



Recovering Resources & Providing Power

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*Waste to Energy Research and Technology (WTER) Meeting
Columbia University, October 20, 2006*

Agenda

- ◆ **Managing the NYC Waste: Is there another way?**
- ◆ **European waste-to-energy facilities**
- ◆ **From the beginning**
- ◆ **Issues**
- ◆ **Processes**
- ◆ **Summary and conclusions**

Minneapolis/St. Paul Area WM Facilities

COMBUSTION PLANTS



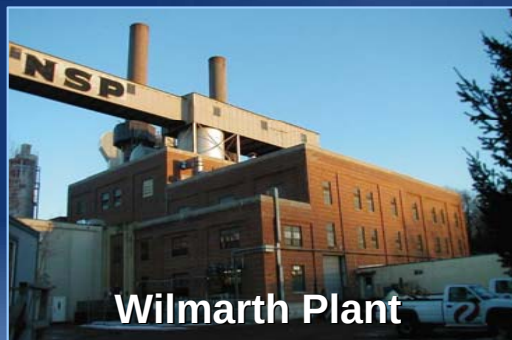
Red Wing Plant



Great River Energy



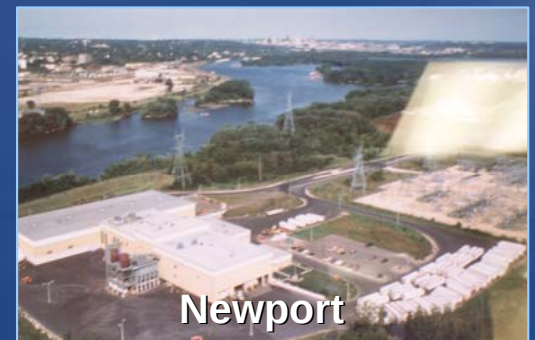
Elk River



Wilmarth Plant



HERC Plant



Newport

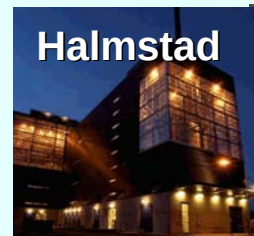
NYC Waste: Is There Another Way?



*NYC transports 34,000
tons of waste per day
7 million miles per year*

- ◆ New York City now transports most of its waste to landfills in other states
- ◆ A waste-to-energy facility could benefit the city and its people
- ◆ Europe's innovative waste-to-energy facilities provide models of efficiency, cost effectiveness and community acceptance

WTE Facilities visited by author in 2006



**WTE Facilities
visited by author
in 2006 (except
Brescia)**



Sonitherm



Northern Tier Plants



- ◆ I/S Reno-Nord - Aalborg, Denmark
- ◆ Vestforbrænding – Glostrup, Denmark
- ◆ SYSAV – Sydkånes Avfallsaktiebolag, Malmö, Sweden
- ◆ Vattenfall Värme Uppsala AB – Uppsala, Sweden
- ◆ Kristinehedsverket – Halmstad Renhållning AB, Halmstad, Sweden

The Netherlands



- ◆ **AEB – Afval Energie Bedrijf; Amsterdam, Netherlands**
 - Largest WtE plant in world mid-2007: 1.4 million tons waste
 - 1 percent of total input leaves plant for landfill
- ◆ **AZN – NV Afvalverbranding Zuid Nederland, near Moerdijk, Netherlands**

Mid Tier



- ◆ MVR Mülverwertung Rugenberger Damm Gmbh & Co. KG, a Vattenfall Company – Hamburg, Germany
- ◆ SOTEC – Freiburg-im-Breisgau, Germany
- ◆ Fermwärme Wien – Spittelau, Austria
- ◆ KRV – Kartner Restmüllverwertung Gmbh – Arnoldstein, Austria
- ◆ SAN – Clergy- Pontoise, Cergy, France

