International WtE projects
Project development and implementation

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Innovation by experience

ÅF in Energy and Environment

World class renown expertise

SWEDEN	FINLAND	SWITZERLAND	RUSSIA
125 Experts	**225 Experts**	**220 Experts**	**280 Experts**

Consulting Co's →

Project / Sales Offices

Subsidiary companies and branches in

• **India**	• **Lithuania**	• **Estonia**	• **Vietnam**
• Romania	• Iran	• Ukraine	• Hungary
• Thailand	• Italy	• Latvia	• Germany
• Indonesia	• Nigeria	• Poland	• Brazil
•Turkmenistan			•**Chech**

120 Experts

Innovation by experience

Waste-to-Energy Consulting

- Solutions for waste-to-energy, sludge and biomass applications
- Project management and engineering services for design and constructing a waste-to-energy plant
- Over 2 million tons of waste per annum incinerated in ÅF designed WtE Plants
- Plants and projects in Finland , Sweden, Lithuania ,Estonia, Ukraine Russia , South Korea and China.

We manage different plant solutions as well as combustion and flue gas cleaning technologies.

Case – WtE in Finland

- **Factors which promote utilising waste as energy in Finland:**

  + Targets to decrease waste depositing to landfills

  + Waste is renewable energy source and it may replace fossil fuels

  + National waste plan 2016->31 % of MSW should be utilised as energy in 2016

  + Three WtE plants in operation, experiences have been positive

- **Factors which trouble utilising waste as energy in Finland:**

  - Costs of landfilling are low (but increasing)

  - Complaints against environmental permits and problems with land use permissions cause delays

  - Local people are against plants because of suspicion on flue gas emissions, increase of traffic and odours of the waste storages

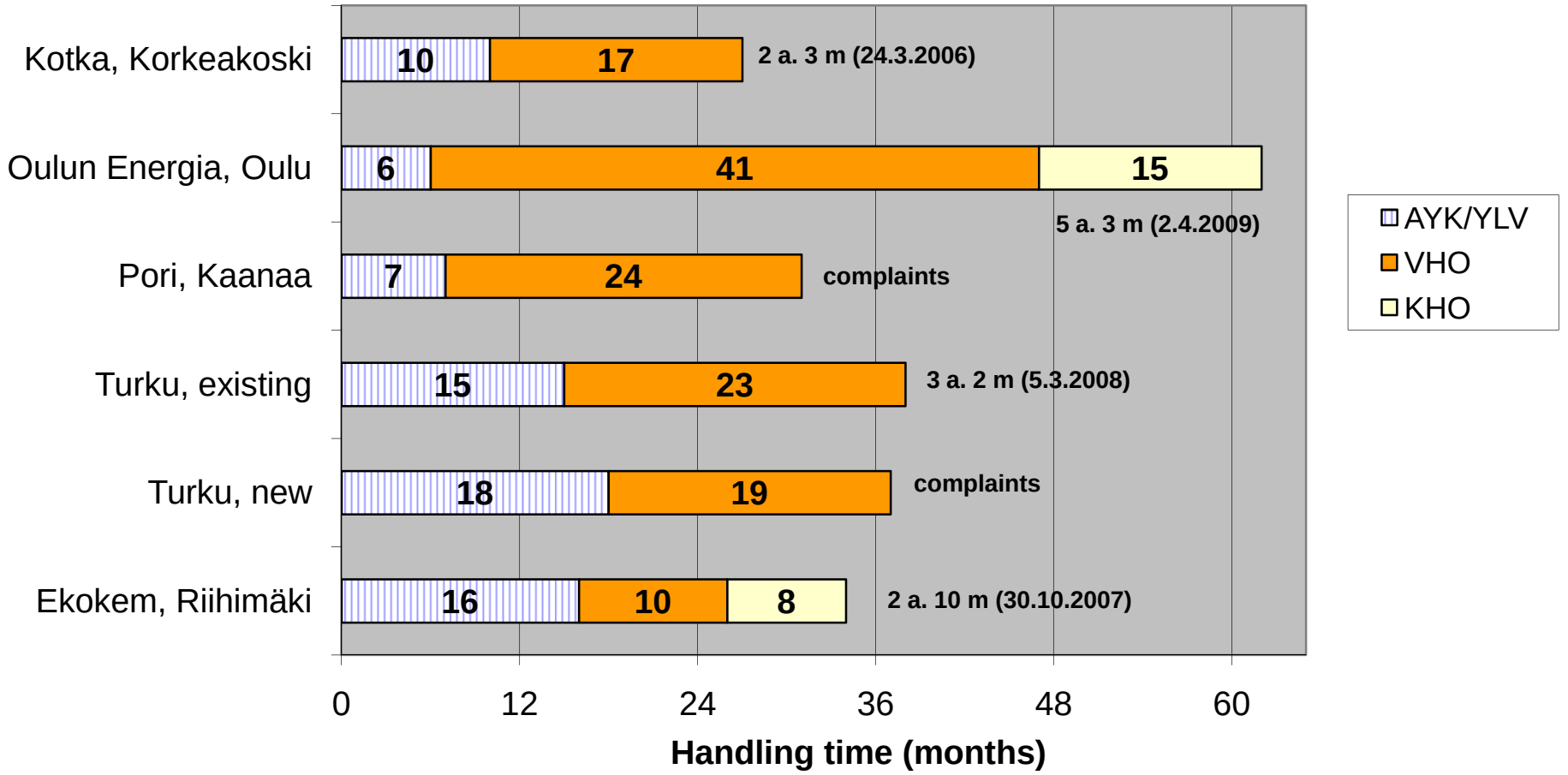
  - Thoughts that recycling will decrease and intentions to minimise waste production would fail

