HEAT AND THE CITY

Heat Networks: Planning for a Zero-Carbon World

UK Local Authority District Energy Vanguards Network

Sheffield, 10 March 2020

VATTENFALL

FVB LOGSTOR natural power switch2

District Energy Vanguards Network

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https://heatandthecity.org.uk/

HEAT AND THE CITY

Peter Russett

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FVB District Energy UK Ltd

The Complete Energy Consultancy

HEATING – COOLING – HEAT PUMPS – CHP – PROCESS – THERMAL STORAGE

Introducing FVB

- *FVB UK is an Anglo-Swedish Planning, Engineering and Management Consultancy.*
- *50 years of Industry Experience Providing Real World Solutions*
- *Combination of Business and Technical Skills Focused on District Heating & Cooling Networks and Specialising in:*
    - *Techno-Economic Support During the Full Project Lifecycle*
    - *Heating & Cooling District Networks*
    - *Energy Productions sources*
    - *Thermal storage*
    - *Process systems*

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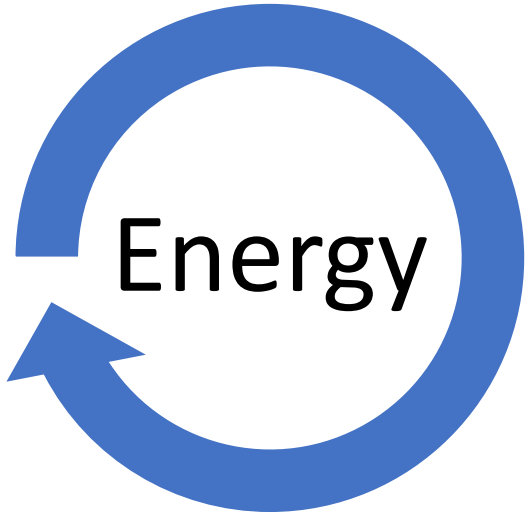
Future-proofing of District Heating



Energy Trilemma

- Carbon Emissions
- Security of Supply
- Energy Costs

District Heating is an energy delivery system

A heat network can be used by multiple heat sources, including low carbon and waste heat to reduce CO2 emissions and provide reliable supply.

Heat networks can deliver heat at a cost comparable to individual gas boilers and at a lower cost than electric heating.

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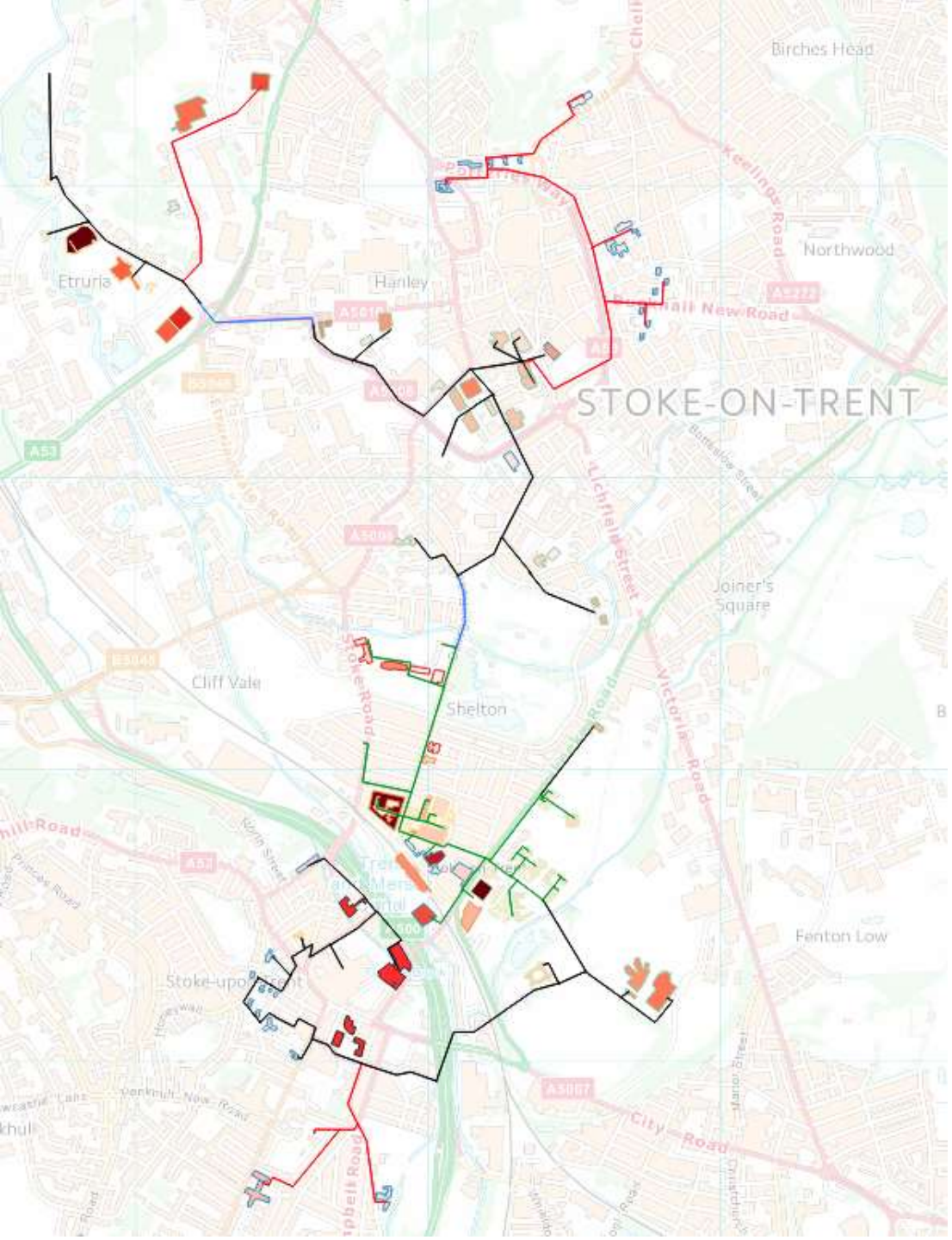
Adaptable District Heating

Key future proofing District Heating principles:

- *A high grade heat source* can supply a *low grade heat network*, but not vice versa.
  - Reducing operating flow and return temperatures. Current 4th generation DH systems can achieve 60-65°C flow and 30-35°C return temperatures.
  - This enables the use of low grade and low carbon heat sources – Heat Pumps and waste heat.

- *A low grade/low pressure heat source* can use a heat network infrastructure rated for *high grade/high pressure heat*, but not vice versa.
  - Install main carrier pipes that are rated for higher temperature or pressure to allow for DH networks link, capacity increase and connection to a different heat source in the future.



The District Heating System

- District Heating Network is to connect over 130 buildings within Stoke on Trent, connecting Stoke Town, Staffordshire University, Stoke College, Etruria and Hanley areas.
- Total design heat production is approx. 48GWh/year mainly produced by Energy from waste and Geothermal plant.

