



**MINISTRY OF FOREIGN AFFAIRS
OF DENMARK**

GX IN DENMARK

WORLD WINTER CITIES 2024

Minister Councillor Jacob Rasmussen - 18 December 2024

AGENDA

EXPLORING VARIOUS FASCETS OF DANISH SUSTAINABILITY

1. Denmark's climate goals and progress
 2. Energy efficiency in Denmark
3. Sector coupling and waste-to-energy
 4. District heating in Denmark
5. Copenhagen as a case in point

1. Denmark's climate goals and progress

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DANISH RENEWABLE ENERGY AND CLIMATE TARGETS

70% GHG REDUCTION IN 2030 AND NET ZERO 2045-2050

Current renewable energy supply



Offshore wind
2.65 GW



Onshore wind
5 GW



Solar PV
3.5GW



Security of supply
99.99999796%

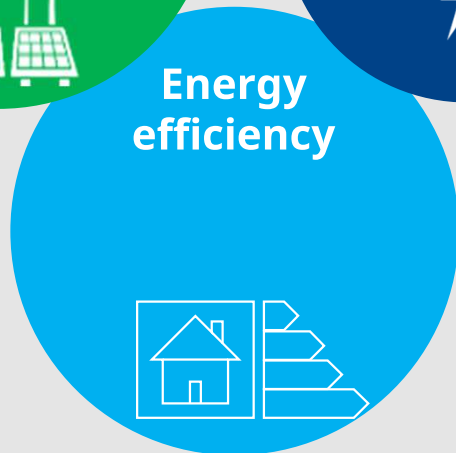
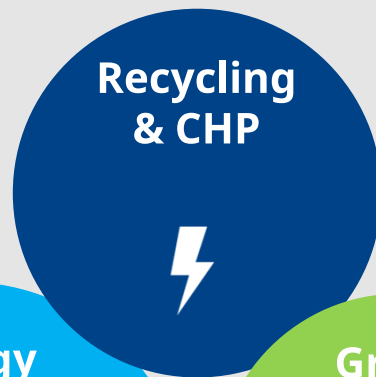
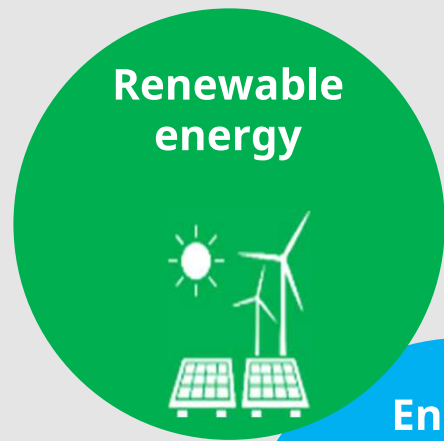


In 2030, Denmark will have **reduced its emissions by 70% from 1990**. Here is how...

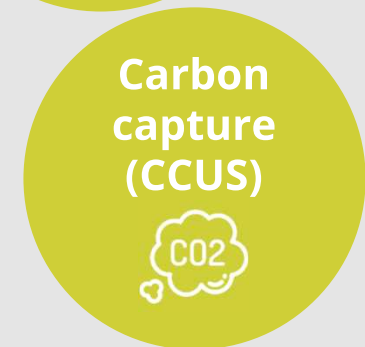
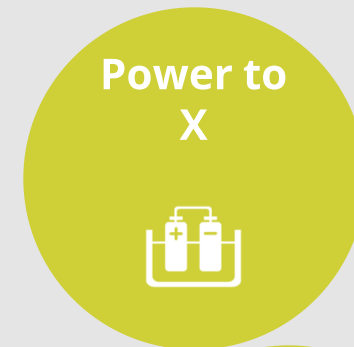
- ✓ 100% renewable electricity and comprehensive electrification
- ✓ Carbon capture and storage
- ✓ 100% green gas
- ✓ District heating and system integration
- ✓ Green H2 to fuel hard-to-electrify sectors

A COMBINED DANISH APPROACH TO SUSTAINABILITY

BY USING A COMPREHENSIVE ARRAY OF APPROACHES, DENMARK LEADS THE WAY



Current solutions

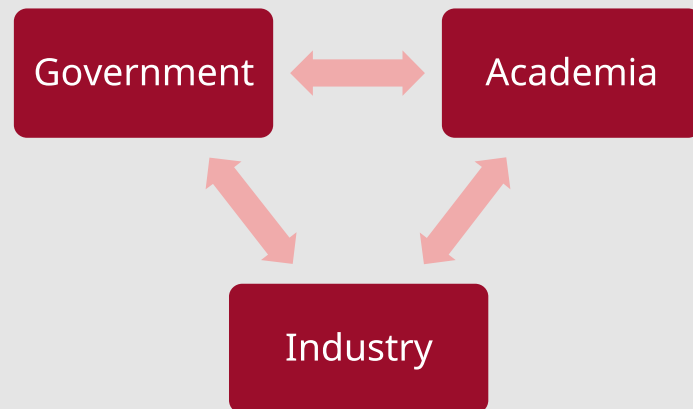


Future solutions

DANISH TRIPLE HELIX APPROACH TO SUSTAINABILITY

SYNERGIES AND COOPERATION AS THE BEDROCK

- Close partnership between government, industry, and academia
- Fosters innovation, cooperation, and inclusion of all stakeholders
- Dialogue enables efficient policy measures that stimulate industry and consumers



