A Neglected Resource:
Using the WtE for District Heating

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Rambøll

- Leading waste-to-energy consultant in Europe
- Long track record of waste-to-energy plant projects. Ongoing projects at > 25 WtE plants
- Independent consulting services
- 50-60 specialist within WtE
Waste-to-energy plant references - Rambøll

- Kiev, Ukraine
- Budapest, Hungary
- Moscow, Russia
- St. Petersburg, Russia
- Moscow, Russia
- Murmansk, Russia
- Uddevalla, Sweden
- Halmstad, Sweden
- Malmö, Sweden
- Uppsala, Sweden
- Torshavn + Leirvik, Faroe Island
- Isle of Man
- South East Region, Ireland
- Germany
- Alderney, UK
- Guernsey, UK
- Bermuda
- Oporto, Portugal
- Gibraltar
- Mallorca, Spain
- Brescia, Italy
- Cairo, Egypt
- Guangzhou, China
- Hong Kong
- Manila, Philippines
- Kaohsiung, Taiwan
- St. Petersbourg, Russia
- Kiev, Ukraine
- Budapest, Hungary
- Murmansk, Russia
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Energy Recovery from Waste

1 tonne of waste

2 MWh heat

2/3 MWh electricity
How much energy from WtE in Denmark

3.3 million tonnes of waste incinerated

<table>
<thead>
<tr>
<th></th>
<th>Electricity</th>
<th>Heat</th>
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<tbody>
<tr>
<td></td>
<td>1.5 million MWh</td>
<td>6.5 million MWh</td>
</tr>
<tr>
<td>% of total</td>
<td>3%</td>
<td>18%</td>
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<tr>
<td>Household</td>
<td>430,000 household</td>
<td>360,000 household</td>
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18 % of all energy for district heating comes from WtE
How to use Energy from WtE in Copenhagen?
How to use energy from waste in Copenhagen?
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How to use energy from waste in Copenhagen?
Various Energy Resources - Copenhagen
How is waste treated in Europe?

Treatment form –
municipal solid waste in Western Europe

Percentage of total waste

- Landfill
- Recycling/composting
- Incineration
- Other

Northwest Europe
Amount of waste going of WtE in Europe (CEWEP)

- Total number of plants: 409
- Total treated waste in million tonnes/year: 52.6
State-of-the-art technology WtE in Europe
SYSAV, Sweden

Units 1 and 2, 1973
SYSAV, Sweden

Units 1 and 2

Unit 3, 2003

Unit 3

Ramboll
SYSAV, Sweden

Units 1 and 2

Unit 3

Unit 4, 2008
How much CO₂ is saved by WtE

CO₂ by producing 10 GJ heat and power and treatment of 1 tonne waste

- Coal as energy source
- Oil as energy source
- Natural gas as energy source
- Waste as energy source

- Landfill/composting of waste
- Energy production
Cost of waste-to-energy

New plant or extension, EU Directive 2005
Construction cost, 700-900 USD/tonne/year

Treatment cost:
- Amortisation
- Operation
- Maintenance

\[
\text{\(\divideontimes\)} \quad \text{Income from sale of electricity} \\
\text{2/3 MWh/t x 60 USD/MWh =} \\
\text{\(\divideontimes\)} \quad \text{USD/tonne} \quad 130
\]

\[
\text{\(\divideontimes\)} \quad \text{Income from sale of heat} \\
\text{2 MWh/t x 30 USD/MWh =} \\
\text{\(\divideontimes\)} \quad \text{USD/tonne} \quad 60
\]

Net treatment cost: Waste-to-energy

\[
\text{\(\text{\(\divideontimes\)} \quad \text{USD/tonne} \quad 30}
\]
Why high W-t-E capacity in Scandinavia?

New environmental standards
- EU regulations
- Kyoto and CO₂

Energy efficiency
- Electricity
- Heat

Landfill ban
- Denmark 1997
- Sweden 2005

Economy
- Low treatment cost