Energy from Waste

The process

04/10/2011

Energy-from-Waste

- Thermal Treatment process – energy releasing

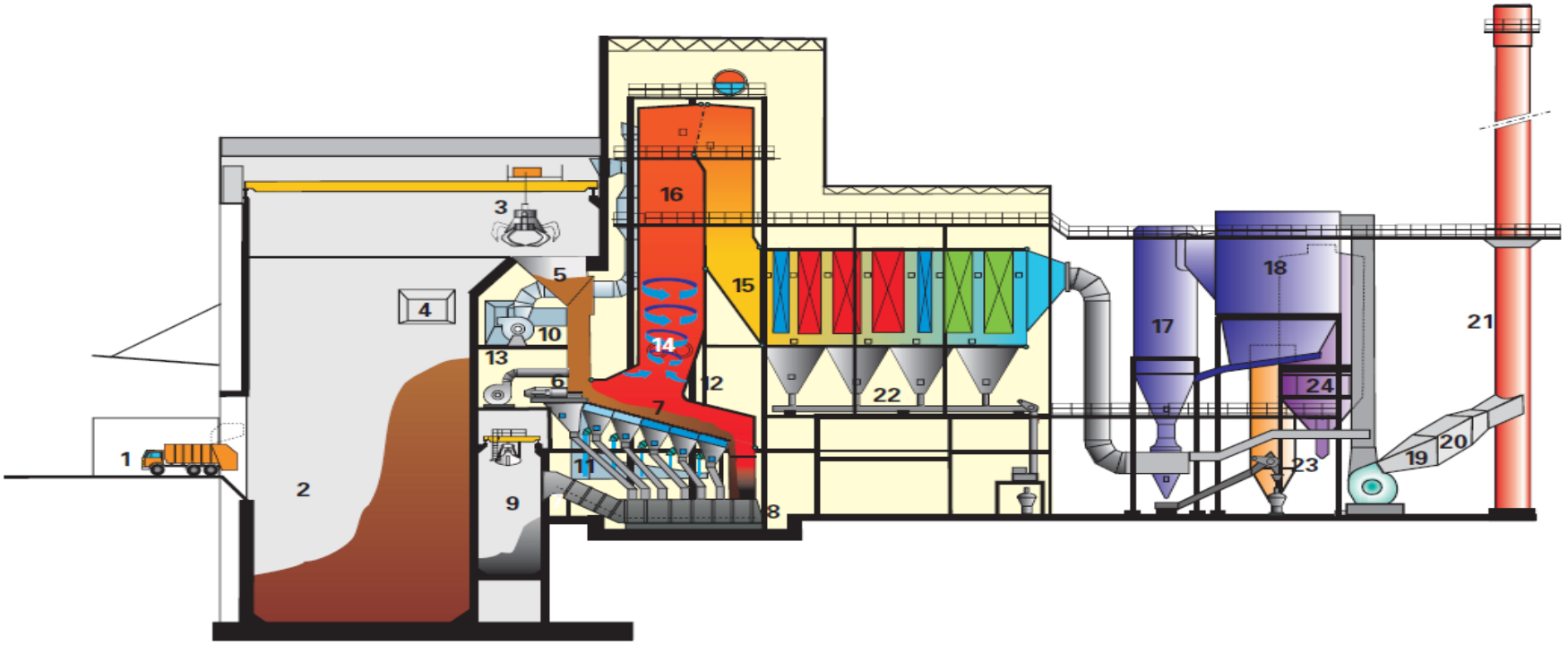
- Main energy conversion technologies
  - Combustion
  - Gasification
  - Pyrololsis
  - Digestion

- Direct combustion – most efficient method and cost effective energy conversion for large scale management of residual (non-recycled) waste.

- Four stage process, drying, vaporising, oxidising & burn out. Takes about 4 hours

- Main components
  - Furnace & grate
  - Water tube boiler & condenser
  - Steam turbine & generator

EFW Plant



Waste receiving and storage

1 Unloading area
2 Waste pit
3 Waste crane
4 Crane control cabin

Combustion and steam generator

5 Feed hopper
6 Ram feeder
7 Reciprocating incineration grate
8 Bottom ash discharger
9 Bottom ash pit
10 Bottom ash crane
11 Primary air intake
12 Primar air fan
13 Primary air distribution
14 Secondary air intake
15 Secondary air fan
16 Secondary air injection
17 Start-up burner
18 3-pass steam generator

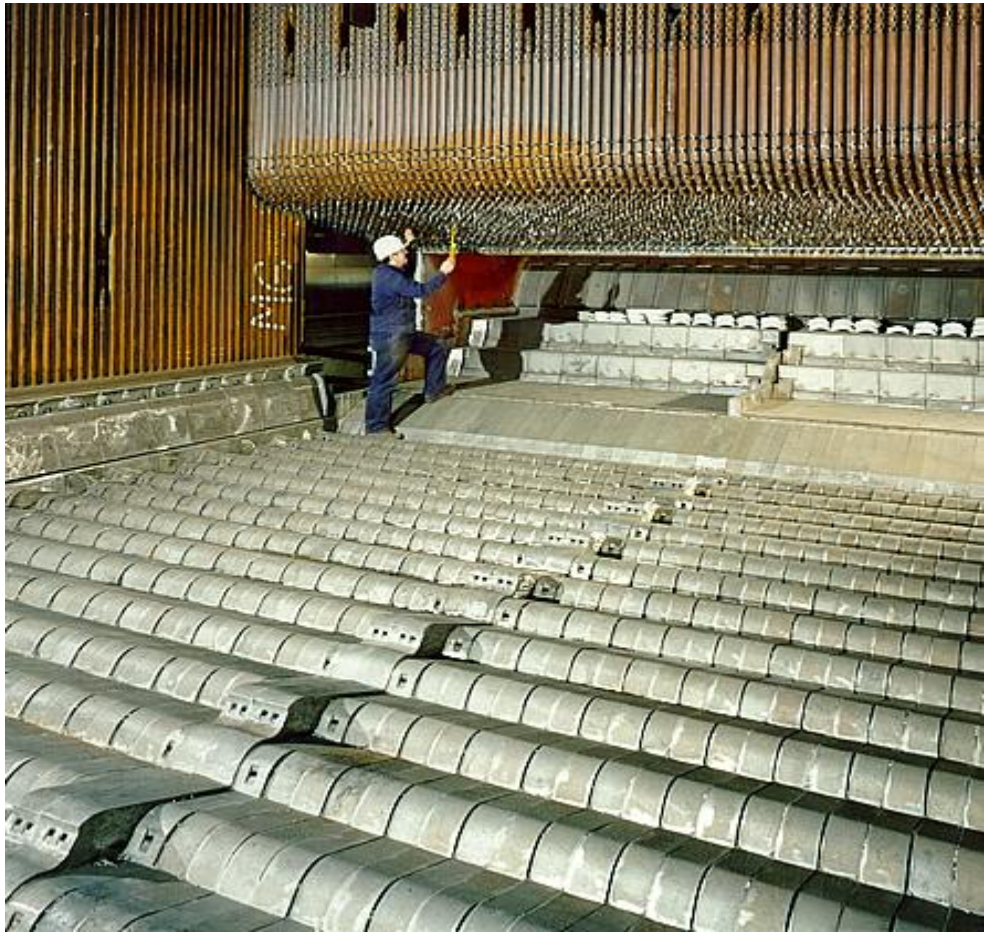
Flue gas treatment

19 SNCR injection levels
20 Semi-dry reactor
21 Fabric filter
22 Induced draft fan
23 Silencer
24 Stack

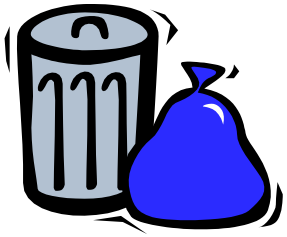
Consumables and residues

25 Lime silo
26 Ash conveying
27 Residue conveying
28 Residue silo

EfW - Moving Grate



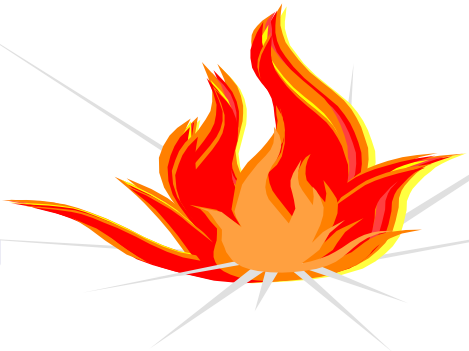
Energy Recovery



Residual MSW

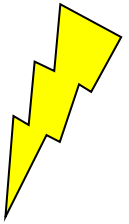
136,000 Tonnes (3)