FVB Scope

FVB with their strategic partner, Natural Power, are the Mechanical & Electrical Design specialists for the DHN scheme, supporting the SoT Council with design services across the installation of all aspects of the project including:

- Heat Distribution Network
- Energy Centres
- Local Connections and Heat Substations
- Future Decarbonisation

Role includes review of potential heat sources and heat production to reduce carbon reliance for the initial and ongoing scheme expansion.

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Achieving Zero Carbon

Västerås – *A Swedish Example*

- Population of approx. 150,000
- Second city in Sweden to have a DH scheme
- DH scheme commenced in 1954
- 98% of heat supplied by DH scheme, 1800GWh/year with a peak load of 600 M
- 31MW cooling network – mainly through free-cooling from Lake Mälaren
- 34GWh/ year electrical energy production

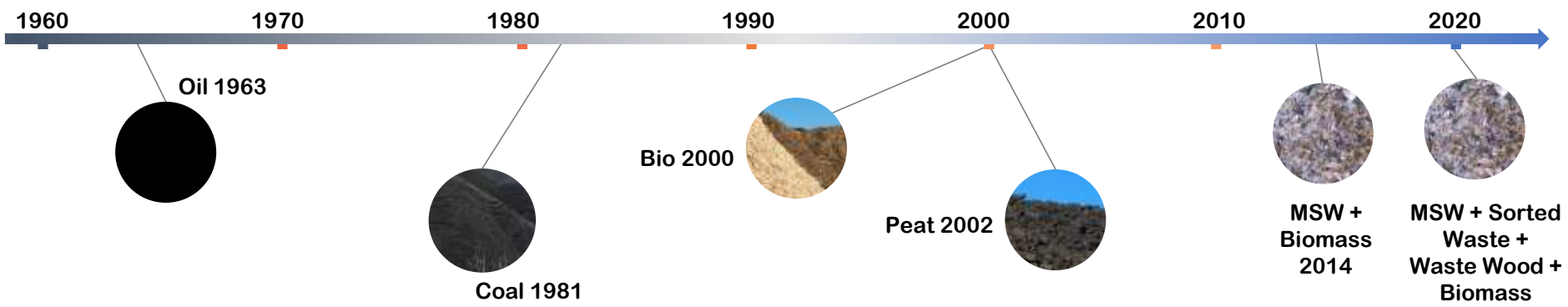
In 2018 Västerås became carbon neutral in its supply of heat.

- Heating plant utilises:
  - Energy From Waste Plant
  - Biomass
  - Heat Pumps
- Thermal storage capacity of 49,000,000 litres

Achieving Zero Carbon

Västerås – *A Swedish Example*

The Fuel Timeline



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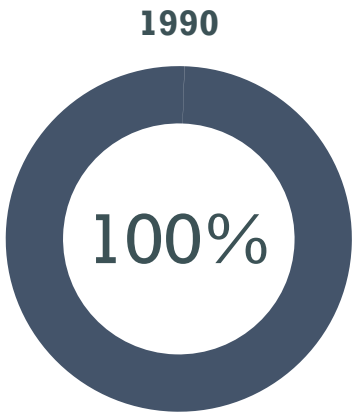
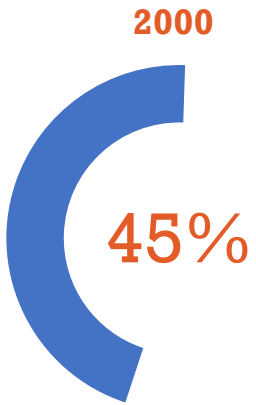
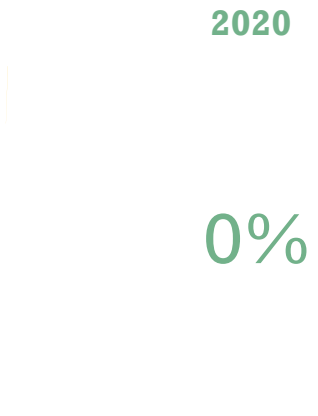
Achieving Zero Carbon

Västerås – *A Swedish Example*







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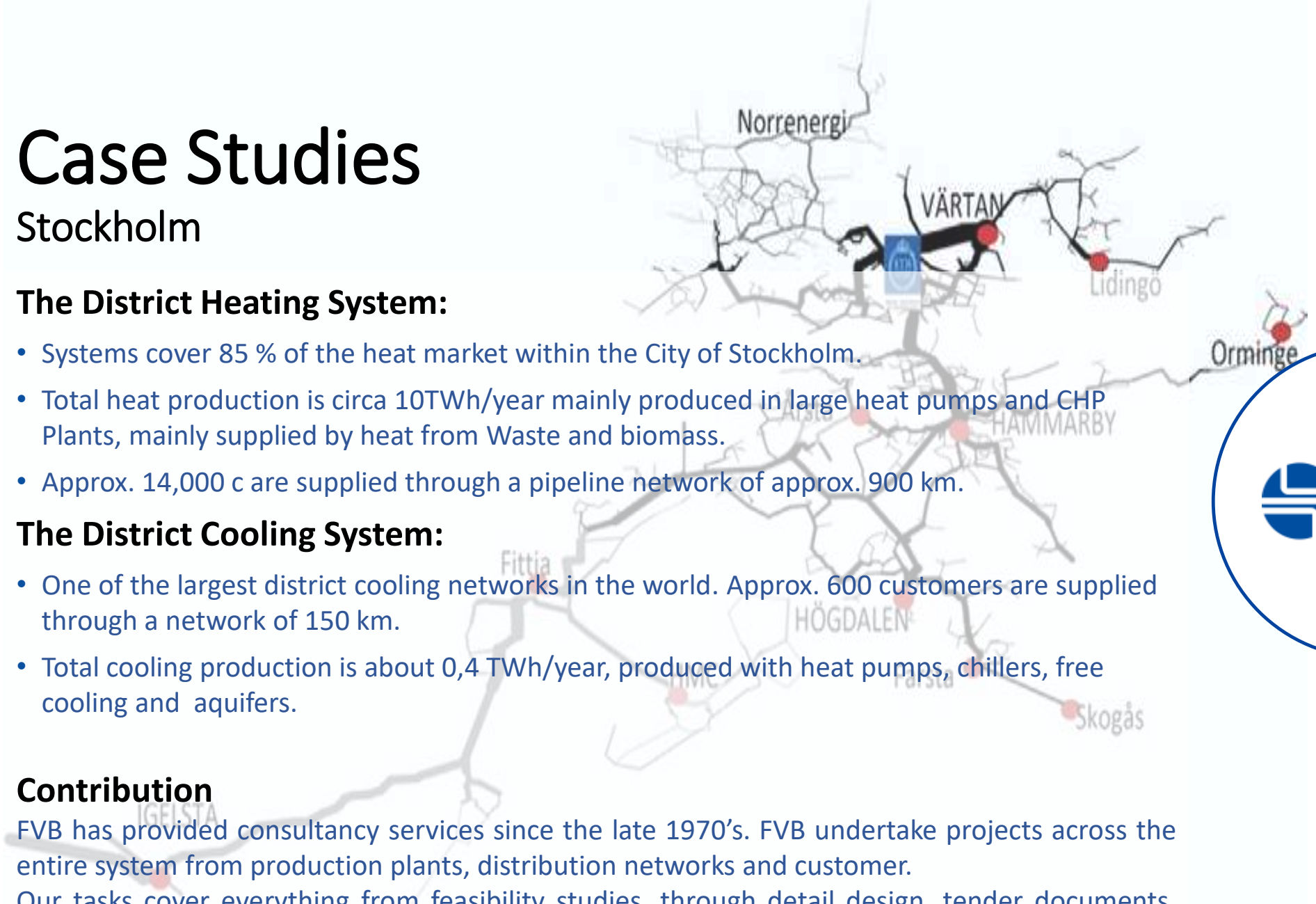
Case Studies

