



DISTRICT ENERGY **INTERNATIONAL CONFERENCE LAC 2025**



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**Net Zero in cities and the
role of District Energy
Abridged version**

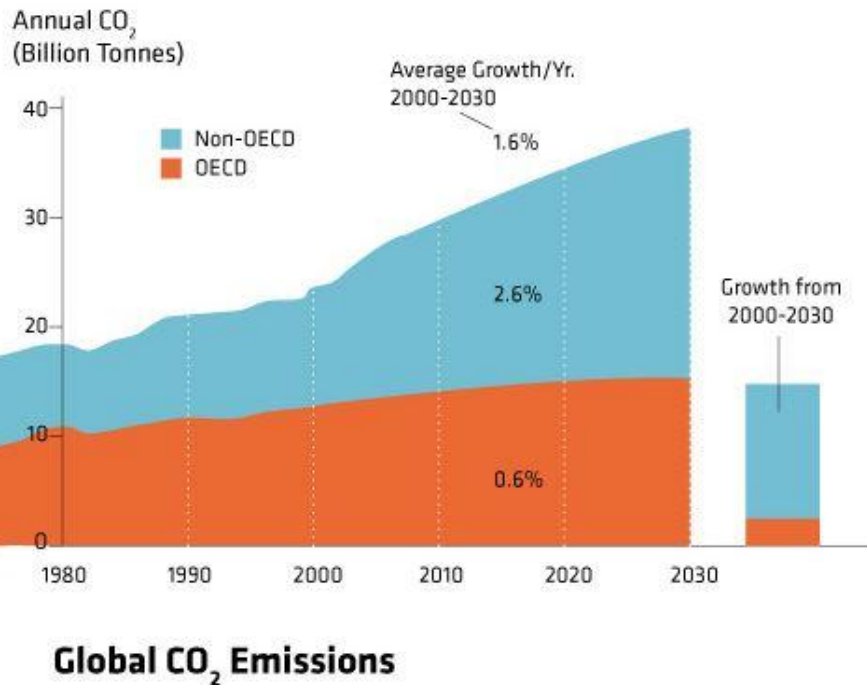


Overview



- **Why net zero ?**
- **What does net zero mean ?**
- **What are options/strategies ?**
- **District Energy Technologies**
- **What examples can be seen**
- **Healthcare - UK National Health Service NHS - role of hospitals in DE**
- **New ASHRAE Design guidance**

Greenhouse Gas Emissions



- **Global:**
4.5 metric tons/person
- **OECD Nations:**
10.6 metric tons/person
- **United States:**
18.1 metric tons/person
- **Non-OECD Nations:**
7.8 metric tons/person
- **Africa:**
1.1 metric tons/person



JRC SCIENCE FOR POLICY REPORT

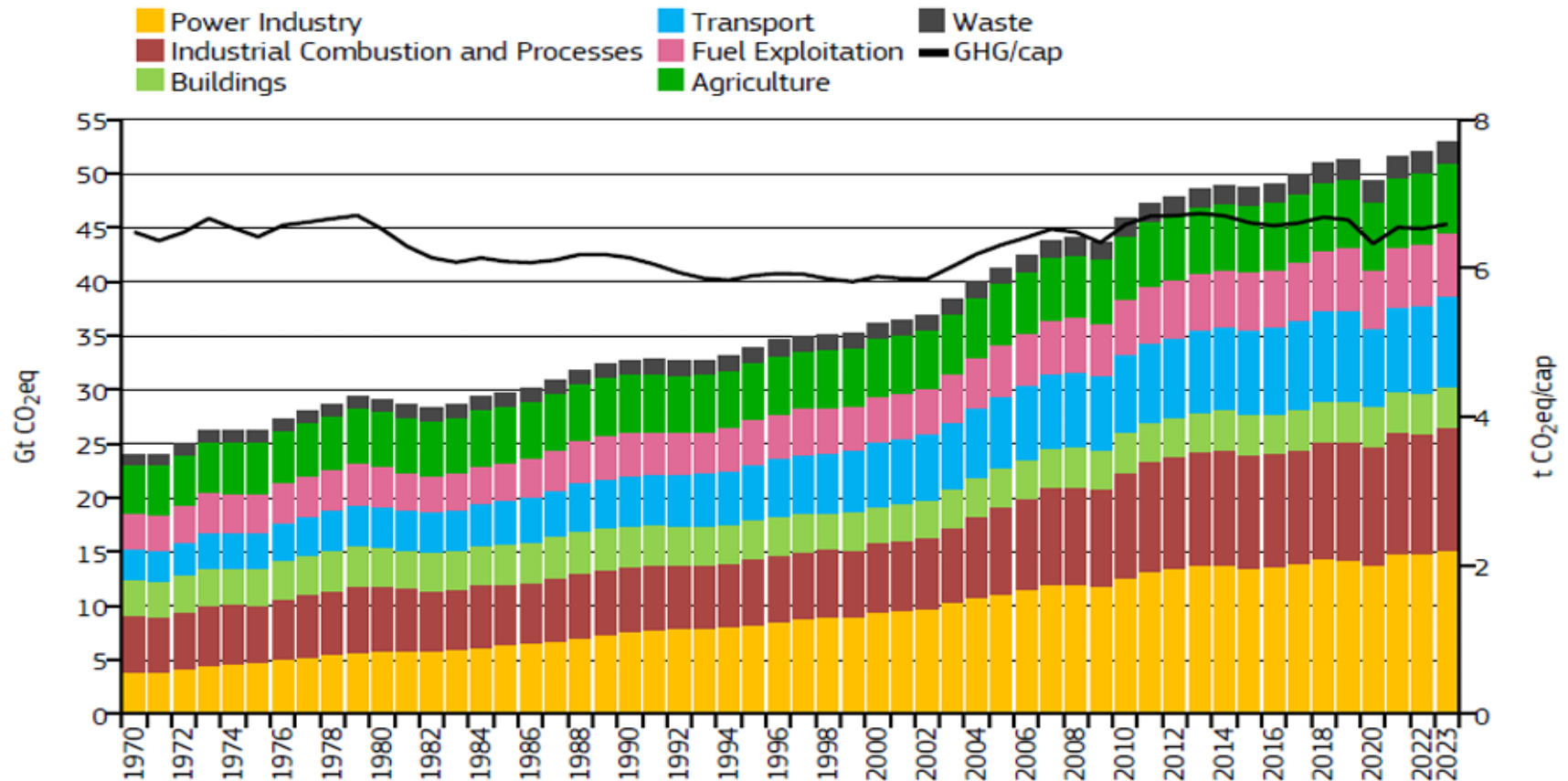
GHG EMISSIONS OF ALL WORLD COUNTRIES

2024



JRC of the EU world GHG data 1.9% up

Figure 2. Global GHG emissions by sector (left axis, bars) and per capita (right axis, black line), 1970-2023



