Energy from Waste – Amsterdam

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WtE Company

- Owned by local government
- Partners: city districts, 19 municipalities
- 400 employees
- Situated in harbour area Amsterdam
- Largest single location WtE company in the world
- Largest renewable energy production plant in Amsterdam
WTE plant (1993)
- 1.4 million inhabitants
- 850,000 tons of MSW

WFPP (2007)
- 530,000 tons of commercial waste
Key Figures

- **Financial performance:**
  - Turnover: > €180 million
  - Profit: > €12 million
  - Low cost price in NL (gate fee): ~ €67/ton

- **Operational performance:**
  - Waste processed (incl. sludge 0.1M): > 1.5 million ton (4,400 tonnes/day)
  - Biomass in waste incinerated: 53% (2013)
  - Energy supplied: > 1,0 million MWh + 600 TJ heat
  - Metals recovered (non) ferrous: > 28,000 ton

- **Environmental performance:**
  - Electrical efficiency: > 30% (most efficient in world)
  - Emission level: < 20% allowed EU Directive
  - Avoided CO2 (total): > 700,000 ton/yr
1st Generation 1917-1969

2nd AVI Noord: 1969 -1993

3rd AVI West 1993 – present

4th WFPP 2007 – present
Waste Fired Power Plant

Virtually zero-discharge

Energy = Electricity & Heat
- >30% net electrical efficiency
- 100% renewable energy
- 53% sustainable (CO₂-free) energy

Valuable Materials
- Sand & granulate for construction
- (Non)-ferrous metals
- Industrial salt, gypsum ....

Waste
(endless stream; 53% biomass)

Residues (<0.5%)

4th generation: WFPP® in a nutshell
High Efficiency concept WFPP®

850 kWh/ton = 30 %
Outline steam reheating

Superheater
- 135 bar
- 335°C
- 130 bar
- 480°C

Turbine
- 14 bar
- 190°C
- 13 bar
- 320°C
- 0.03 bar
- 25°C

Drum

Boiler

Reheater

Superheated steam 440-480°C
Steam pressure 125-130 bar
Steam reheating after HP-turbine
Second and Third economiser
Boiler WFPP
Flue-gas cleaning WFPP
Emission levels

[Bar chart showing emission levels for various pollutants, including NOx, NH3, C tot.org., HCl, HF, SOx, CO, PM, Hg, Cd, Th, HM, PCDD/F, with WFPP as % and Dutch limit indicated.]
CO2-reduction

Overall Greenhouse Effect (input 1 million ton waste)

- Landfill: 1036 kton CO2/year
- Landfill & Biogas: 404 kton CO2/year
- W-t-E: 156 kton CO2/year
- WFPP Power only: 438 kton CO2/year

Avoided CO2:
- Short-cyclic CO2 consumption: 456 kton CO2/year
- Avoided CO2 Electricity production: 384 kton CO2/year
- Avoided CO2 Metal recovery: 82 kton CO2/year
- Avoided CO2 Heat delivery: 414 kton CO2/year

Direct CO2 Emission:
- CO2 emission (fossil): 902 kton CO2/year

Overall CO2-reduction: 1540 kton CO2/year
WFPP® compared to alternative renewables

WFPP® is the most cost-effective renewable option...

...with also the highest supply reliability
City of Amsterdam powered by AEB
Integration with Waste Water Treatment Plant

- **Waste water**
  - Sewage sludge 100 kton/yr
  - Biogas 25,000 m³/day

- **Waste Fired Power Plant**
  - Electricity 20,000 MWh/yr
  - Heat 50,000 GJ/yr

- **Solid Waste**

- **Recovery**
Sludge incineration
District Heating

- Supplying heat to companies and households in Amsterdam
- Joint Venture with Energy company in Amsterdam
- Natural gas replaced by heat from waste
- 15,000 houses connected
- Grow towards 60,000
Energy & Resources projects

- Greengas hub of biogas
- Steam network harbour area
- Expansion DH-network (WPW) and district cooling
- Windpower
- Energy of feedstock from Green Waste
- Extended bottom ash treatment plant
- Optimization Waste Management Chain

Amsterdam. Triple R: Reduce, Reuse, Recycle
Production of biogas from waste water

Waste trucks tank biogas at BASE

700 waste trucks per day

Amsterdam waste and waste water resource

CO2 reduction and decrease of particle emissions

Improved air quality in the city

Waste to Energy: Green Gas Hub Amsterdam

Steamcracking of sludge
Co fermentation organic waste
Maxiumum benefit from waste by planning smart cities!
Thank you for your attention!