Time schedule

Preliminary time schedule of a WtE Plant

Phase	2009		2010				2012				2013				2014				2015			
	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Studies																						
Feasibility study																						
EIA Process																						
Preparation of EIA Programme (5 months)																						
Preparation of EIA (6 months)																						
Waste competition																						
Waste handling tendering																						
Environmetal permit																						
Licencng of Environmenatl Permit (3 months)																						
Handling and complaints (10 months)																						
Pre-engineering																						
Pre-engineering (6 months)																						
Contracts for main equipment																						
Execution																						
Engineering and construction (26-30 months)																						

Processing time of environmental permits for WtE Plants. Status 1.2.2011



YLV=Environmental authorities
VHO= Regional Court
KHO= Supreme Court

Innovation by experience

III Project execution cases

Plant solutions: Kotka, Ekokem and Oulu

Combustion and flue gas cleaning technologies

ÅF project development and management in project execution

Other international WtE projects

Kotka Energia
Avoimena huomiseen.

7 years hard work

2002 spring - Concept development started

2003 – EIA

2004- environmetal permit awarded

but followed with complaints

2005 - waste supply contracts signed

2006 - construction and environmental

permit finally granted

2006 August- start of the project execution.

2008 October - first fire with MSW

Innovation by experience

Kotka Energia
Avoimena huomiseen.

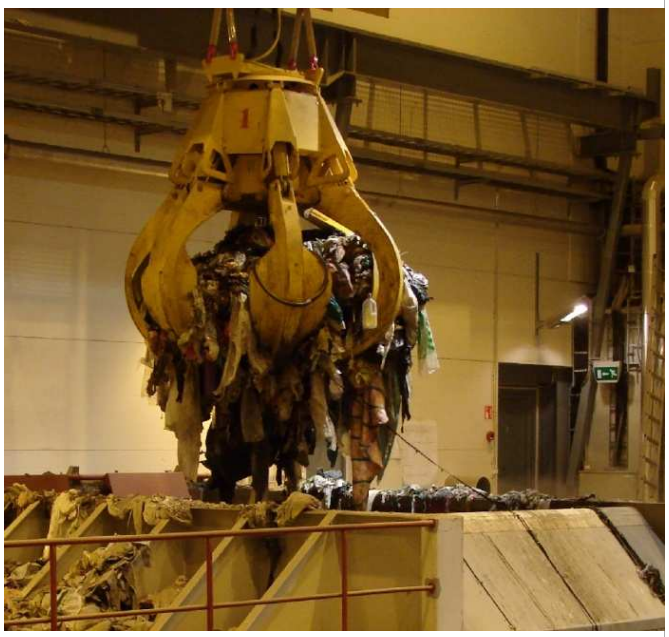
Project implementation

- EPCM – ”Multiple purchases”
- Construction cost escalation caused biggest budget problems
- Equipment budget as planned
- Biggest problems in turbine and boiler delivery

Kotka Energia
Avoimena huomiseen.