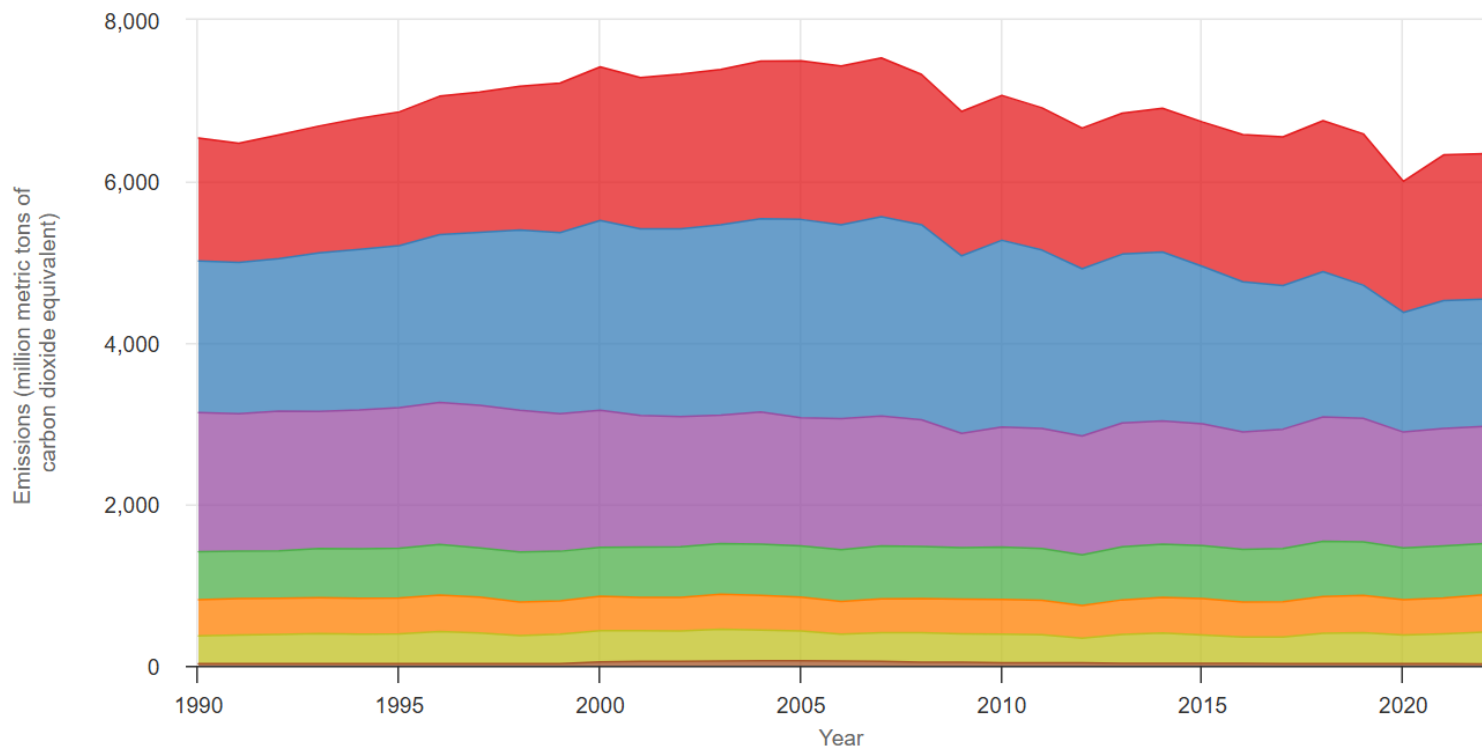
Source: JRC, 2024

US Greenhouse gas emissions 3% down

Date range: 1990–2022

U.S. Greenhouse Gas Emissions by Economic Sector, 1990–2022

Export



● Transportation ● Electric power industry ● Industry ● Agriculture ● Commercial ● Residential ● U.S. territories

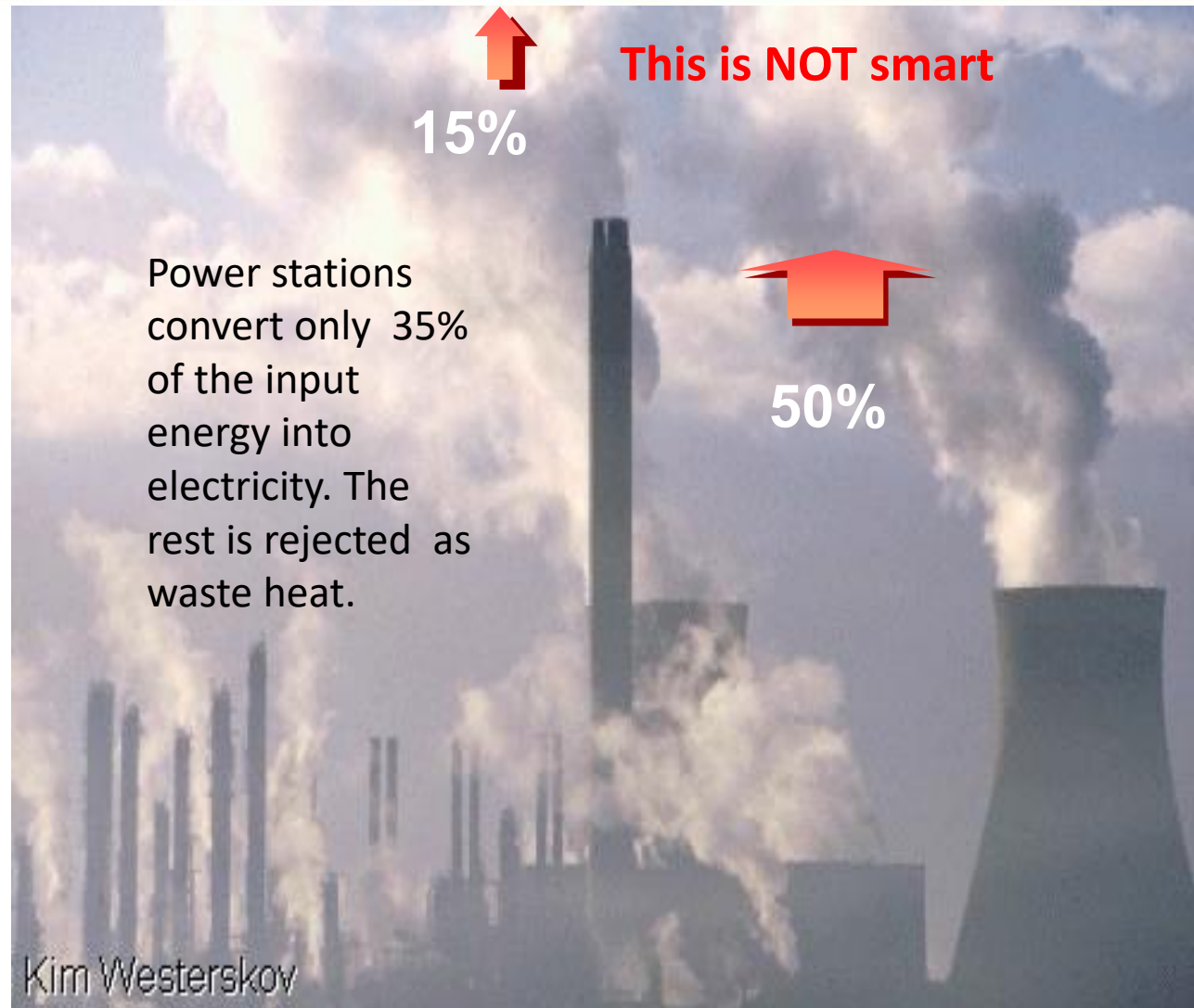
Source: U.S. EPA's Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2022. <https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks>

