An inconvenient truth: How NZ can take off to Paris with Energy from Waste

Dr. Marc R. Stammbach / MD HZI Australia

BANZ Webinar, 6 Dec 2016

Basics of EfW
Office block, warehouse, EfW or tourism?

Issy-les-Moulineaux – Paris, France
We need at least three bins to achieve “zero waste to landfill”

Energy & Compost from biowaste with anaerobic digestion

Energy & Material from non recyclable waste with thermal treatment

Recycling
- Compost & fertiliser

Direct Recycling
- Glass, paper, metals

Recycling
- Metals & minerals

EfW closes the energy cycle - Material and energy recycling are complementary

EfW saves up to 2t CO₂ per treated t of waste.

EfW offsets CO₂ from power production.

Material Recycling
- AUS & NZ 43%
- EU 40%
- CH 50%
- Reduction

Thermal Recycling
- AUS & NZ 0%
- EU 24%
- CH 49%

Methane emissions
- AUS & NZ 57%
- EU 36%
- CH 1%

Groundwater leakage

EfW eliminates Methane emissions from Landfill.
Energy from Waste
An Essential Part of a Sustainable Waste Management System

IN

- none-recyclable waste
- additives for flue gas cleaning

waste reception and storage

combustion and energy recovery

flue gas treatment

energy utilization

OUT

- energy - electricity and heat
- bottom ash for recycling
- cleaned flue gas
- flue gas cleaning residues

Integrated Solutions and Turnkey Capability
for thermal Energy from Waste plants

Proprietary Technology from HZI

Engineered by HZI

Managed by HZI

Project, Site and Construction Management

- Grate Combustion
- Energy Recovery
- Flue Gas Treatment
- Residue Treatment

Integrated Solution

- Maximized Efficiency
- Reliable Execution

Civil

Electrical and Control Technology

Balance of Plant and Energy Utilization

Site and Building Services
LEAP - Low Excess Air Combustion Process

PA = primary air
SA = secondary air
RFG = recirculated flue gas

Combustion operates between 0 to 2.1 vol% oxygen over grate
**Electric Power and R1 status for classification of EfW as “recycling”**

**Main Features**
- Only electricity production without heat utilization

**Efficiency**
- Up to 27%
- R1 around 0.7 to 0.8

\[
R1 = \frac{Ep - (Ef + Ei)}{0.97 \times (Ew + Ef)}
\]

Energy efficient if R1 > 0.65 for new plants

Reference for R1:
- EC Guidelines on the Energy Efficiency Formula
Maximized Energy Recovery
Tailor-Made Solutions

Influencing factors:
- Steam parameters
  - Turbine size and design
  - Condenser type and design (ACC, cooling tower, district heating condenser)
  - ...

<table>
<thead>
<tr>
<th>Efficiency [%]</th>
<th>Power</th>
<th>Heat</th>
<th>Heat from Flue Gas Condensation</th>
<th>Process Steam</th>
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<tbody>
<tr>
<td>&lt; Power only</td>
<td>31.0</td>
<td>18.9</td>
<td>65.5</td>
<td>86</td>
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<tr>
<td>&gt; Heat only</td>
<td></td>
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Ferrybridge, UK – A second plant has been ordered

- Client: Ferrybridge Multifuel Energy Ltd. (Owned by SSE & WTI)
- Start-up: 2015
- Technology:
  - Furnace: Grate furnace (water/air-cooled)
  - Energy recovery: 5-pass boiler, turbine generator set
  - Flue gas treatment: SNCR, semi-dry system
- Technical Data:
  - Fuel: RDF, waste wood, MSW
  - Waste capacity: 675,000 t/a
  - Net calorific value: 8.5-16.5 MJ/kg
  - Thermal capacity: 2 x 117 MW
  - Steam: 2 x 145 t/h (71.5 bar, 430 °C)

- Multi-fuel facility for RDF and waste wood
- Fuel delivery by road and train
- High efficient process with direct driven turbine
- Built on power station site
- Integrated site management to ensure continuous operation of power station
- HZI with maintenance contract
### Energy Efficiency - Maximum Steam Supply

