Heat Pumps in the Northern Ireland Green Economy: Opportunities and Challenges

Heat Pumps: Knowledge X-Change and Networking Event
Ulster University, Belfast

June 2024

Dr Simon Todd

Managing Director
Causeway Geothermal (NI) Ltd

CAUSEWAYENERGIES

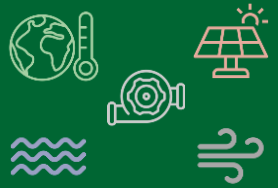
About Causeway Geothermal Ltd

Technology-led energy infrastructure startup

Target Market

- Larger demand heating and cooling in heat networks, public services, commerce and industry
- ~30% of global emissions
- $trillion market

Method



- Innovate, design, develop, finance
- Geothermal & other renewable heat, cooling and storage solutions
- Technology leading edge

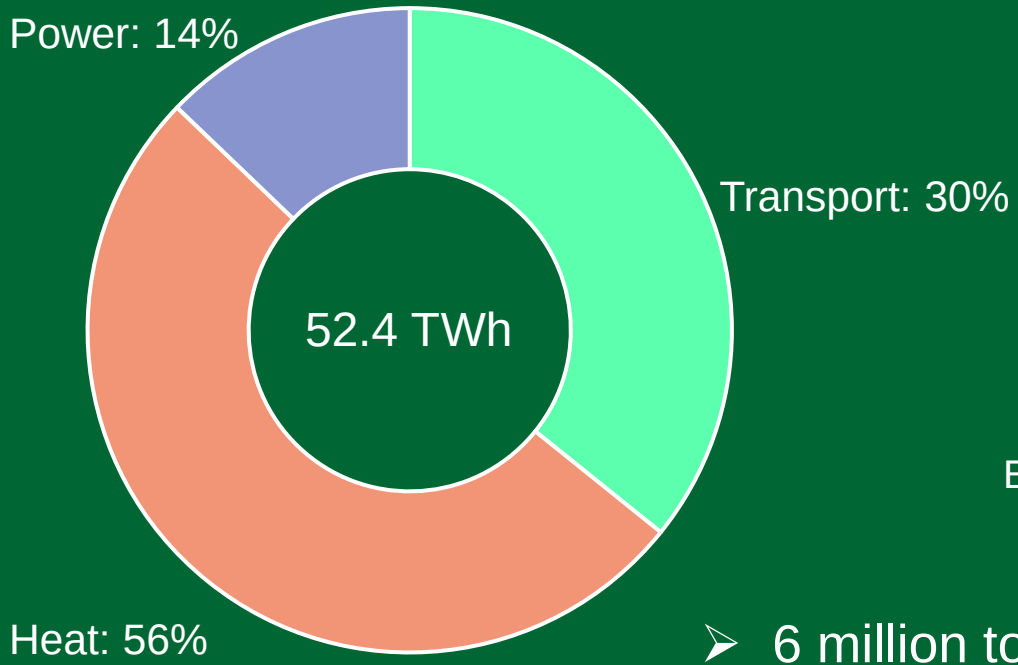
Strategy

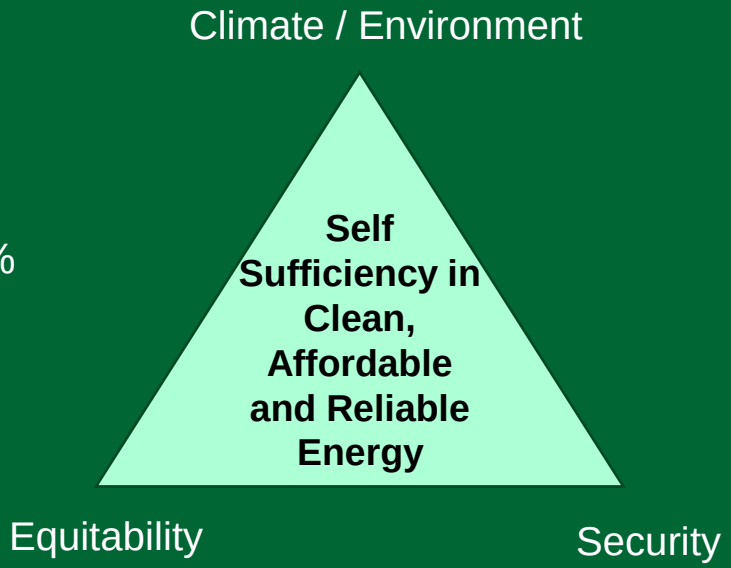
- First mover in each market sector
- Projects that are repeatable at scale
- Multi-national, multi-industry tech and expertise
- IP crocodiles in our “moat”