FUEL



RESIDUES

ENERGY



Electricity to grid

76000 MWh

APCR
(4%)

Treatment

IBA
(26%)

Ferrous Recovery

Non Ferrous Recovery

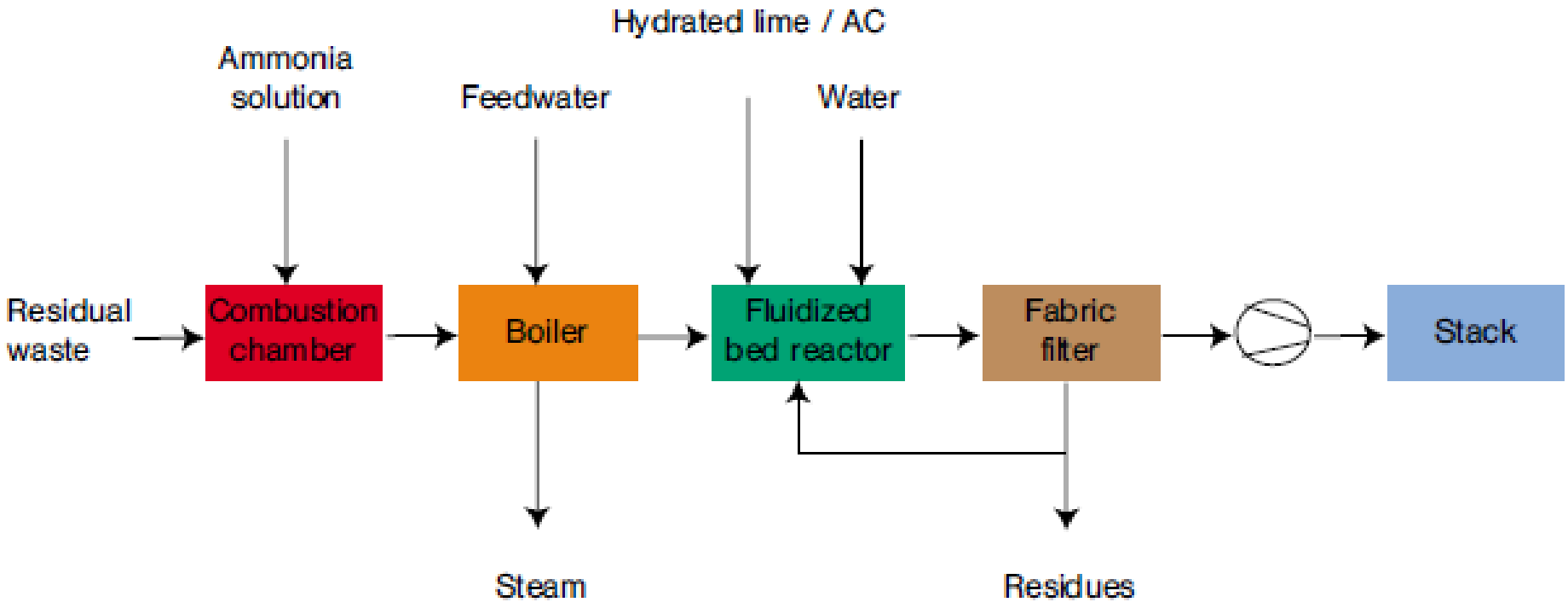
Aggregates

Water ~ re-use

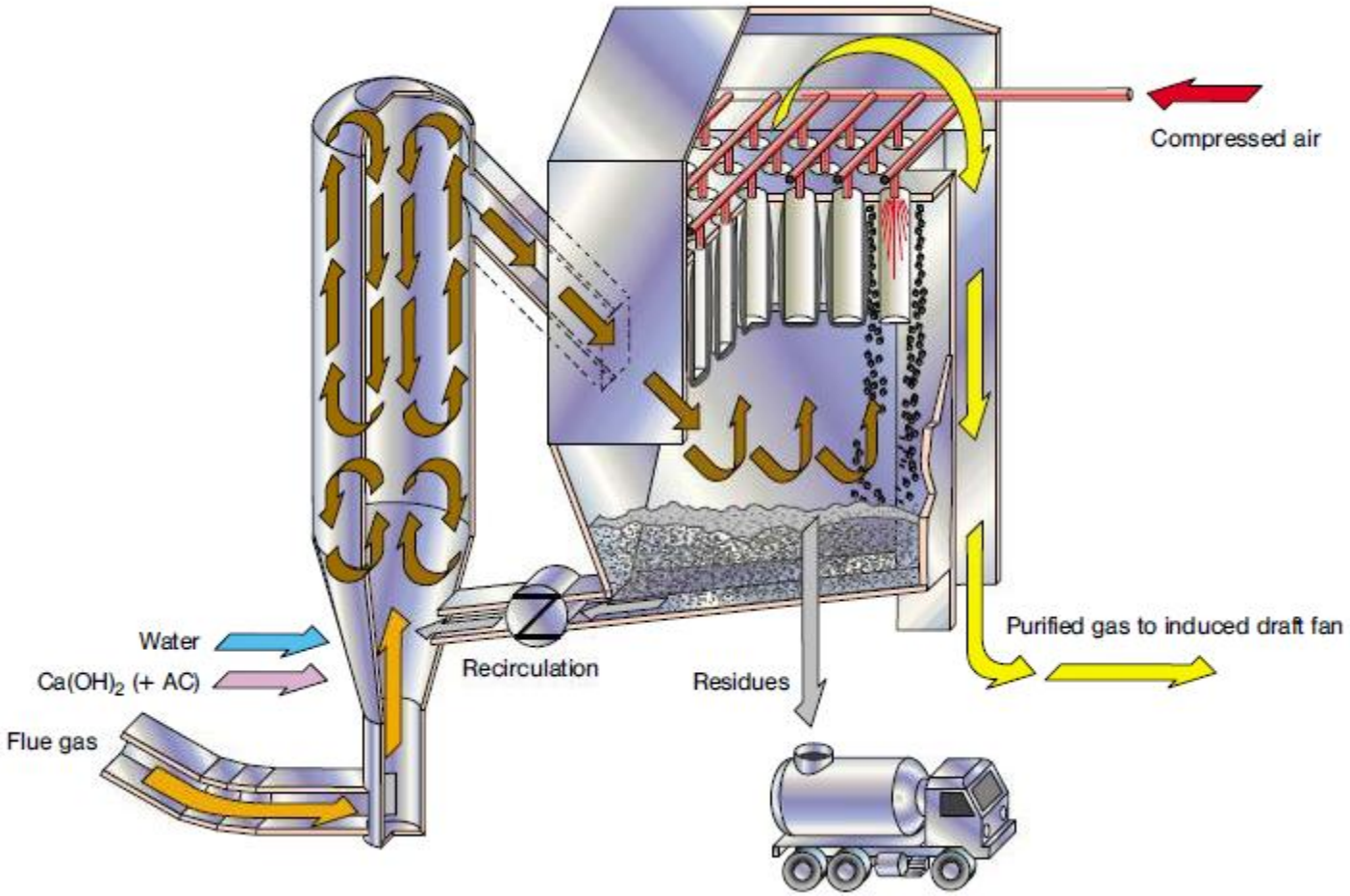
Waste Incineration Directive (WID)

Parameter	Limit / Reference Period / Measure		
Particulate matter	30 mg / m3	1/2 hour average	Continuous
	10 mg / m3	Daily average	Continuous
Hydrogen chloride	60 mg / m3	1/2 hour average	Continuous
	10 mg / m3	Daily average	Continuous
Carbon monoxide	100 mg / m3	1/2 hour average	Continuous
	50 mg / m3	Daily average	Continuous
Oxide nitrogen	400 mg / m3	1/2 hour average	Continuous
	200 mg / m3	Daily average	Continuous
Sulphur dioxide	200 mg / m3	1/2 hour average	Continuous
	50 mg / m3	Daily average	Continuous
TOC	20 mg / m3	1/2 hour average	Continuous
	10 mg / m3	Daily average	Continuous
Heavy metals	.5 mg / m3	1/2 hour period	Quarterly
Dioxin / furans	.1 ng / m3	6 hours	Bi-annual

Abatement Process



FGT Process


Compressed air
Purified gas to induced draft fan
Water
$Ca(OH)_2$ (+ AC)
Flue gas
Recirculation
Residues

STV 3

Case study.