Government

- Political targets
- Tender rounds & support
- Infrastructure guarantees



Industry

- Investments & development
- Construction
- Delivering on political targets



Academia

- Research and development
- Technological innovation
- Knowledge resources

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ENERGY EFFICIENCY

The cheapest energy is the energy we do not use

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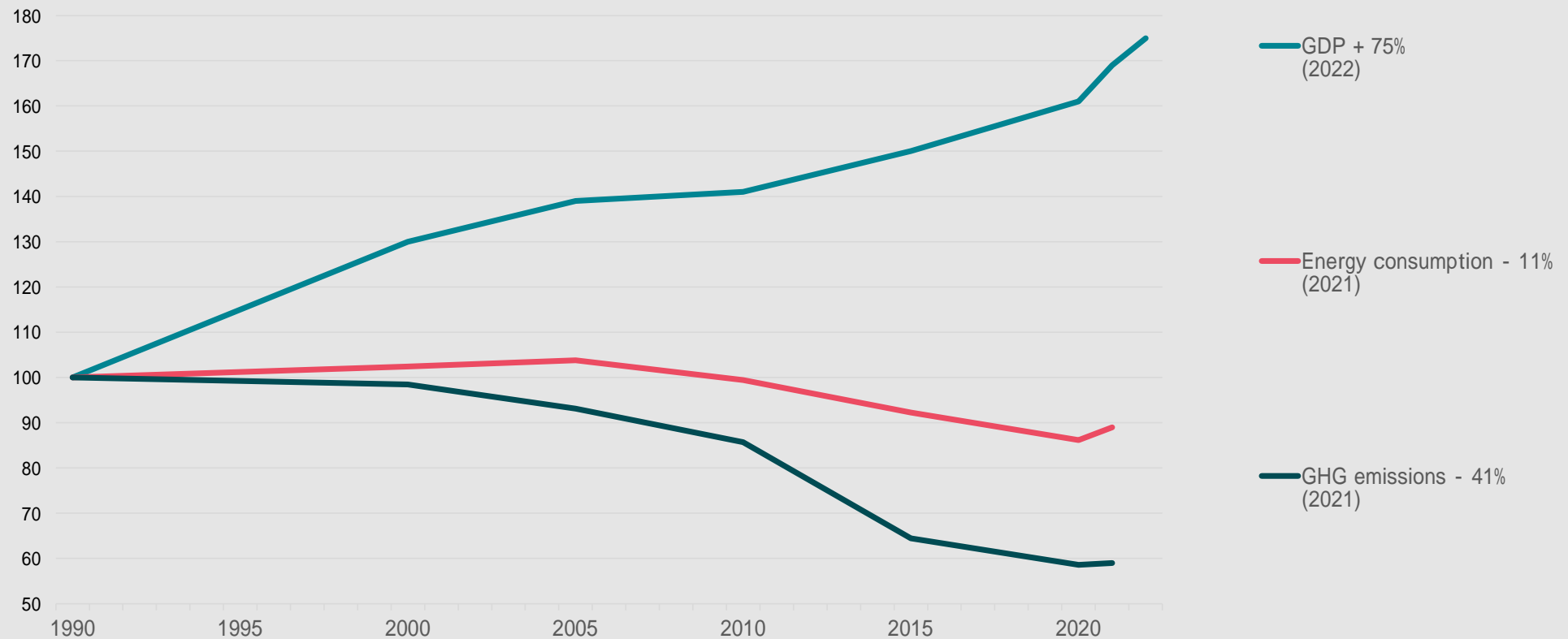
Using less energy for the same output

(or)