Progress

- 2020-21 startup in Ireland and Northern Ireland
- 2022 first revenue
- 2023 first patent application (in USA)
- 2024 first design for build projects

#HeatisHalf of the Energy Trifecta

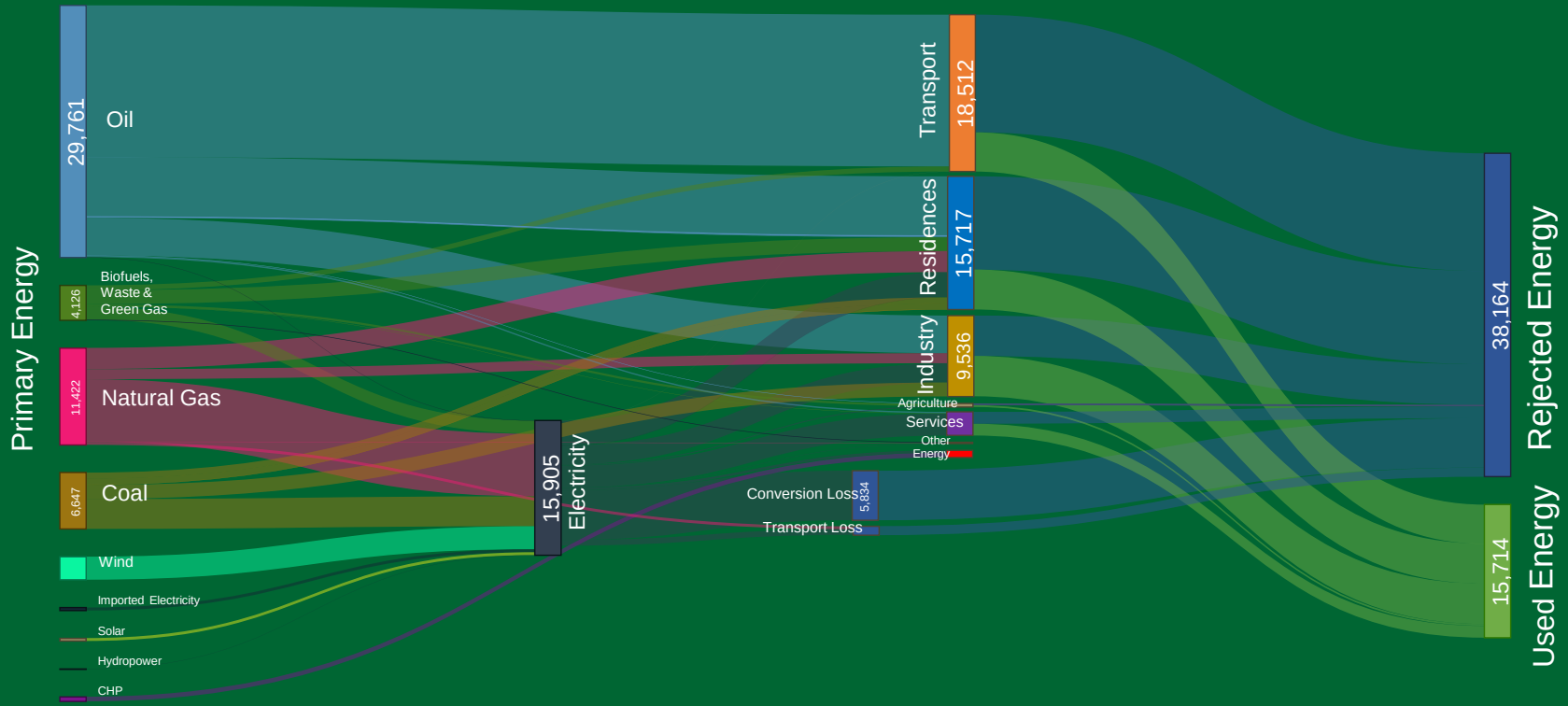




- 6 million tonnes CO2e emissions
- £3 billion costs

Energy Flow

Our current energy systems are hugely wasteful



A prioritized and systematic approach

1

Final use demand reduction (energy conservation)

- Societal behaviour change, e.g. personal transport
- Energy transition engineering

2

Electrify (most) everything (avoid energy transformation)

- Build out renewable electricity infrastructure
- Optimise efficiency and flexibility of end use
- Maximise use of local renewable energy – not just renewable electricity like wind, solar PV, but renewable heat – solar thermal, geothermal, water, air