Stockholm



The District Heating System:

- Systems cover 85 % of the heat market within the City of Stockholm.
- Total heat production is circa 10TWh/year mainly produced in large heat pumps and CHP Plants, mainly supplied by heat from Waste and biomass.
- Approx. 14,000 c are supplied through a pipeline network of approx. 900 km.

The District Cooling System:

- One of the largest district cooling networks in the world. Approx. 600 customers are supplied through a network of 150 km.
- Total cooling production is about 0,4 TWh/year, produced with heat pumps, chillers, free cooling and aquifers.

Contribution

FVB has provided consultancy services since the late 1970's. FVB undertake projects across the entire system from production plants, distribution networks and customer.
Our tasks cover everything from feasibility studies, through detail design, tender documents, evaluations to supervision during construction and commissioning.

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Global Presence – Local Solutions

FVB has over two hundred District Energy focused employees world-wide; with offices in Sweden, United Kingdom, Canada and the United Sates of America; FVB has consulted in District Energy for 50 years, working in over 30 countries.

FVB are bringing the best in class Scandinavian experience, knowledge and delivery capabilities to the UK market.

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Services

Feasibility and Master Planning

- Feasibility Studies
- Energy modelling
- Master Planning, Energy Mapping
- Energy and Environmental Polocy
- Marketing and Sales consulting

Design & Engineering

- Design from Feasibility to Construction
- 3D Design
- Specification & Tender Documentation
- Control Strategies
- Detailed pipework and route appraisal
- Network Hydraulic [Netsim] and Buried Pipeline Stress Analysis [Rohr2]
- CDM Compliance
- BIM Design

DH Network Adoption Support

- Design Due-Diligence
- Owners Engineer
- Commissioning and Operational Support
- Performance Assurance
- Financial Modelling & Business Assessment

Site Operation Support

- Scheme Optimisation
- LTHW Conversion and modification
- Operating network Hydraulic Analysis and Modelling
- Network Extensions

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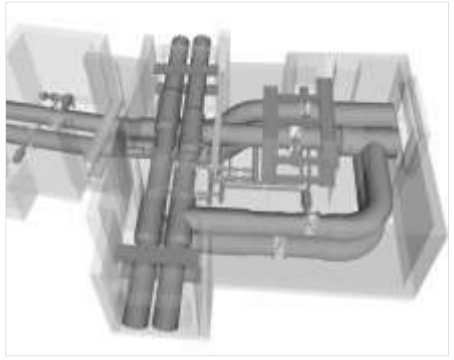
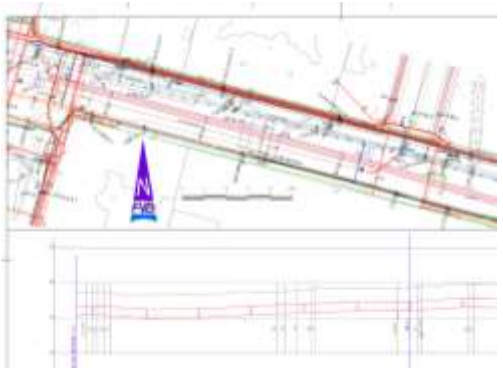
Areas of Operation

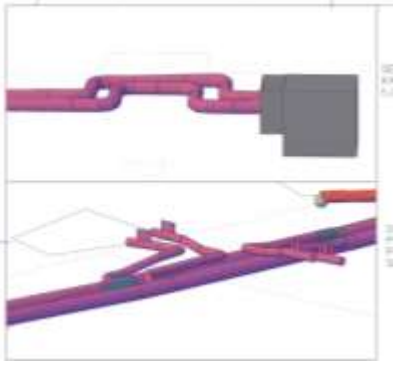
Exponential Energy Solutions®

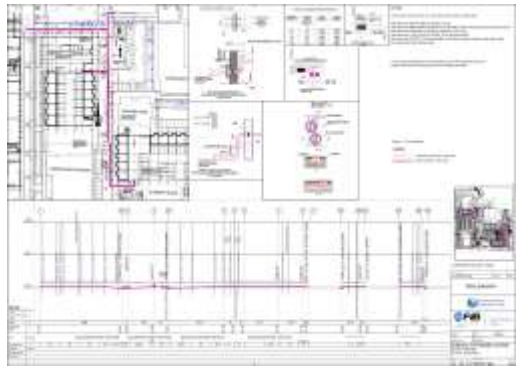
- District Heating and Cooling Networks
- Heat Pumps
- Low Carbon Networks
- Ambient Loops
- Energy Centres
- Thermal Storage
- Combined Heat & Power
- Energy from Waste
- Industrial Waste Heat
- Boiler Plant
- Solar Thermal
- Deep Water Cooling
- Gas Peaking Plant
- Steam System Design

FVB









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HEATING & COOLING
HEAT PUMPS
CHP
PROCESS
THERMAL STORAGE

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HEAT AND THE CITY

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natural power

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Planning for Low Carbon Heat