Aspects/issues examined



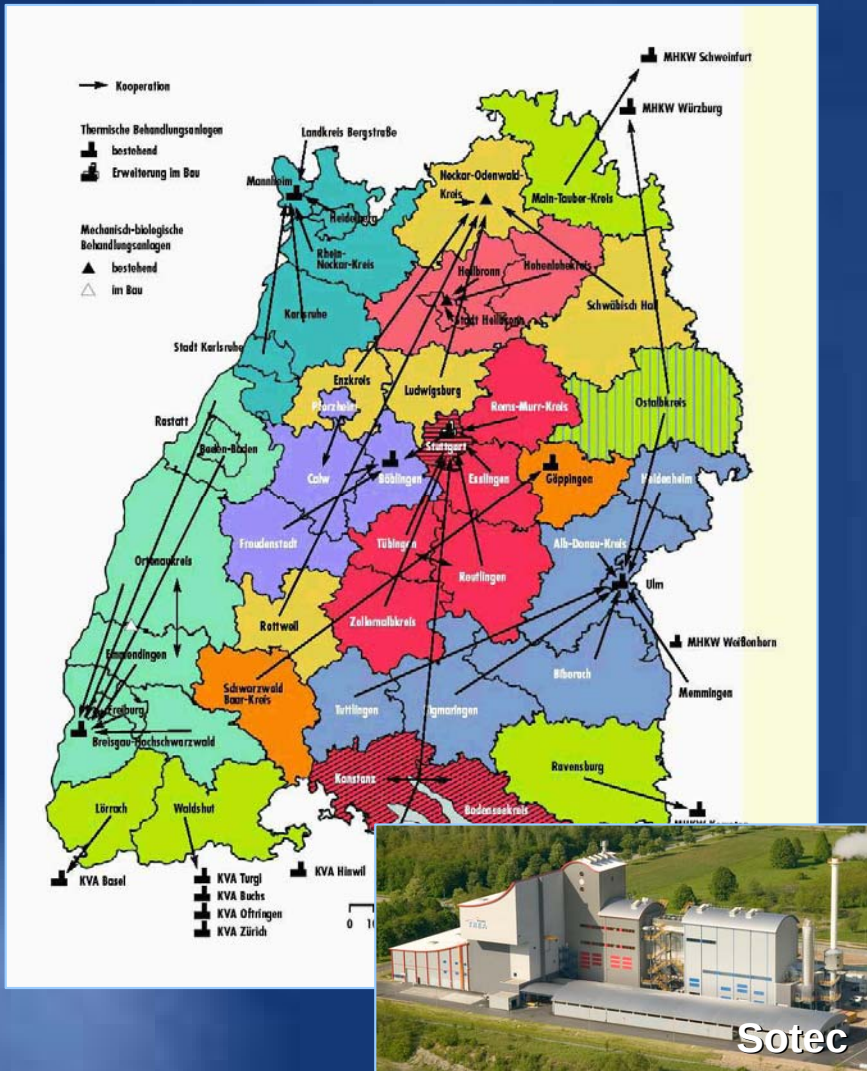
- ◆ Municipalities
- ◆ Contracts w/
Municipalities and
Haulers
- ◆ Governmental
Agency Support
- ◆ Public
Opposition/Support
- ◆ U.S./E.U./State
Standards