Producing more with the same energy input, and minimizing energy waste

DENMARK'S ECONOMY DECOUPLING ENERGY AND GDP

DECOUPLING ECONOMIC GROWTH FROM GHG EMISSIONS AND ENERGY CONSUMPTION



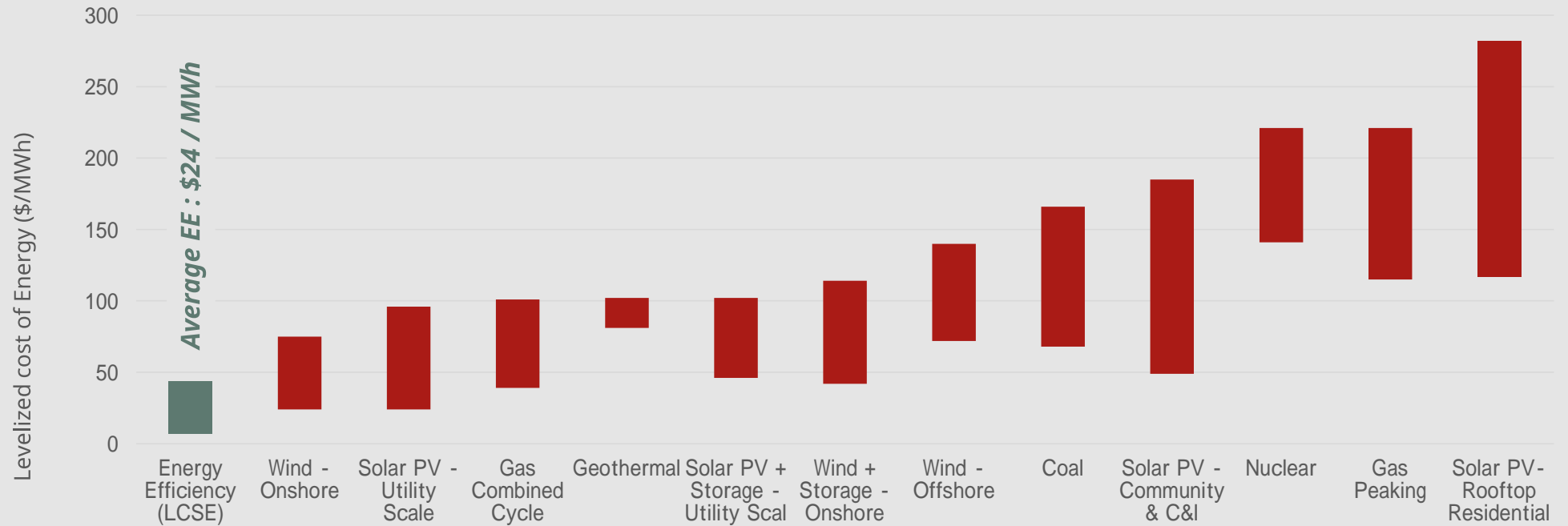
JHL5

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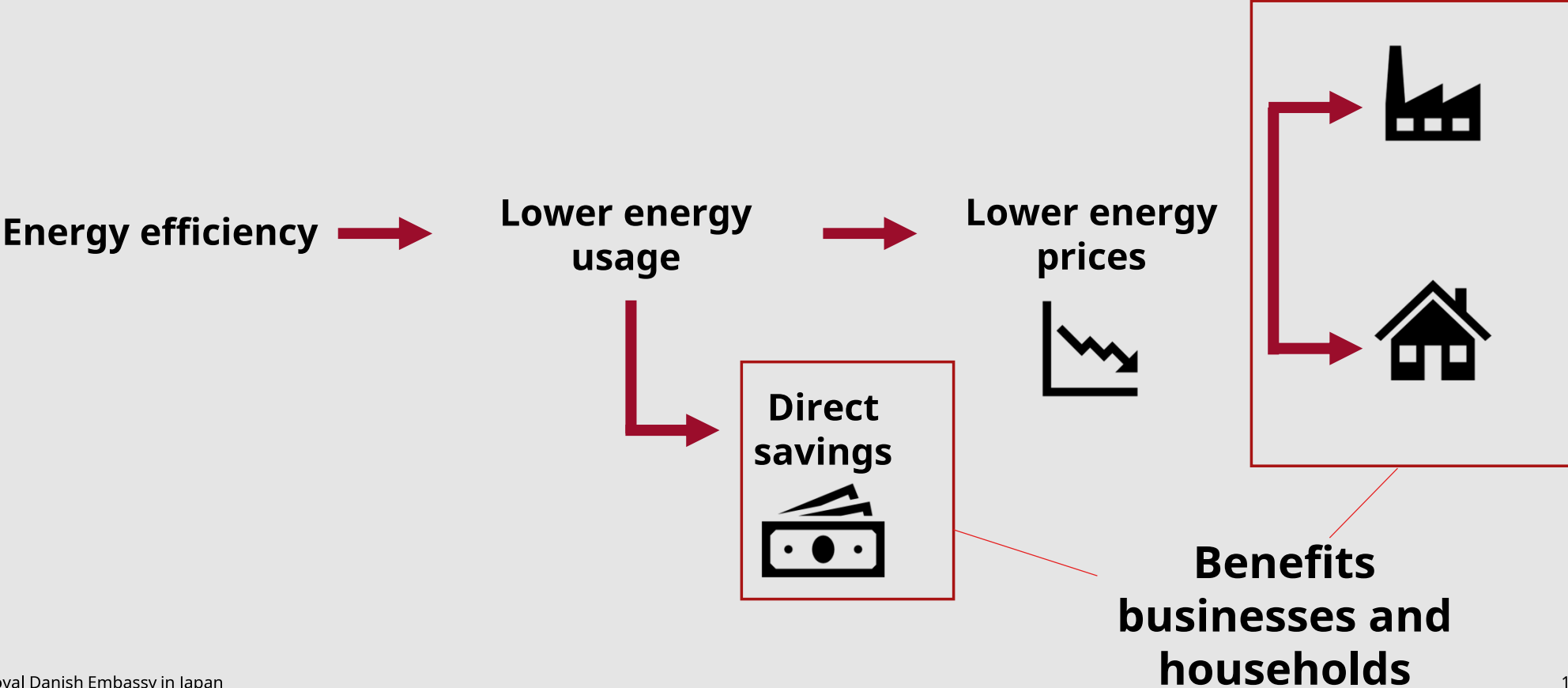
Se noter og om jeg kan finde nyere statistik