Vanguards – Sheffield 2020

Date: 10th March 2020

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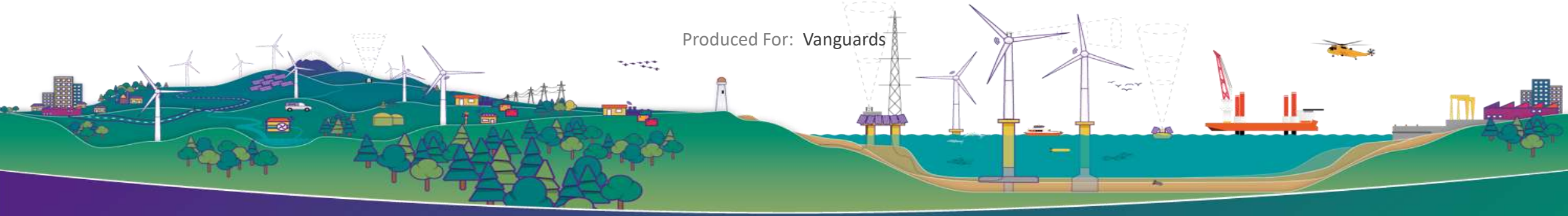
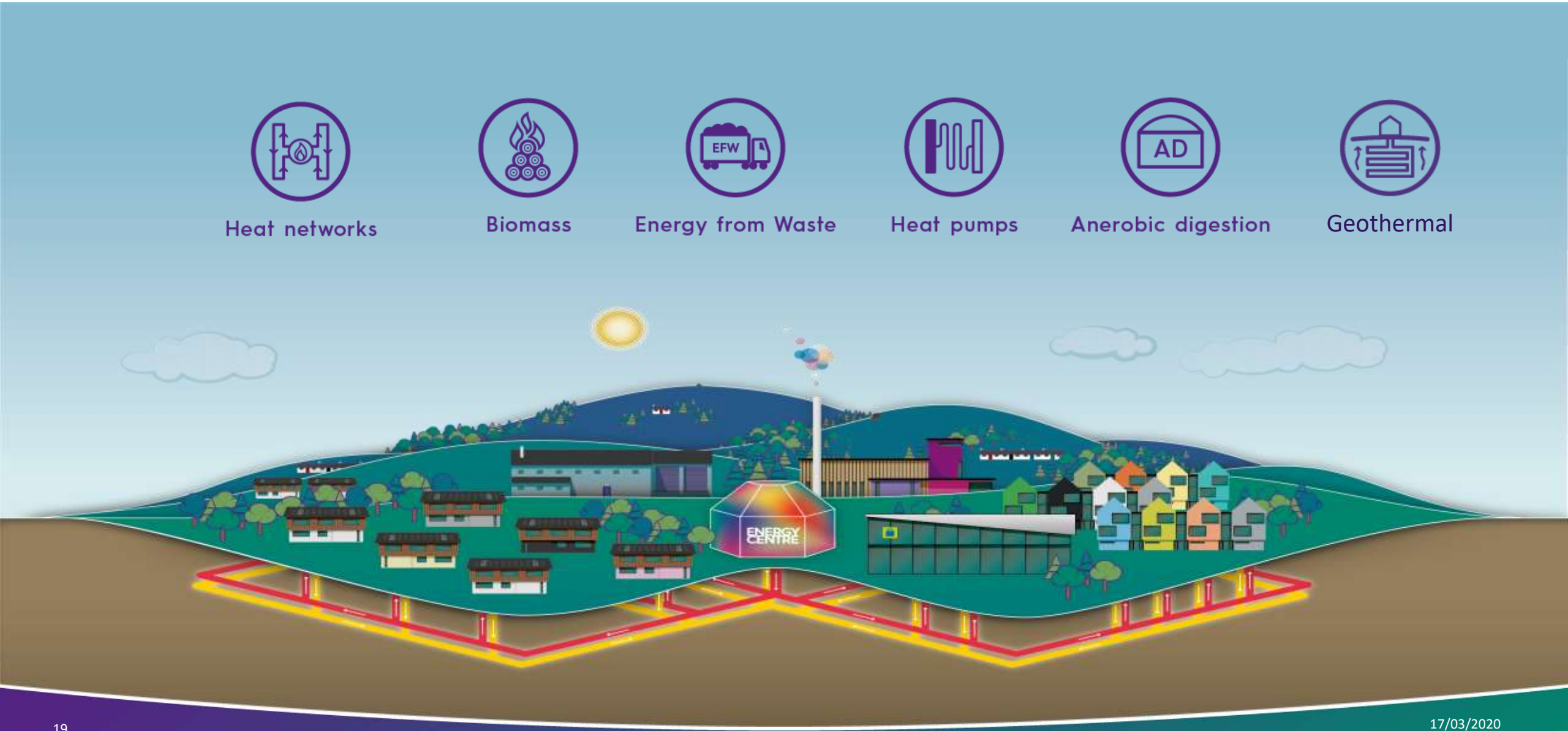
Produced For: Vanguards