**Lucerne, Switzerland**

**Client:** Renergia Zentralschweiz AG  
**Start-up:** 2015

**Technology:**
- Incineration
- Energy recovery
- Flue gas treatment

**Technical Data:**
- Fuel: Municipal waste
- Waste capacity: 250,000 t/a (2 x 15.6 t/h)
- Net calorific value: 10.85 MJ/kg
- Thermal capacity: 2 x 47 MW  
- Steam: 2 x 58 t/h (41 bar, 410°C)

**Technical Data Table:**

<table>
<thead>
<tr>
<th></th>
<th>MW</th>
<th>% of Input</th>
<th>kWh / t Waste</th>
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<tbody>
<tr>
<td>Fuel Input</td>
<td>94</td>
<td>100%</td>
<td>3,010</td>
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<tr>
<td>Electricity</td>
<td>17.8</td>
<td>18.9%</td>
<td>570</td>
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<tr>
<td>Process Steam</td>
<td>52.0</td>
<td>55.3%</td>
<td>1,670</td>
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<tr>
<td>Total Energy</td>
<td>69.8</td>
<td>74.2%</td>
<td>2,240</td>
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</tbody>
</table>

### Energy Efficiency - Combined Steam and Power

**Vaasa, Finland**

**Client:** Westenergy Oy  
**Start-up:** 2013

**Technology:**
- Furnace: Grate furnace (water-cooled)
- Energy recovery
- Flue gas treatment

**Technical Data:**
- Fuel: Municipal and industrial waste
- Waste capacity: 160,000 t/a (1 x 20 Mg/a)
- Net calorific value: 11.0 MJ/kg
- Thermal capacity: 61.1 MW  
- Steam: 73.1 t/h (40 bar, 400°C)

**Technical Data Table:**

<table>
<thead>
<tr>
<th></th>
<th>MW</th>
<th>% of Input</th>
<th>kWh / t Waste</th>
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<tr>
<td>Fuel Input</td>
<td>61.1</td>
<td>100%</td>
<td>3,055</td>
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<tr>
<td>Electricity</td>
<td>13.6</td>
<td>22.3%</td>
<td>680</td>
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<tr>
<td>District Heating</td>
<td>40.0</td>
<td>65.5%</td>
<td>2,000</td>
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<tr>
<td>Total Energy</td>
<td>53.6</td>
<td>87.8%</td>
<td>2,680</td>
</tr>
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</table>
Energy Efficiency - Heat only
Uppsala, Sweden

Client: Vattenfall Värme Uppsala AB
Start-up: 2005

Technology:
- Furnace: Grate furnace (water-cooled)
- Energy recovery: 4-pass boiler, absorption heat pump, ESP, wet wet scrubber (acid, limestone), condensation reactor, heat exchanger, baghouse filter, low temperature SCR

Technical Data:
- Fuel: Municipal and industrial waste
- Heated capacity: 210,000 t/a (1 x 26.4 t/h)
- Net calorific value: 10.5 MJ/kg
- Thermal capacity: 73.3 MW
- Steam: 100 t/h (saturated 20 bar)

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<th>MW</th>
<th>% of Input*</th>
<th>kWh / t Waste</th>
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</thead>
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<tr>
<td>Fuel Input</td>
<td>73.3</td>
<td>100%</td>
<td>2,780</td>
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<tr>
<td>District Heating incl. Heat from Condensation</td>
<td>75.0</td>
<td>102%</td>
<td>2,840</td>
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<tr>
<td>Total Energy</td>
<td>75.0</td>
<td>102%</td>
<td>2,840</td>
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</tbody>
</table>

* Based on LHV

Flue Gas Treatment Concepts
**FGT Systems**

**Hitachi Zosen Inova Semi Dry**

**Types**
- Hitachi Zosen Inova Semi Dry System

**Main Features**
- System based on fluidized bed reactor
- Reliable operation through minimization of moving parts
- High recirculation rate, therefore high buffering capacity and low sorbent consumption
- Possible modification to other additives
- Safely fulfills EU stack emission guidelines (17.BlmsSchV, WID and lower)