District Energy reduces energy waste a lot

- UK thermal power stations are around 40% efficient – so 60% energy is wasted
- Energy centres serving heat and power are over 80% efficient – less than 20 % wasted.
- So DE can halve emissions
- But a total transition away from Thermal Power stations is impossible. The new power plants are nuclear which will be Net Zero carbon.
- Renewable such as wind and solar are being installed but suffer from variable supplies and cannot match to user demand

UK Power plants produce electricity

- 35 GW installed gas fired power
- 35 GW thermal power fuelled
- 70 GW heat rejected
- More heat thrown away than UK needs
- UK has closed all coal power.



Zero Carbon Cities



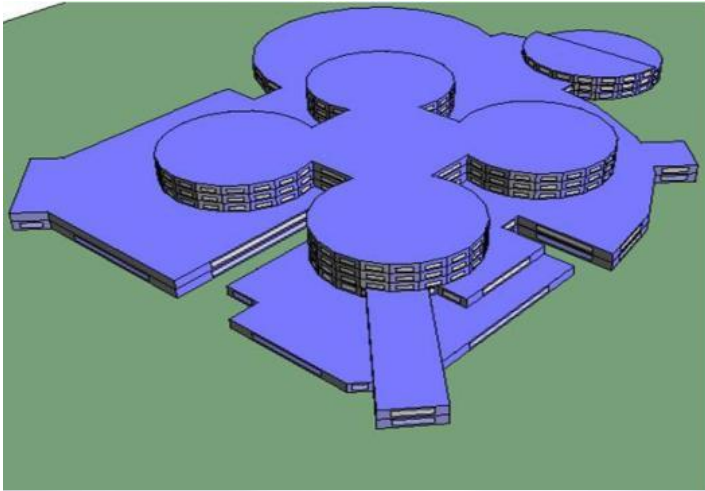
Tri-Gen Systems

- Tri-gen = simultaneous on-site generation of electricity, heating, and cooling
- Conventional grid electricity
- 30% efficient
- Tri-gen, by utilizing heat by-product
- 70% to 90% (good quality CHP)
- Can be future-proofed to use natural gas now and biofuels/waste/AD or other sources later
- Nuclear power stations are NZ because they use uranium, not fossil fuel.



Gas distribution is standard

- example Romford Hospital energy centre



‘Low Energy’ Hospital in Romford,UK

- Over 50% naturally ventilated
- Energy reduced from 101 to 58 GJ/100m³/annum
- Lighting controls
- But 4 big gas fired boilers – ‘as usual’

Gas distribution is standard

- example Romford Hospital energy centre

- 4 medium pressure hot water boilers installed – but low heating load and high performance fabric = no heat demand = no need for gas supply.
- Actually no need for any boilers
- ‘Sometimes 1 is used’ on low heat
- Money wasted – £250M at 2025 rates



Why net zero in Healthcare ?



The first principal of healthcare is “primum non nocere;”

- first, do no harm



Net zero healthcare



October 2020 NHS
published



Delivering a 'Net Zero' National Health Service



UK NHS Hospitals NZ standard Feb 2023



All hospitals

- New NZ immediately
- Existing to reduce emissions by 2040

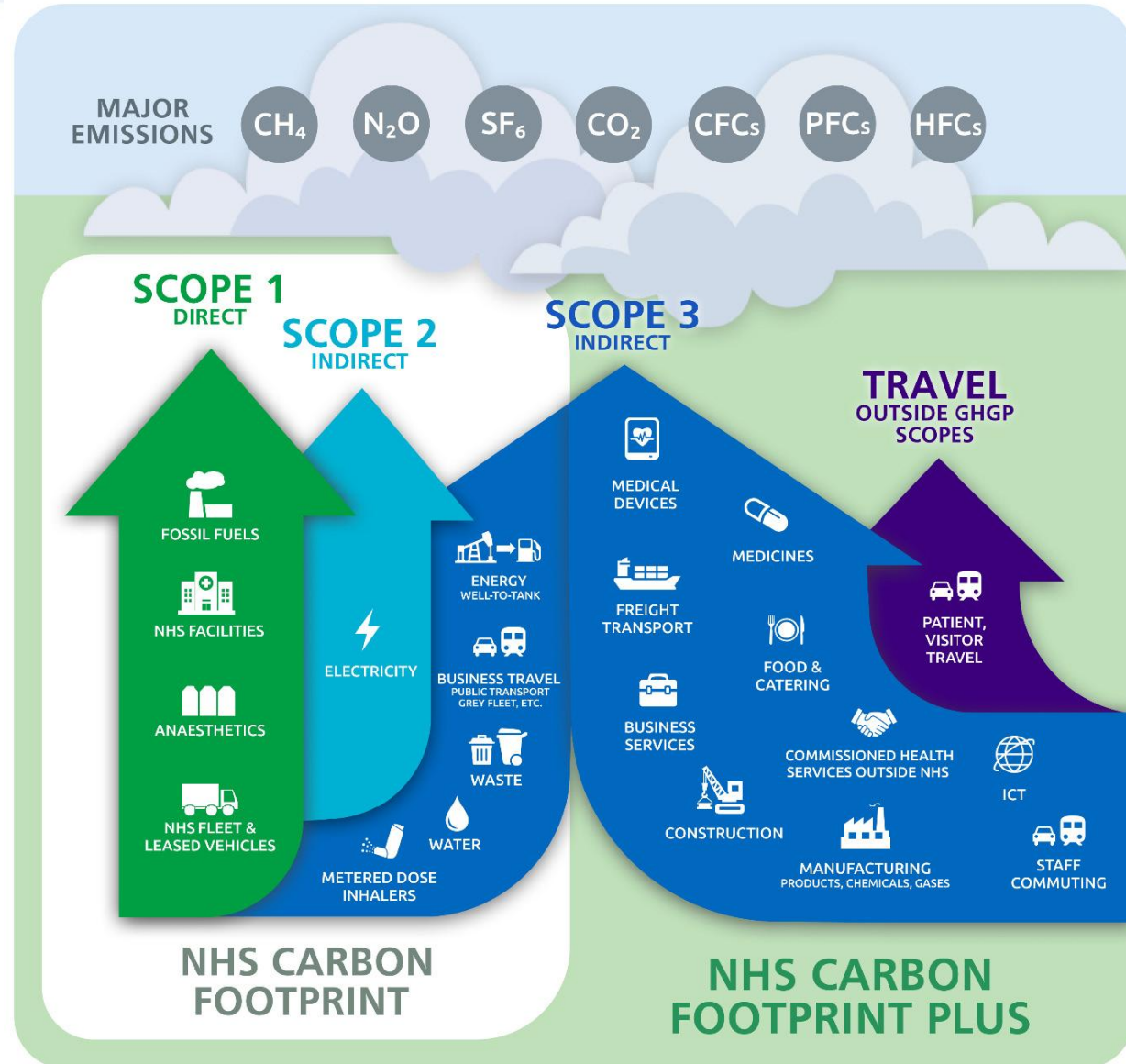
Delivering a “Net Zero” National Health Service’ (2020) plots an ambitious yet feasible set of actions to respond to climate change with clear targets for achieving a net zero health service for direct emissions by 2040 and indirect emissions by 2045