Johan Hegaard Liborius, 2024/11/28

Cost of saved energy is lower than electricity generation



ENERGY EFFICIENCY BENEFITS CONSUMERS AND BUSINESSES



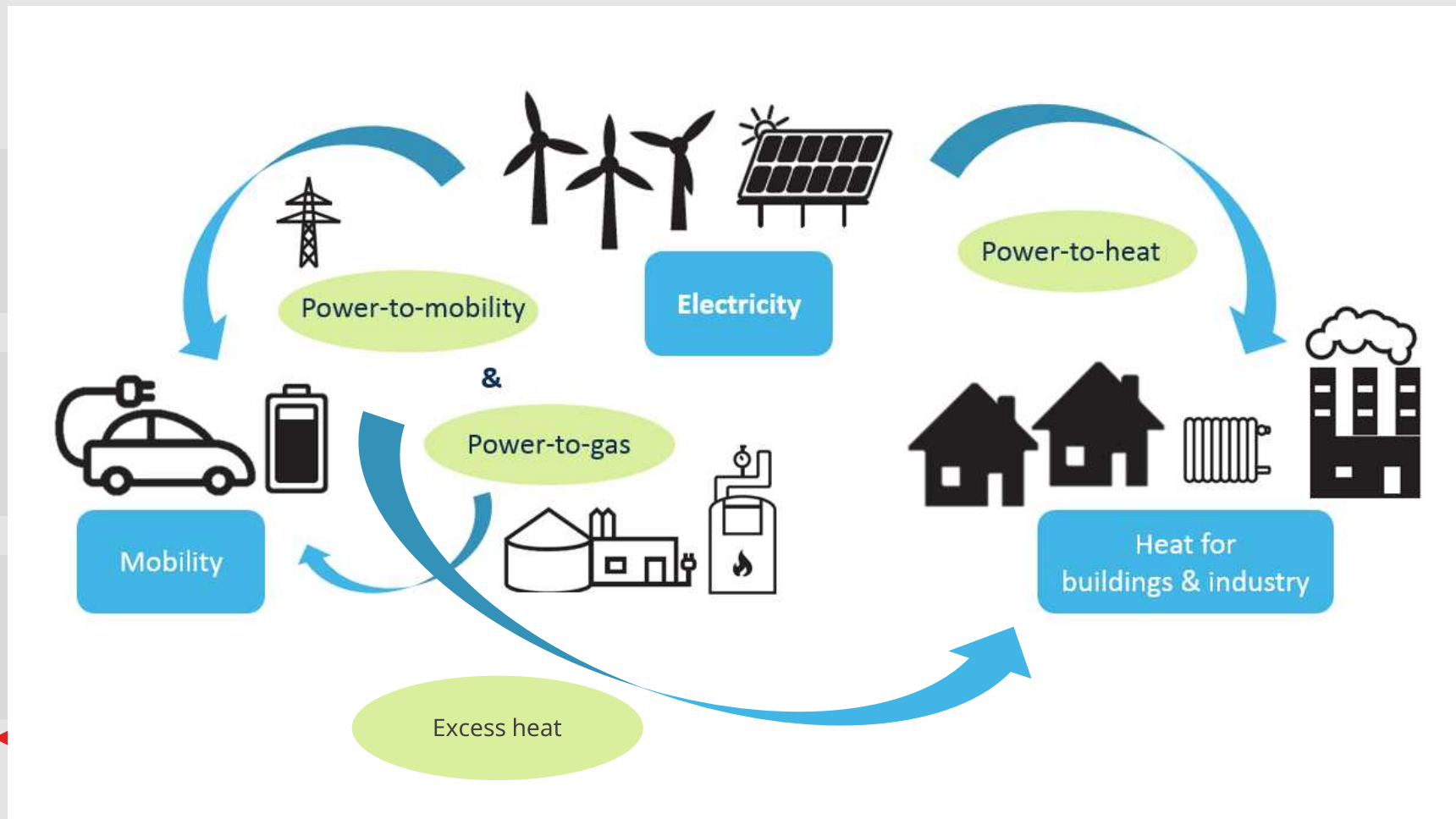
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WHAT IS SECTOR INTEGRATION?

THE IMPORTANCE OF COMBINING ENERGY SOURCES

- **Definition: To integrate renewable energy with the greatest possible efficiency between sectors and thus, make better use of our resources.**
- Going from thinking in silos into looking across all energy systems
- The transition requires collaboration and knowledge sharing between actors and sectors (see next slide)

SECTOR INTEGRATION



HOW CAN SECTOR INTEGRATION BENEFIT CITIES

Benefits

- The ability to displace CO₂
- Support flexibility
- Increase security of supply
- Avoid waste of energy
- Reduce the load on the infrastructure
- Create added value by leveraging synergies between sectors

Requirements

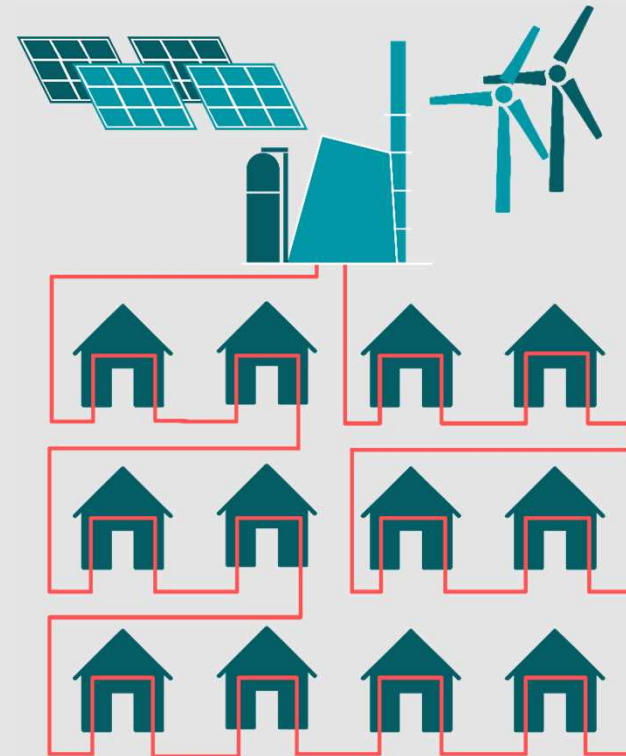
- Technological development
- Digitalization
- Regulation of the various branches of the utility sector
- Investments in the framework and infrastructure
- The consideration of ensuring consumers reasonable prices, security of supply etc.