**Capacity**
- Flue gas volume up to 500,000 m³/h

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**FGT Systems**

**Xerosorp, Dry Scrubbing**

**Types**
- Xerosorp
- Xerosorp+

**Main Features**
- Dry flue gas treatment process for the removal of acidic gaseous contaminants by absorption with sodium bicarbonate.
- DeDiox with activated carbon
- Gas/Solid – separation in fabric filter
- Combination of the above process with low temperature DeNOx: Xerosorp+

**Capacity**
- Flue gas volume up to 250,000 m³/h
### FGT Systems
#### HZI Multistage Wet Scrubber

**Main Features**
- For flue gas from all types of energy-from-waste facilities
- Multifunctional: quenching, gas absorption, dust separation, dioxin removal, condensation
- Neutralization agent: sodium hydroxide (or hydrated lime)
- Adsorbent injection (for additional dioxin removal)
- Gas Point: very low emissions achievable
- Open for extensions (e.g., heat recovery by condensation)

**Capacity**
- Flue gas volume: up to 250,000 m³/h

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### FGT Systems
#### DeNOx different solutions

**Main Features**
- **SNCR**
  - Injection of ammonia water or urea solution into post combustion chamber
  - With or without ammonia recovery
  - Reaches NOx removal up to 80%

- **SCR**
  - Catalysts for NOx-removal and dioxin reduction
  - Arrangement on hot (235°-260°C) or cool (180°-220°C) side of flue gas scrubbing
  - Reaches NOx removal up to 90%
  - Xerosorp+
    - Energy efficient and compact solution pictured right

**Capacity**
- Flue gas column up to 250,000 m³/h
## Concept evaluation FGT
### 7 Key Questions

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
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<tbody>
<tr>
<td>Emission NOx &gt; 80 mg/m³ ?</td>
<td>SNCR down to 120 mg/m³</td>
<td>Low temperature</td>
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<tr>
<td></td>
<td>Dyno® down to 80 mg/m³</td>
<td>SCR system.</td>
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<tr>
<td>Emission levels WID compliant?</td>
<td>One step process</td>
<td>Lower emissions: Combined processes</td>
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<tr>
<td>Plume at the stack acceptable?</td>
<td></td>
<td>Dry or semi-dry scrubbing</td>
</tr>
<tr>
<td>Solidification of APC residues required?</td>
<td>No use of Bicarbonate.</td>
<td>Evaluate Xerosorp system with Bicarbonate.</td>
</tr>
<tr>
<td>High discharge fees of APC-residues?</td>
<td>Wet scrubbing &amp; residue treatment</td>
<td>Semi-dry scrubbing</td>
</tr>
<tr>
<td>Draining of treated waste water possible?</td>
<td>Wet scrubbing in favour.</td>
<td></td>
</tr>
<tr>
<td>Connection to District Heating Network?</td>
<td>Wet scrubbing with flue gas condensation.</td>
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## Concept evaluation FGT
### Four main concepts

- **HZI Xerosorp**
  - WID compliance
  - No water discharge
  - No plume
  - Residue solidification
  - Flue gas condensation

- **HZI Semi Dry**
  - WID compliance
  - No water discharge
  - No plume
  - Residue solidification
  - Flue gas condensation

- **HZI Semi Dry & Scrubber**
  - WID compliance
  - No water discharge
  - No plume
  - Residue solidification
  - Flue gas condensation

- **HZI Scrubber**
  - WID compliance
  - No water discharge
  - No plume
  - Residue solidification
  - Flue gas condensation
Quantity of APC residues

 APC residue quantity of different APC techniques
 based on 600 HCl / 200 SO2 (in mg/m3N) as raw gas concentration

Some more details and references from over 550 plants
Your Reliable Partner for Complex EfW Projects