04/10/2011

Northumberland PFI Contract

- 28 year contract from April 2007
  - Special Purpose Vehicle (SPV)
  - SITA Northumberland O & M Contractor

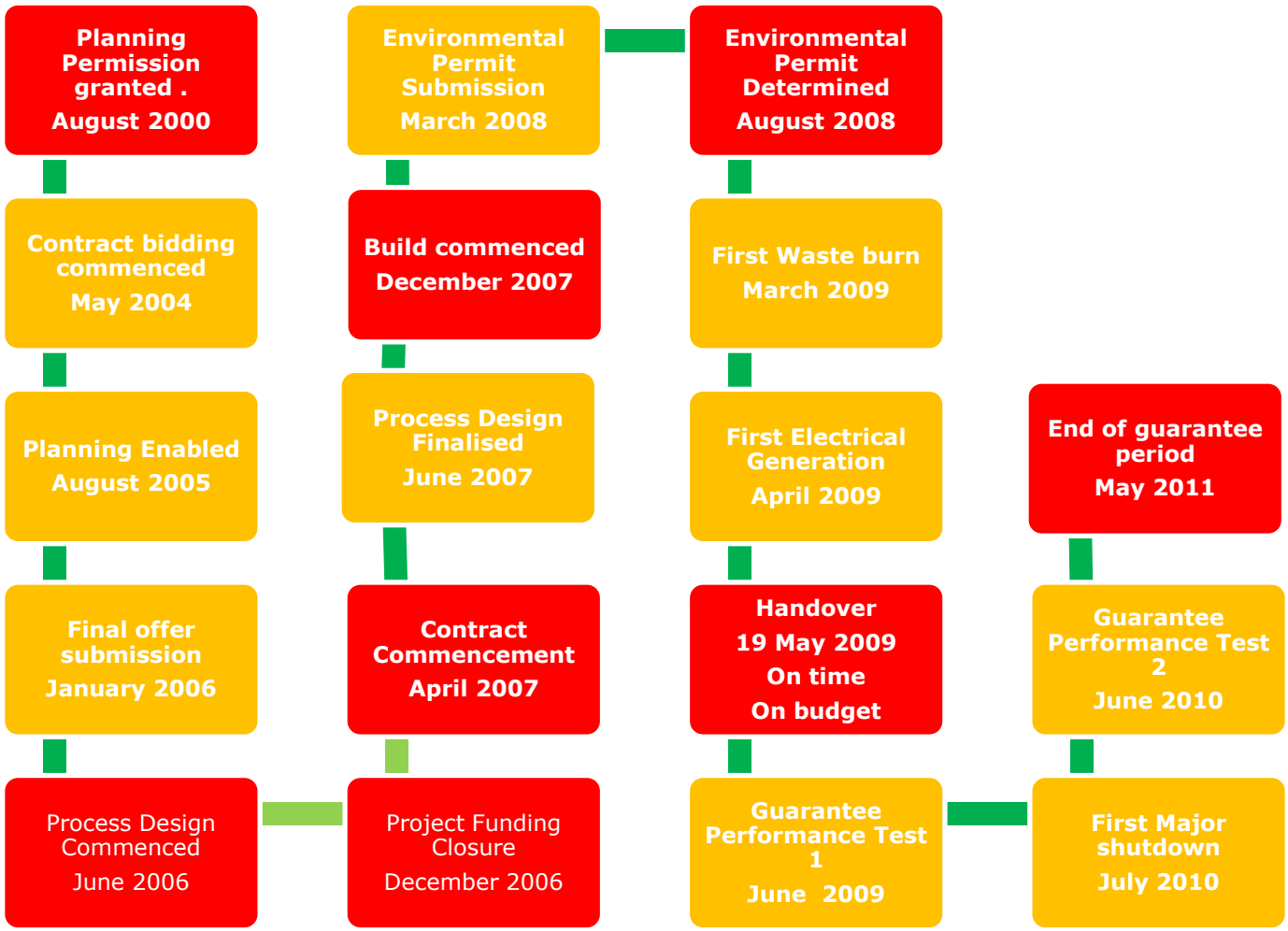
- Range of services provided by SITA UK
  - EfW, composting, recycling, HWRC's, Landfill, Transfer & haulage

- PFI Assets
  - New EfW Plant – 136 000 tonnes on Teesside
  - New MRF – 50 000 tonnes at West Sleekburn
  - 4 transfer stations including one new build at West Sleekburn
  - 15 HWRC's – three new build

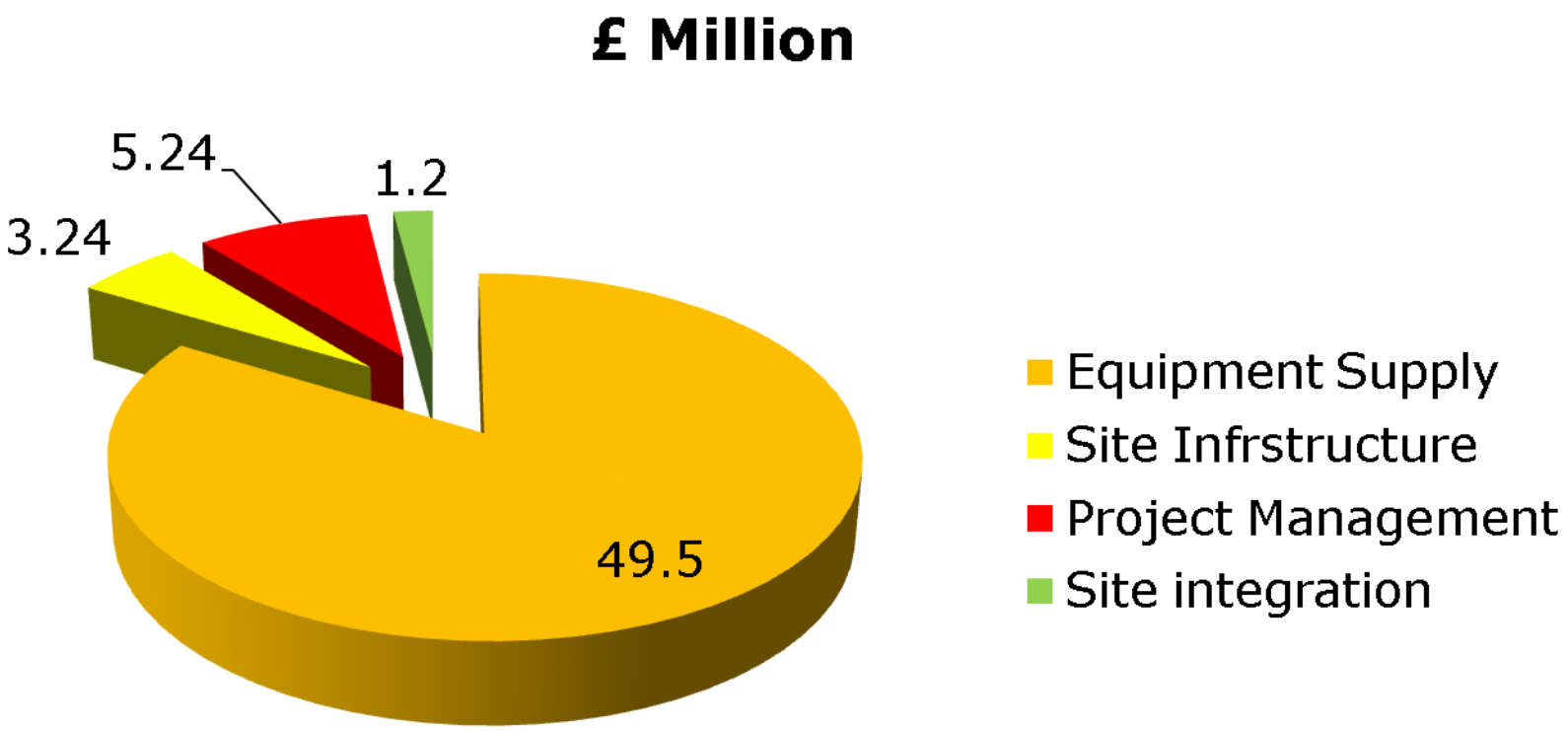
Teesside Line 3

- EfW 136 000 t.p.a. mass burn on a moving grate
- Fuel type is residual Municipal Solid Waste
- Technology provider VonRoll *INOVA*
- 4 pass heat recovery boiler. Pass 1 & 2 radiant, pass 3 & 4 convection
- 3 stage flue gas treatment
- 11 MW Steam Turbine Generator
- Air Cooled Condenser

