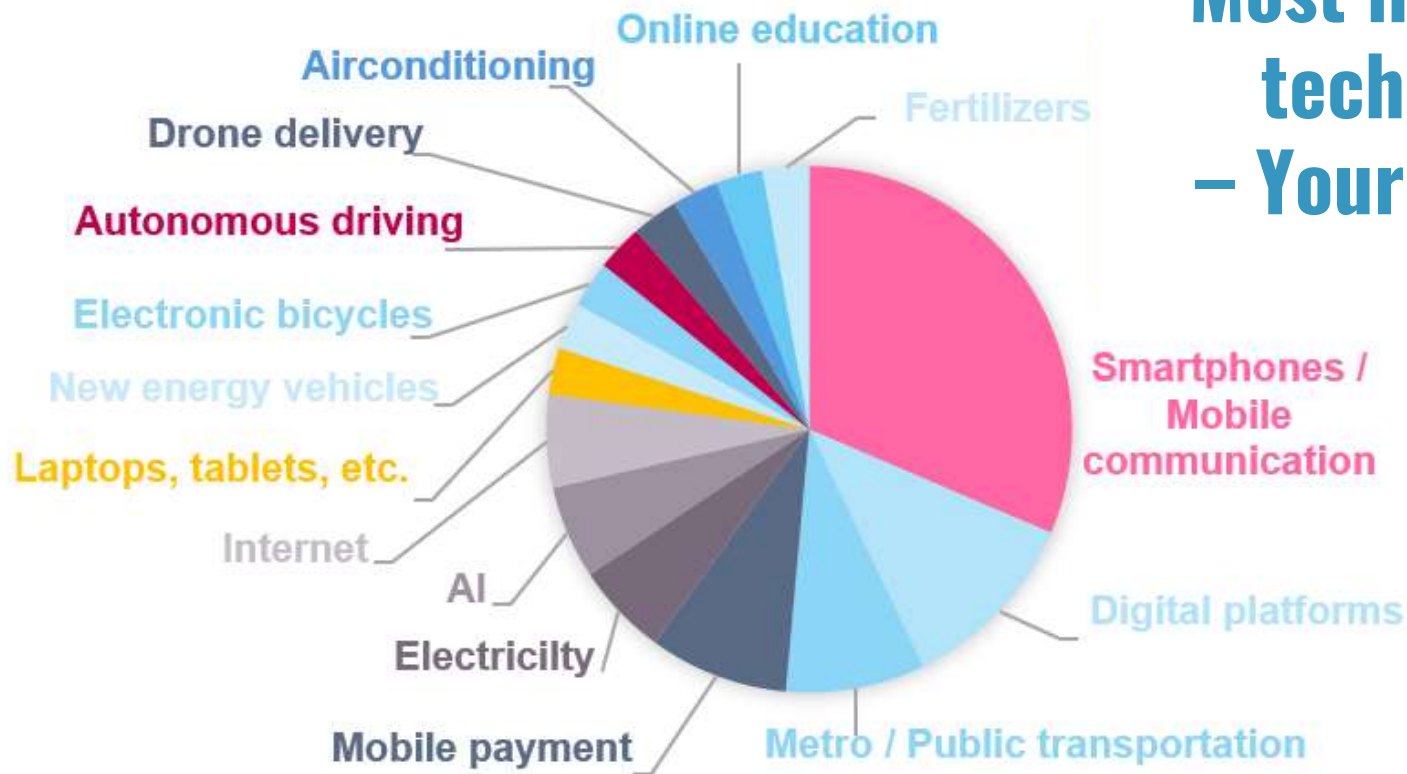
	Lecture		Assignments
Week 1 (Feb. 19)	Introduction		• <i>ICE (1 pt)</i>
Week 2 (Feb. 26)	Histories	Basic utilities: Water, Sewer, Power	• <i>ICE (3 pts)</i>
Week 3 (Mar. 5)		Transportation (1): Modern roads & cars	• <i>ICE (3 pts)</i>
Week 4 (Mar. 12)		Transportation (2): Railroads & the metro	• <i>ICE (3 pts)</i>
Week 5 (Mar. 19)		Modern buildings and modern home	• <i>ICE (3 pts)</i>
Week 6 (Mar. 26)		Communication (1): Telephones & the TV	• <i>ICE (3 pts)</i>
Week 7 (Apr. 2)		Communication (2): The Internet, social media, & mobile technologies	• <i>ICE (3 pts)</i> • <i>IP-Topic statement -1 & Meeting</i>
Week 8 (Apr. 9)	Theories	Science and Technology Studies (1)	• <i>ICE (3 pts)</i>
Week 9 (Apr. 16)		Science and Technology Studies (2)	• <i>ICE (3 pts)</i>
Week 10 (Apr. 23)			• <i>IP-Presentation-1</i>
Week 11 (Apr. 30)			• <i>IP-Feedback-1</i>
Week 12 (May 7)	Futures	Future cities (1)	• <i>ICE (2 pts)</i> • <i>Field trip</i>
Week 13 (May 14)		Future cities (2)	• <i>ICE (2 pts)</i> • <i>IP- Topic statement -2 & Meeting</i>
Week 14 (May 21)		Future cities (3)	• <i>ICE (2 pts)</i>
Week 15 (May 28)			• <i>IP-Presentation-2</i>
Week 16 (Jun. 4)			• <i>IP-Feedback-2</i>

THOUGHT EXPERIMENTS

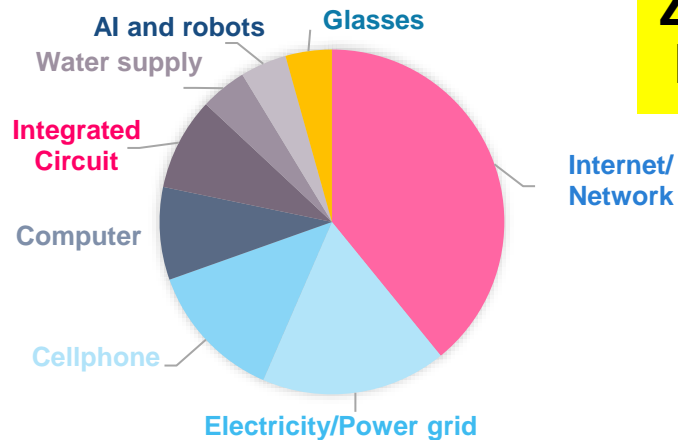
What are the technologies that shape your everyday life in Shenzhen?
Take ten minutes to complete the following tasks.

1. Write down a list of technologies that come to your mind immediately,
2. Choose one technology that you consider the most important. Reflect on how this technology impacts urban life and how your life would be different without it.