COMBINED HEAT AND POWER

A COMMON AND EFFECTIVE USE OF SECTOR INTEGRATION

Using excess heat from power production to heat homes...

- **Increases efficiency** of power plants up to 25%
- Reduces fuel use and increases revenue
- **Requires** district heating system



THE DANISH WASTE MODEL

HOW WASTE MANAGEMENT CAN CONTRIBUTE TO SUSTAINABILITY, HEAT, AND ENERGY



Credit: State of Green

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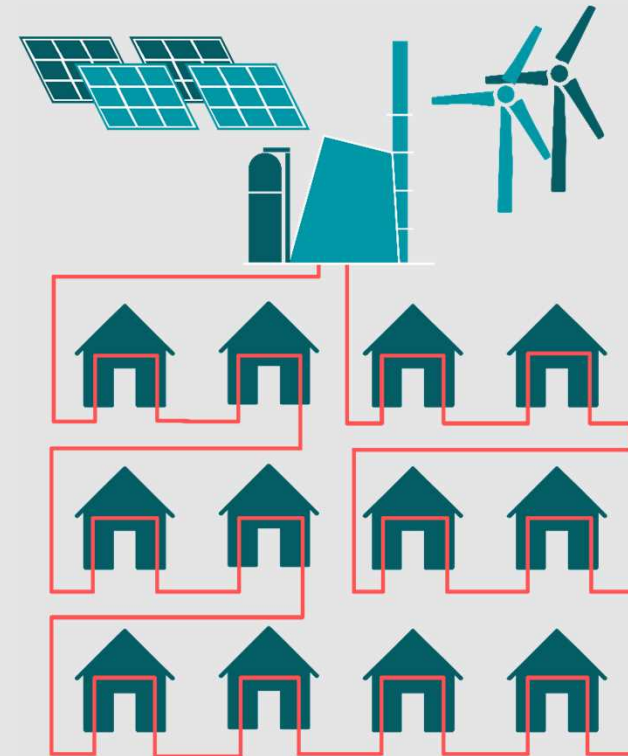
DISTRICT HEATING

“a system for distributing **heat generated in a centralized location** through a system of insulated pipes **for residential and commercial heating**”

DISTRICT HEATING

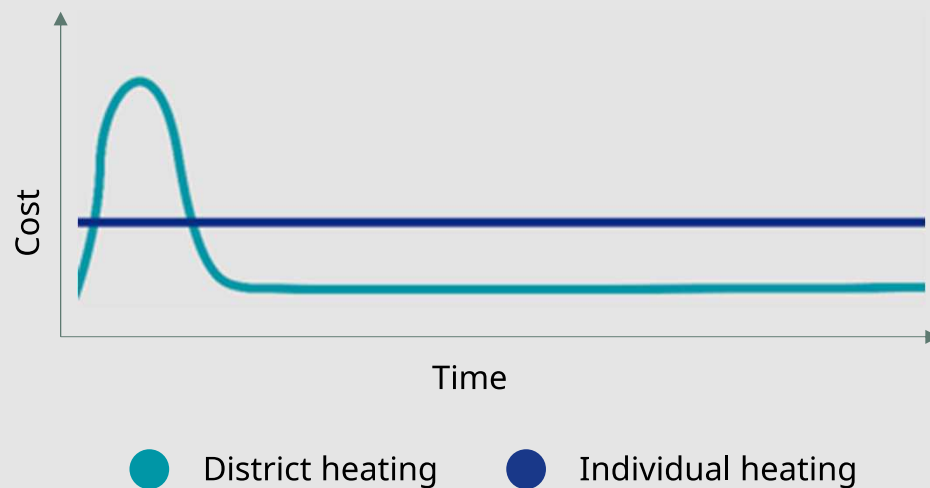
“a system for distributing **heat generated in a centralized location** through a system of insulated pipes **for residential and commercial heating**”

- All heat sources can be used – as long as they are hooked up to the pipe network
- Cheap heat
- High security of supply
- Green transition without interfering with homeowners
- Adds flexibility to power generation



DISTRICT HEATING IS A CONSIDERABLE INVESTMENT

HIGH INITIAL COSTS THAT LEAD TO CONSISTENTLY CHEAP HEATING



Short term, installing the proper infrastructure for district heating is a **considerable investment**.

Over time, the investment pays off.