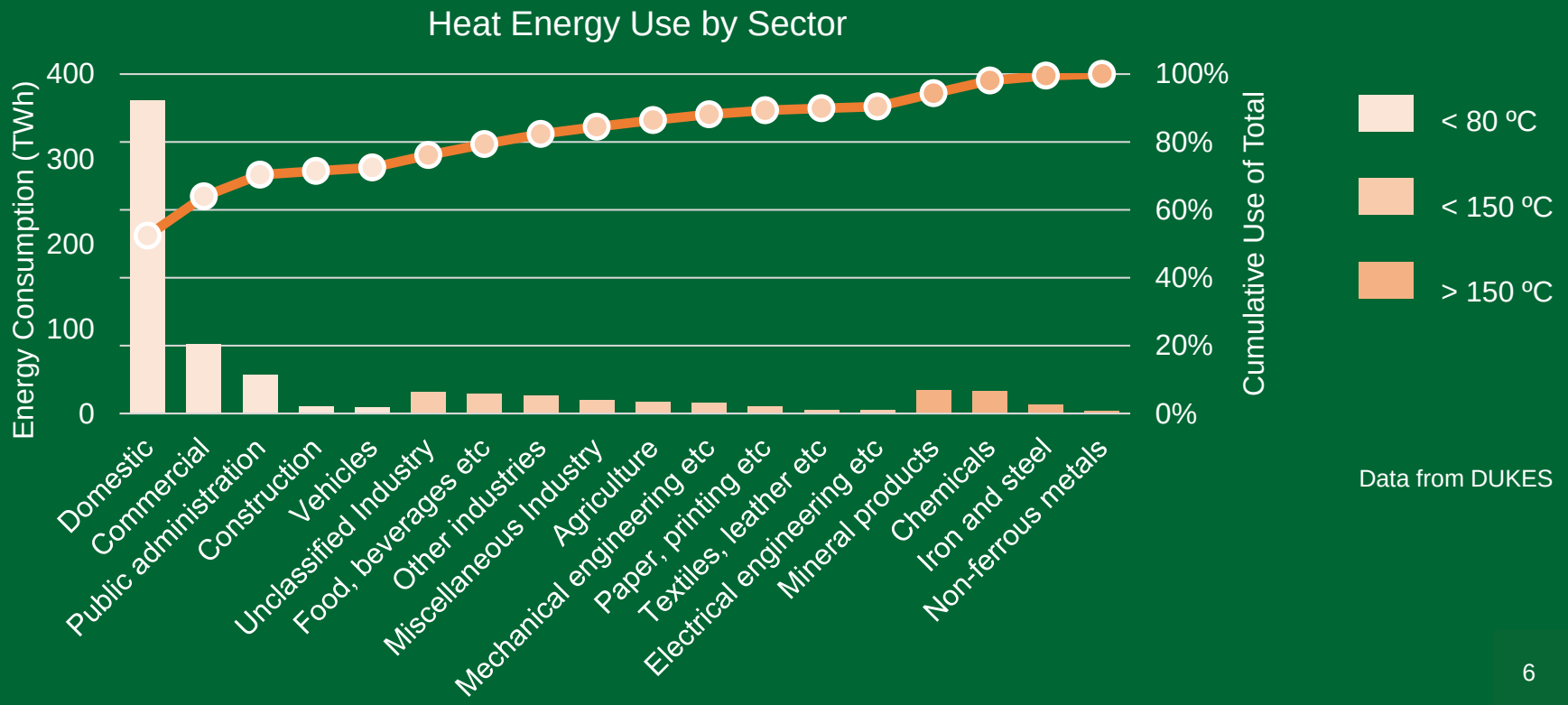
3

Save green gas for the hardest to abate sectors

- High temperature (> 150 ºC) processes, aviation, shipping
- Biomethane <> Biofuels <> Biomass <> Hydrogen <> Fossil Gas w/ CCS

UK Heat Energy Use

Main challenges are domestic, commercial, public sector and lower temperature industry



Data from DUKES

The opportunity that is electrification of heat

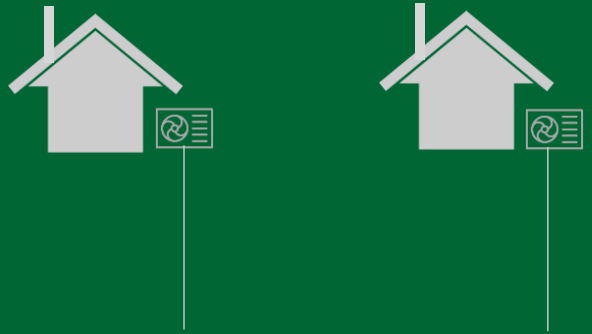
Example of hospital, thermal energy source is geothermal