Fuel in Kotka WtE Plant

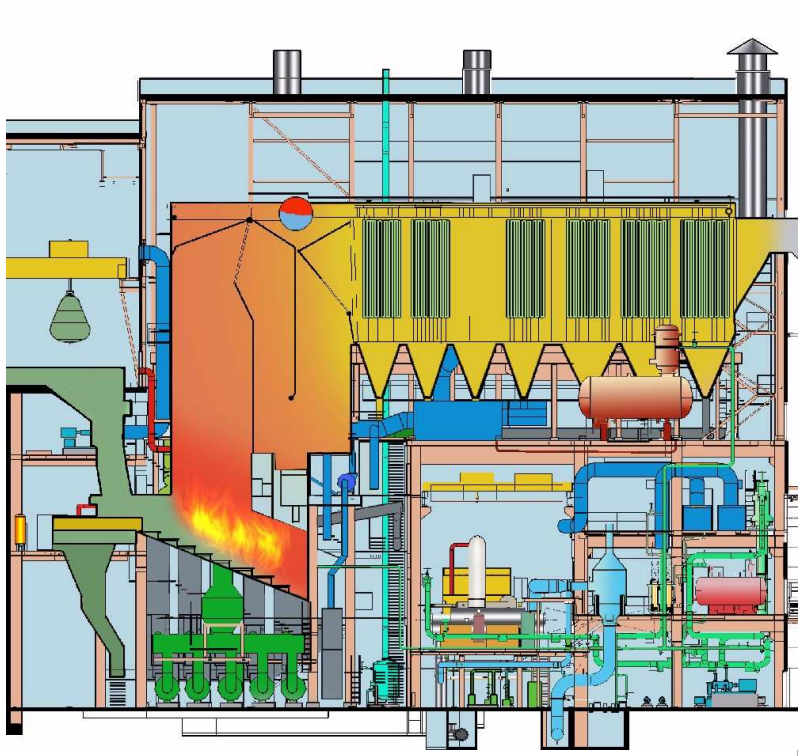
- 85 % source sorted MSW; 15% industrial waste
- Fuel coming from South–East Finland 540.000 inhabitants
- 84 000 – 100 000 tpa depending on plant availability and heat value of the waste as received
- Heat value was some lower than expected



Kotka Energia
Avoimena huomiseen.

Plant characteristics at Kotka

- CHP plant
- DH 30%
- Steam for industry 50%
- Electricity 20%
- Keppel-Seghers grate-boiler
  - 100.000t/a of MSW
  - Air cooled grate
  - Fuel effiency 33,7 MWf
  - Steam: 41 bara, 400°C
  - SNCR
- Alstom semidry flue gas treatment



Kotka Energia
Avoimena huomiseen.

ÅF Services for a new Waste-to-Energy Plant in Kotka

- Project execution period 6/2006-03/2009
- Services provided:
  - Feasibility study (grate and fluidised bed were evaluated)
  - Environmental Impact Assesment & Environmental Licensing
  - Pre-engineering, tender evaluation and preparation of contracts for main equipment
  - All design work, purchasing of equipment, delivery control
  - Project and site management, commissioning and performance test

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Main schedule - Ekokem

- EIA 2005 September
- Environmental permit approval 2006 April
- Construction time 2006 February – 2007 June
- Plant start up 2007 September
- Environmental permit granted finally 2007
- Take over of Boiler delivery 1/2008