Project Time Line



Project Costing



Summary

Teesside 3 - a successful project

- Project on time & budget
- Challenges integrating into an operational site infrastructure
- Realised cost saving synergies from existing operational infrastructure
- Challenges of fitting a modern facility into pre-determined planning foot print and elevation
- First of a SE / SITA specification facility

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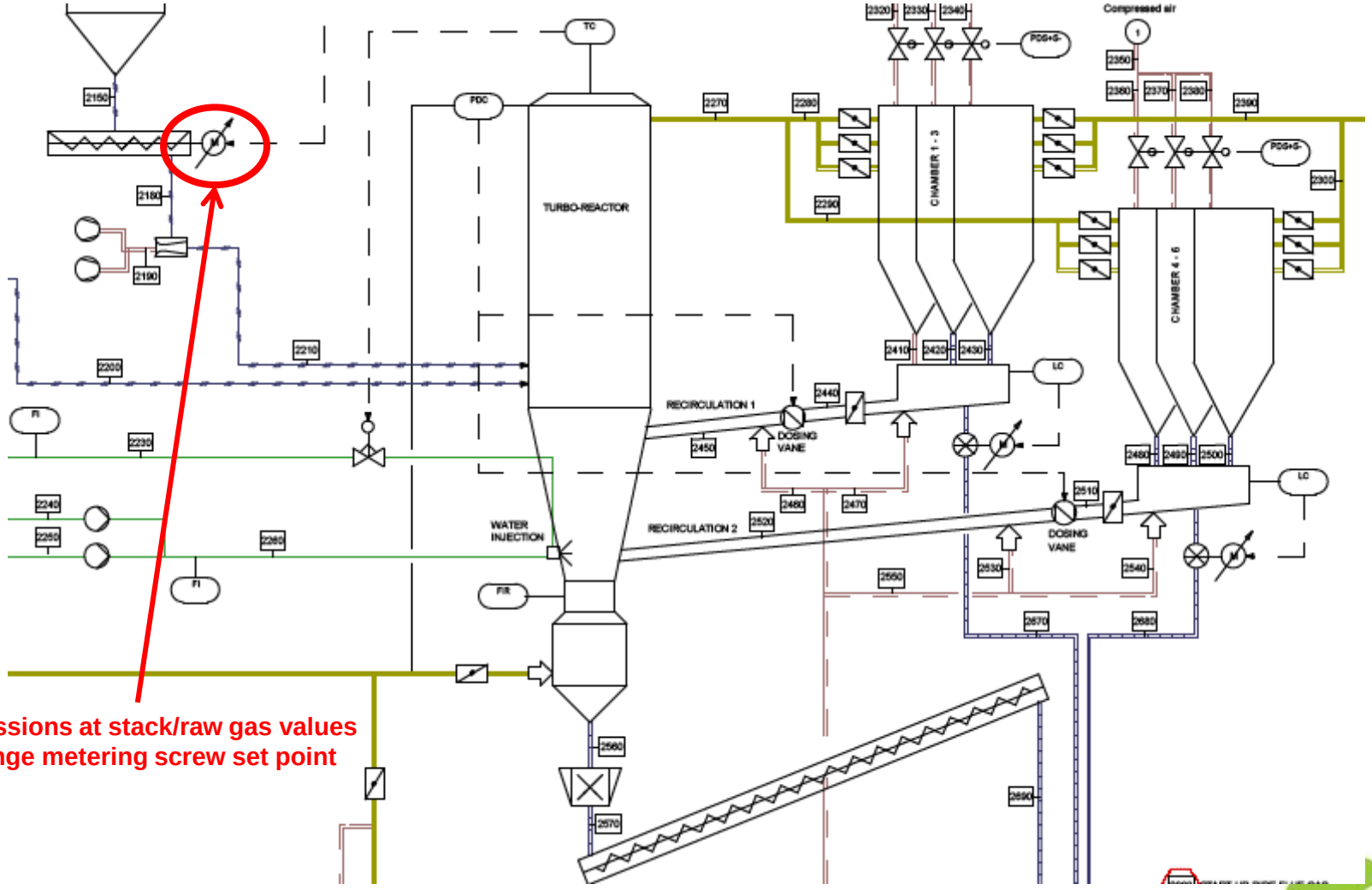
Lime Optimisation

04/10/2011

Stages of optimisation.

- Feedback control of reactor had oscillatory response up to 22/06//10
- Tighter feedback control reduced oscillatory response up to 13/08/10
- Increase in baseline lime addition further reduced oscillatory effect up to 09/11/2010
- Introduction of a raw gas HCl analyser operating as feed forward control reduced lime use from 09/11/2010

Flue gas treatment – Line 3

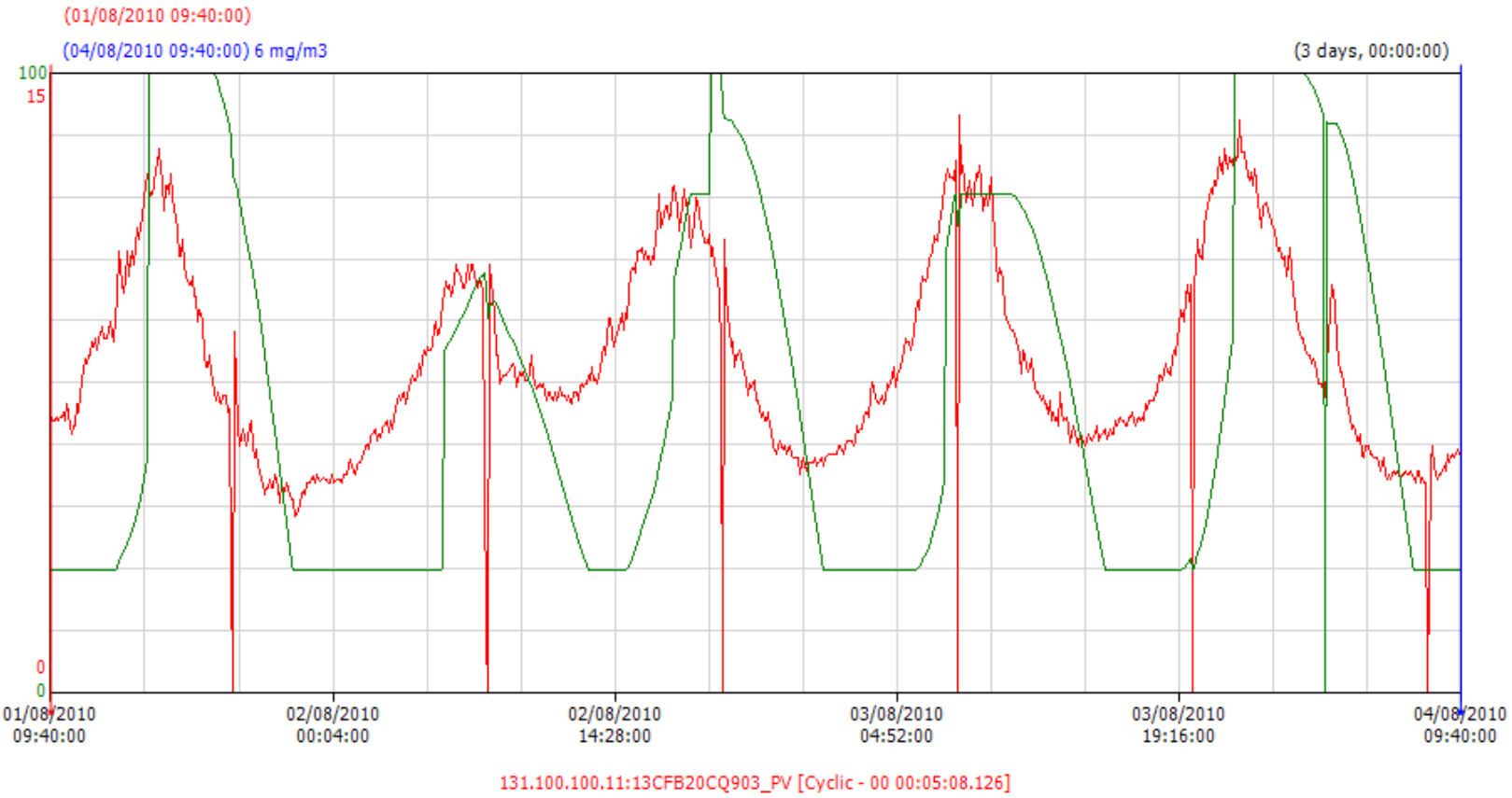


Feedback control (2009-2010)