15,260 t of steel up to 850 workers on site

- 140 km power cables
- 100 km control cables
- 7,580 signals
- 19,700 drawings
- 1,450 HAZOP analysis

3D Model – Ferrybridge 2 – scheduled for first fire in 2018
Lucerne, Switzerland

- New plant with 2 lines supplying steam to neighbouring paper mill
- Hitachi Zosen Inova supplies incineration and flue gas treatment
- Process aims for high energy efficiency and low emissions using a two-stage dry sorption process with two heat exchangers
- Advanced technology with Inova Grate, staged secondary air injection and advanced combustion control system

Buckinghamshire, UK

- Big single line plant
- Enabled for combined heat and power production
- Hitachi Zosen Inova acting as Turnkey contractor including civils
- Bottom ash transported to adjacent IBA treatment area
- Developed in exclusive partnership with FCC UK
Severnside, UK

- EPC turnkey contract for complete plant incl. civil works
- Located in South Gloucestershire with rail link for waste transport from West London by containers
- Electrical power production: 38 MW gross
- Use of LEAP (O₂, wet = 5 vol.%) and DyNOR (NOₓ < 150 mg/Nm³)
- Bottom ash treatment on site (by others)
- Developed by SITA UK as Public Private Partnership with West London Waste Authority

Herefordshire and Worcestershire, UK

- EPC turnkey contract for complete plant incl. civil works
- Located west of Birmingham to recover energy from municipal waste
- Electrical power export: 18MW, enough to power 43,000 homes
- Development by Mercia as a Waste Management Service PFI contract for the councils of Herefordshire and Worcestershire
- First fire: 5 October 2016
### Poznan, Poland

- **Client**: SITA Zielona Energia Sp. z o.o.
- **Start-up**: 2016
- **Technology**
  - **Furnace**: Grate furnace (air-cooled)
  - **Energy recovery**: 4-pass vertical boiler, turbine
  - **Flue gas treatment**: SemiDry with SNCR
- **Technical Data**
  - **Fuel**: Municipal and industrial waste
  - **Waste capacity**: 240,000 t/a (2 x 15 t/h)
  - **Net calorific value**: 7.6 MJ/kg
  - **Thermal capacity**: 2 x 31.5 MW

Hitachi Zosen Inova is lead partner in a consortium with HOCHTIEF Polska in a turnkey construction contract.

- New EfW plant including bottom ash treatment and FGT residue solidification plant on site
- Building Permit engineering
- Combined heat and power:
  - max. electrical power ca. 17 MW
  - max. district heat export ca. 34 MW
- Developed by SITA Polska as Public Private Partnership with city of Poznan as public partner.

### Dublin, Irelnd

- **Client**: Covanta
- **Start-up**: 2017
- **Technology**
  - **Furnace**: Grate furnace (air-cooled)
  - **Energy recovery**: 4-pass horizontal boiler, turbine
  - **Flue gas treatment**: SemiDry and wet scrubber, with SNCR
- **Technical Data**
  - **Fuel**: Municipal waste
  - **Waste capacity**: 600,000 t/a (2 x 32 t/h)
  - **Net calorific value**: 11.5 MJ/kg
  - **Thermal capacity**: 1 x 102.5 MW
  - **Steam**: 1 x 125 t/h (62 bar, 443°C)

- EPC turnkey contract for complete plant excluding civil works
- Located on Poolbeg Peninsula in Dublin to recover energy from municipal waste
- Electrical power export: 58 MW, enough to power 80,000 homes
- Very low emissions and high efficiency by applying advanced combustion technology and a condenser with seawater cooling
Ivry-sur-Seine, France

- Consortium IP13 (Suez consortium leader) awarded design, building and operations contract
- Combined EIW and MBT plant for total waste treatment capacity of around 490,000 t/a of municipal solid waste, replacing a thermal EIW plant from 1960 on the same site
- HZI responsible for grate and boiler
- Combined heat and power export:
  - max. electrical power: ca. 15 MW
  - max. district heat export: ca. 118 MW