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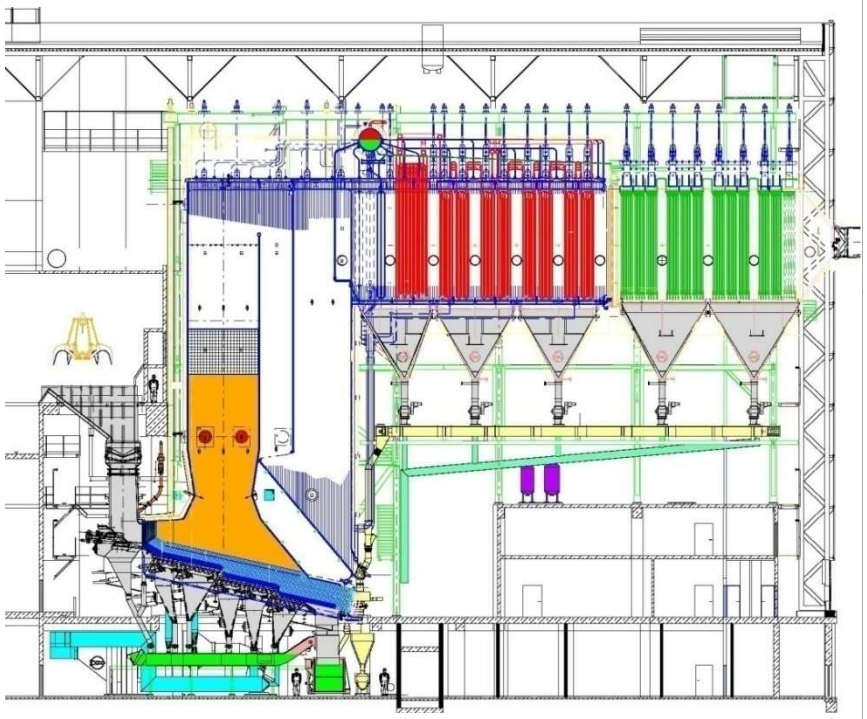
Plant characteristics at Ekokem

CHP Plant

- 34 MWth Heat;
- 10 MWe electricity

Project main characteristics

- 150.000 t/a MSW
- Water cooled grate
- Fisia Babcock Grate-boiler
- 55 MWf
- Steam :320℃, 26 bara
- SNCR
- Wet flue gas treatment from existing incineration line



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ÅF services in building new Waste to Energy Plant in Riihimäki

- Project exection period 06/2005 – 12/2007
- Services provided
  - Pre-engineering for incineration line #1
  - Preparation of the inquiry documents
  - Tender evaluation grate incineration line & new flue gas treatment system
  - All design work
  - Purchasing of equipment, delivery control
  - Project and site management
  - Commissioning supervision
- New project 01/2009 – 12/2010
  - Pre-engineering for a line #2 incl. prep. of inquiry documents for main equipment

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Emission limits to air according to WID

		Day	30 min A (100 %)	30 min B (97 %)	10 min	
particles	mg/Nm^3	10	30	10		Continuous measurement
TOC	mg/Nm^3	10	20	10		Continuous measurement
HCl	mg/Nm^3	10	60	10		Continuous measurement
HF	mg/Nm^3	1	4	2		Continuous measurement
SO2	mg/Nm^3	50	200	50		Continuous measurement
NOx	mg/Nm^3	200	400	200		Continuous measurement
CO	mg/Nm^3	50	100		150 (95 %)	Continuous measurement

		30 min - 8 h	
Cd, Tl	mg/Nm^3	0.05	
Hg	mg/Nm^3	0.05	Continuous measurement
muut metallit *)	mg/Nm^3	0.5	