Our services

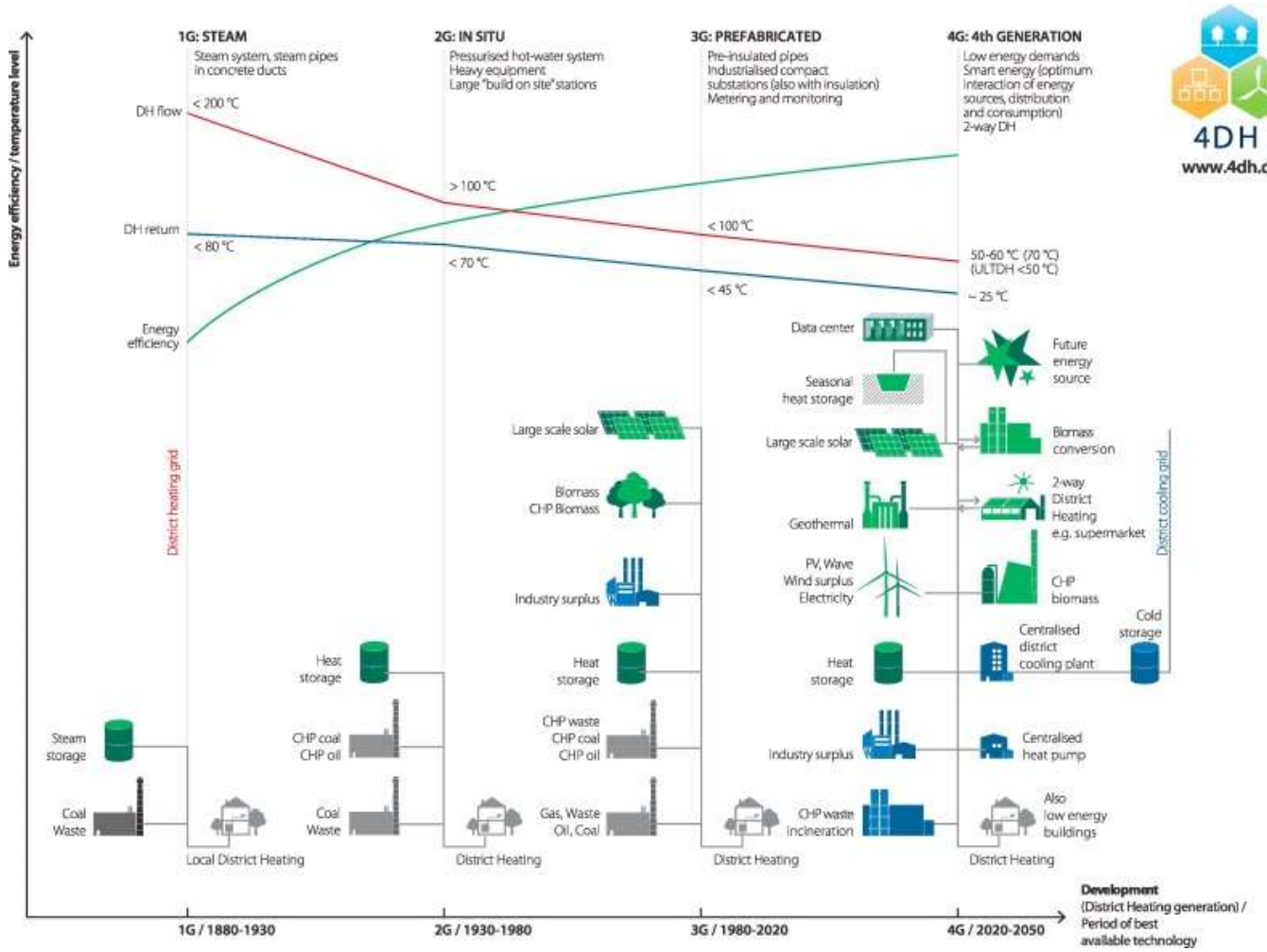
Renewable Heat



“Low carbon and low cost

=

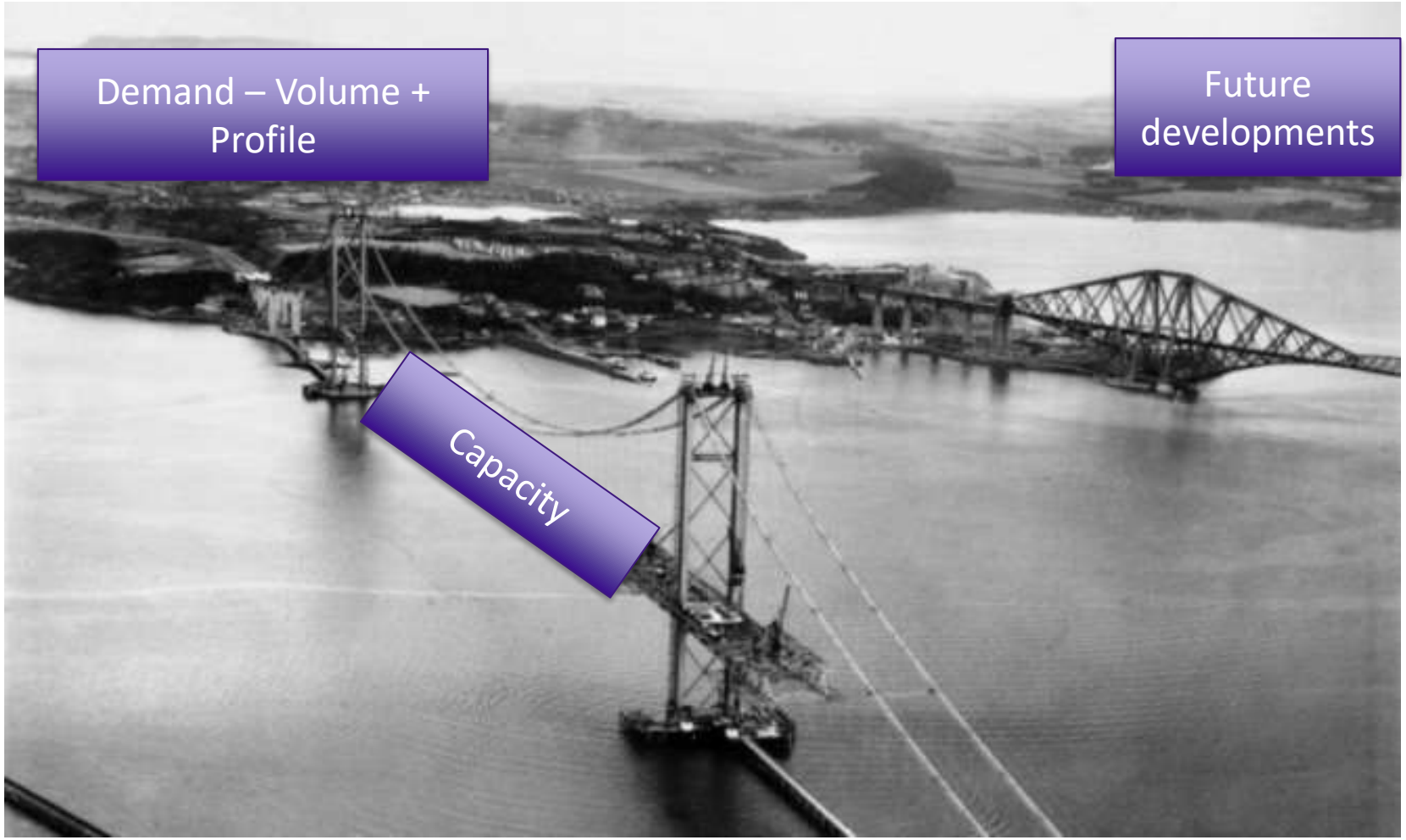
4th Generation district heating”



4th Generation is actually very difficult.

(but not impossible!)