And remember the added benefits:

- Sustainability
- Security of supply

DISTRICT HEATING IN DENMARK

BY THE NUMBERS

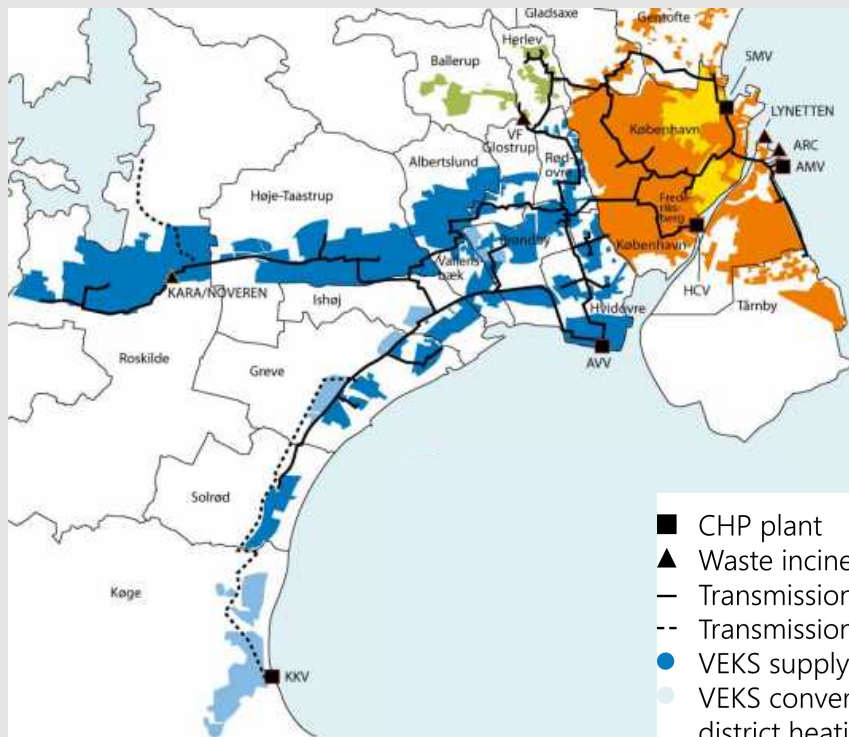
- 64 % of all houses DH-heated
- 33,000 km across Denmark
- District heating: 17% of Denmark's final energy demand
- Annual heat sale: 2.5 billion Euro = 2-3% of GDP
- Direct employment: 2,000 persons
 - Incl. suppliers: 10,900 persons



GREATER COPENHAGEN HEAT SUPPLY

A WIDE RANGE OF GENERATION SOURCES IN THE DISTRICT HEATING NETWORK

GREATER COPENHAGEN HEAT SUPPLY



- CHP plant
- ▲ Waste incineration plant
- Transmission line district heating
- Transmission line DH under construction
- VEKS supply area
- VEKS conversion area from natural gas to district heating
- CTR supply area
- Vestforbrænding supply area
- Steam based district heating

Heat sources:

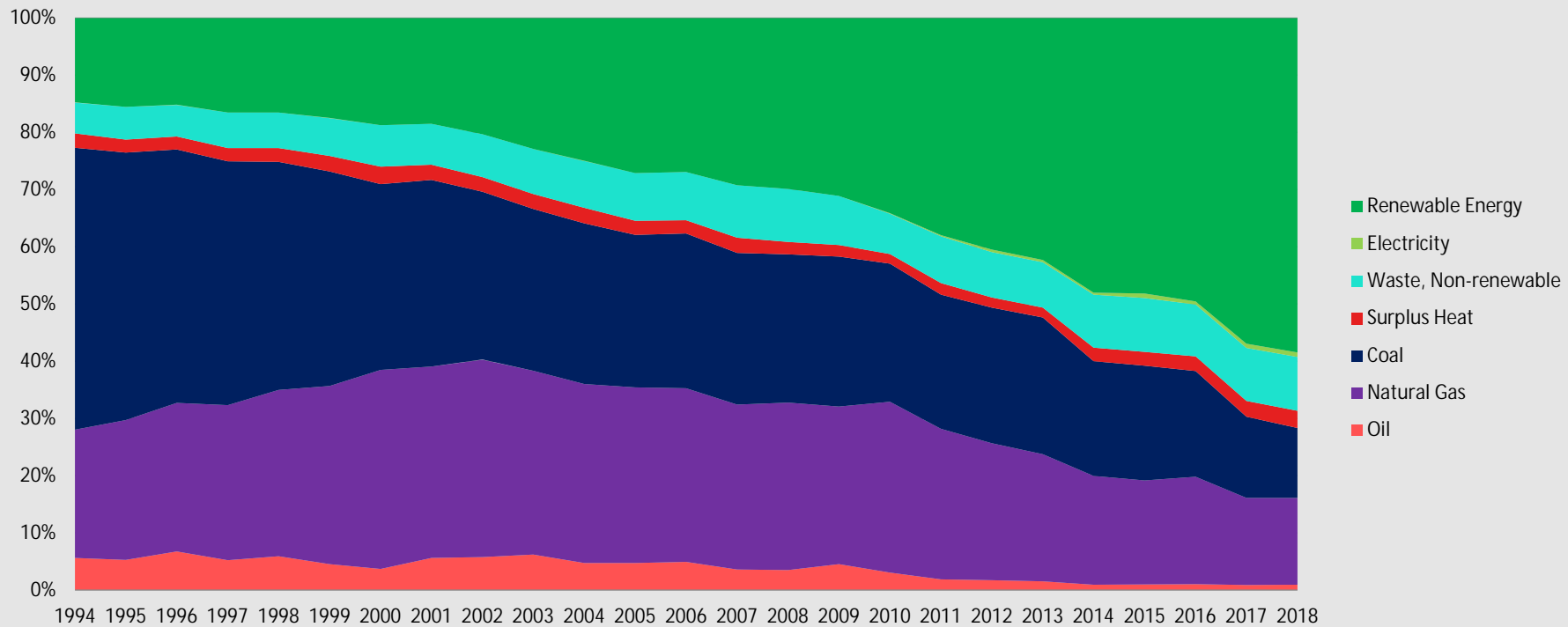
CHP from...