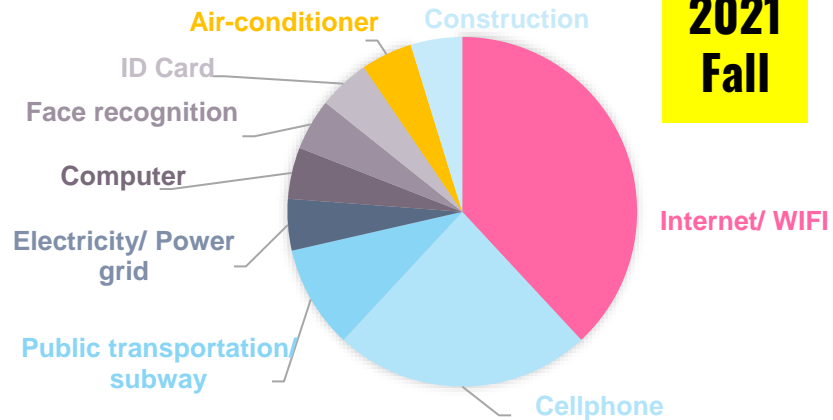
Most important technology – Your answers



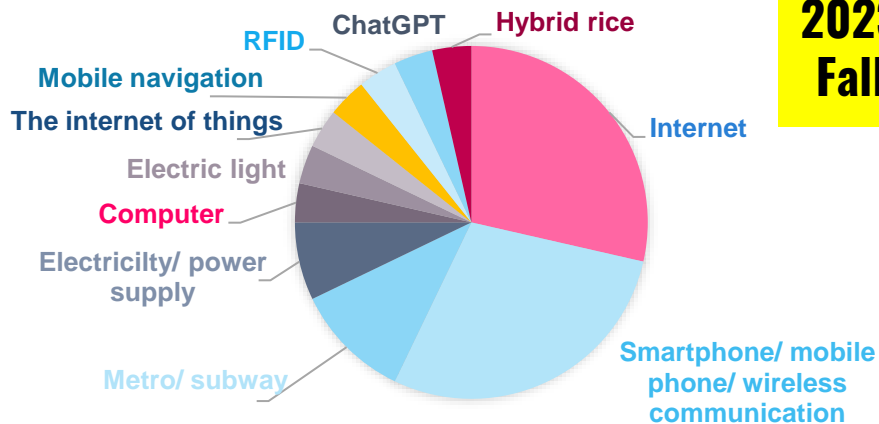
**2020
Fall**



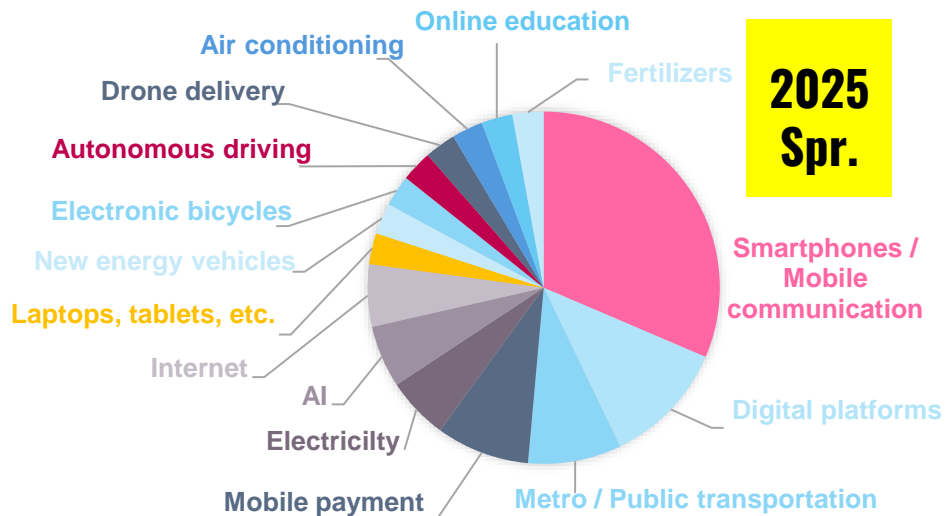
**2021
Fall**



**2023
Fall**



**2025
Spr.**





2.

URBAN UTILITIES: DEFINITION

What are urban utilities?



URBAN UTILITIES

people cannot
live without
them

- » A public service provided and consumed collectively in cities, such as a telephone or electric-light system, a streetcar or railroad line, the internet, or the like.
- » Essential utilities
 - ♦ Water
 - ♦ Sewage
 - ♦ Garbage
 - ♦ Power
 - ♦ Gas (Heat)
 - ♦
- » An evolving definition

Transportation

Communication



3.

ESSENTIAL UTILITIES IN MODERN CITIES: WATER AND SEWAGE

How are basic utilities provided and managed in modern cities?



Water and sewage

- » 3.1 Ancient practices
- » 3.2 Modern practices
- » 3.3 The industrialization of water supply and sewer management

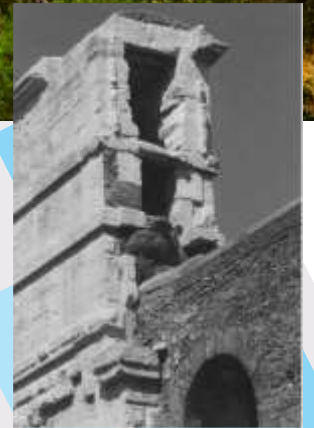
3.1 Ancient practices

- » Water supply in ancient cities
 - ◇ Wells
 - ◇ Cisterns (贮水池)
 - ◇ Aqueducts (渡槽, 水渠)
 - ◇ Filtering systems
 - ◇ Rainfall-harvesting systems