NHS Net Zero Building Standard

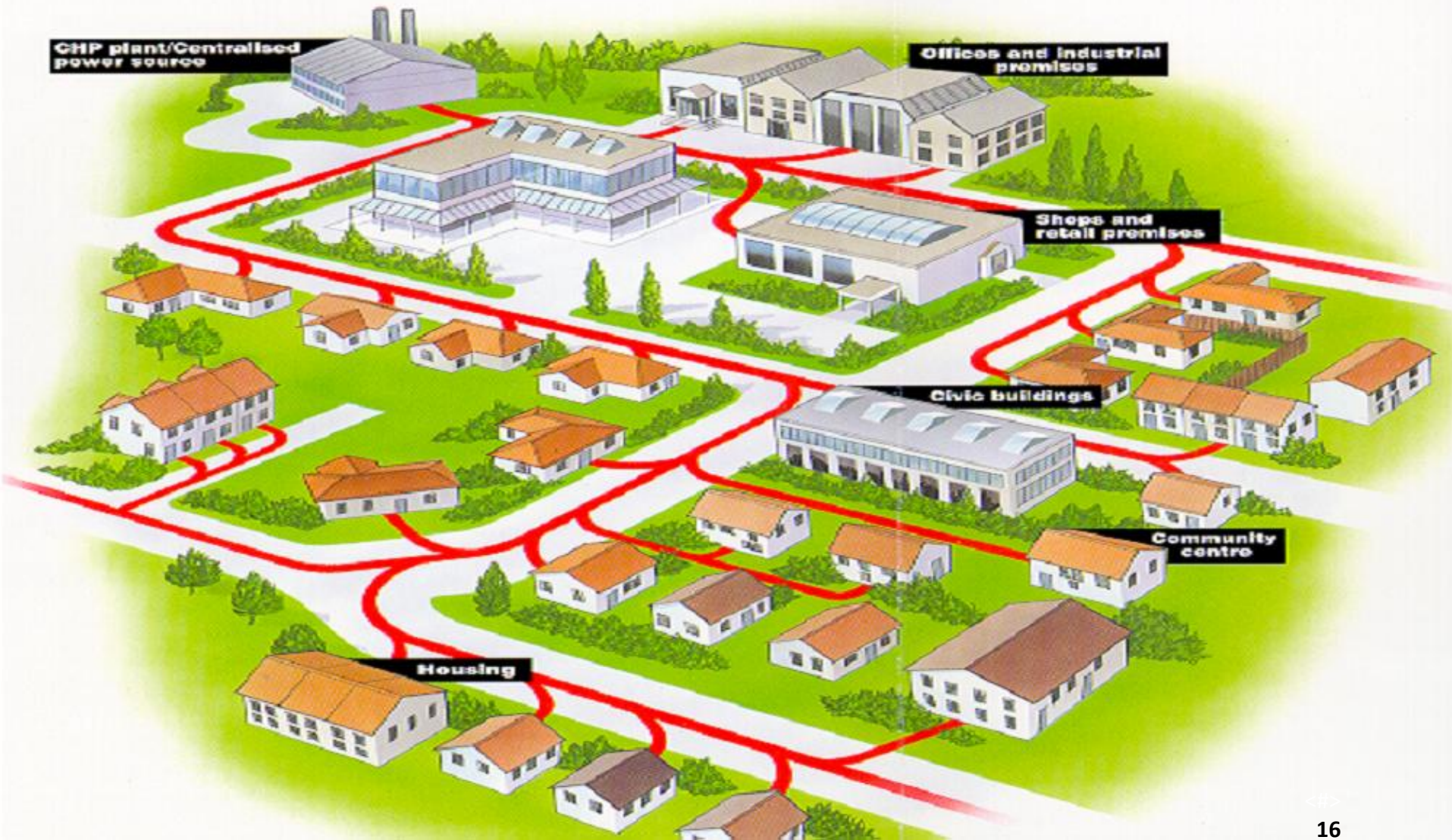


NHS NZ Hospitals

- New NZ standard published February 2023
- Covers operational plus embedded carbon
- Only 15 % of carbon is operational