Original oscillatory feedback control effect (08/10/2009 – 22/06/2010)

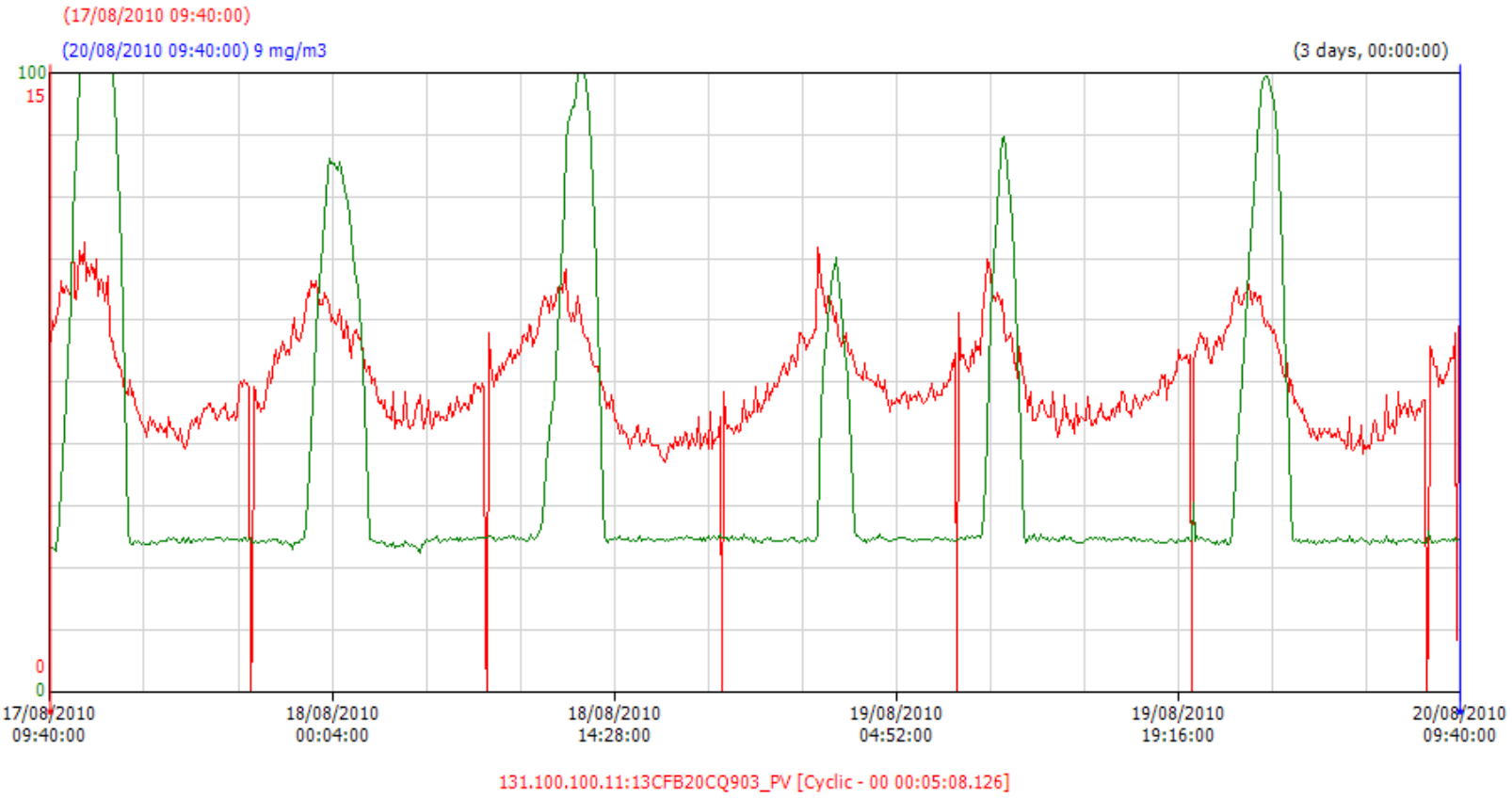
Tightly tuned feedback control (2010)

Reduction in oscillatory effect due to more tightly tuned feedback loop (22/06/2010 – 13/08/2010)



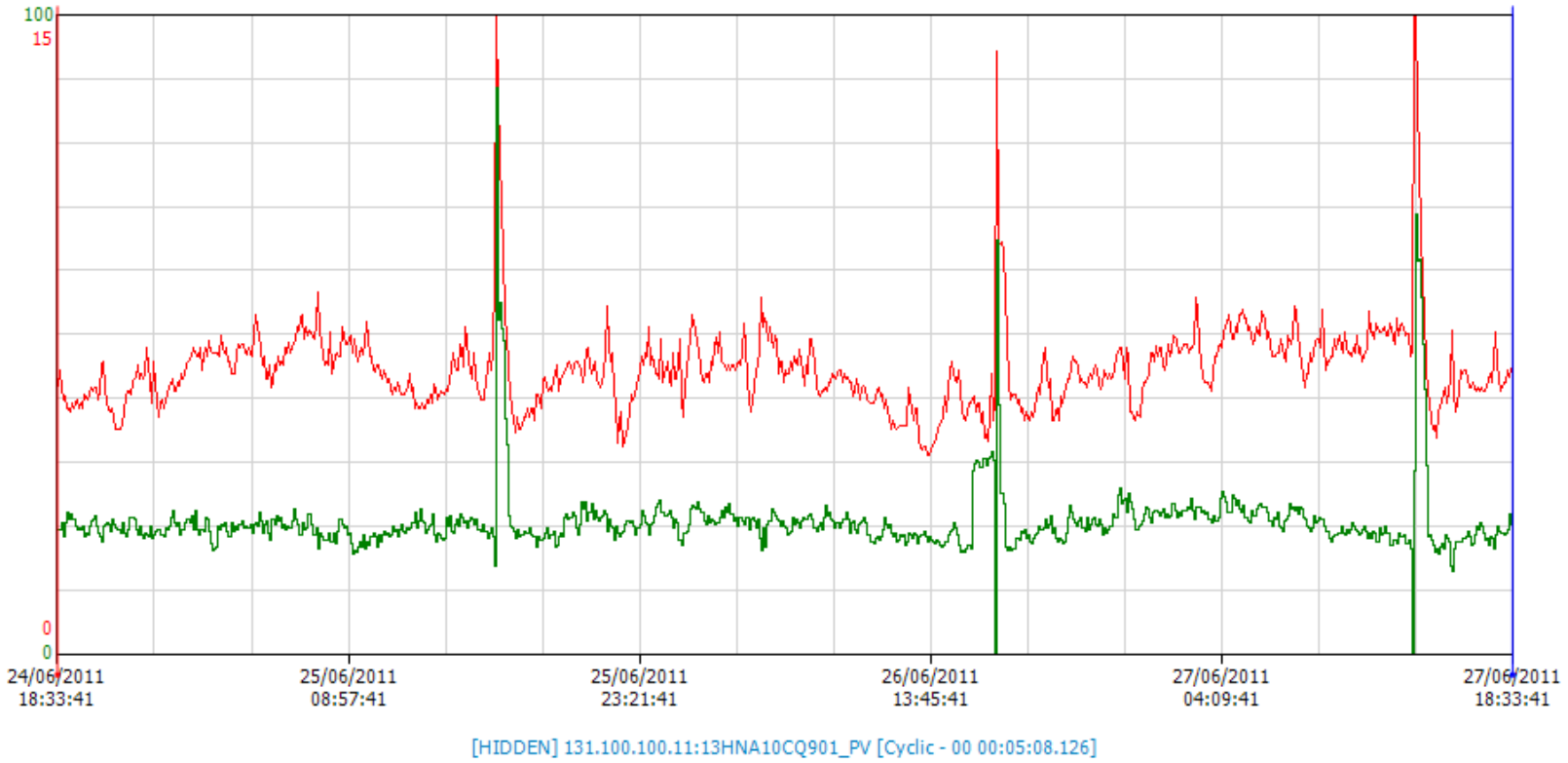
Predicted feedforward/feedback control (2010)

Reduction in oscillation magnitude due to increased baseline lime addition (13/08/2010 – 09/11/2010)