Communicating with Public



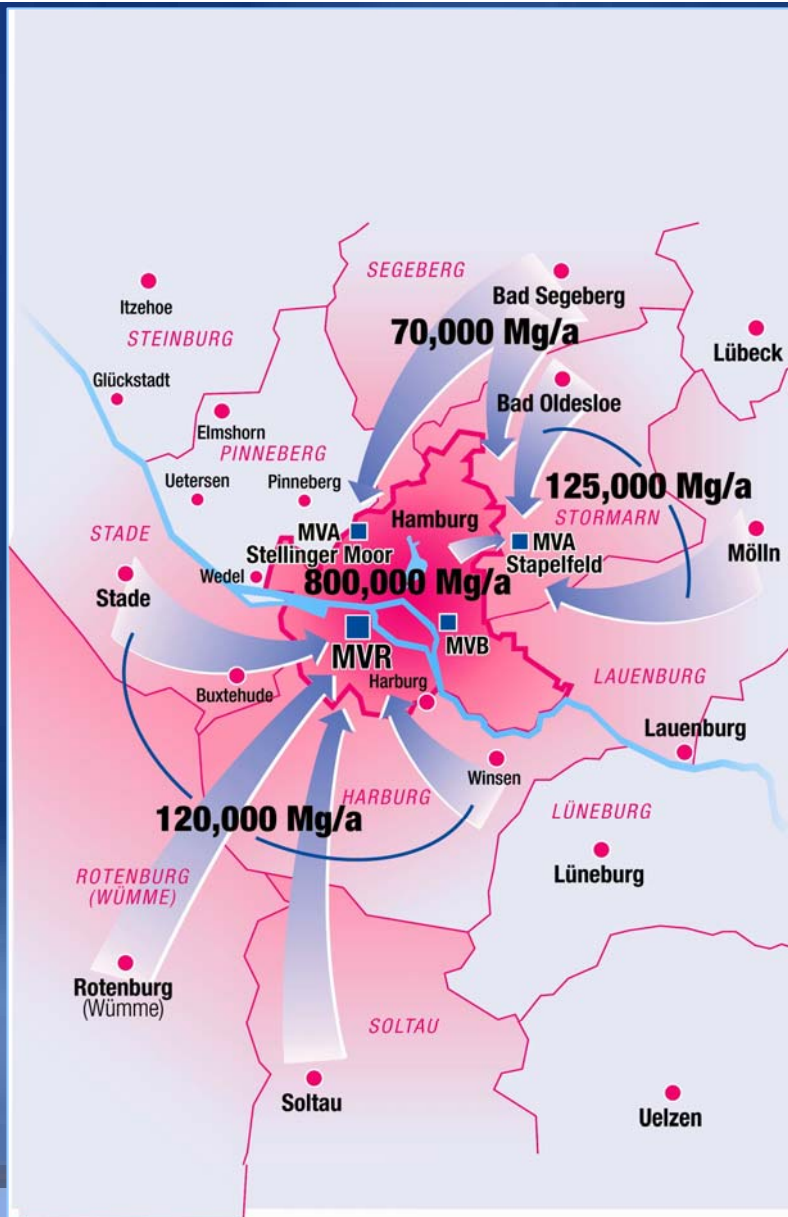
- ◆ Local meetings
 - Spittelau
 - Freiburg-im-Breisgau
 - Malmo
- ◆ Press
 - All Facilities
- ◆ Display panels
 - SOTEC
- ◆ Graphic displays
 - AEB
- ◆ Plant tours
 - Most plants

Transport of Waste



- ◆ Need good transport routes
 - The shorter the distance, the less paid for diesel fuel and transport
- ◆ Regional
- ◆ Municipality coalition
- ◆ Rail Delivery – SOTEC
- ◆ Barge transport
- ◆ Tractor trailer
- ◆ Distance transported

Transport of Waste: MVR, Hamburg



Recyclable Products, MVR, Hamburg



- ◆ Ferrous/non-ferrous metals
- ◆ Bottom ash and fly ash
- ◆ Gypsum: by-product of most plants at discharge of SO₂ scrubber
- ◆ HCL: by-product of HCL scrubber

