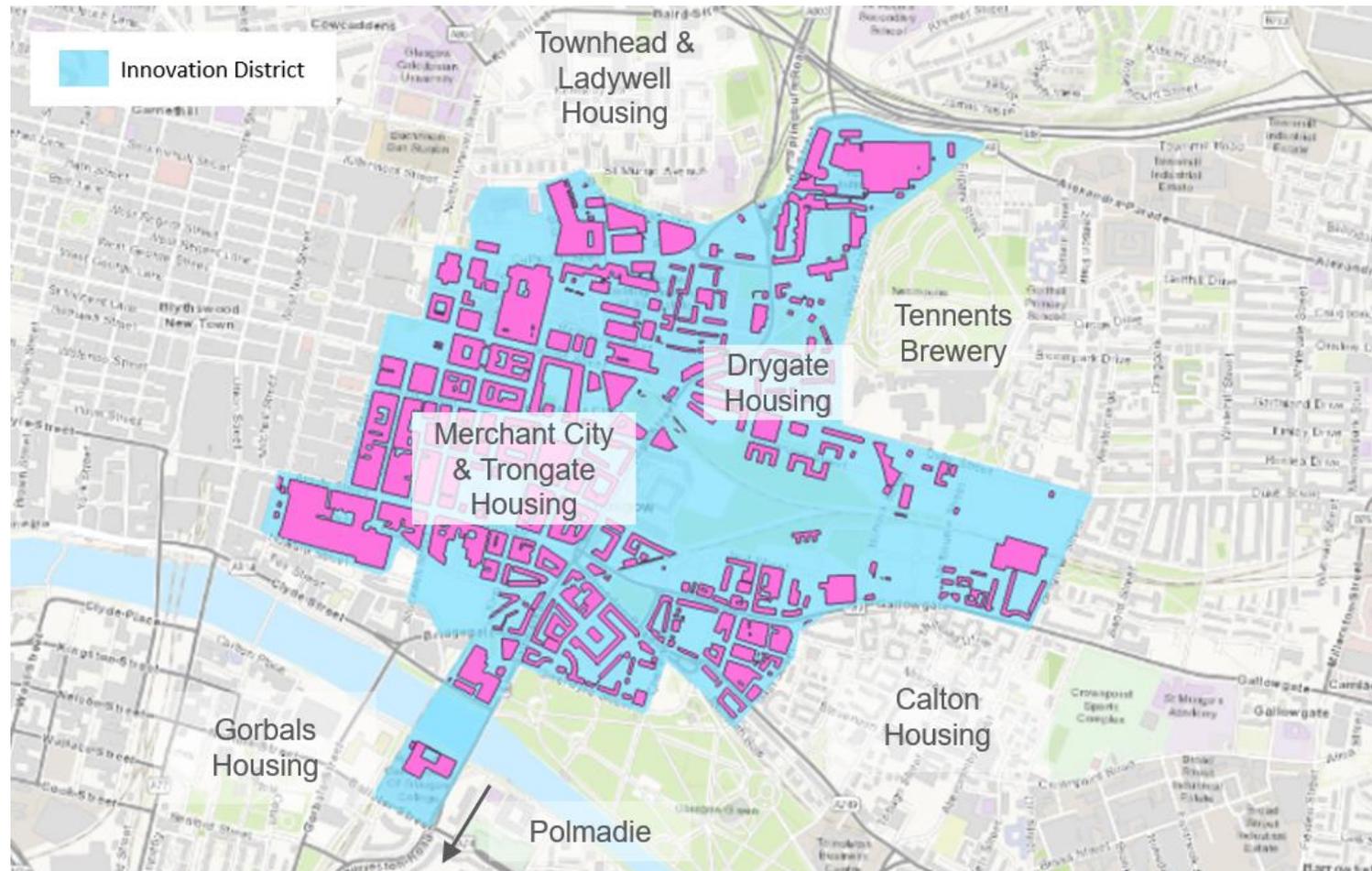


Feasibility Study: Climate Neutral Glasgow City Innovation District Final Report

Dr Roddy Yarr, University of Strathclyde, 28th September 2021

Climate Neutral District Objectives

- Technical and financeable solutions to achieve energy • Adapted to the impact of assessed climate change for carbon neutral operation; the city; and
- Targeting 100% renewable heat, power, transport and • Socially inclusive. sustainable 'places' with well being a central theme;