Antrim Area Hospital

- Residential
- Public services e.g. hospitals
- Commercial
- Industry
- Agriculture/Horticulture
- Heat Networks

Residential decarbonisation

Single homes to urban heat networks



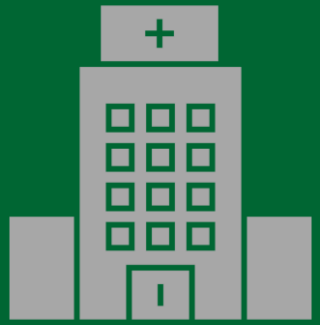
- Single customers, < 10 KW
- Technology ready
- 40% of NI homes off gas grid
- Fabric + HP + X
- One-stop-shop business model

- Many customers, MW+
- Some technology innovation
- Deep retrofit for existing buildings
- Pipes in the streets
- Utility business model

Commercial, Industry, Public Services

Insights from Causeway's engagements

Public Services



Manufacturing

Agriculture

Challenges

- Retrofit vs Greenfield
- Incumbent design thinking
- Technology innovation diffusion
- Electricity price structure
- Carbon monetization

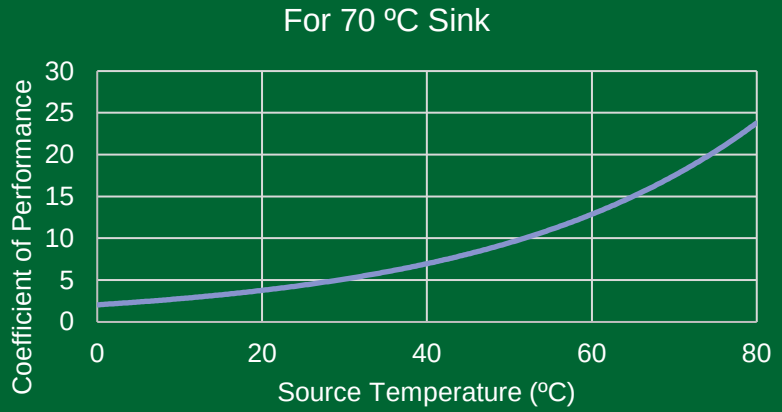
Opportunities

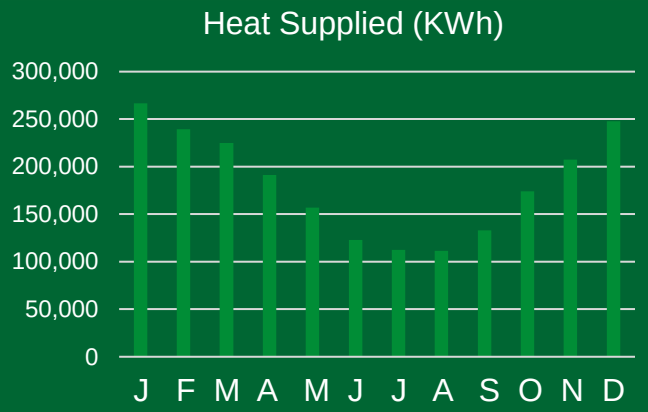
- Leading-edge technology
- Integrated systematic approach
- FOAKs to create tipping points
- "Energy as a Service" in "Clusters"
- Path to cost-competitiveness with fossils

Increasing electricity demand

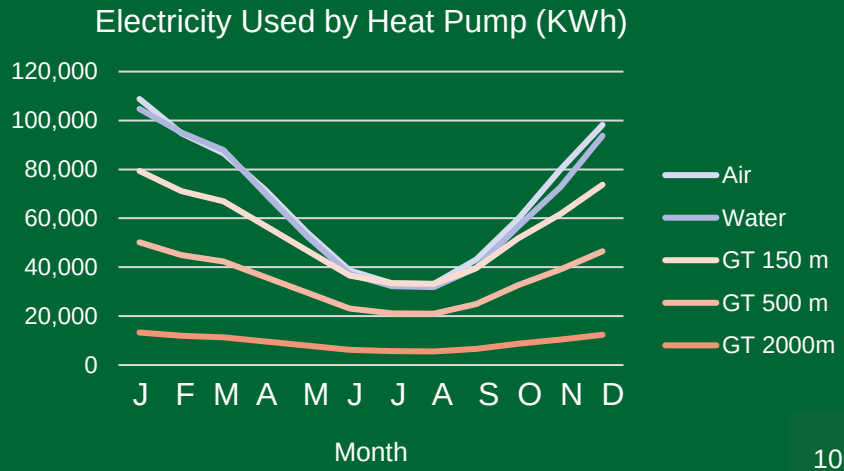
1. We must be strategic about thermal energy

$$\text{Heat Pump Coefficient of Performance} = \frac{Q_{Heat}}{W_{Electricity}}$$