Hartlebury, UK

- EPC turnkey contract for complete plant incl. civil works
- Located west of Birmingham to recover energy from municipal waste
- Electrical power export: 18MW, enough to power 43,000 homes
- Development by Mercia as a Waste Management Service PFI contract for the councils of Herefordshire and Worcestershire
Severnside, United Kingdom

- EPC turnkey contract for complete plant incl. civil works
- Located in South Gloucestershire with rail link for waste transport from West London by containers
- Electrical power production: 38 MW gross
- Use of LEAP (O2, wet = 5 vol.%) and DyNOR (NOx < 150 mg/Nm3)
- Bottom ash treatment on site (by others)
- Developed by SITA UK as Public Private Partnership with West London Waste Authority

Buckinghamshire, UK

- Single line plant
- Enabled for combined heat and power production
- Hitachi Zosen Inova acting as Turnkey contractor including civils
- Bottom ash transported to adjacent IBA treatment area
- Developed in exclusive partnership with FCC UK
Vantaa, Finland

- Utilization of municipal waste of the Helsinki metropolitan area
- Hitachi Zosen Inova supplier of furnace / boiler
- Combined cycle power plant with superheating of 91 bar steam to 520°C by exhaust gas of 80 MW gas turbine
- Combined heat and power production - 107 MW heat and 78 MW electrical power
- Advanced SNCR system - DyNOR™
- Designed for maximum energy recovery

Cleveland 4+5, United Kingdom

- EPC turnkey contract for complete plant incl. civil works
- Independent new plant adjacent to existing plant incl. line 3 built by Hitachi Zosen Inova
- Electrical power production 21 MW, turbine enabled for combined heat and power production
- Developed by SITA UK as Public Private Partnership under the Project Finance Initiative
Poznan, Poland

- Hitachi Zosen Inova is lead partner in a consortium with HOCHTIEF Polska in a turnkey construction contract
- New EfW plant including bottom ash treatment and FGT residue solidification plant on site
- Building Permit engineering
- Combined heat and power:
  - max. electrical power ca. 17 MW
  - max. district heat export ca. 34 MW
- Developed by SITA Polska as Public Private Partnership with city of Poznan as public partner

Barcelona - Sant Adrià de Besòs, Spain

- Existing waste treatment plant for Barcelona supplying electricity and district heating / cooling to local inhabitants
- Replacement / modernisation of existing grate furnace (built by Hitachi Zosen Inova in 1975) while plant remains in operation
- Hitachi Zosen Inova supplier of grate furnaces to Ros Roca S.A. (general contractor)
### Vaasa, Finland

- EFW plant for 400,000 inhabitants in more than 50 communities in Western Finland
- First plant in Finland with heat supply to district heating network
- Combined heat and power production - 40 MW heat and 13 MW electrical power
- Container system for slag storage
- Advanced SNCR system – DyNOR™
- Supplier of furnace, boiler, water steam cycle, district heating system, crane facilities, electrical installation and control system for complete plant, BOP

<table>
<thead>
<tr>
<th>Client</th>
<th>Westenergy OY</th>
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<tr>
<td>Start-up</td>
<td>2013</td>
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#### Technical Data

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<th>Fuel</th>
<th>Municipal and industrial waste</th>
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<td>Waste capacity</td>
<td>160,000 t/a (1 x 20 Mg/a)</td>
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<tr>
<td>Net calorific value</td>
<td>11.0 MJ/kg</td>
</tr>
<tr>
<td>Thermal capacity</td>
<td>61.1 MW</td>
</tr>
<tr>
<td>Steam</td>
<td>73.1 t/h (40 bar, 400°C)</td>
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</table>

### Oslo Klemetsrud Line 3, Norway

- Independent third line to adjacent existing plant
- Hitachi Zosen Inova general contractor for incinerator / boiler and flue gas treatment
- Optimized for maximum energy recovery - with district heat economizers and condensation of flue gas (absorption heat pumps) - 50 MW heat and 10 MW electrical power
- Combined heat and power production
- Designed for minimum emissions