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The Team

Technical Team

- University of Strathclyde
- Glasgow City Council
- Atkins (Lead consultant)
- UK Energy Systems Catapult
- The Weegie Board
 - Star Renewable Energy
 - Comsof
 - Mini Bems
- Ikigai Capital
- Smarter Grid Solutions



Steering Group



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Headlines

Emissions Reduction

The District Heat Network '100% uptake' Scenario provides a **credible pathway** to 84% emissions reduction from baseline, and innovative grid flexibility approaches can offer a further 9% reduction. These measures coupled with some residual GHG emissions capture technology (and nature-based solutions) provide a pathway to Net Zero by 2030.

Whole Systems Approach

The positive collaboration of the stakeholders, existing planned infrastructure and emerging policy levels (e.g. Avenues; GTS; LEZ) and the natural asset of the River Clyde affords the city of Glasgow a **unique opportunity** to achieve climate neutral status and attract the necessary investment to do so.

Scale

The city's decarbonisation roadmap provides opportunity for this model to **scale and to replicate** across the whole city and beyond. This includes connecting communities and businesses in geographically separate locations. This technical work has shown that the natural heat resource in the River Clyde and other natural and built environment resources exist to enable this.



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The most feasible scenario

Aggregated Carbon emissions (ktCO₂e/yr) CNGCID

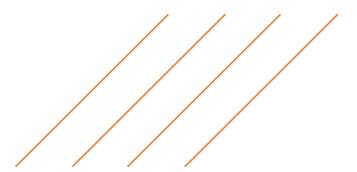


- Environmental Greenspaces*
- Building Energy Efficiency
- Transport Measures

- DHN Phase 1
- Transportation Measures

- DHN Phase 2
- Transportation measures

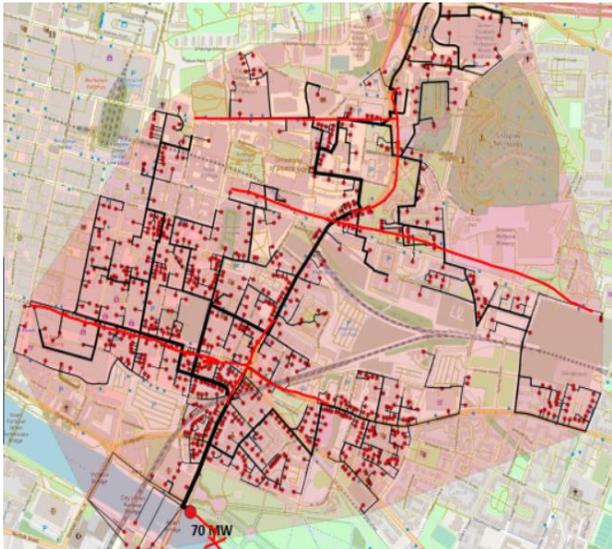
- Residuals



Energy (Buildings) Key Findings

At 93% of the baseline 2020 emissions, a step change approach is required:

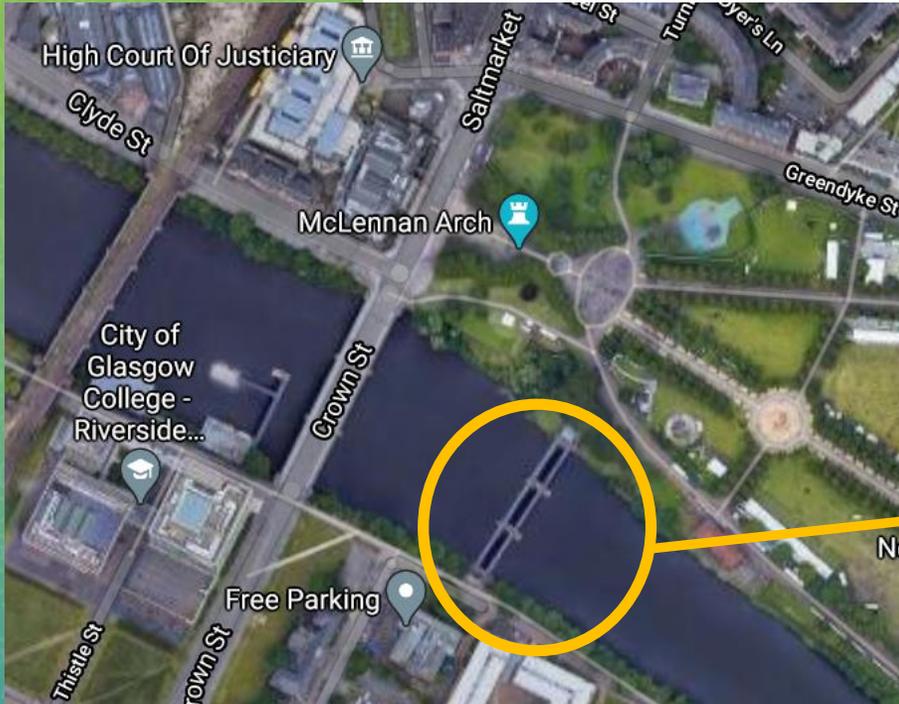
- › A phased city wide DHN is credible and most effective
- › Phase 1 equivalent to 50% of districts annual heating demand.
- › Enabled by building energy efficiency measures
- › Unique opportunity to utilise existing avenues programme.
- › Further 9% reduction available through innovative grid management. (PV, VPP and BES)



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Heat Potential in the River Clyde



- 175km long
- 3,250km² catchment
- 10m³/s flow rate over the weir (95%)
- 200MW potential at the weir and pipe bridge, we need 100MW
- Heat discharges added from STWs (circa 20MW)

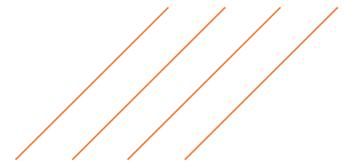
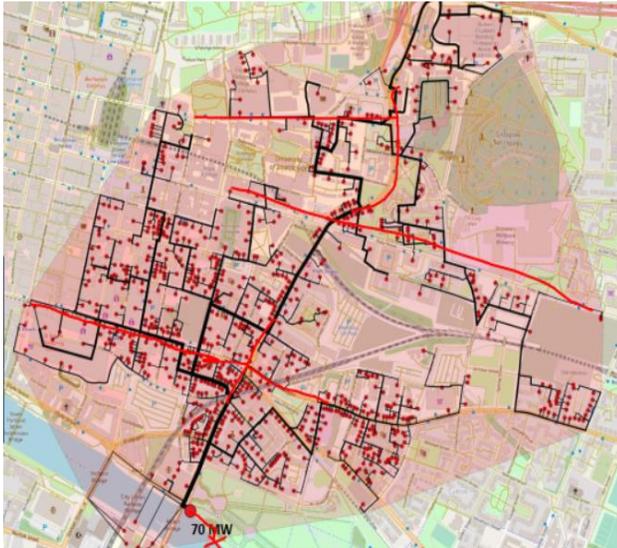
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Transportation Key Findings

Transportation is the second major contributor. The approach to decarbonising transport must be implemented consistently across the city

- › Avoid, Switch & Improve approach.
- › Freight consolidation: Last mile delivery hubs including e-mobility and required infrastructure.
- › Provide Urban Realm & priority for pedestrians and wheelers.
- › Integration where possible with the Avenues programme is a key component to making the decarbonisation measures a success.