Based on gas consumption data from AMH building, Belfast City Hospital

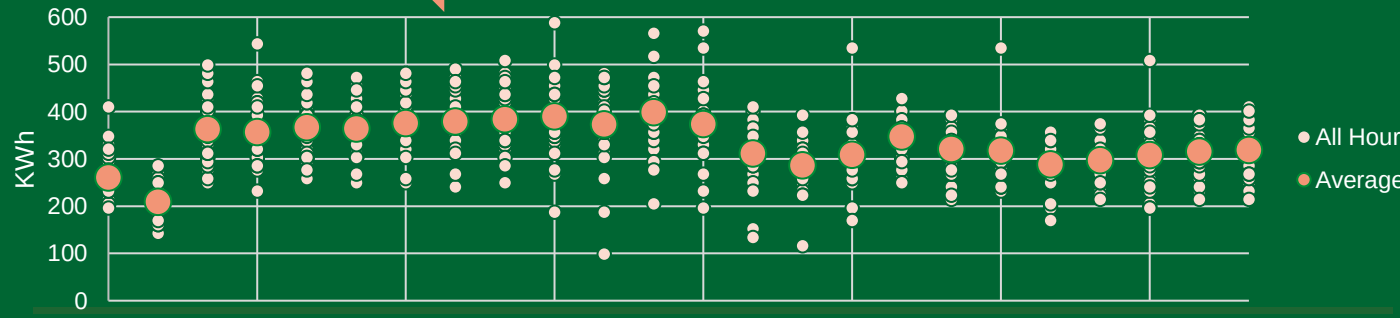


Increasing electricity demand

2. Demand side management is critical

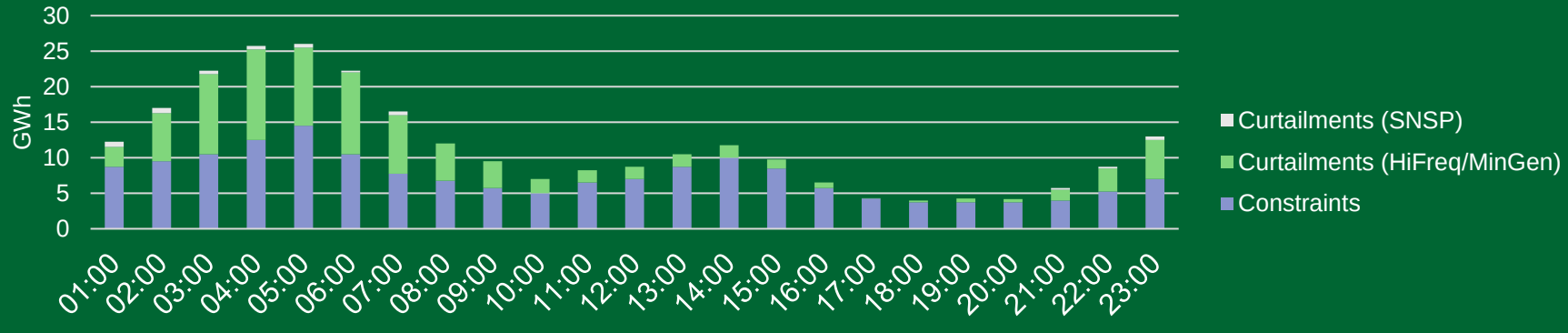
Heat Supplied

Shift more hot water making to nighttime



Based on gas consumption data from AMH building, Belfast City Hospital

Dispatched Down Wind

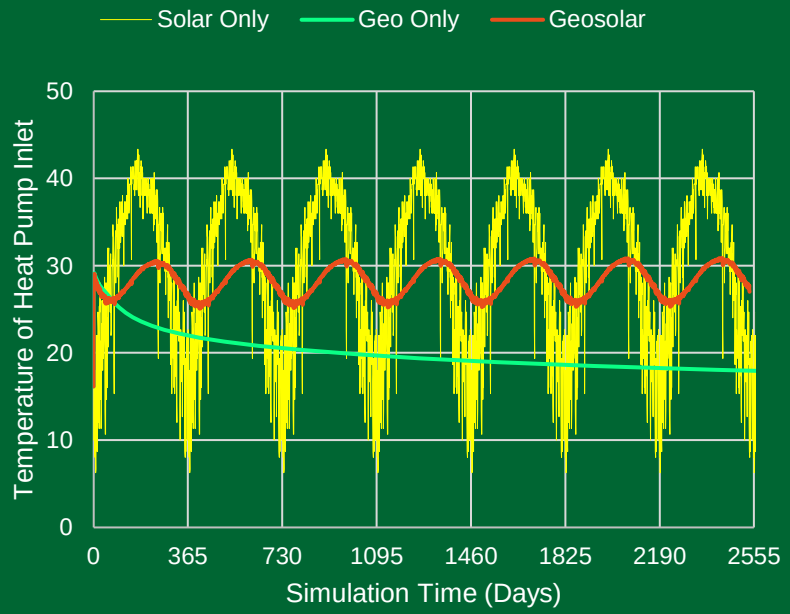


From EIRGRID/SONI

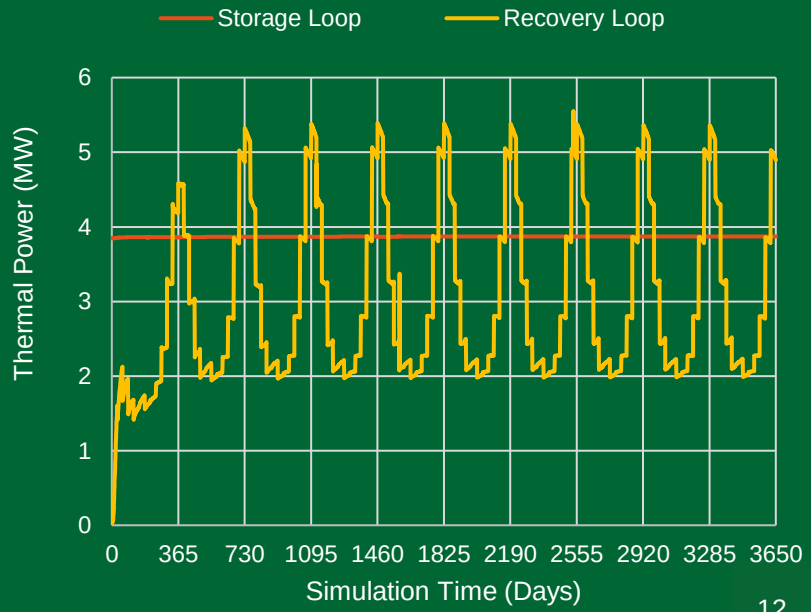
Increasing electricity demand

3. Energy storage includes thermal energy storage

Example 1: Peak summer solar heat supply stored for recovery in winter peak demand



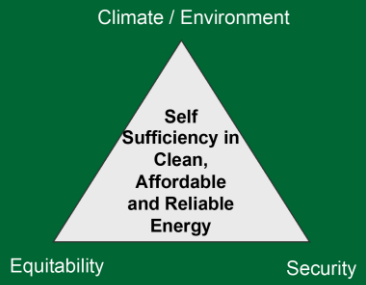
Example 2: Steady waste heat supply is load balanced by summer storage



Northern Ireland plc

Opportunities in the green economy

Energy Trifecta



- Good jobs
- Regional balance
- Productivity
- Net Zero

Technology Innovation

- World class teaching & research organisations
- Tradition of “in the shed” innovation
- Existing capabilities
- Business talent

Partnership

- Shared challenges
- Investment in NI
- Skills & technology transfer
- Testing here, scaling up there

Northern Ireland's Heat Pump Ecosystem

The opportunity is so big and challenging, the need is for collaboration, not competition

Network Owner / Operator

Councils

Wind Developers

Engineering & Construction

Low/Zero Carbon Heat

Government

Tech Startups

Education & Research

Heat Pump OEMs

Utilities

Social Housing

Northern Ireland's role in the energy transition

Why does this matter?

Global GHG Emissions
(Gts CO2e)

Total Addressable Market
($trillions)

ACCELERATING THE ENERGY TRANSITION

Geothermal + Heat Pumps = Low carbon, low cost and secure heat for industry, commerce and heat networks.

CAUSEWAYENERGIES