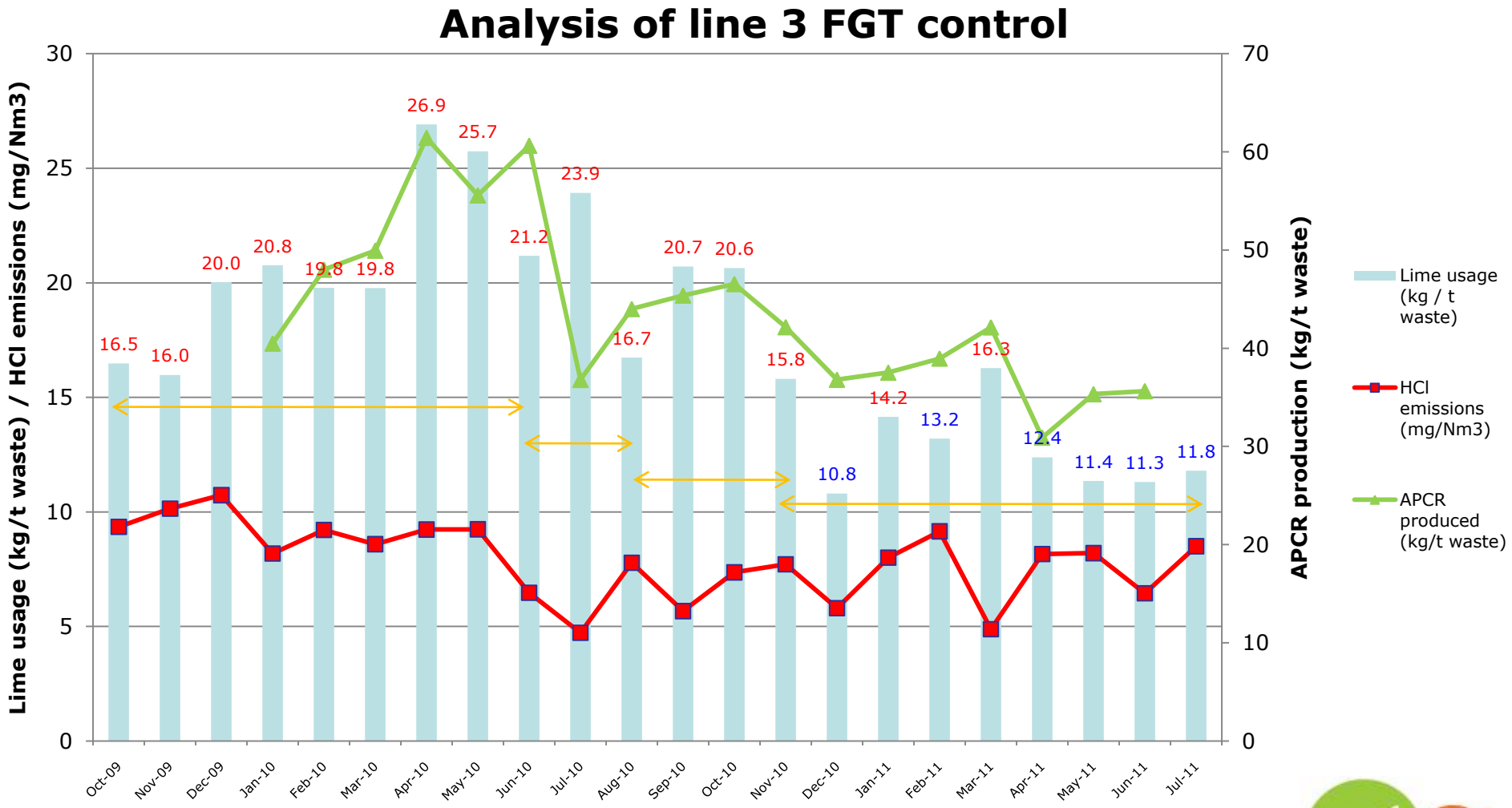


Combined Feedforward/feedback control (2011)

Reduction in lime controller magnitude and HCl emissions due to raw gas analyser feedforward control (09/11/2010 onwards)



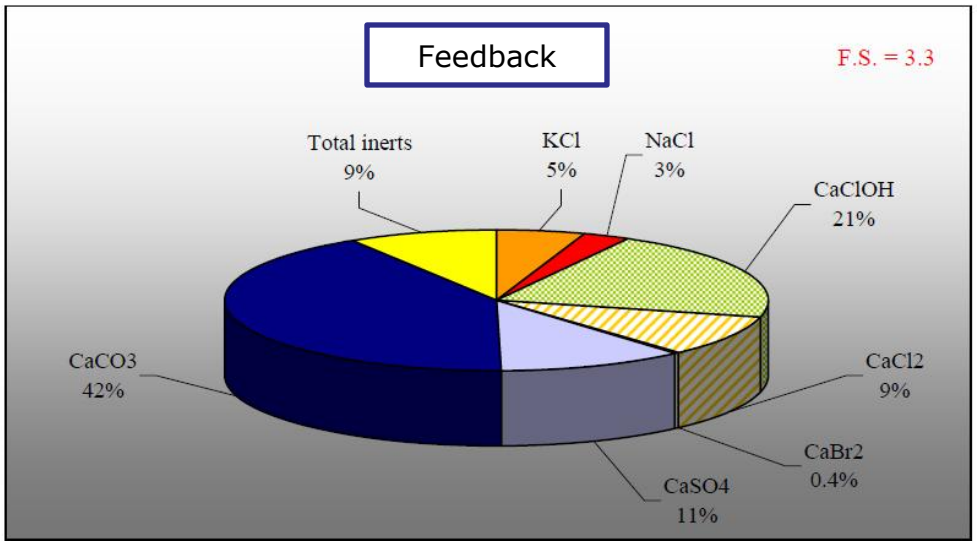
Control system comparisons



Control system comparisons
APCR analysis

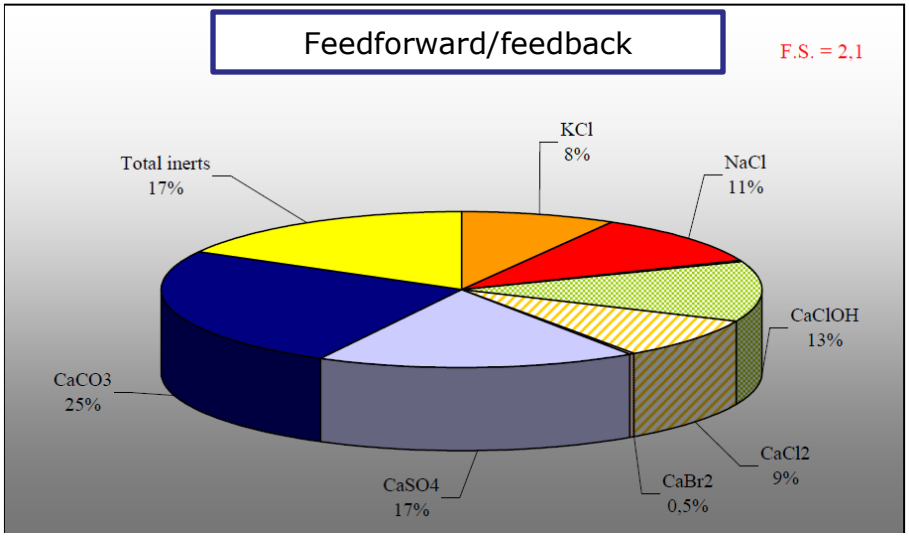
Original feedback control

Sample 1 : APCR Line 3



Combined feedforward/feedback control

Sample 1 : Line 3 16/06/2011



- Lower $CaCO_3$ composition
- Higher $CaSO_4$
- Lower Ca(OH)Cl content
- Higher inerts and KCl/NaCl indicate reduced APCR volume