Zero Energy Cities must use District Energy



Buckshaw Village - exemplary sustainable development in Chorley



But uses gas throughout

Gas is still the norm for UK houses

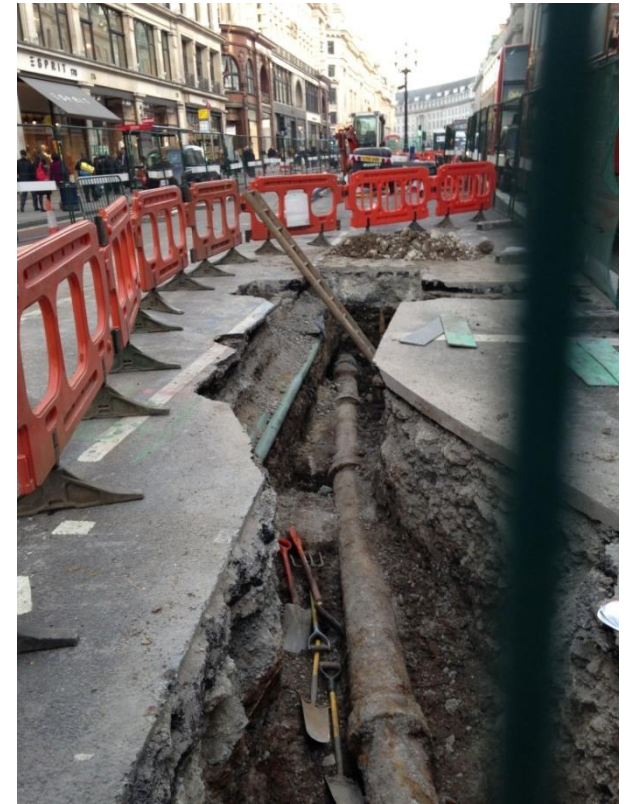


Gas supplies being installed into NEW houses 2025



UK has no underground walk through ducts

Regent street London – sewer repairs close street



Gas network is being expanded and upgraded



New gas mains into existing streets

ASHRAE TASK FORCE FOR BUILDING DECARBONIZATION

- ASHRAE's TFBD was formed in Spring 2021 as an initiative of President Chuck Gulledge and President-Elect Mick Schwedler.
- Jurisdictions globally are confronting climate change and recognizing that building decarbonization is an important component in their efforts.
- The worldwide building sector accounts for about 40% of energy-related carbon emissions and buildings remain a major sector that lacks sufficient mitigation policies.
- As the standards authority for energy usage in buildings, ASHRAE recognizes that our long-standing initiatives in energy efficiency should be expanded to building decarbonization.



ASHRAE DECARBONISATION - Hospitals

- GUIDE FOR HOSPITALS
PUBLISHED 2024
- FOR NEW HOSPITALS
- ALL ELECTRIC
- CAN D.E. BE USED ??



Decarbonizing
Hospital
Buildings



Toronto – zero carbon cooling from Lake Ontario



Water-Source Heat Pumps

- Liverpool Docks
- Stanley tobacco warehouse and other regeneration projects could use dock water for heating and cooling



District energy is Sustainable energy see ASHRAE Standard 189, ASHRAE Green guide and CIBSE guide

Media City UK

**First Excellent BREEAM
Communities development**

**Net Zero carbon energy
On site generation
TRI GEN systems.....**

Electricity

District heating

District cooling

**Renewable energy using canal
water**

**Economic growth for Salford and
Manchester**

Live + work + play community

'Green' spaces inside and out

Pleasant happy friendly places

Safe and thriving environment



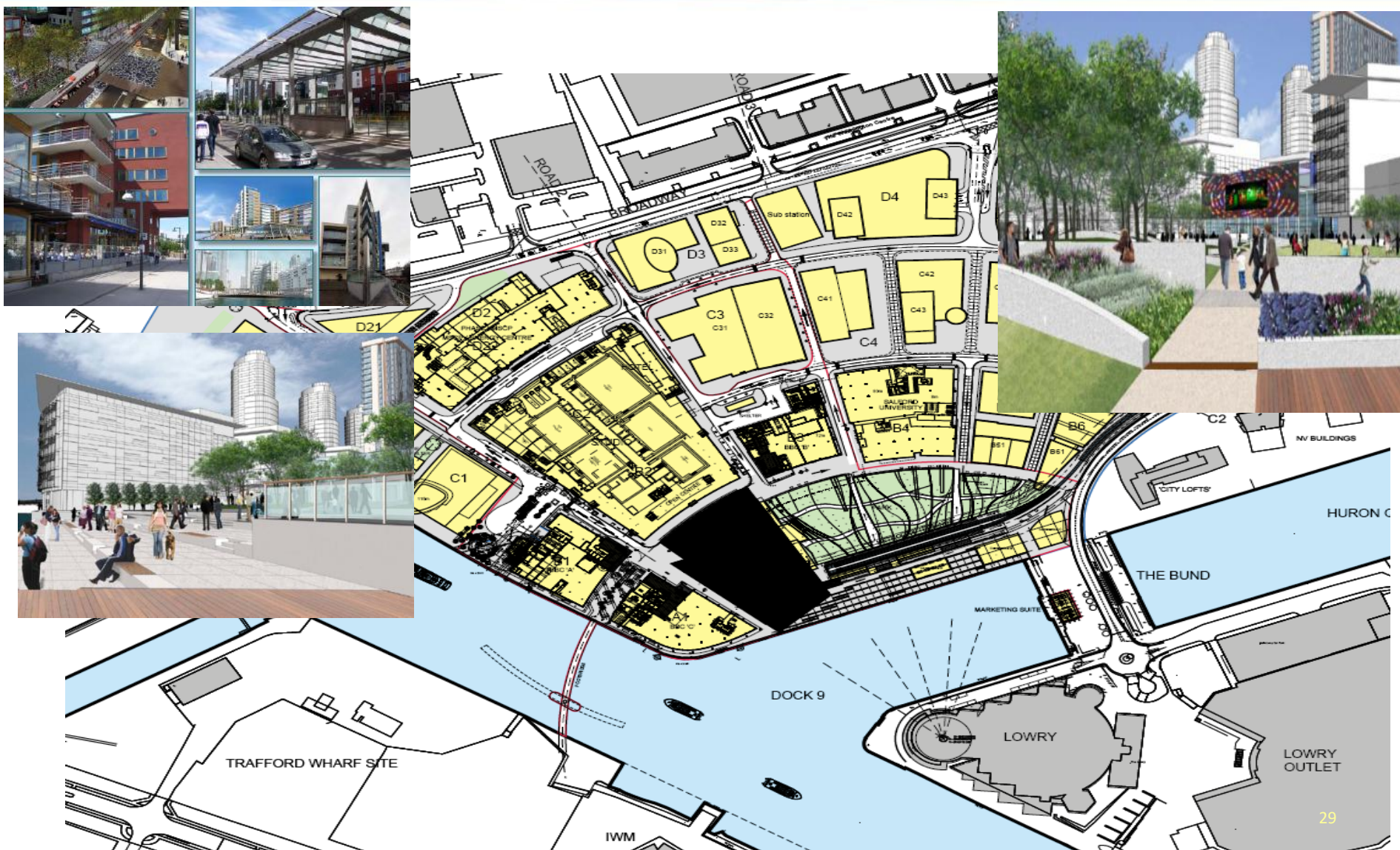


Media City UK is a 'near' net zero carbon development because it uses natural gas now but can be upgraded.