Designing for heat networks



Heat Demand

Half Hourly Metered = ☺

Estimated from

Heat Profile

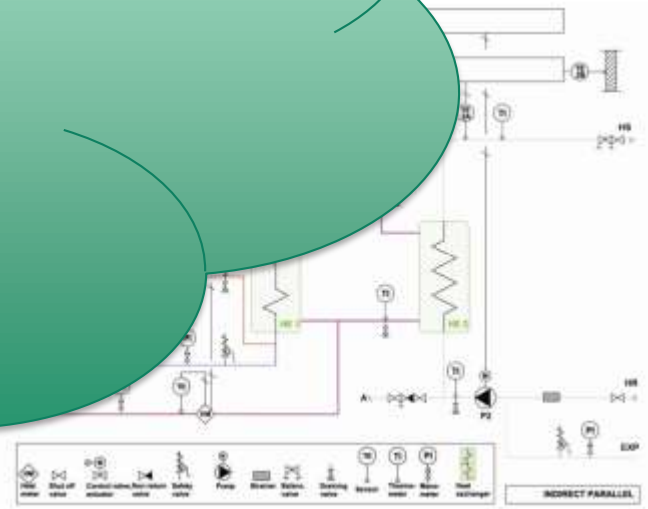
Extracted from BMS =

Secondary Side

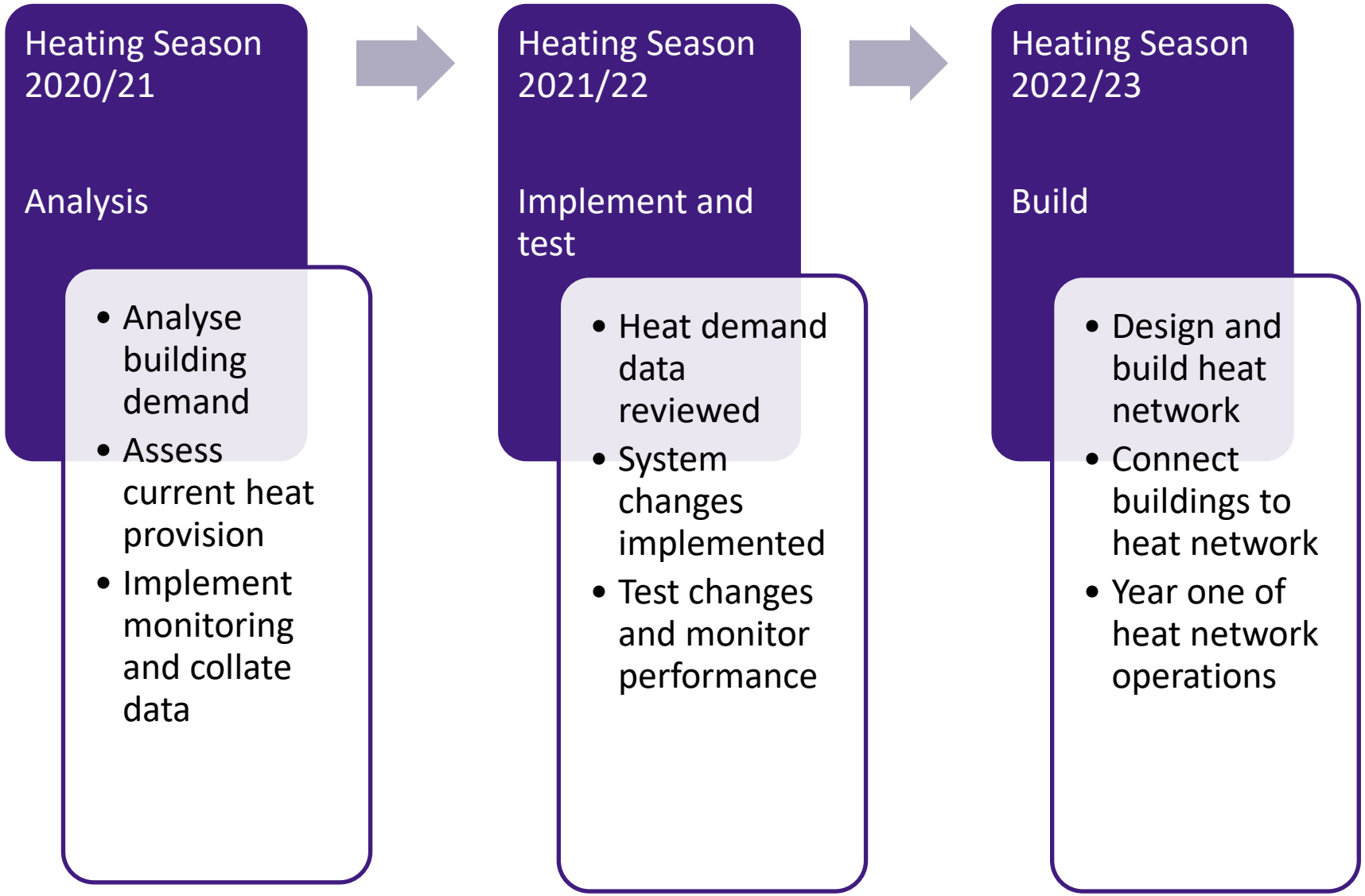
and Validated = ☺

Visit = ☹

TIME



Roadmap to implementation



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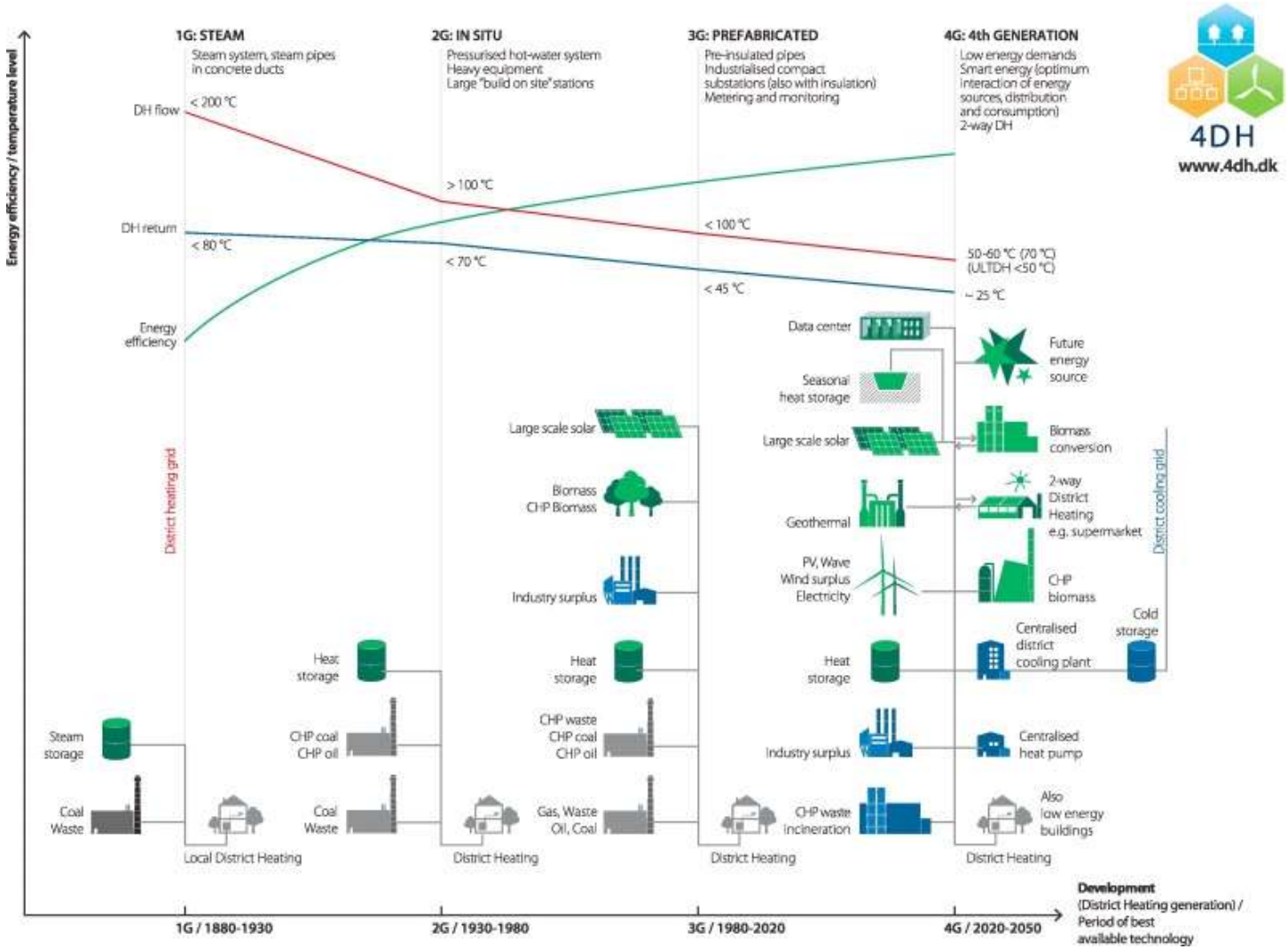