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<td>Start-up</td>
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#### Technology

- Furnace: Grate furnace (water-cooled)
- Energy recovery: 4-pass boiler, absorption heat pump
- Flue gas treatment: ESP, wet scrubber with condensation stage, heat exchangers, SCR
- Residue treatment: Waste water treatment

#### Technical Data

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<tr>
<th>Fuel</th>
<th>Municipal and industrial waste</th>
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<td>160,000 t/a (1 x 20.0 t/h)</td>
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<td>Net calorific value</td>
<td>12.0 MJ/kg</td>
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<td>Thermal capacity</td>
<td>66.7 MW</td>
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<td>Steam</td>
<td>77.8 t/h (41 bar, 400°C)</td>
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**Newhaven, United Kingdom, UK**

<table>
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<th>Veolia</th>
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<td>Start-up</td>
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</table>

**Technology**
- Furnace: Grate furnace (air-cooled)
- Energy recovery: 4-pass boiler, turbine
- Flue gas treatment: SNCR, semi-dry process

**Technical Data**
- Fuel: Municipal waste
- Waste capacity: 226,000 t/a (2 x 14.5 t/h)
- Net calorific value: 8.9 MJ/kg
- Steam capacity: 2 x 43.5 t/h (50 bar, 405°C)

- Hitachi Zosen Inova is lead partner in a consortium with HOCHTIEF in a turnkey construction contract
- Additional land secured adjacent to site for lay down and pre-assemble
- As a result of difficult ground conditions, first EfW facility using floating caisson as construction method for bunker construction (now grouted and fixed in position)

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**Thermo-Chemical Recycling**
Urban mining from fly ash Swiss style – 99,995% zinc

Reference: www.bsh.ch

Re-use of hazardous flue gas residuals Norwegian style

- Langøya is located in Holmestrand fjord (Norway):
  - Consists of limestone with an age of 300 to 400 million years
  - Approximately 3 km long and 500 m wide
  - Limestone extraction for cement production up to 1985 left two craters totaling 9.3 mio cbm below sea level
- Waste treatment since 1985:
  - Treatment and final disposal of hazardous waste, inorganic industrial wastes, unearthed soil and sediments.
  - Fill large craters as rehabilitation work supported by Norwegian authorities
  - Accepts waste from Scandinavia & Northern Europe

Reference: Picture and information from www.noah.no (downloaded 15 Sep 2015)
Bottom ash treatment to metal and road aggregate

Bottom ash treatment – wet and dry

De-tox of bottom ash with thermo-chemical recycling

Environmental benefits:
• 15–20% less weight, less water required
• Significant reduction in residual organic carbon content thanks to afterburning
• Lower values for critical heavy metals
• Recycles multi-composite articles, e.g. coffee capsules, toys, clothes with zippers, foils with metals, cables etc

Status:
• Pilot successful in KEZO Hinwil, Switzerland
• 200'000 tpy dry bottom ash recycling plant in construction serving 6 EfW plants (end of 2015)

Reference: Picture and information from www.zar.ch (downloaded 10 June 2014)
200’000 tpy bottom ash plant fed by 6 EfW Plants

Inauguration May 2016 – awaiting first full year results

Plus ferrous, aluminium, glass, copper, silver and gold recovery with an ash mining tower
With EfW to “Paris” (climate change agreement)

New Zealand’s annual GHG emissions broken down by sector

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<th>Year</th>
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<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
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<td>31.7</td>
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<td>-12.3</td>
<td>-14.4</td>
<td>-15.5</td>
<td>-15.1</td>
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<td>Deforestation</td>
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<td>Gross removals</td>
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<tr>
<td>Total</td>
<td>61.5</td>
<td>60.8</td>
<td>59.1</td>
<td>58.9</td>
<td>60.9</td>
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New Zealand waste statistics and high level GHG impact with EfW