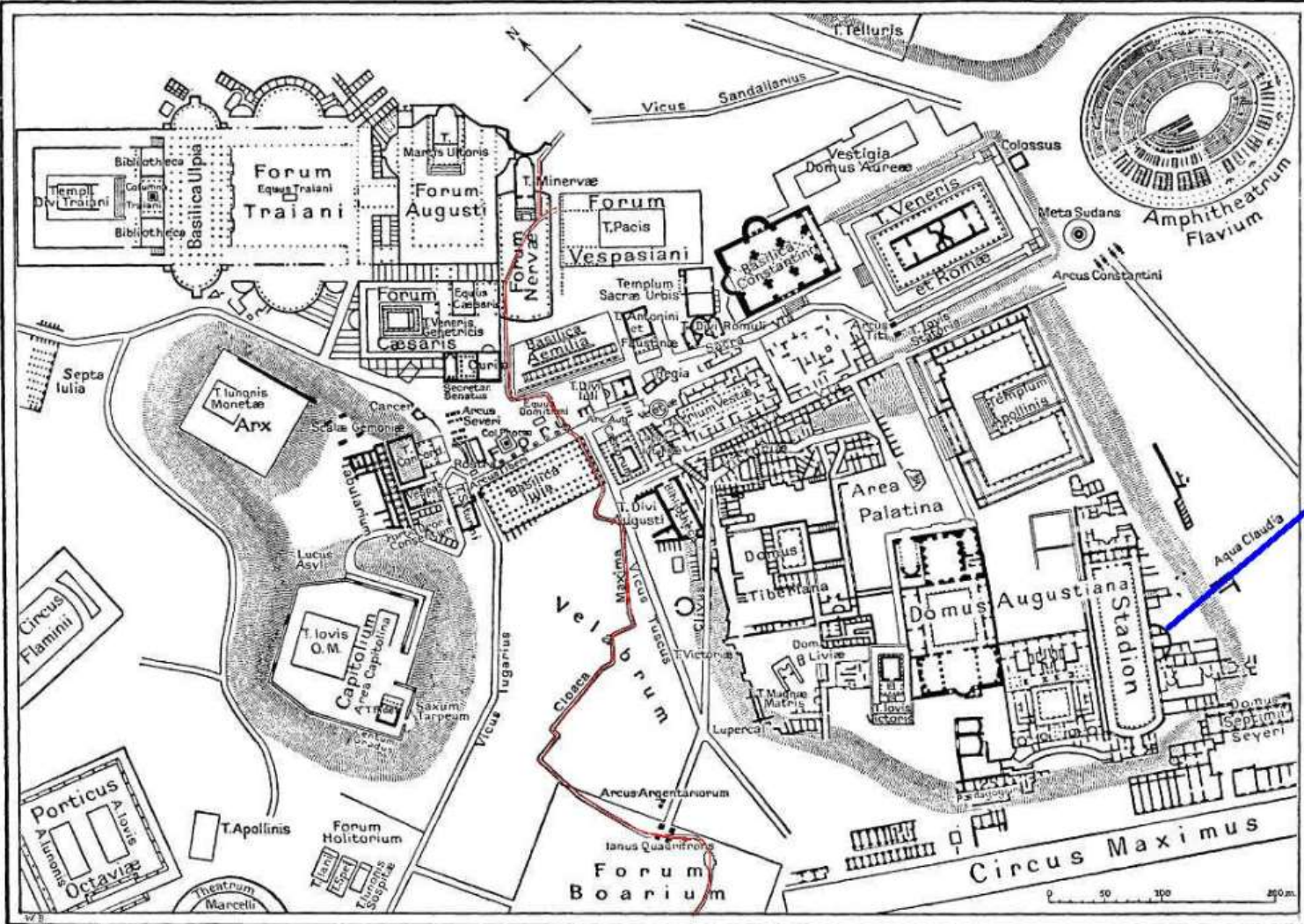
Pont du Gard, a Roman aqueduct in France.

Source: https://en.wikipedia.org/wiki/File:Pont_du_Gard_BLS.jpg



3.1 Ancient practices

- » Sewer systems in ancient cities
 - ◇ **Cloaca Maxima in Ancient Rome:** one of the earliest sewer systems in the world, constructed around 600 BC
 - ◇ **Fushou Ditch in Ganzhou (赣州福寿沟), China:** for the purposes of sewage collection and disposal and containing flooding; constructed in Earlier Song Dynasty, from 1069 to 1077



Cloaca Maxima in downtown Rome during the Roman Empire

(red line on the map)