*) **other heavy metals: Sb, As, Pb, Cr, Co, Cu, Mn, Ni, V**

		6 - 8 h	
dioxines and furanes	ng/Nm^3	0.1	Continuous measurement

Innovation by experience

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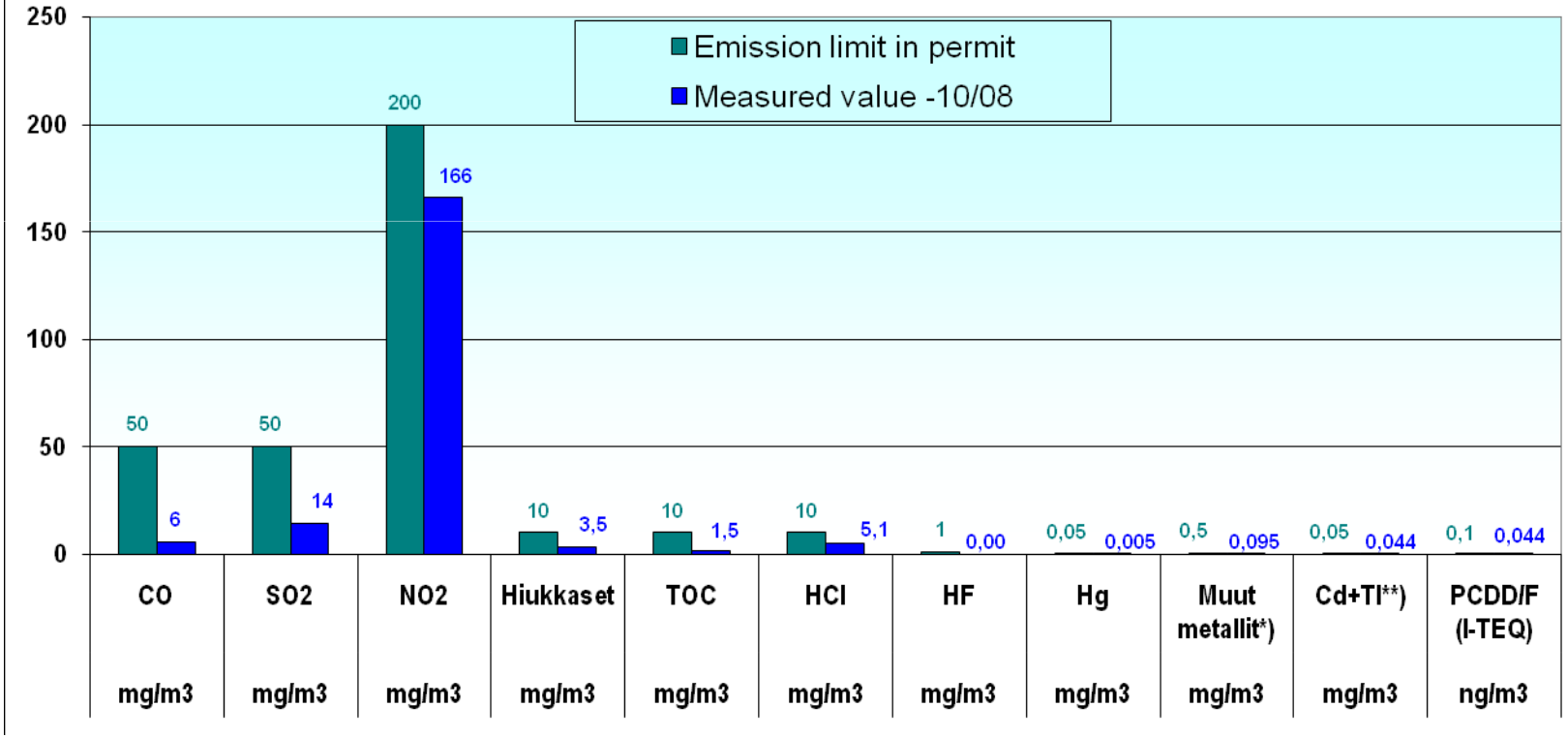
Yearly averages on emissions to air 1-10/2008
Waste power plant



Innovation by experience

Plant comparison

	EKOKEM PL 181, 11101 RIIHIMÄKI PUH: 0107551000 FAX: 0107551300	Kotka Energia Avoimena huomiseen.
Capacity:	**17,4 t/h, 150 000 t/a**	**10,6t/h, 85 000 t/a**
Heating value:	**8-16 MJ/kg**	**8-14 MJ/kg**
Fuel effiency:	**53 MWf**	**34 MWf**
Availability:	**8000 h/a**	**8100 h/a**
Incineration technology:	**Grate, water cooled**	**Grate, air cooled**
DeNOx:	**SNCR**	**SNCR**
Boiler type:	**4-pass, horisontalboiler**	**4-pass, horisontalboiler**
Steam parameters:	**320℃, 26 bar(a)**	**400℃, 41 bar (a)**
Cleaning of heating surfaces:	**rapping and water spraying of empty passes**	
Fluegas temperature:	**220 ℃**	**160 ℃**
Boiler supplier:	**Fisia Babcock Environment GmbH**	**Keppel-Seghers**
Flue gas treatment:	**SNCR + wet**	**SNCR+semidry**
FGT supplier:	**FBE (Steinmüller)**	**Alstom**
Energy production:	**Combined heat and power DH 33 MW, electricity 10 MW**	**Process heat (10-20 MW), DH (4-20 MW) and electricity (4-9 MW)**

Fuels

	EKOKEM PL 181, 11101 RIIHIMÄKI PUH: 0107551000 FAX: 0107551300	Kotka Energia Avoimena huomiseen.
Sourcesorted MSW	X	X
Startup fuel	oil	natural gas
Solid industrial waste	X	X
Conatminated wood waste incl.		
Impregnated wood (i.e CCA)	X	-
Biofuel	X	X
Sludge (municipal and indusrial)	X	-
Heat value as received	**8-16**	**8-14**