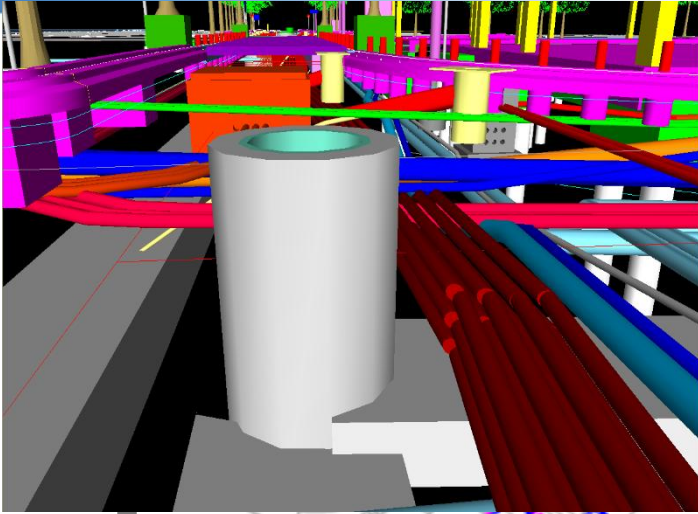


Sustainable development using district energy system

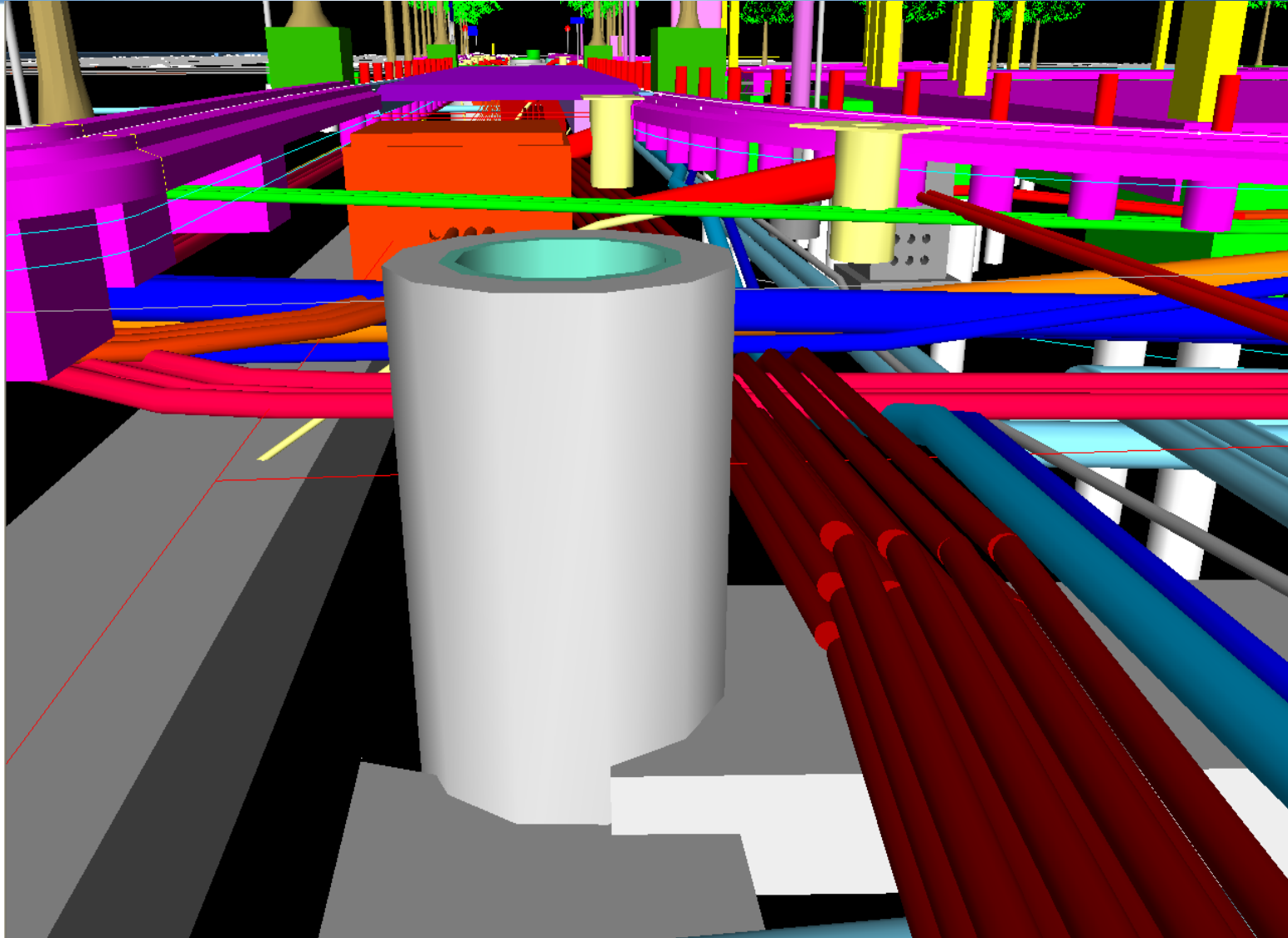
BREEAM Communities 'Excellent' at Media City UK