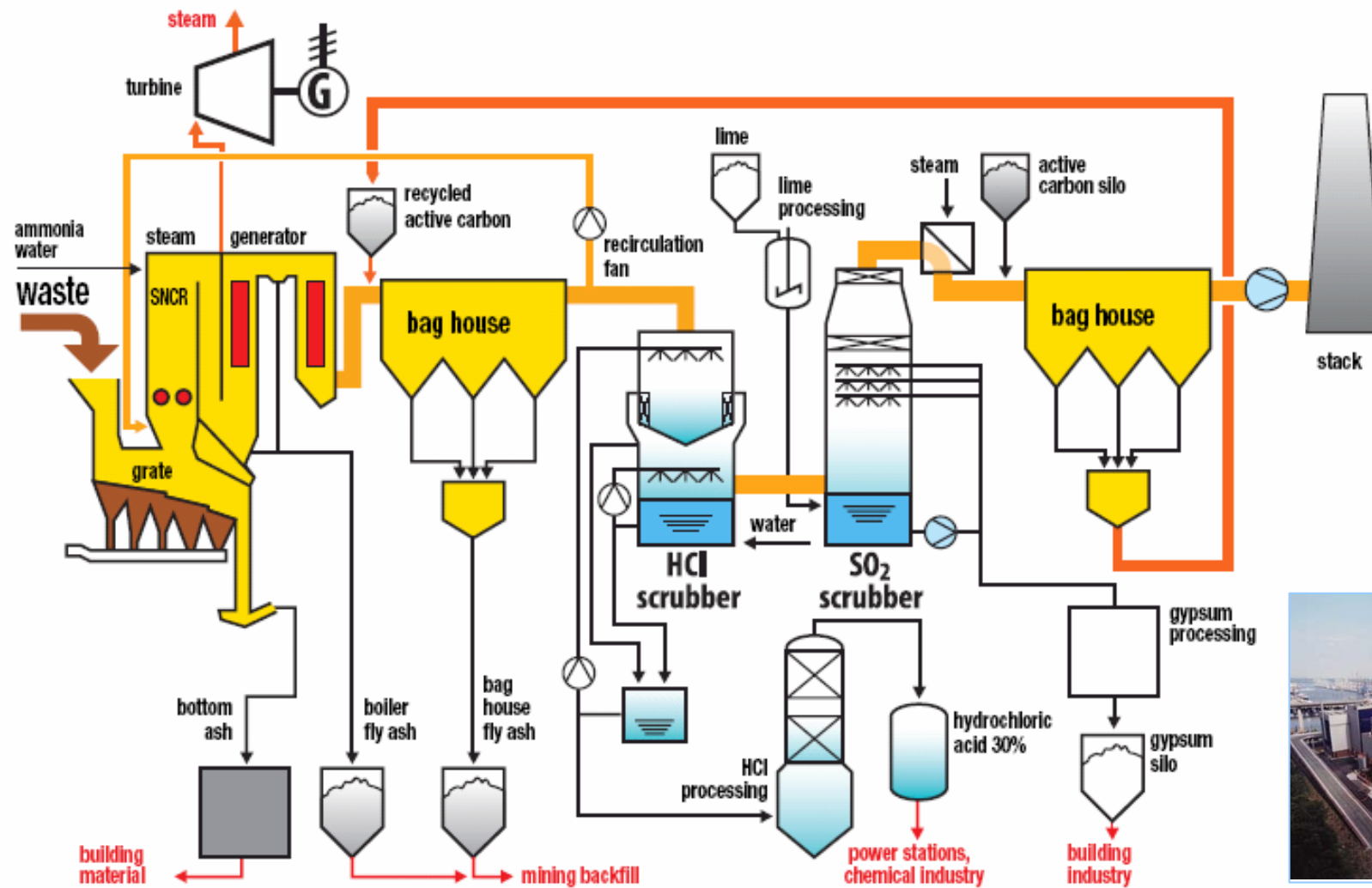
Scrap production

Year	Quantity of Fe scrap / Mg	Specific scrap quantity kg/Mg waste
2001	7,850	26
2002	7,790	25
2003	7,623	24
2004	7,617	23