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HEAT AND THE CITY

Ian Allan

Switch2

VATTENFALL

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Switch2 Energy

Making a success of heat networks

Over 35 years' experience

164 employees

40 engineers

35,000 PAYG customers

Serving 80,000 customers

500 schemes

Processing £26 million in payments

105 energy centres

280,000 bills sent annually

The challenges

Customer perception and satisfaction

Lack of knowledge

Poorly operated schemes

Vulnerable residents

Debt exposure

Adapting to regulation

Reliable heat

Affordable heat

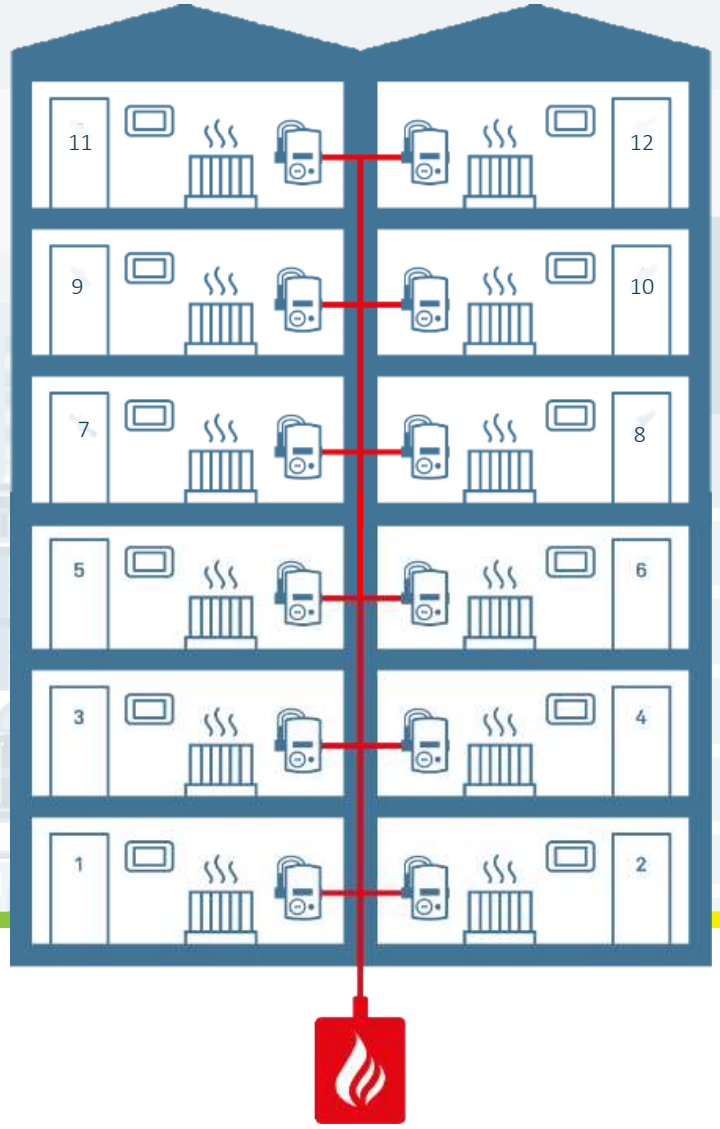
Comfort & convenience

Communal heating Vs district heating: The difference

An example district heating scheme

Communal heating Vs district heating: The difference

An example of a communal heating scheme



DIGITAL REVOLUTION

BRINGING REAL SAVINGS TO HEAT NETWORKS

optimise

- Reduction in planned and reactive maintenance
- Improved efficiency of heating system
- Combats fuel poverty
- Reduced primary energy costs
- Abolish critical events

CARBON SAVINGS

Heat networks in a digital world

The role of metering in delivering reliable low cost networks

- Operations
- Meters the eyes and ears of your network
- Return temps
- Quality of heat
- Proactive maintenance
- 5G and NB IoT

Private wire on heat networks

Thank you

HEAT AND THE CITY

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Reducing Whole Life Costs Using Leak Detection

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LOGSTOR
distributing energy efficiency

