SHARPENING THE FOCUS & NARROWING THE FRAME
FIRST STEP IN ANALYZING DISTRICT ENERGY OPPORTUNITIES
AGENDA

1. **Setting the scene** – TRENDS & SHAPING LIVABLE CITIES
2. **The role of the City** - ENERGY SUPPLY FRAMEWORK
3. **Advertising Cities** - Examples
4. **The energy mapping process incl. GIS**
5. **Another City Example**
6. **Questions?**
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URBANISATION IS A MEGATREND
INCREASING ENERGY USAGE
INCREASING WASTE PROBLEMS
THE HIDDEN BACKBONE OF THE LIVEABLE CITY

Surplus biomass for CHP plant
Surplus straw for CHP plant
Offshore wind farm
Large building
Residential building
Harbour, unloading of biomass
Wastewater treatment and biogas plant
Solar heating plant and heat storage
Distant building w/solar PV
Outskirt building w/heat pump, solar PV and wind turbine
CHP plant fuelled by gas, straw, wood, city waste + heat storage
District heating/cooling plant + cold water storage
Industry with process energy and surplus heat
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HOW DISTRICT ENERGY ASSIST CITIES AND ADD VALUE
SMART ENERGY SYSTEMS

- National power grid
- City-wide district heating grid
  - storage for CHP and RES
- City district cooling grid
  - storage and optimal cooling
- National natural gas grid
  - storage, CHP and small houses
- Buildings and other end-users
  - Optimized building envelope
  - Low temperature heating
  - High temperature cooling
  - Micro DC grid electronics
  - Adjust consumption to dynamic prices
SMART CITIES AND GRIDS

- **Same criteria for cost effectiveness** for all investments
- Interaction between **smart grids, buildings and end-use**
- Energy depends on **time and quality**

![Diagram showing the relationship between RES- and EE directives and building directive, including various components like Fossil fuels, Biomass resources, Production CHP Storages RES, District Heating and Cooling, Power grid, Gas grid, District energy Substation, Individual Production, Building envelope, Heating and Cooling, Micro DC grid, Indoor Climate, Hot tap Water, Electricity services.](image)
PLANNING AND REGULATION NEEDED TO OVERCOME MARKET CHALLENGES
STICK ‘N’ CARROT - INCENTIVISE DESIRABLE ACTIONS
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Challenge
Desire to cut carbon emissions

What was done
Proposed zero carbon target by 2025
Illustrated that it was possible and realistic

Effect
Copenhagen continues to introduce green solutions
COPENHAGEN DISTRICT HEATING SYSTEM
DENMARK

Challenge
Utilization of all available heat sources in the Copenhagen region in the most efficient way

What was done
Planning, collaboration, design, implementation, optimization

Effect
One of the largest city-wide district heating systems in the world
Supplies low-carbon heat to one million people
"The London Heat Map has helped in the successful development of district energy projects in the city and ensure that new developments to either connect to local heat networks or future-proof to connect to envisaged networks. The London Heat Map represents the first step in the DE development process that will contribute towards us achieving our goals of delivering 25% of London's Energy Supply by 2025."

– Peter North, Senior Manager, Programme Delivery, GLA, 2016
CHICAGO LAKESIDE – THE FUTURE OF URBAN DESIGN
CHICAGO, US

Challenge
Vision to breathe new life into South Chicago
How to create a liveable and sustainable city for future generations

What was done
Prepared design concept for sustainable energy, water management and waste management
Fossil fuel reduction of 90%, CHP & District Energy

Effect
New way of living
Urban design strategy is key differentiator
Winner of Sustainia Community Award

Visualisation: Skidmore, Owings & Merril LLP/MIR.
ENERGY MASTERPLAN FOR THE GREATER MANCHESTER AREA, UK

**Challenge**
New carbon and energy policy commitments
Need for efficient, cost-effective heat

**What was done**
Developed a district heating energy masterplan across ten authorities

**Effect**
Provides a basis for decisions about specific projects to be initiated
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(DANISH) ENERGY STRUCTURE

**Strategy**

**Policy**
- National: Energy supply
- Regional: Energy supply
- Local: Master Planning, Energy supply

**Planning**
- National: Energy supply
- Regional: Energy supply
- Local: Master Planning, Energy supply

**Projects**
- Regional: Waste handling, CHP production, Storage, Heat Transmission
- Local: Heat distribution network, Peak-load production
### METHODOLOGY FOR (DISTRICT) ENERGY PLANNING