Hydrochloric acid production, 30%, EN 939

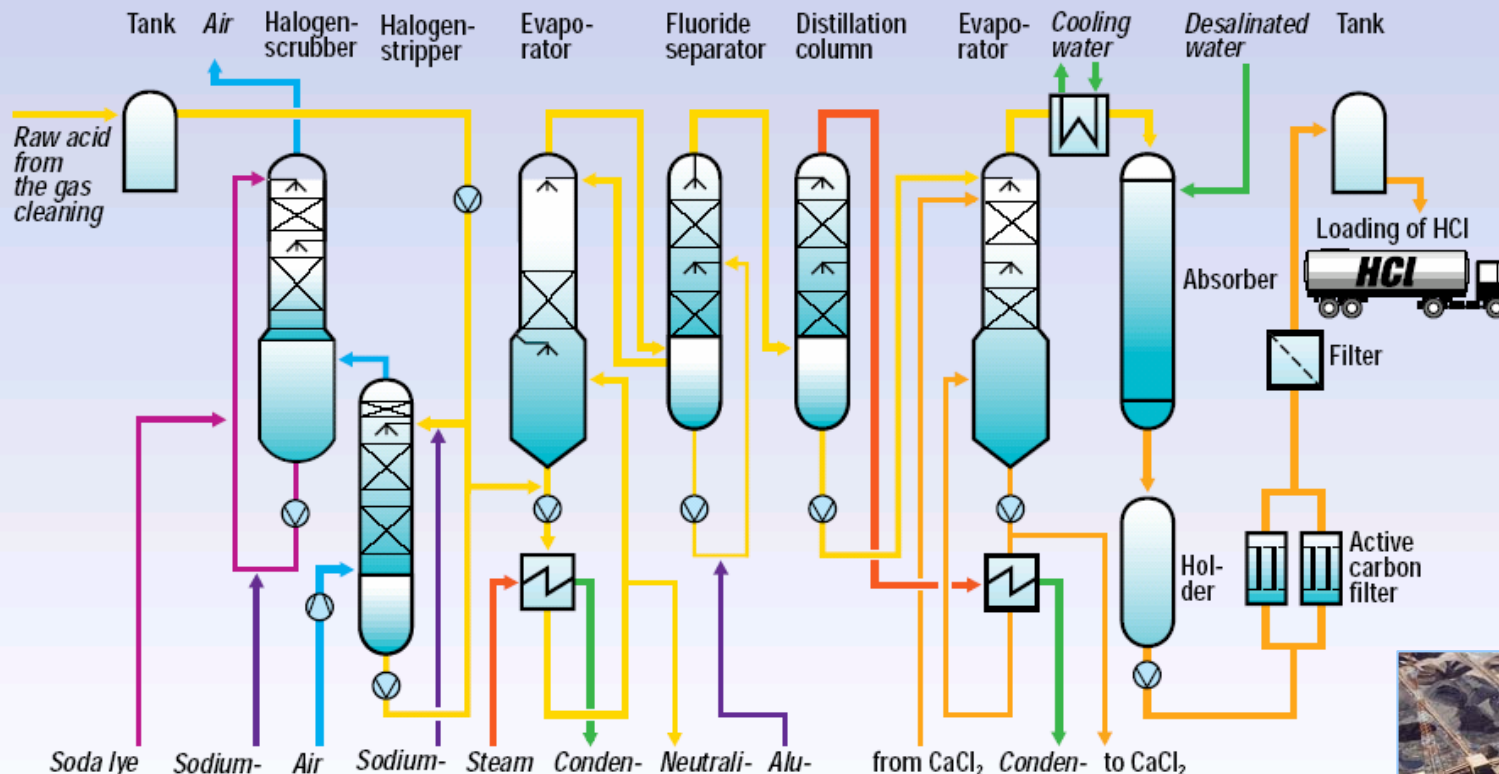
Year	Quantity Mg	Specific HCl quantity kg/Mg waste
2001	3,820	12.5
2002	4,030	13.1
2003	3,755	11.7
2004	4,041	12.4

Process Flow: MVR



Recyclables: Hydrochloric acid (MVR)

Process Scheme of HCl-Rectification-Plant



Low Emissions

Parameter	Unit	Guaranteed value	Limit value	Expected value	Actual value
Dust	mg / Nm ³	10	10	<2	0
HCl	mg / Nm ³	5	10	<2	0
HF	mg / Nm ³	1	1	<0.3	<0.3
SO ₂	mg / Nm ³	20	50	<3	<3
Hg	mg / Nm ³	0.05	0,05	<0.02	<0.02
Cd+Tl	mg / Nm ³	0.05	0,05	<0.01	<0.01
Σ Heavy metals	mg / Nm ³	0.5	0,5	<0.1	<0.1
Dioxins and furans	ng / Nm ³	0.1	0,1	<0.04	<0.04

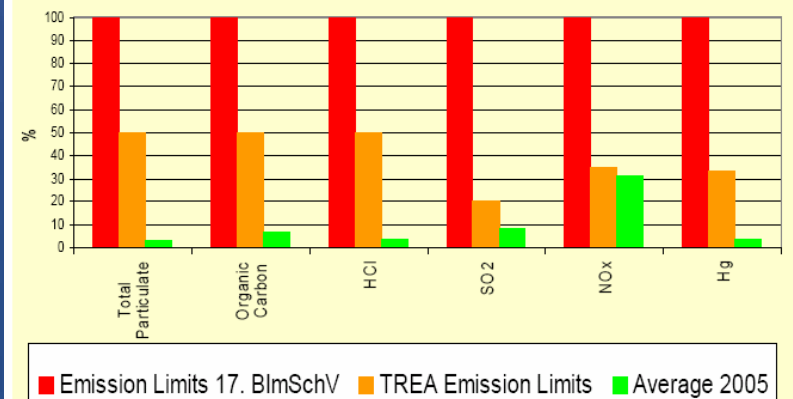
SOTEC



I/S Reno-Nord



Comparison of Emission Limits



Low Emissions (%of allowable)