https://en.wikipedia.org/wiki/Cloaca_Maxima



A Qing Dynasty map of Fushou Ditch in Guanzhou

<http://economy.guoxue.com/?p=4904>

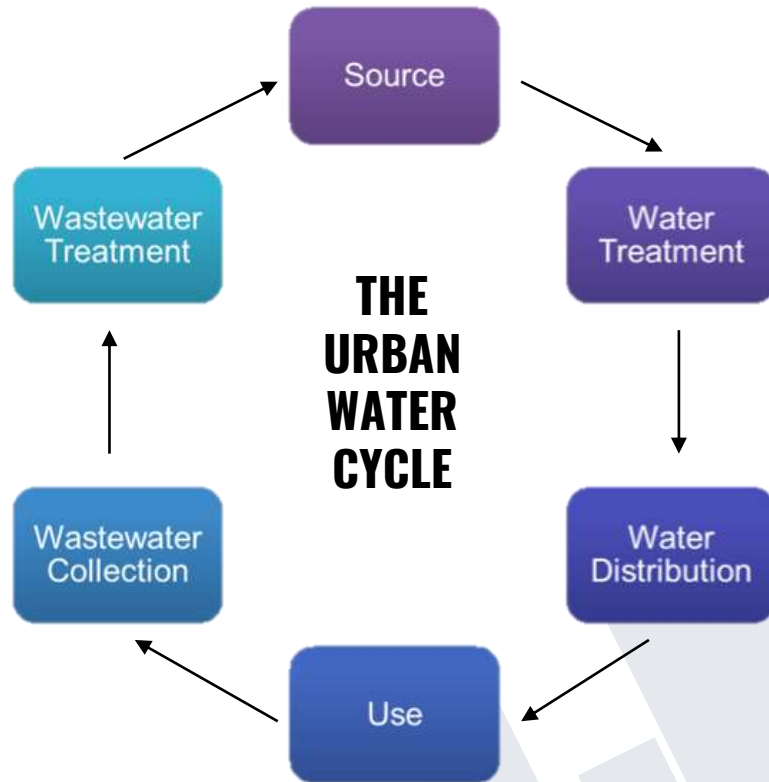


An outfall of Fushou Ditch

http://www.lzcbnews.com/pad/202001/02/content_2975.html

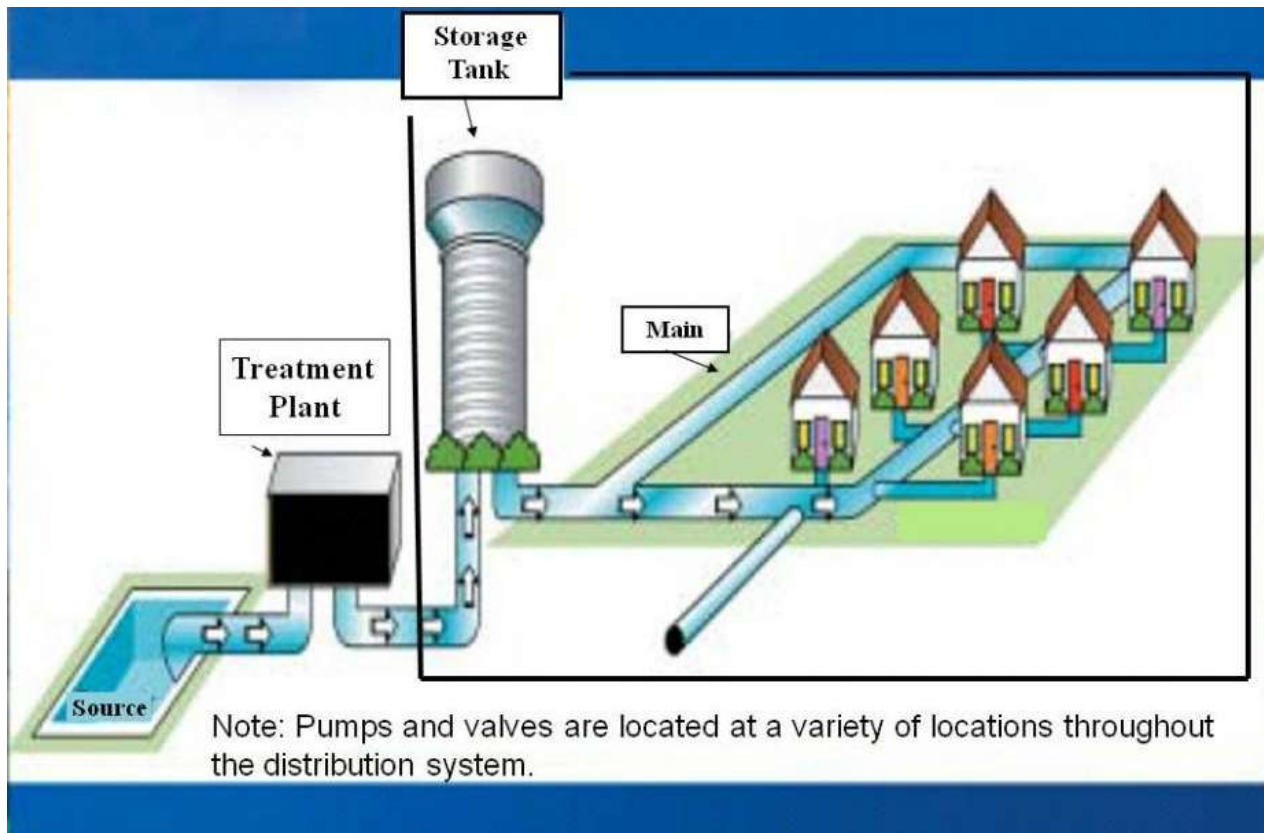
3.2 Modern practices

The urban water cycle



3.2 Modern practices

- » **Water supply and distribution** in modern cities, revolutionized by new technologies developed during the Industrial Revolution
 - ◇ **Source** (lake, river, ground water, etc.)
 - ◇ **Centralized supply and purification facilities** (water plants, water treatment technologies)
 - ◇ **Storage** (water tower, water pipes, reservoir)
 - ◇ **Pressurization** (pump stations)
 - ◇ **Distribution** (pipe networks: wooden → → iron)
 - ◇ **Usage at home** (tap water)



Modern Water Distribution System

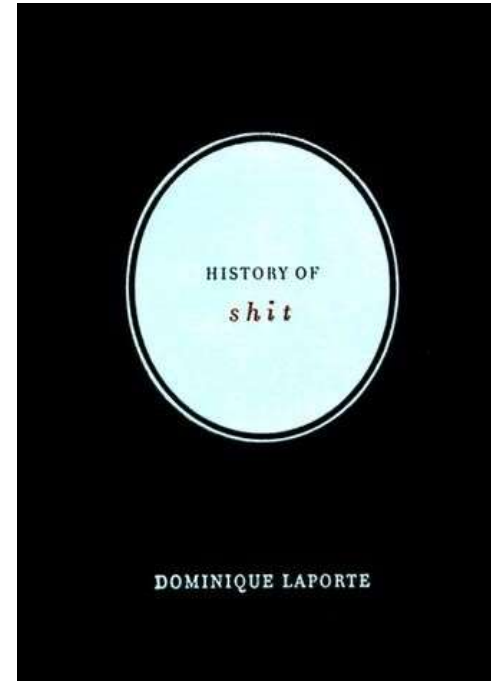
<https://www.epa.gov/dwsix-yearreview/drinking-water-distribution-systems>