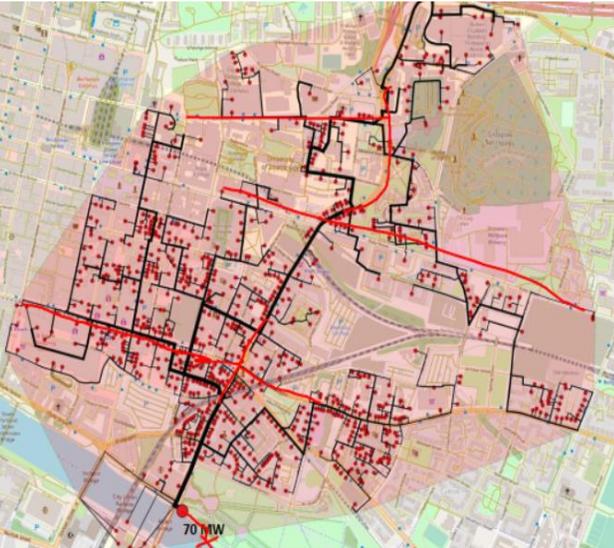


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Environmental & Resilience Key Findings

There is strong potential for developing a highly effective urban environmental improvement programme for the district, based on a *climate corridors* concept centred on the multi-function, multi-benefit features of green infrastructure.

- › The climate change related risk of increased flooding, both river and surface flooding, urgently needs to be addressed
- › There is scope for enhancing the planned interventions with a more fully integrated sustainable outcomes led approach across all key sectors.
- › Strong potential to increase vegetation cover with additional indirect benefits e.g. improved city image, tourism, and improved health and wellbeing.
- › Integration with the Avenues programme is a key to enable delivery and to complimentary benefits.



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Climate corridor vision (Example of High St. Transformation)



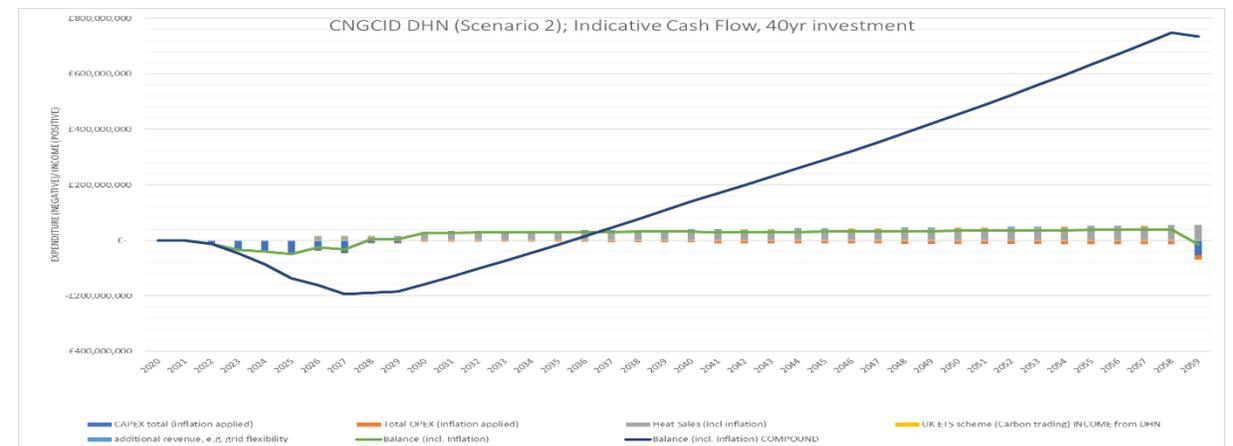
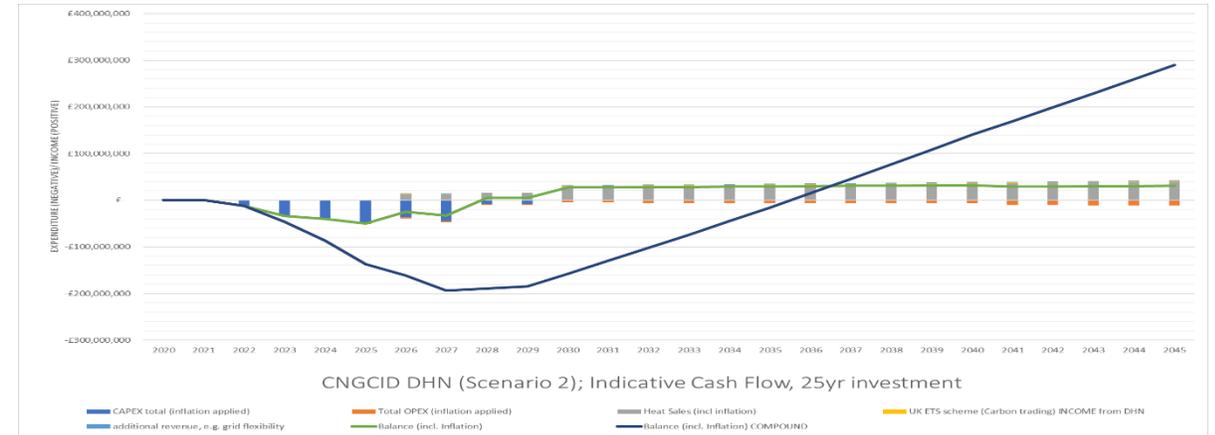
High Street today