SITA Tees Valley Development

Teesside Line 4 & 5

04/10/2011

SITA Tees Valley lines 1,2,3,4,5

Early July

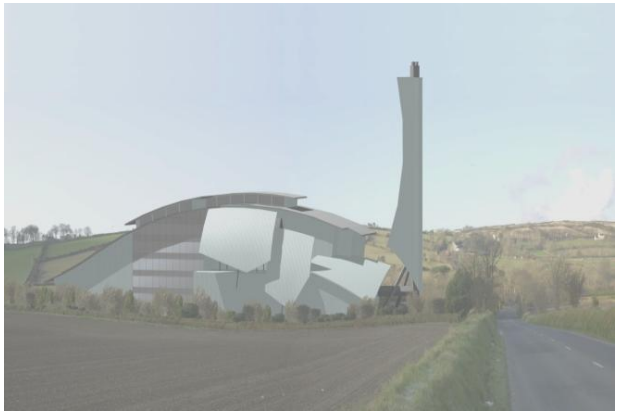
The End

www. sita.co.uk

Tees Valley

Kirklees

Isle of Man

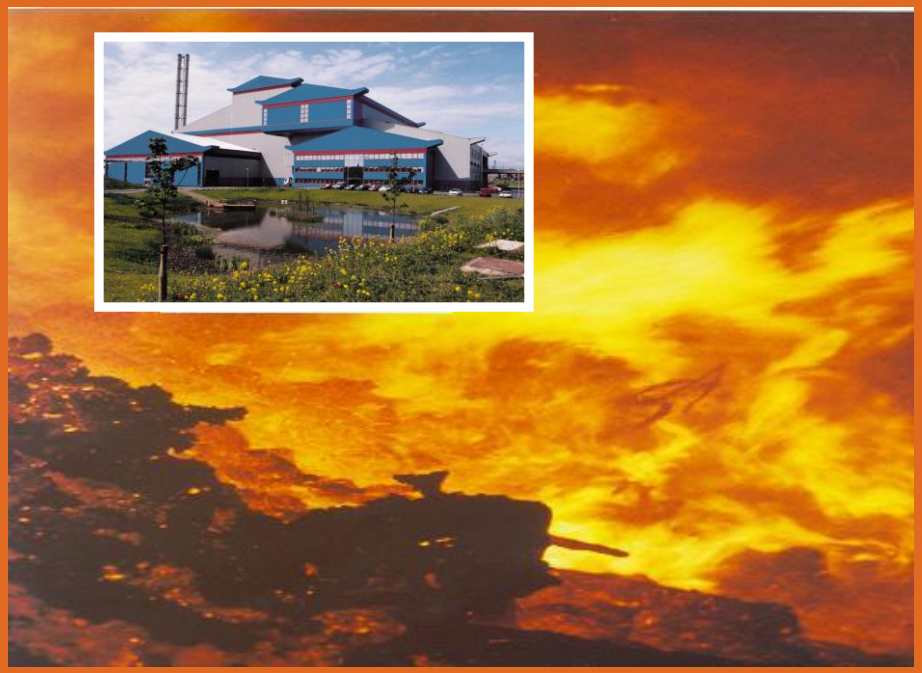


Energy from Waste on Teesside

Teesside Line 3

BLA Energy from Waste Seminar

October 13th 2011



Introduction

- **Phil Stevens**
  - Plant Manager SITA Tees Valley SITA UK

- **Purpose**
  - To give an overview of the Teesside 3 project (STV 3)
  - A brief introduction to SITA UK

- **Content**
  - Energy from Waste process
  - STV 3 Case study
  - Lime optimisation
  - Site development

SITA UK

04/10/2011

Who we are

- SITA UK is a recycling and resource management company.
- SITA UK serves over 12 million people and handles more than nine million tonnes of domestic, commercial and industrial waste through a network of recycling, composting, energy-from-waste and landfill facilities.
- SITA UK employs over 5,500 staff and has an annual turnover in excess of £750 million.

Our vision and mission

A company is built upon its vision, its people and the values / goals they share.

OUR VISION

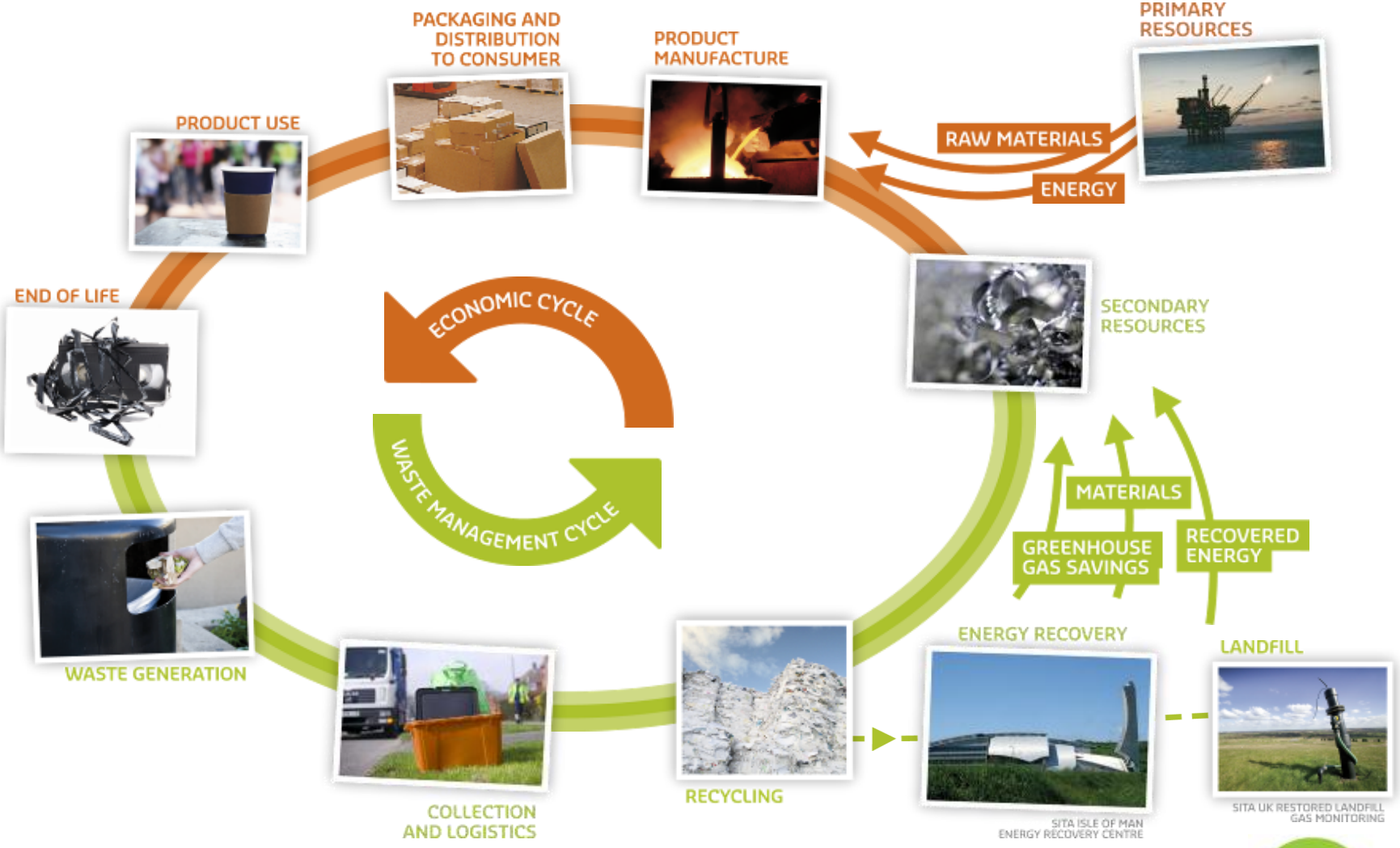
We want to live in a society where there is no more waste.

OUR MISSION

SITA UK is a recycling and resource management company.

We deliver sustainable and increasingly innovative solutions for the public, local government, industry and commerce, enabling our customers to minimise the impact of their waste on the environment.