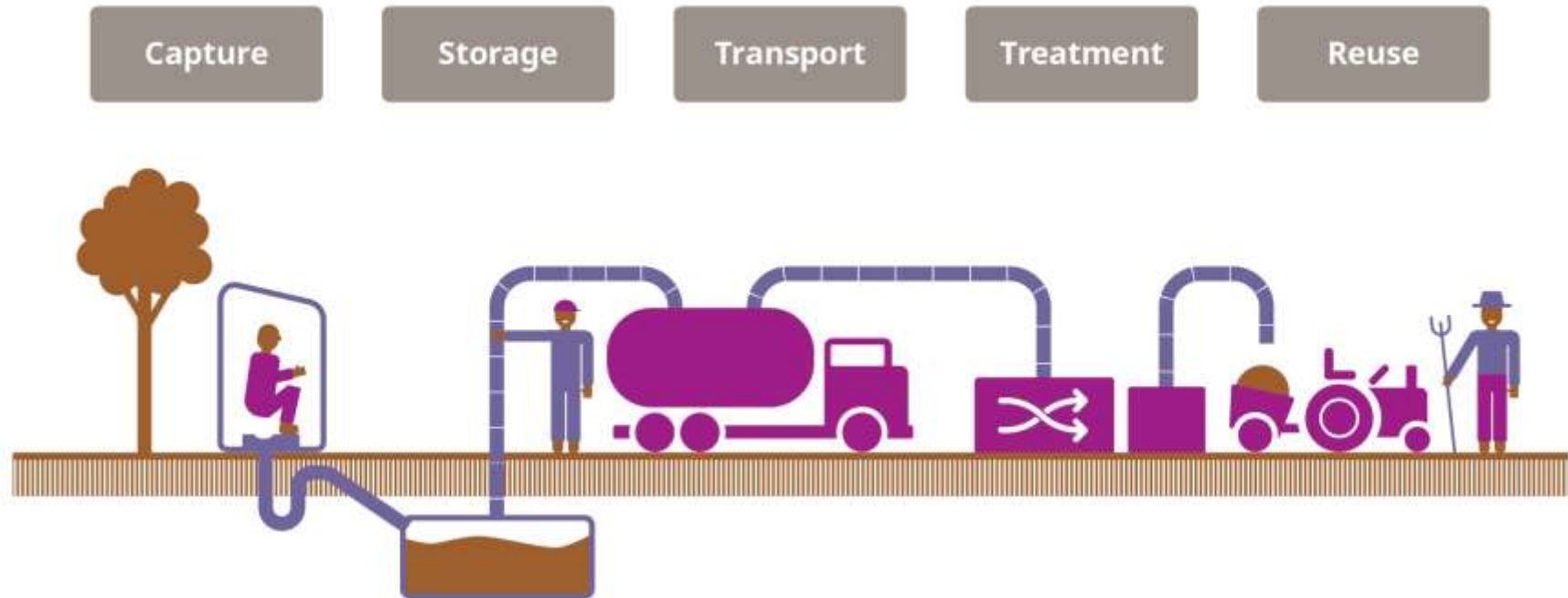
3.2 Modern practices

- » **Wastewater:** “used water from any combination of domestic, industrial, commercial or agricultural activities, surface runoff or stormwater, and any sewer inflow or sewer infiltration” (Tilley et al., 2014)
- » **Sources and types:**
 - ◇ Domestic wastewater from residences, commercial & institutional buildings
 - ◇ Black water (from toilets) vs. Grey water (from domestic equipment other than toilets)
 - ◇ Industrial wastewater
 - ◇ Infiltration/inflow through leaks, foundation drains, etc.
 - ◇ Stormwater

3.2 Modern practices

- » Wastewater catchment at home: **Flushing toilet**
- » **Sewer lines**
 - ◇ Planning: catchment zones, different types of sewer lines (sanitary sewer vs. combined sewer), transportation technologies
 - ◇ Construction engineering
 - ◇ Construction material: High strength cement
- » **Wastewater treatment:** from discharged into the environment (rivers and seas) to treatment through physical, chemical, or biological processes.





<https://washmatters.wateraid.org/blog/faecal-sludge-management-a-critical-pathway-to-safely-managed-sanitation>

3.3 The industrialization of water supply and sewer management

- » Population of some cities in England in the Industrial

Revolution

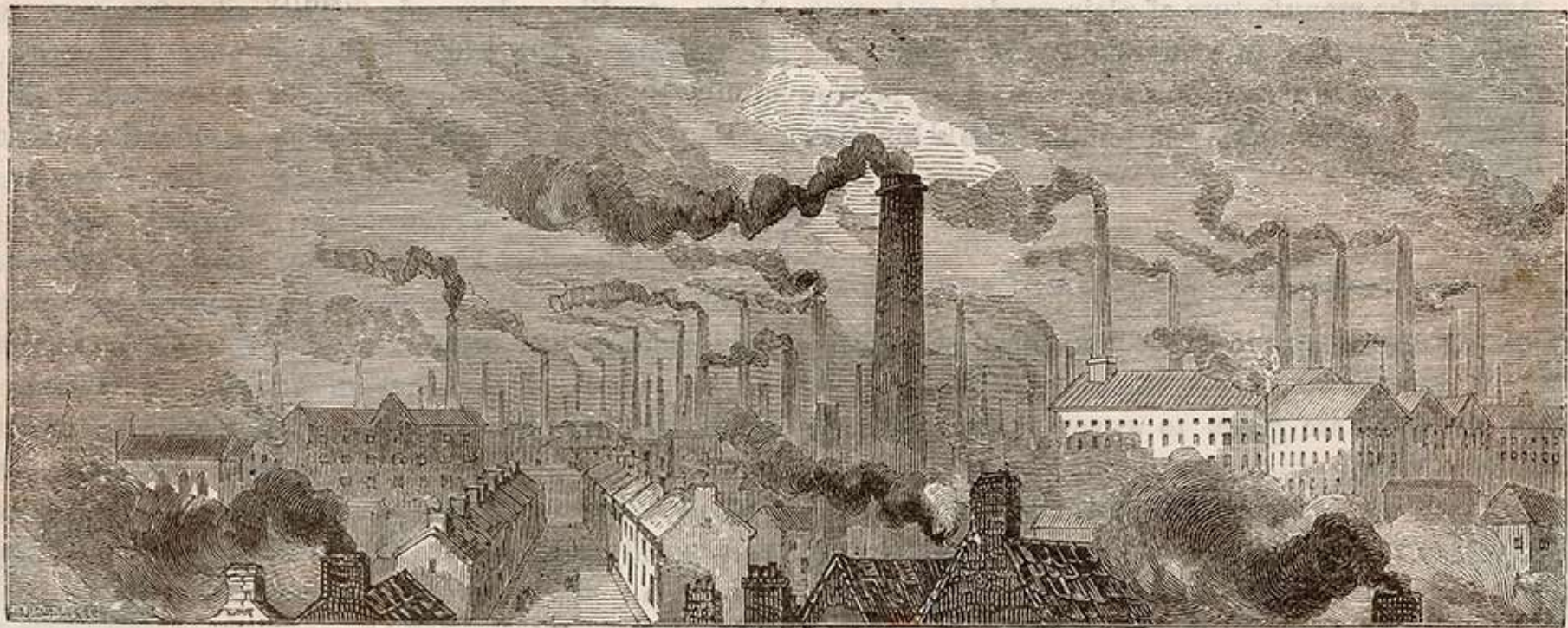
Cities	1801	1841
Manchester	35,000	353,000
Leeds	53,000	153,000
Birmingham	23,000	183,000
Sheffield	46,000	111,000

Diseases and epidemics

- Overcrowding - slums
- Poor sanitation
- Poor water systems
- Cholera (霍乱)!

- » Urban population of Great Britain: 8.3 million (1801) → 16.8 million (1850) → 30.5 million (1901)
- » Urban population in Europe: 100 million (1700) → 400 million (1900)

In 1853 - 1854 more than 10,000 Londoners were killed



MANCHESTER, FROM THE ENTRANCE TO THE LONDON AND NORTH-WESTERN RAILWAY.

A view of Manchester in 1870

<https://www.scienceandindustrymuseum.org.uk/objects-and-stories/air-pollution>

“

From this foul drain the greatest stream of human industry flows out to fertilize the whole world. From this filthy sewer pure gold flows. Here humanity attains its most complete development and its most brutish; here civilisation works its miracles, and civilised man is turned back almost into a savage.

Alexis de Tocqueville (1835)

The Great Stink of London (1858)

- » Unusually hot summer in 1858 (90 F /32 C)
- » 200,000 cesspits (污水坑) across London, whose overflows drained directly to the putrid (腐臭的) Thames
- » Cholera ran rampant and the air was a miasma (毒瘴) of human waste smells, slaughterhouse run-off, and factory emissions
- » No one, from the poorest of the poor to the wealthiest of the wealthy, was exempt from the odor.
- » The stench was so horrid that the Houses of Parliament was unable to work normally.

Night-men collecting sewage from cesspits, from Henry Mathew's "London Labor and the London Poor"





The “Silent Highway” – Man: Your MONEY or Your LIFE

A satirical cartoon from *Punch* magazine shows a skeleton rowing along the Thames (1858)



SEARCH FOR CLEAN WATER!!