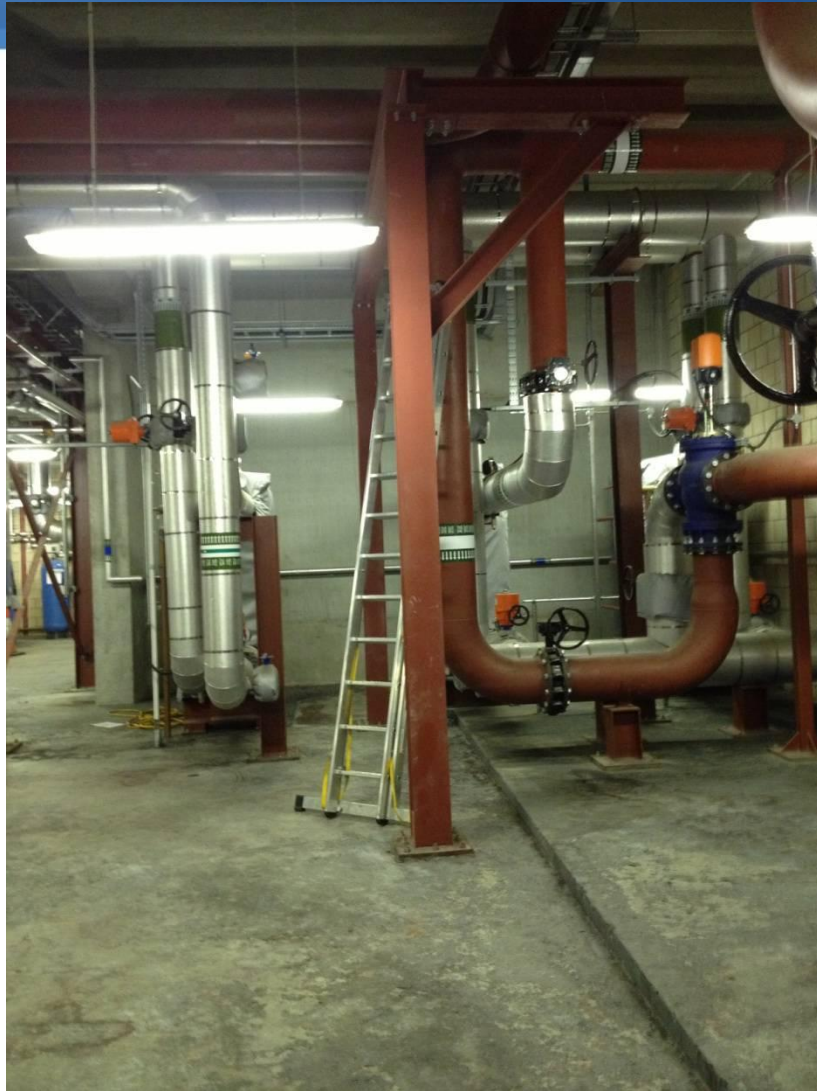
Media City NZ Energy systems



Utility Co-ordination using BIM – a 3D view of underground services ideal for installation of District Energy systems. A digital tool.



Absorption chiller and pumps



Typical Pipework Installation



Media City UK delivering the vision



DE is a key to Zero Energy Cities

Integrate Waste Management with Energy Generation

Resource Use

- Efficient Use
- Minimum Waste
- Increased Recycling

Environmental

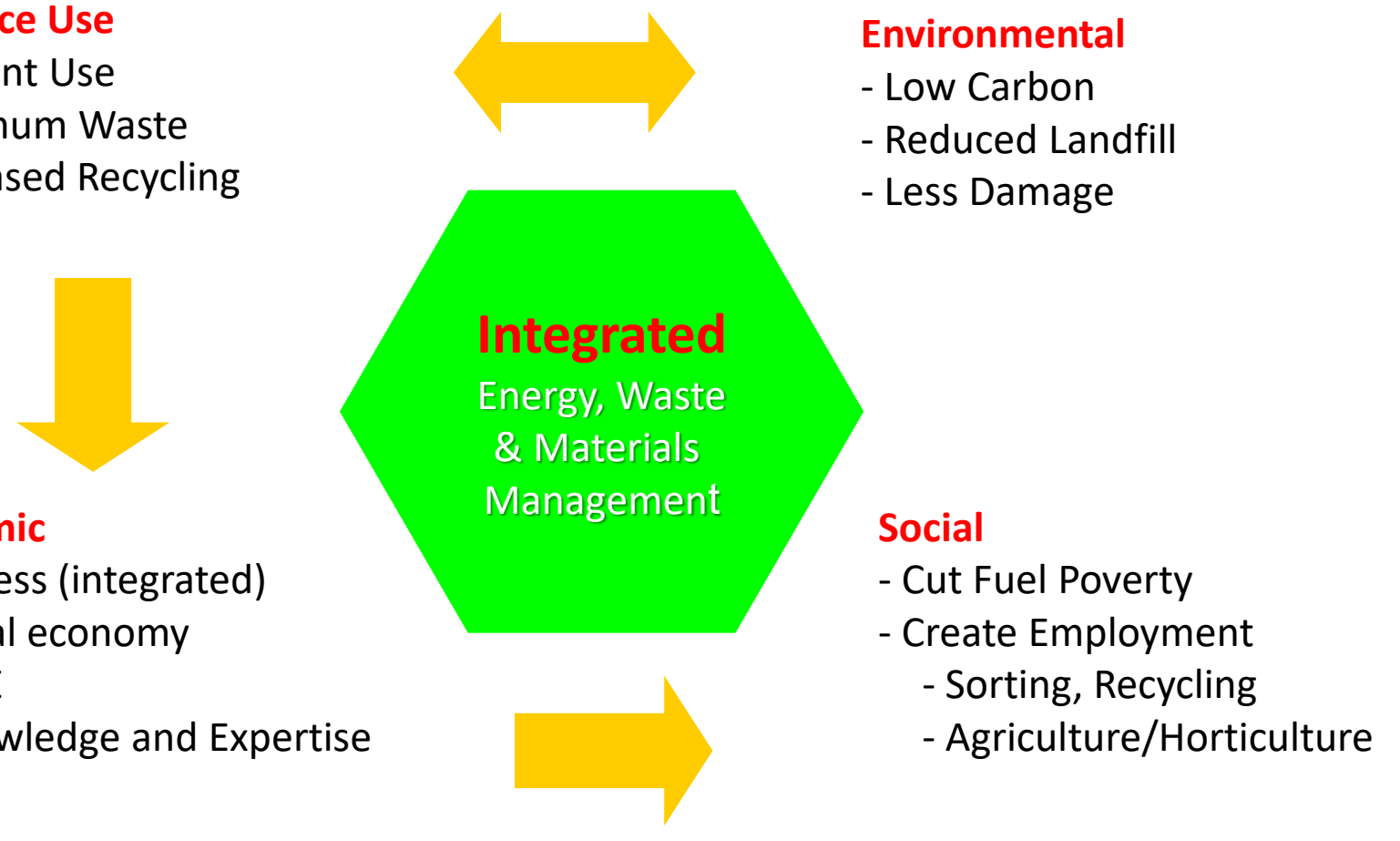
- Low Carbon
- Reduced Landfill
- Less Damage