The circular economy



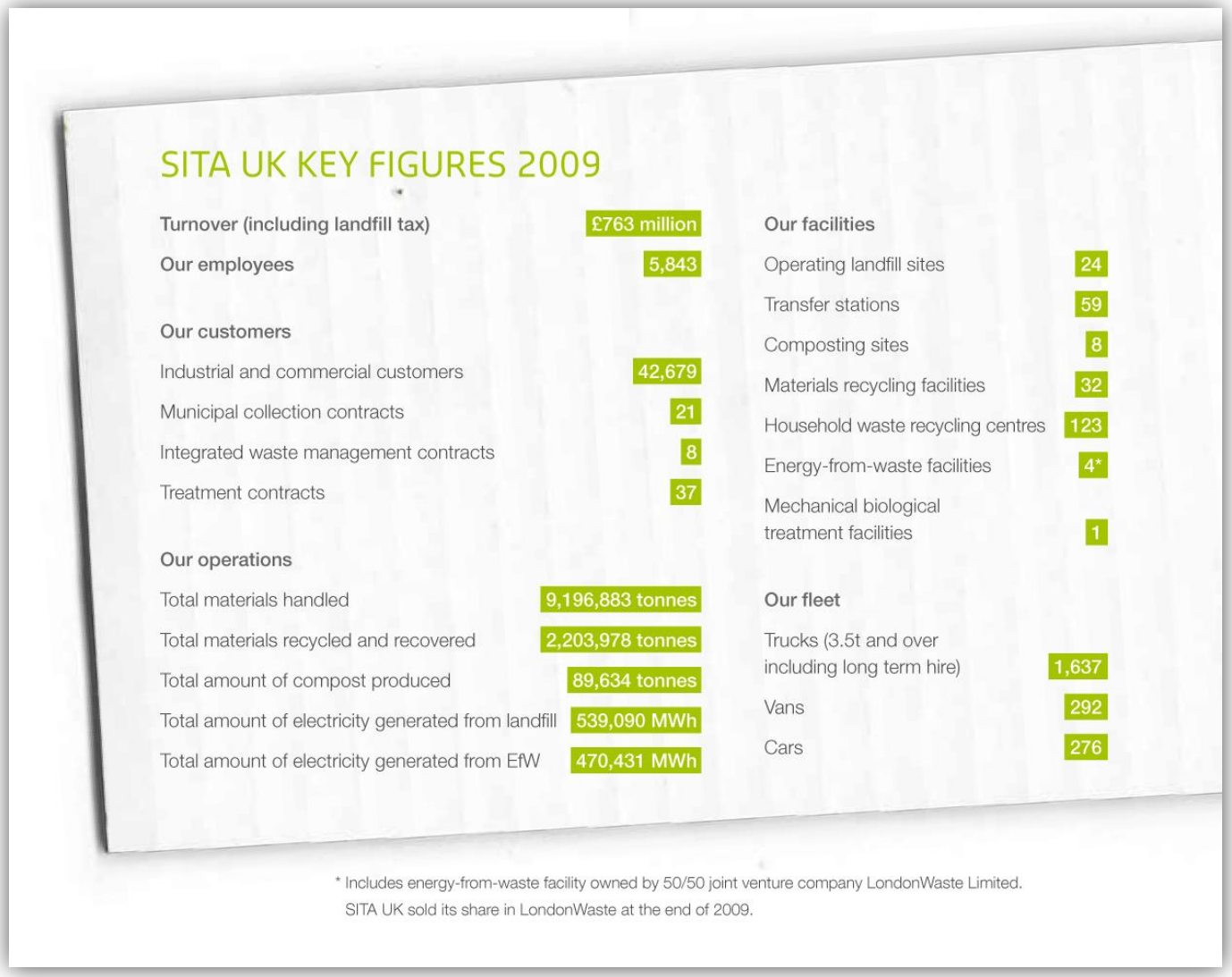
The circular economy … our role

The role of SITA UK

To **collect**, **treat** and **return secondary resources** and **recovered energy** back into the cycle of production and consumption.

See *Achieving the vision of no more waste: Engaging in the circular economy* for more details.
This publication is available to download from www.sita.co.uk.

Key figures 2009



SITA UK KEY FIGURES 2009

Turnover (including landfill tax)	£763 million
Our employees	5,843

Our customers

Industrial and commercial customers	42,679
Municipal collection contracts	21
Integrated waste management contracts	8
Treatment contracts	37

Our operations

Total materials handled	9,196,883 tonnes
Total materials recycled and recovered	2,203,978 tonnes
Total amount of compost produced	89,634 tonnes
Total amount of electricity generated from landfill	539,090 MWh
Total amount of electricity generated from EfW	470,431 MWh

Our facilities

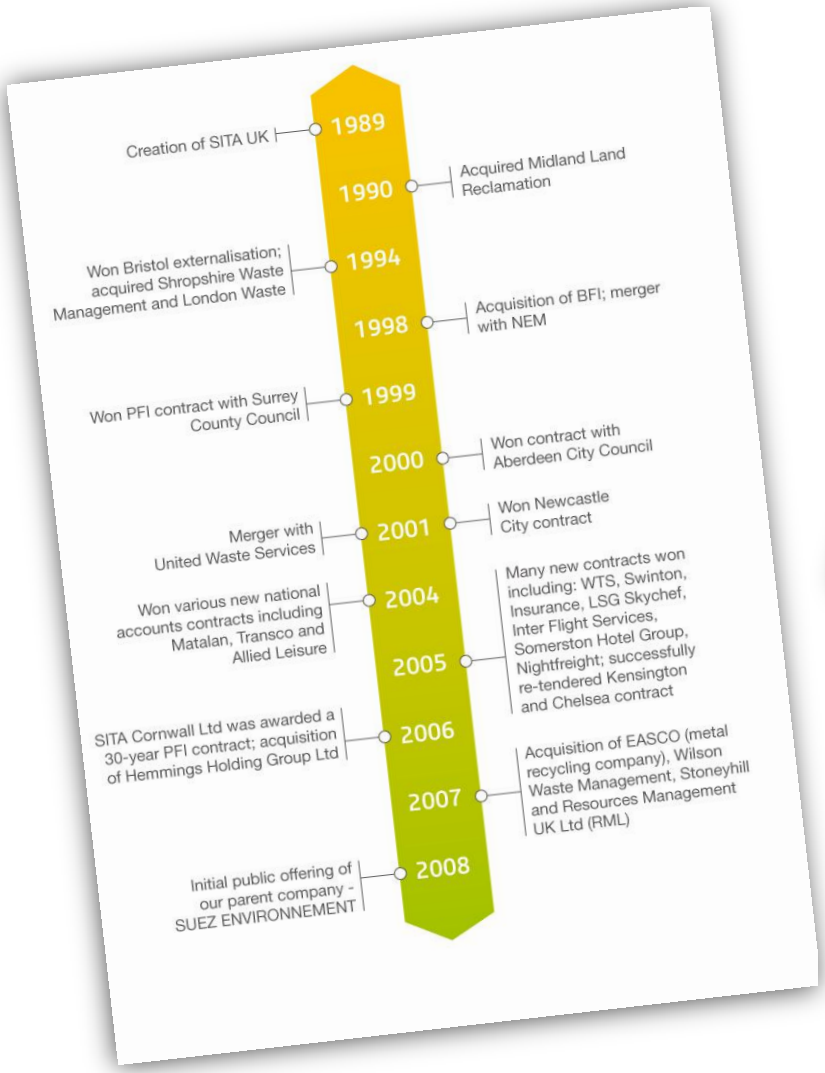
Operating landfill sites	24
Transfer stations	59
Composting sites	8
Materials recycling facilities	32
Household waste recycling centres	123
Energy-from-waste facilities	4*
Mechanical biological treatment facilities	1

Our fleet

Trucks (3.5t and over including long term hire)	1,637
Vans	292
Cars	276

* Includes energy-from-waste facility owned by 50/50 joint venture company LondonWaste Limited. SITA UK sold its share in LondonWaste at the end of 2009.

Our history


1989
Creation of SITA UK
1990
Acquired Midland Land Reclamation
1994
Won Bristol externalisation; acquired Shropshire Waste Management and London Waste
1998
Acquisition of BFI; merger with NEM
1999
Won PFI contract with Surrey County Council
2000
Won contract with Aberdeen City Council
2001
Won Newcastle City contract
Merger with United Waste Services
2004
Won various new national accounts contracts including Matalan, Transco and Allied Leisure
2005
Many new contracts won including: WTS, Swinton, Insurance, LSG Skychef, Inter Flight Services, Somerston Hotel Group, Nightfreight; successfully re-tendered Kensington and Chelsea contract
2006
SITA Cornwall Ltd was awarded a 30-year PFI contract; acquisition of Hemmings Holding Group Ltd
2007
Acquisition of EASCO (metal recycling company), Wilson Waste Management, Stoneyhill and Resources Management UK Ltd (RML)
2008
Initial public offering of our parent company - SUEZ ENVIRONNEMENT


HISTORY OF THE SITA BRAND
1919
2008

Our parent company

- SUEZ ENVIRONNEMENT is a world leader exclusively dedicated to water and waste management services and is committed to the challenge of protecting resources and ecosystems.
- Each day, SUEZ ENVIRONNEMENT (Paris: SEV, Brussels: SEVB) and its subsidiaries deal with the challenge to protect resources by providing innovative solutions to industries and to millions of people.
- SUEZ ENVIRONNEMENT supplies drinking water to 90 million people, provides wastewater treatment services for 58 million people and collects the waste produced by 46 million people.
- SUEZ ENVIRONNEMENT has 65,900 employees and, with its presence on a global scale, is the world's leader exclusively dedicated to environmental services.
- SUEZ ENVIRONNEMENT, a 35.4% GDF SUEZ affiliate, reported sales turnover of 12.3 billion Euros at the end of financial year 2009.