LEFT: Map from 1917 showing the Thirlmere aqueduct which brought water to Manchester (constructed between 1885 and 1894)

Source: <https://www.scienceandindustrymuseum.org.uk/objects-and-stories/water-and-sanitation>

RIGHT: The New River in London, officially opened in 1613, bringing fresh water from the River Lea and other springs and wells, into London homes

Source: <https://www.museumofthehome.org.uk/explore/stories-of-home/a-brief-history-of-running-water/>



People gathered around the first public drinking fountain in London

W.A. Atkinson, c.1859-1860.
Object number 7/1986

Source: <https://www.museumofthehome.org.uk/explore/stories-of-home/a-brief-history-of-running-water/>



Sir Joseph William Bazalgette (1819-1891), 19th-century English civil engineer, a chief engineer of the Metropolitan Board of Works, designer of a sewer system for central London (starting construction in 1859 in response to the Great Stink and finished largely in 1866)

<https://www.ice.org.uk/ICEDevelopmentWebPortal/media/News/Blogs/bazalgette.jpg>

Joseph Bazalgette (top right) at the northern outfall sewer being built below London's Abbey Mills pumping station.



<https://www.theguardian.com/cities/2016/apr/04/story-cities-14-london-great-stink-river-thames-joseph-bazalgette-sewage-system#img-1>



Crossness Pumping Station,

just one part of the extensive
and expensive sewer project
London undertook in the 19th
century.

<https://history.howstuffworks.com/historical-events/ridiculous-history-the-great-stink-london.htm>

Sewer-building campaign in Europe and then worldwide

» Paris, France:

- ◇ 1805-1812: 182 new miles of sewer
- ◇ 1850-1878: ordered by Napoleon III and designed by Baron Haussmann and Eugène Belgrand; separate underground passages for drinking water and sewage using iron piping and digging techniques made possible by the Industrial Revolution, and in 1878 the system was 360 miles long.

» US

- ◇ The first sewer systems were built in the late 1850s in Chicago and Brooklyn.
- ◇ The first sewage treatment plant using chemical precipitation was built in Worcester, Massachusetts in 1890.

Watch video: How The Toilet Changed History

(0'0" – 5'12")

By It's OK to be Smart | PBS

<https://www.youtube.com/watch?v=GWQG1YZS9I4>



Dysentery 痢疾

Typhoid 伤寒

Parasite 寄生虫

Latrine 茅厕，便坑

Porcelain throne (俚)马桶

Feces 粪便

Defecate 排便

Gutter 地沟

Skara Brae 苏格兰一处新时期时期遗址

Mohenjo Daro 巴基斯坦一处考古遗址

Indus River 印度河

Filth 污垢

Excretion 排泄物

Caca (儿童用词)粪便

Cloaca Maxima 马克西姆下水道（古罗马时期）

Tiber River 台伯河（意）

Stink 恶臭

Clog up 堵塞

Outbreak (疾病的)爆发

Plague 瘟疫

Aromatic herbs 芳香植物

Ajax 英国约翰·哈林顿发明的抽水马桶名称

S trap (马桶的)S形冲水道

Cesspool粪池、污水坑

Cholera 霍乱

Butt 屁股

Diarrhea 腹泻

Dehydration 失水

Tainted 污染的

Enclose 围住、封装

Malaria 疟疾

Discussion

- What was the cause of diseases like cholera according to ancient Romans and pre- or early modern Europeans?
- Why has the flush toilet been so important to urban living?

Watch video: History of wastewater treatment - from Hippocratic sleeve to activated sludge (0'0" – 5'45")

By Karl-Uwe Schmitz

<https://www.youtube.com/watch?v=oBMVXXXTne0>



Odor臭味

Charcoal 木炭

Straining 过滤

Contaminants 污染物

Coagulant 絮凝剂

Alum 明矾

Positively charged 带正电荷的

Flock 群、簇

Boiler 烧水炉/壶

Hippocratic sleeve 希波克拉底套
筒(西方最早的过滤净水装置)

Sediment 沉积物

Aqueduct 高架渠

Bleak 灰暗的

Pandemic 传染病

Desalination 脱盐作用、淡化

Set the scene for 为...铺平道路、打下了基础

Microorganism 微生物

Slow sand filter 慢砂滤池

Purification 净化

Sedimentation basin 沉淀池，澄清池

Flocculant 凝聚剂

Gravel filter 卵石滤池

Chlorine disinfection 氯消毒

BOD (Biological Oxygen Demand) 生化需氧量

Ammonia 氨

Activated sludge process 活性污泥法

Oxidize 氧化

Ammonium 氨

Nitrate 硝酸盐

Nitrite 亚硝酸盐

WWTP (Wastewater Treatment
Plants)

SBRs (sequencing batch reactor)

CBRs (continuous batch reactor)

Oxidization ditches 氧化沟

Trickling filters 滴滤池[器]，滴
流生物滤器；

Phosphorus 磷

Reverse osmosis 反渗透；反渗
析

Hormone levels 激素水平

(Carbon) Footprints 碳足迹

Where does Shenzhen's running water come from?



Left: https://baoyingsw.guangdongwater.com/Engineering/index_2159.html

Right: <https://baike.baidu.com/item/%E7%8F%A0%E6%B1%9F%E4%B8%89%E8%A7%92%E6%B4%B2%E6%B0%B4%E8%B5%84%E6%BA%90%E9%85%8D%E7%BD%AE%E5%B7%A5%E7%A8%8B/22673893?fr=aladdin>



Image sources

Upper:

https://m.sohu.com/a/363050538_120149202/read

Bottom left:

<https://baike.baidu.com/item/%E8%A5%BF%E6%B1%9F/32356>

Bottom right:

<https://baike.baidu.com/item/%E4%B8%9C%E6%B1%9F/35219?fr=aladdin>





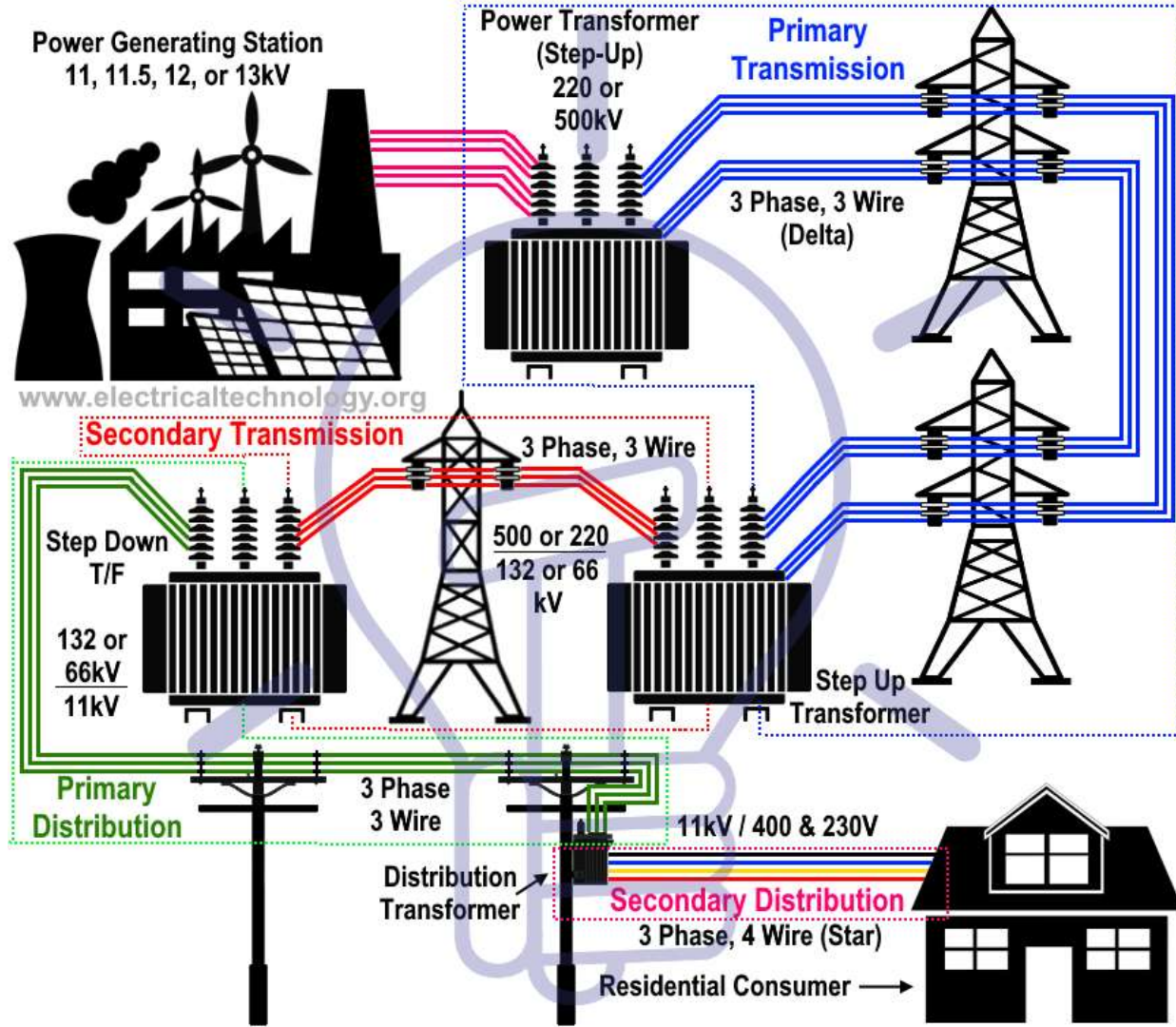
4.

ESSENTIAL UTILITIES IN MODERN CITIES: ELECTRICITY AND ELECTRIC LIGHT



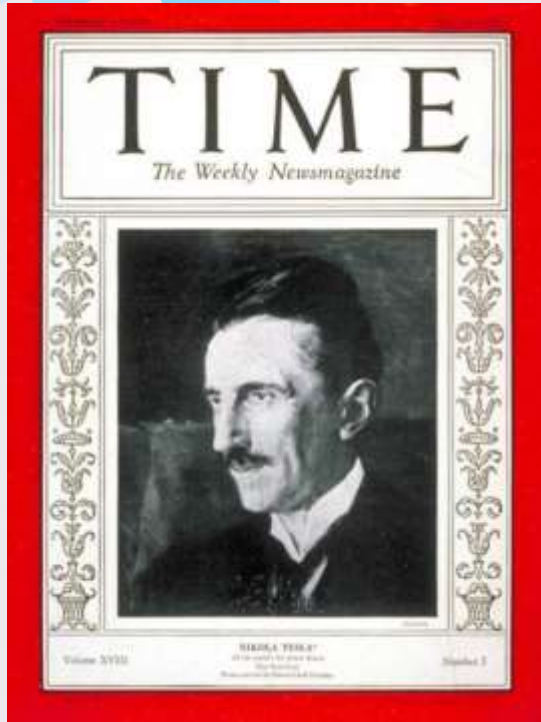
Urban Power

- » **Generation**
 - ◇ Central electricity station modelled on the gas-works
- » **Transmission**
 - ◇ From DC (Direct Current) to AC (Alternating Current)
- » **Early public use of electricity in urban settings**
 - ◇ Street lighting
 - ◇ Commercial lighting
- » **Electrified home and everyday life**



A Typical AC Power Supply System

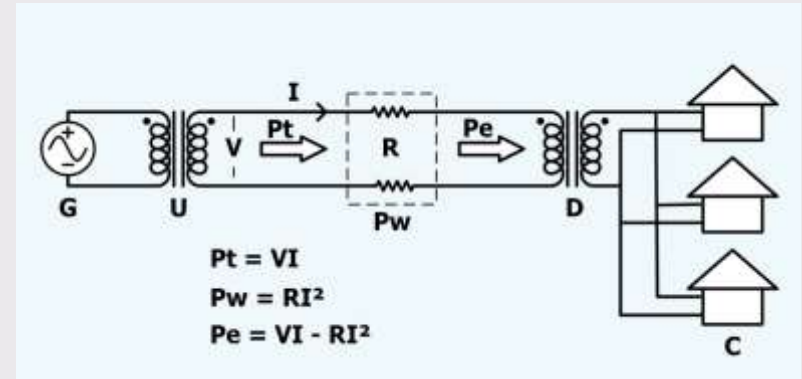
- Generation
- Transmission
- Distribution



Nicola Tesla (1856-1943)

A Serbian-American inventor and futurist who is best known for his contributions to the design of the modern alternating current (AC) electricity supply system.