- **MSW Statistics (1):**
  - Daily MSW Generation in urban areas: 3.68 kg/capita/day
  - Urban Population: 3,612,147 people
  - Yearly MSW Generation in urban areas: 4,852,000 t/y

- **Greenhouse Gas abatement (2):**
  - Impact with 40% recycling and 60% to EfW: 0.86 t CO2e/t MSW

- **NZ with 40% recycling and 60% EfW:**
  - Resulting Greenhouse Gas impact: -4.2 mio t CO2e/y
  - Baseline 2012 (3): +3.6 mio t CO2e/y
  - Net impact: -0.6 mio t CO2e/y

References:

«Waste hierarchy» beyond Energy from Waste

Not only Energy-from-Waste …

- **PREVENTION**
- **PREPARE FOR RE-USE**
- **RECYCLING**
- **OTHER RECOVERY**
- **DISPOSAL**

... but also Material-from-Waste!

- Metal Recovery
  - Precious metal
  - Ferric
  - Aluminium

Hitachi Zosen INova
Carbon Recovery with Greenhouses

Energy from Waste & Protected Cropping

- Nectar Farms:
  - developing 80 – 100 ha glasshouses
  - first facility in Stawell (Victoria)
  - offtake with Costa Group (ASX:CGC)
  - offshore distribution (ME, Asia)
  - Berkeley Calga AgriFund

- Hitachi Zosen Inova:
  - > 500 EfW plants built worldwide
  - 30 plants under long term O&M contract
  - Leading turn-key EPC supplier
  - On-time, in-budget & bankable
  - Part of Hitachi Zosen Corporation
Co-location benefits of protected cropping & waste to energy

- 24/7 sustainable, efficient ‘smart’ farming project
- The reduction of waste streams into landfill
- Creation of clean energy from waste (reduced carbon footprint)
- Capture and utilisation of CO₂ waste stream (closed loop)
- Regional employment from major project construction and commissioning
- Permanent, full time employment (60 FTE/10 ha and 30-50 FTE/EfW)
- Development of new, hi tech, clean and green industries
- Tangible ‘Food Bowl to Asia’ and MiddleEast

... and the Cost
## Reality check from UK – What are real gate-fees?

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Median</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-2000 EfW</td>
<td>£73/t</td>
<td>£36/t to £110/t</td>
</tr>
<tr>
<td>Post-2000 EfW</td>
<td>£99/t</td>
<td>£65/t to £132/t</td>
</tr>
<tr>
<td>Landfill inclusive £80/t</td>
<td>£100/t</td>
<td>£89/t to £135/t</td>
</tr>
<tr>
<td>Pre-2000 EfW</td>
<td>$146/t</td>
<td>$72/t to $220/t</td>
</tr>
<tr>
<td>Post-2000 EfW</td>
<td>$198/t</td>
<td>$130/t to $264/t</td>
</tr>
<tr>
<td>Landfill inclusive $160/t</td>
<td>$200/t</td>
<td>$188/t to $270/t</td>
</tr>
</tbody>
</table>

WRAP: Gate Fees Report 2015, www.wrap.org.uk/gatefees, FX rate used 2 AUD equals 1 £

**UK market prices:**
- £130/t for lower range in large plants 400,000 tpy to 600,000 tpy
- £198/t for medium range in medium plants 200,000 tpy to 300,000 tpy
- £264/t for higher range in small plants 50,000 tpy to 100,000 tpy
EfW closes and extends the material and energy cycle

- Energy from Waste is environmentally sound and empowers the circular economy
- Recovers steam, heat and electricity (50% renewable) and is “recycling” with R1 > 0.65
- Chemically recycles – recovery of metals from flue gas treatment residues
- Thermally recycles – urban mining of metals and aggregate from bottom ash
- Turns NZ’s CO2 emission from waste below zero and will achieve “zero waste to landfill”
- Co-location with greenhouses improves energy efficiency, recycles carbon and generates hundreds of new jobs

Waste is our Energy.  
Engineering is our Business.  
Sustainable Solutions are our Mission.  

Check our References.