Pollutant	Annual load 2004	Limit value Annual load	2002	2003	2004
PM	473 kg	4,726 kg	17%	24%	10%
C total	509 kg	12,603 kg	3.4%	3.3%	4.0%
CO	12,375 kg	78,771 kg	13%	15%	16%
HCl	188 kg	4,726 kg	6.9%	3.7%	4.0%
NOx	108,098 kg	157,542 kg	64%	71%	69%
SO2	2,758 kg	23,631 kg	32%	13%	12%
HF	26 kg	158 kg	16%	18%	17%
Cd/Tl	698 g	3,150 g	22%	23%	22%
Hg	332 g	31,510 g	1.0%	1.2%	1.1%
Sb, As, Sn	11.4 kg	78 kg	12%	15%	15%
As, BaP	2.2 kg	78 kg	--	2.7%	2.8%
PCDD/F	1.12 mg	78 mg	6.4%	2.1%	1.4%

MVR



Ash Disposal



- ◆ **KRV (Arnoldstein, Austria) uses oxygen enrichment of combustion air**
 - Reduces ash volume, makes ash less leachable
 - Greater MSW load is achieved and more megawatts are generated
- ◆ **APC ash to salt mines**
- ◆ **Landfill maintenance**
- ◆ **Other uses, mixed with concrete**

Architectural Design

Halmstad



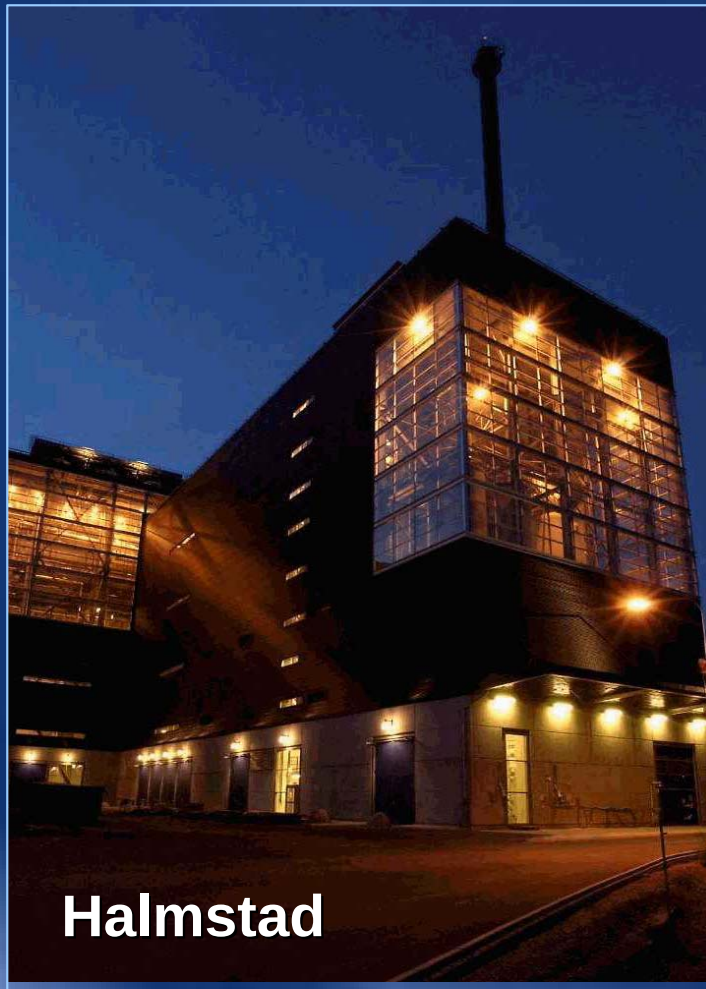
Uppsala



Spittelau



Electricity and District Heating



Capital Investment – New Retrofits



- ◆ AEB WFPP (Waste For Power Plant project)
 - €80 million were made available as “green financing” by the government
 - Additional recyclables
 - Treatment of wastewater sludge - other energies developed
 - District heating

Unique Technology Qualities



Summary/Conclusions for NYC

- ◆ Optimize recycling
- ◆ Pleasing Architectural Design
- ◆ Install BACT (Best Available Control Technology)
- ◆ Determine best transport access to facility
- ◆ Develop dialogue with city planners on a new direction that incorporates WtE in Waste Management plan
- ◆ Design and build a 500,000 to 750,000 tons per year on periphery of NYC

Questions?