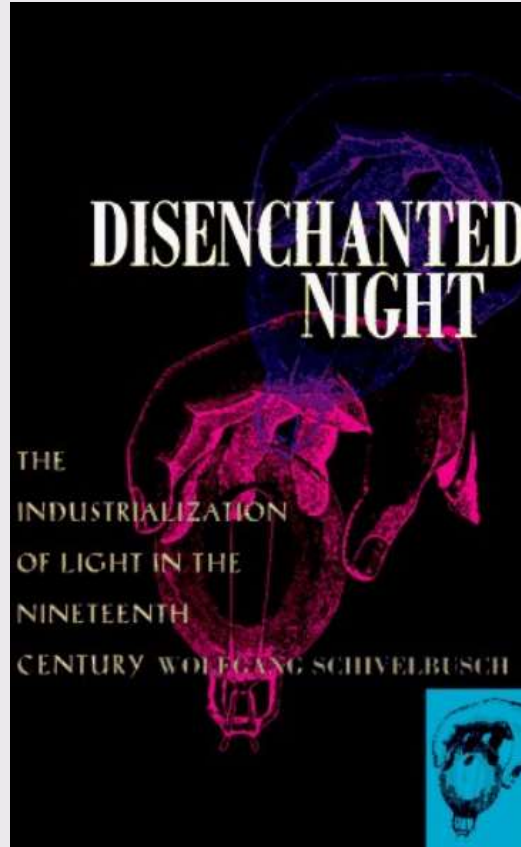
Left: Tesla on *Time* Magazine commemorating his 75th birthday (1931)



A schematic representation of long distance electric power transmission. C=consumers, D=step down transformer, G=generator, I=current in the wires, Pe=power reaching the end of the transmission line, Pt=power entering the transmission line, Pw=power lost in the transmission line, R=total resistance in the wires, V=voltage at the beginning of the transmission line, U=step up transformer.



Wolfgang Schivelbusch
(1941-)
German scholar of cultural
studies, historian, and author



Wolfgang Schivelbusch
(1983). Translated by
Angela Davies (1988).
DISENCHANTED NIGHT The
Industrialization of Light in
the Nineteenth Century.
Berkeley: University of
California Press.

**The provision of light
from central sources
changed the nature of the
home and the individual's
relation to society.**

Lamplighters

Gaslight was introduced to the streets of London in the early 19th century (1807), replacing oil lamps



Left: <https://www.sheetmusicwarehouse.co.uk/victorian-illustrated-covers/the-lamplighter-schottische-as-played-by-weipperts-band-dedicated-to/>
 Right: http://www.celticguitarmusic.com/tbhp_lamp.htm

Reaction to electric lamps (according to Schivelbusch)

» Critique

- » Aesthetic dislike (ugly, obnoxious)
- » Street lamp as a sign of authority/tyranny and surveillance (especially in urban France)

» Approval

- » The spread of electric street lamps and commercial lighting: Increasing safety, the rise of nightlife, and the shop window

Social Impacts of Electric Lamps

(according to Schivelbusch)

- » On the one hand:
 - ◊ “The end of individual enterprise and an autonomous energy,” replaced by centralized generation and supply of power and corporate monopoly capitalism
- » On the other hand:
 - ◊ Increasing **individuality** both at home and in public space (safety → more autonomy to move around)
 - ◊ Increasing **night** activities, both commercial and non-commercial

**Demonstration
of arc lamp on
the Avenue de
l'Opera in Paris
(1878), the first
form of electric
street lighting**



https://en.wikipedia.org/wiki/Street_light#Arc_lamps

Schivelbusch on the Succession of Old and New Technologies

So far we have followed the history of artificial illumination as a simple straight line. Lighting technology appears to have progressed in logical steps from the hearth flame via the torch, the candle and the Argand lamp to gaslight, without faltering or looking back. But **technical progress is more than a resolute stride forward**; it also involves the developmental stages that have been left behind.

Often, **these do not simply disappear, but live on, in modified - that is, modernised - form.** ... (p.49)

Watch video: History Brief: Electricity and Its Impact in the 1920s

(0'07" – 3'28")

By Reading Through History

<https://www.youtube.com/watch?v=n3M9HKK-onM>



Electrical wiring 电线线路

Lantern 灯

Soot 烟灰，煤烟

Open flame 明火

Appliance 家用电器

Vacuum cleaner 吸尘器

Iron 熨斗

Stove 炉子

Toaster 烤面包片机

Tea kettle 茶壶

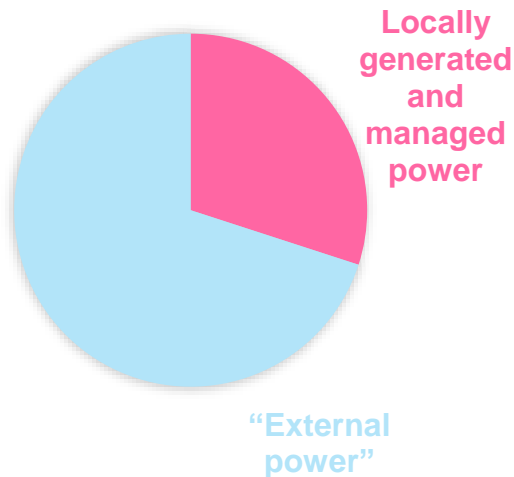
Phonograph 留声机

In season 当季的

Discussion

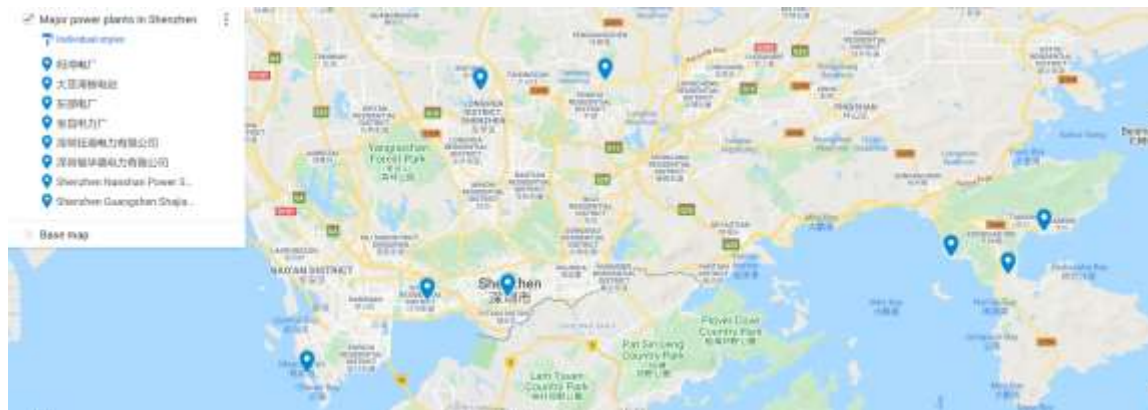
What were the impacts of electricity on American life in the early 20th century?

Where does Shenzhen's electricity come from?



External power: Purchased from China Southern Power Grid (南方电网)

- Hydropower from Yunan, Guizhou, Guangxi
- Nuclear power from Daya Bay
- Other power plants in the southern provinces (Guangdong, Guangxi, Guizhou, Yunnan, Hainan)



QUESTIONS?

If you have any questions about the course, write them down. Feel free to ask me in the QQ group or via email. You can also bring your questions to our next class.





END OF CLASS

SEE YOU NEXT WEEK.