- Waste incineration
- Wood pellets and wood chips
- Natural gas
- Coal

Other sources: Oil and heat storage

CLEAN HEATING TRANSITION

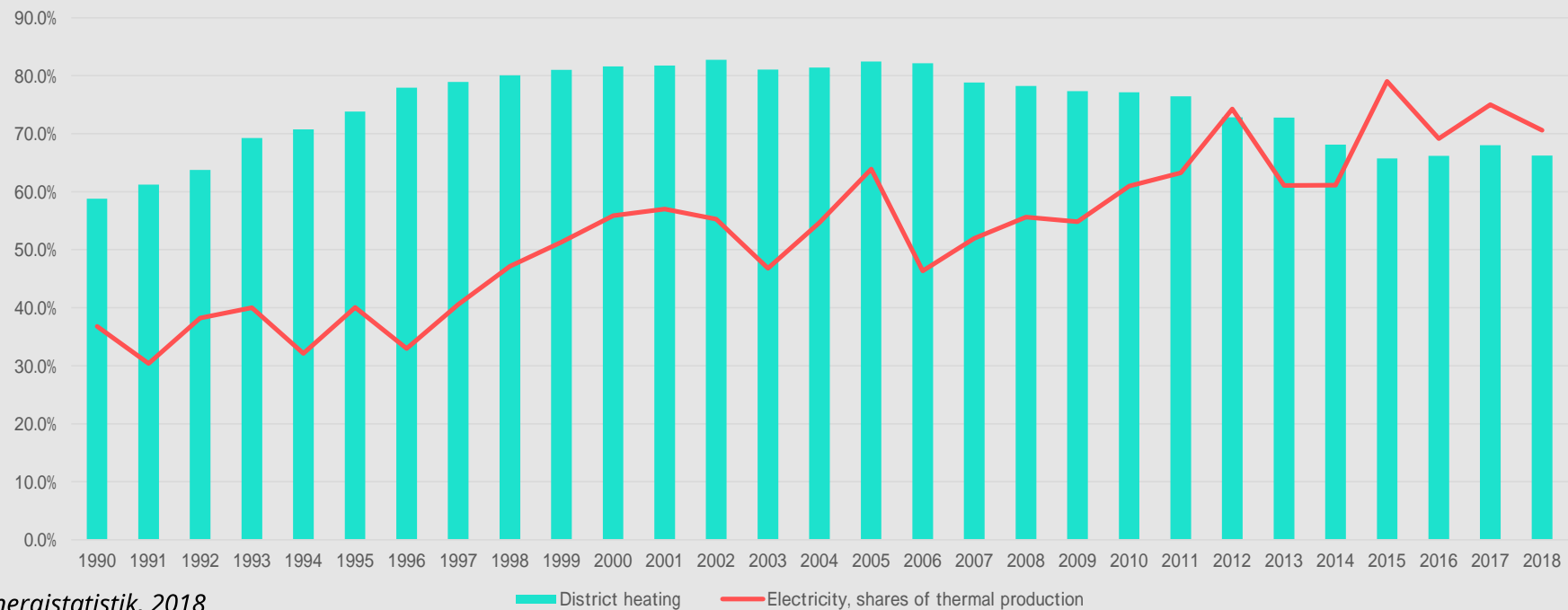
RENEWABLE ENERGY AND WASTE MAKE UP MAJORITY OF DISTRICT HEATING SUPPLY



Energistatistik, 2018

SECTOR COUPLING PLAYS A KEY ROLE IN DISTRICT HEATING

CHP SHARES OF ELECTRICITY AND DISTRICT HEATING PRODUCTION



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COPENHAGEN

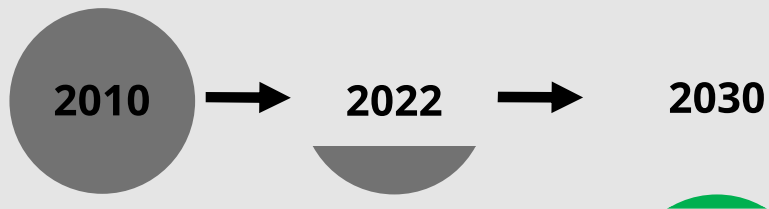
By the numbers

- 660,000 / 2,000,000 inhabitants
- 7,200 inhabitants / km²
- 345,000 homes (90% apartments)

Sustainability

- 99% district heating
- 590MW wind energy

Copenhagen's territorial emissions...
decreased by 74% from 2010 to 2022
will be **net positive by 2035**