<table>
<thead>
<tr>
<th>Step</th>
<th>Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data Collection</td>
<td>• Develop heat demand and supply map and database</td>
</tr>
<tr>
<td>Strategy</td>
<td>• Identify opportunities, scenarios and networks</td>
</tr>
<tr>
<td>Technical design</td>
<td>• Energy Modelling, plant selection etc</td>
</tr>
<tr>
<td>Financial Assessment</td>
<td>• Whole Life Costing</td>
</tr>
<tr>
<td>Comparative Assessment of the Scenarios</td>
<td>• Selection Criteria and Ranking</td>
</tr>
<tr>
<td>Project Reporting</td>
<td>• Risks and Recommendations</td>
</tr>
</tbody>
</table>
PLANNING AND DELIVERING DH OVER TIME

POSSIBLE HEAT ANCHORS
KEY - Further opportunities may be present
1. University of Dundee
2. Saebaes Yard
3. Tayside Digital Media Park
4. Hawhill Medical Centre
5. Overgate Retail Park
6. Wellgate Retail Park
7. Gallagher Retail Park
8. Hilton Dundee
9. Apex Hotel and Spa
10. City Quay and Merchant Quay development
11. Cultural Quarter Contemporary School of Art
12. NRC Financials
13. Michelin Tyre Ltd
14. Baldovie Industrial State
15. Discovery Quay
16. -
17. Dunsinane Industrial Estate
18. Dryburgh Industrial Estate
19. Ninewells Hospital
20. Dundee Technology Park
21. Dundee MediPark
22. Dundee Technopole Park
23. Kingsway West Retail Park
24. Tesco Riverside
25. Lochee DHN (Potential)
26. Dalfiel DHN (Existing)
27. Dundee University DHN (Existing)
28. Coldside Development (potential)
29. Whitfield DHN (Potential)

Possible sources of solar thermal/ agriculture AD from surrounding agriculture

Dundee energy from waste

Dundee

DUNDEE

CITY CENTRE CLUSTER

COLDSIDE DEVELOPMENT CLUSTER

DC THOMPSON PAPER

WATER SOURCE HEAT PUMPS

MENZIESHILL/ NINEWELLS CLUSTER

CITY CENTRE CLUSTER

POSSIBLE HEAT ANCHORS

POSSIBLE HEAT SOURCES

POSSIBLE HEAT CLUSTERS

EXISTING / OPPORTUNITY NETWORKS

Possible heat anchors
Possible heat sources
Possible heat clusters
Existing / opportunity networks

Strategic vision
Zone the town/city
Interconnect clusters and safeguard the vision
Deliver the clusters

Dundee energy from waste

Riverside Landfill (closed) large scale solar

Ramboll

Newport-on-Tay
GIS - Establishing a Database
HEAT MAP USES

HEAT MAPPING
- Energy Demand
- Energy Resources
- Prevailing Fuel Sources
- Existing and Planned Networks

IDENTIFICATION OF OPPORTUNITIES
- Geographical proximity of resources/demand
- Fuel poverty
- Future Development

PROJECT PRIORITIES
- List of DH Network opportunities
- Hierarchy of potential projects
GIS – BUILDING BLOCKS

Filtering → Analysis → Planned Development Layers

Supply → Opportunity Identification
GIS – PLANNING TO IMPLEMENTATION

INITIAL MAPPING
DE PROJECT IDENTIFICATION
NETWORK ROUTING AND OPTIMIZATION
NETWORK DESIGN
CHANGES TO NETWORK THROUGH DESIGN PROCESS
CONSTRUCTION DRAWINGS
RECORD “AS BUILT” DRAWINGS
OPERATION AND MAINTENANCE
WHAT TO BE AWARE OF – REDUCE RISK

Planning and future proofing
Scale of scheme
Heat density in the supplied area
Rate of connection to the network
Complexity of scheme
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CONCLUDING REMARKS

District Energy is a key enabler for liveable cities.

The public is instrumental in creating the pre-conditions for District Energy.

We all need to be better in communicating the benefits of District Energy.
THANK YOU

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