Supply Side – CHP, EfW, etc

Demand Side

Distribution Network

Passive v Active Monitoring

Passive – Dipstick

Active – Oil warning light

Passive v Active Monitoring

Passive Leak Detection System

Leak Detection Wires …

Monitoring Device…

Surveillance System

Aarhus Case Study

One manual measurement each year

Failures only showed when manual measurement made

1 failure in every 240 m trench

Failure Types

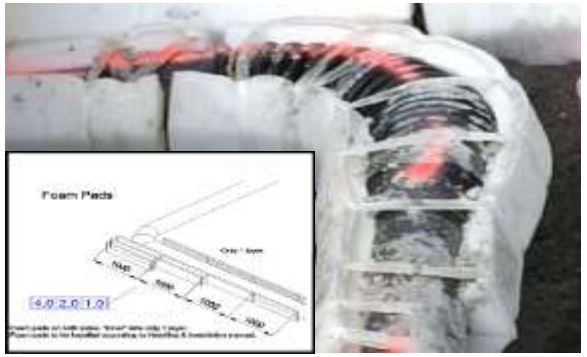
Casing damage

Poor Installation

Fatigue Fracture

3rd Party Damage

Beyond Service Life



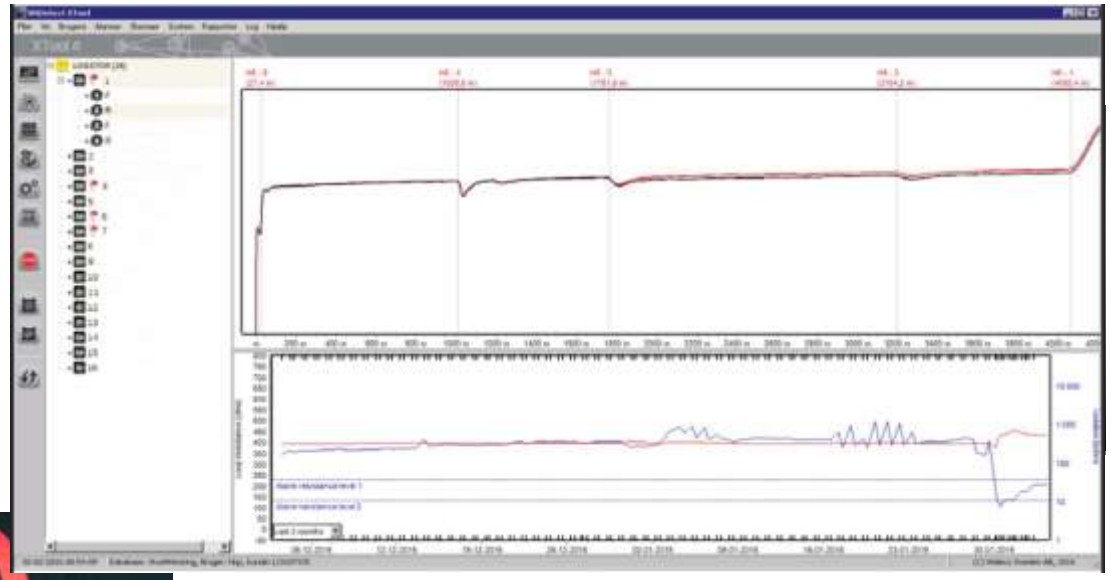
Expansion

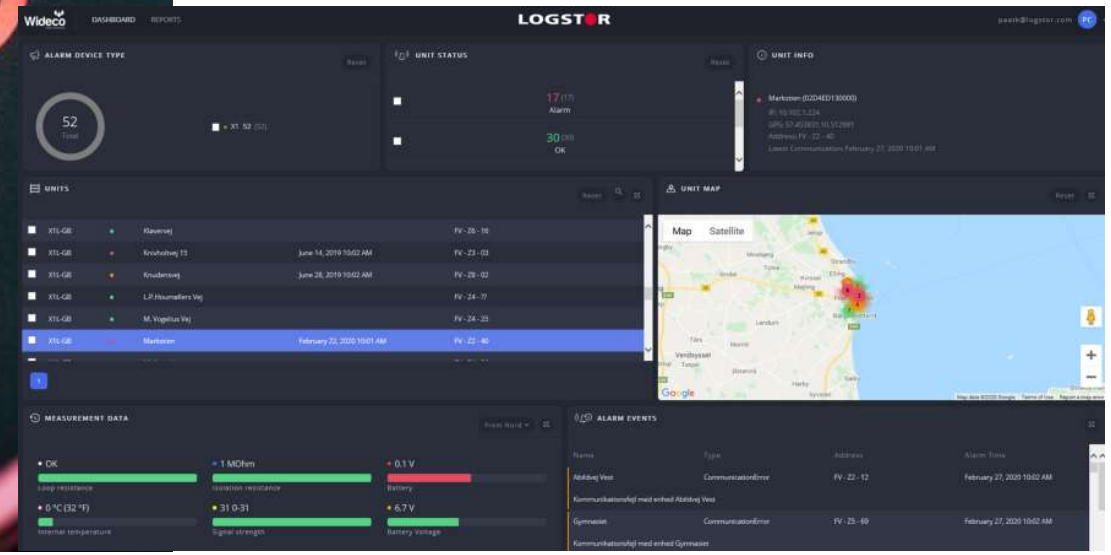
Active Leak Detection System

Leak Detection Wires …

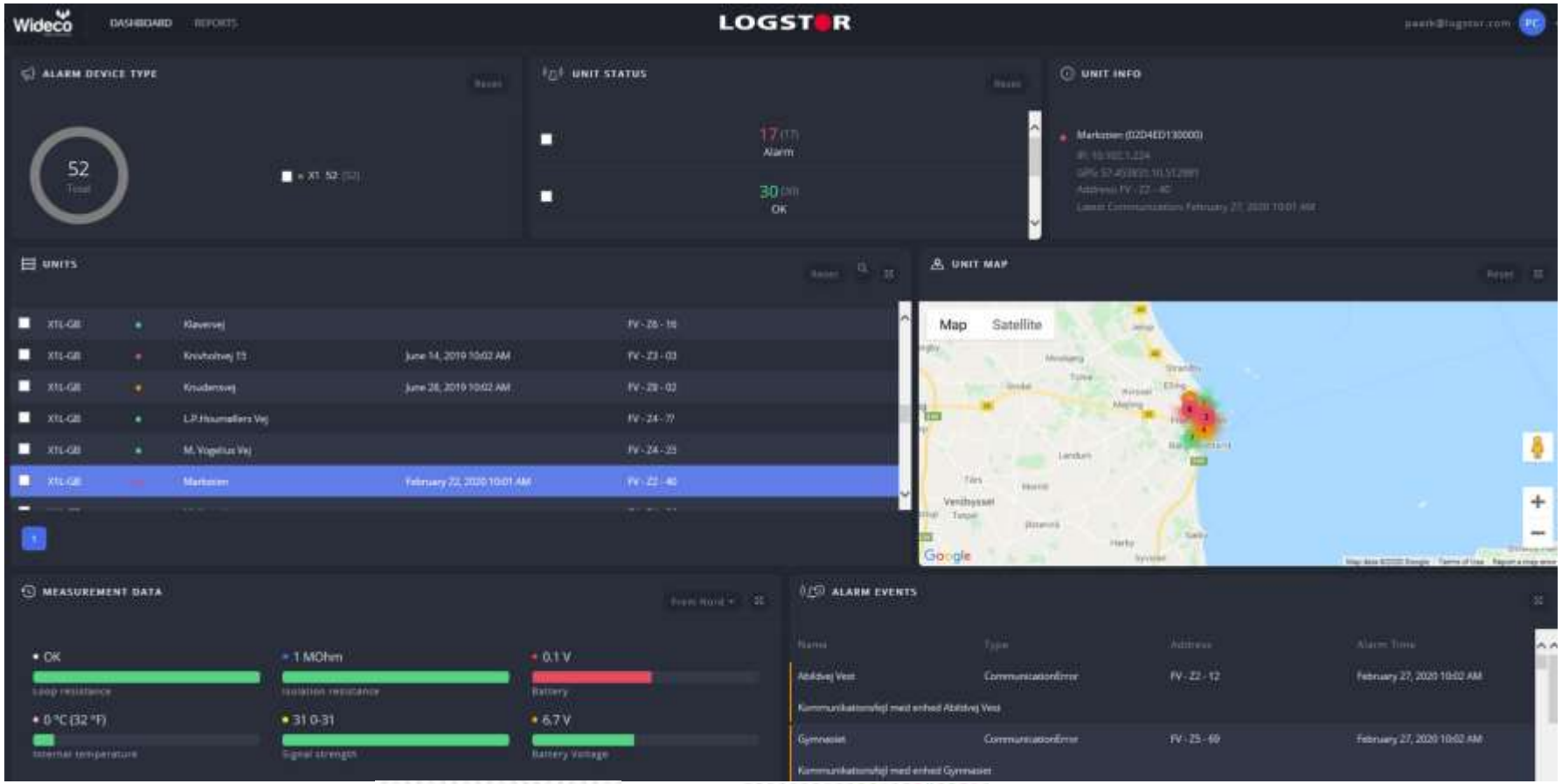
Monitoring Device…

Surveillance System





Full Digitised Detection System



Increases Quality - Reduces Cost

Benefits

- Defects show in first 6 – 9 months
- Contractors bare cost of repair in defects period
- **Now 100% focus from installers on quality**
- Issues spotted immediately – monitor and react AND pinpoint exactly
- 3rd party damage spotted immediately – cost borne by them
- Maintenance & whole life costs dramatically reduced
- Lifetime of system extended

Why would you not have Active Surveillance??

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