Financial Key Findings

- › Total Cost (today's money): £210M to £500M dependent on scope
- › Cash Flow model analysis requires:
 - › Heat price of 15p/kWh required.
 - › Power provided at 5p / kWh
 - › Carbon price greater than £40 /tonne CO₂
 - › Continuation of discounted business rates for DHNs

Investment case	Result
20 year	IRR 5.6%, NPV -£24M
25 year	IRR 7.9%, NPV -£1.2M
40 year	IRR 9.9%, NPV £+35M
Indicative heat pricing	15p/kWh ¹



Note – this is heat only; no grants or subsidy; low carbon price; no coal sales



Bankability Key Findings

The Project has the potential to be attractive to institutional investors for the following reasons:

- › A stable, creditworthy, existing anchor heat (and power) load, which could result in the long term contracted inflation-linked revenues while still delivering best value to the customer
- › A diversified customer base capable of growing over time within, and beyond, the boundaries of the GCNID
- › A strategy for delivering additional zero carbon heat generation, while transitioning existing (currently more cost effective and technically proven) CHP generation to optimise the system.
- › A holistic and whole systems approach to infrastructure, stimulating competition, consortium building and future-proofing.
 - digital/broadband, metering and energy efficiency, power generation and heat generation/capture, EV charging and flooding related adaptation measures – development, procurement and rollout, which could result in a more economically efficient solution through data-led design, coordination of physical works, infrastructure sharing,

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Recommended Actions

Create a task force for the project.

- › Public and private representation
- › Include key offtakers (Council; NHS; University; Business)
- › Develop scope of work and funding bid for next stage

Accelerate Focus to Delivery

- › Align with the Avenues Team on Scope, Planning and Programme
- › Ensure we future-proof infrastructure and build scale.

Transportation and 'Place' Interface

- › A structured interface with city wide transport planning
- › Include Urban Environmental Improvement programme
- › Develop Community Communications Plan

Create a legal structure

- › Provide governance
- › Manage funding and execution of de-risking of enabling works
- › Interface with phase 1 demand users & stakeholders
- › Project life cycle management including:
 - › Environmental impact assessments
 - › Concept design
 - › Financial modelling and funding



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