Economic

- Business (integrated)
- Rural economy
- SME
- Knowledge and Expertise

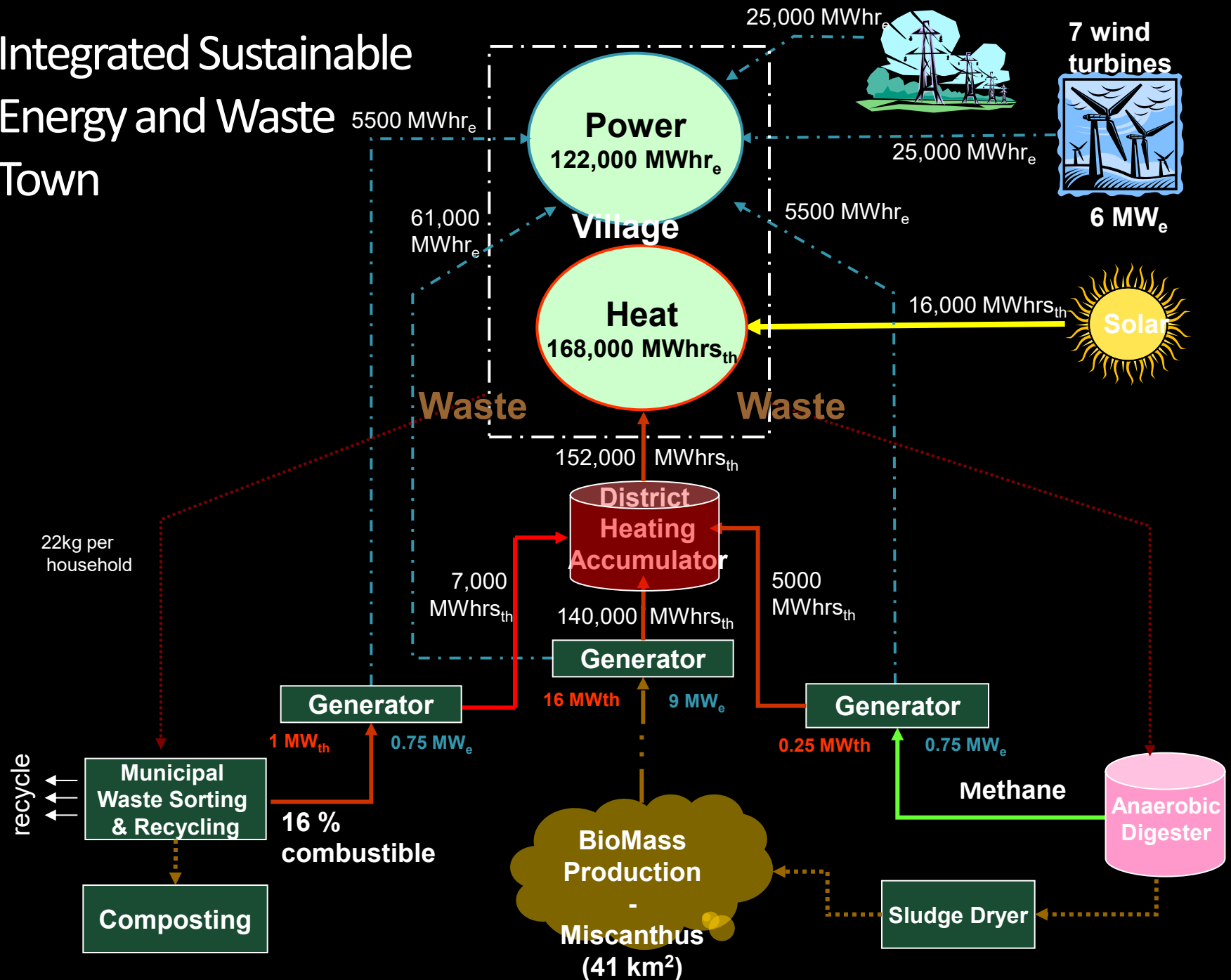
Social

- Cut Fuel Poverty
- Create Employment
 - Sorting, Recycling
 - Agriculture/Horticulture



Integrated
Energy, Waste
& Materials
Management

Integrated Sustainable Energy and Waste Town



Pilkington Glass



- Glass requires sand and electricity
- Rising costs of electricity threatened its future
- So new 15MW waste to energy plant was an answer.
- 'Free' electricity
- St Helens heated by new district heating network – low cost heat supplied to city
- Net Zero energy
- Future proofed



Southampton District Energy scheme

- Started in 1986 as a 1MW geothermal scheme
- Water from borehole to aquifer 1.7km below ground at 76C
- Served Civic centre with 76 C flow 50C return
- Tr-gen added 5.7 MW in and also supplies at 76C flow 50C return.
- Royal Southampton Hospital supplies 1MW

Hong Kong - Sea water cooling

- HSBC was first major example – very successful
- Sea water cooling is ‘renewable energy’
- Using water achieves higher chiller COPs – typically 6 to 7 possible



Individual 'splits'

- Each apartment gets their own.
- Variety of installations – patchy
- Heat rejected rises to affect apartments above – hot air issues
- Shorty life in use
- Poor value compared to centralised cooling and local fan coils



High density residential

- Centralised cooling system
- Chilled water to each residence
- Residence cooling system connects via plate heat exchanger.
- Separates central cooling water circuit from each residential circuit



DE being installed into Hong Kong streets





- Based at Bridlington but planning for much more
- Uses geothermal energy 1 km deep river water flowing below Yorkshire
- Water temperature 50 C
- Heat pumps could raise temperature
- Start with existing hospital energy centre

Hospitals can be the key to getting DE started

- Hospitals need NZ strategies including DE
- Hospital Energy centre can be starting point of a DE
- Hospitals can make income
- Heat sold can be low cost to help poorer communities



Newcastle Hospital – district heat and cooling networks



The task ahead.

Hospitals use a lot of energy – more and more equipment, 24 / 365 usage, specialist environments

Royal Free Hospital DE



Royal Free London **NHS**
NHS Foundation Trust

Marlborough
clinic
Community
gynaecology

Camden social housing with DE



District energy systems are beginning to happen in UK – examples shown here...

- **Feasibility**
 - Warwickshire CC
 - Coventry District Heating
 - Wrexham District Heating
 - Watford town centre
- **Operational**
 - Media City UK
 - Stratford, London
 - Kings Cross London (Google NZ HQ)
 - Birmingham
 - Southampton
- **In planning stage**
 - Liverpool City
 - St Helens City
 - Manchester – several
 - East Yorkshire
 - Runcorn



Wirral Waters and Liverpool Waters



Zero carbon city which uses waste heat to serve neighbouring district with low cost, low carbon heat energy.

NZ London – with District Energy started but a lot yet to do



Conclusions



- NZ is achievable and cost effective
- Recover heat from internal heat loads
- No gas supply and no heating boilers. Save your money. Use recovered heat.
- Design starting with considering the human/users and the processes
- Integrated sustainable design approach needed
- Use ASHRAE's technology support

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ASHRAE Standards



- ANSI/ASHRAE/IES 90.1-2019 Energy Standard for Buildings Except Low-Rise Residential Buildings
- ANSI/ASHRAE Standard 90.2-2018 Energy Efficient Design of Low-Rise Residential Buildings
- ANSI/ASHRAE Standard 105-2014 Standard Methods of Determining, Expressing and Comparing Building Energy Performance and Greenhouse Gas Emissions
- ANSI/ASHRAE/ICC/USGBC/IES 189.1-2020 Standard for the Design of High-Performance Green Buildings Except Low-Rise Residential Buildings
- ANSI/ASHRAE/ASHE Standard 189.3-2017 Design, Construction and Operation of Sustainable High Performance Health Care Facilities
- SPC 228P Standard Method of Evaluating Zero Net Energy and Zero Net Carbon Building Performance

References

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Questions and discussions

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