Royal Danish Embassy in Japan

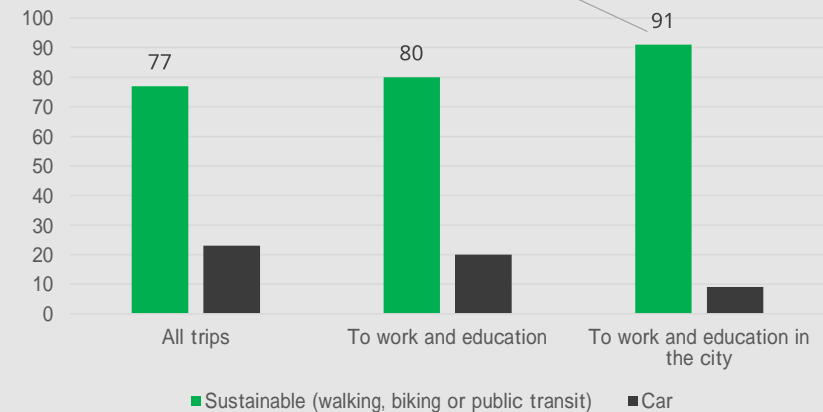
Sustainable transport is a big part

91% of commuting in the city is sustainable

Biking	58%
Walking	17%
Public transit	16%

every day

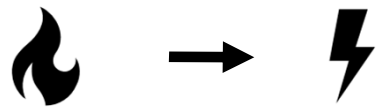
Copenhagengers' transit habits



COPENHILL

Waste-to-energy plant delivering heat and electricity to Copenhagen

440,000 tonnes waste / year ≈100,000 homes powered / year

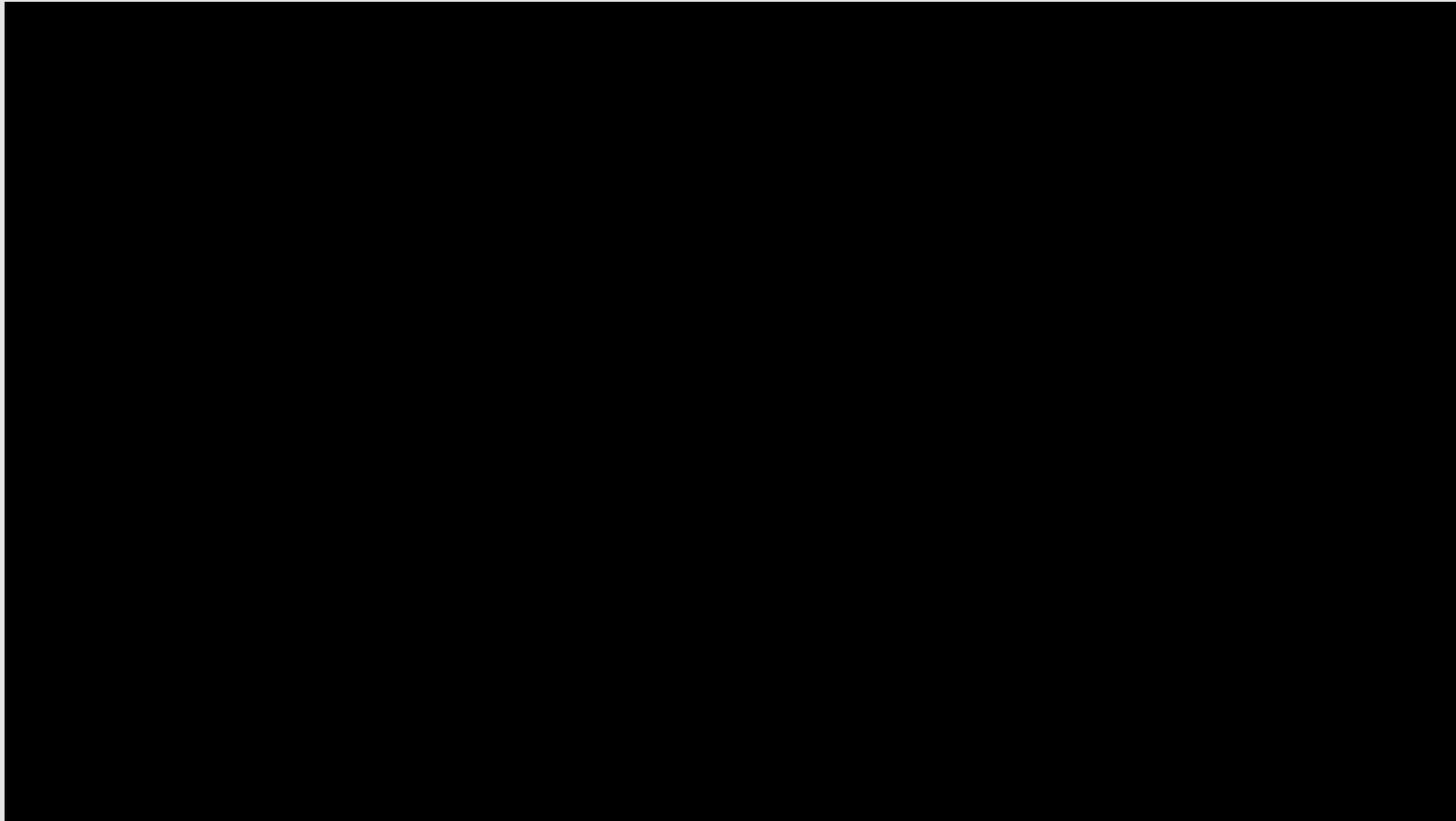


- Waste incineration → electricity
- Surplus heat → district heating
- Flexibility to shift from electricity to district heating based on demand



DANISH APPROACH TO LIVEABLE CITIES

CREATING SUSTAINABLE CITIES WITH A HIGH QUALITY OF LIFE



Credit: State of Green