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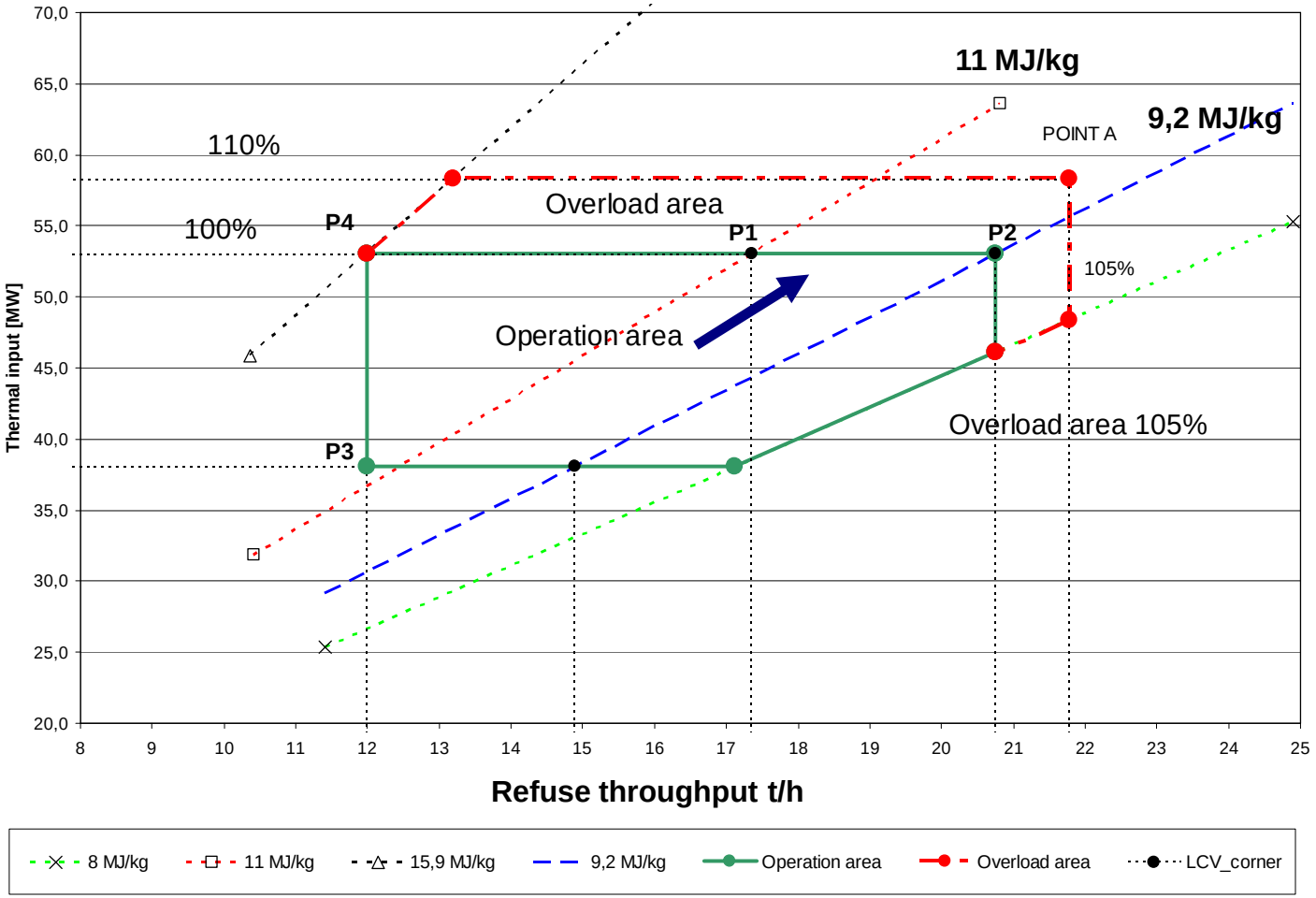
In practice



Innovation by experience

Municipal solid waste

Innovation by experience

Basic waste =>
Basic slag

ÅF Services for a new WtE Plant in Oulu, Finland

- Project period 2010-2012
- Services provided including:
  - Feasibility study (grate and fluidized bed were evaluated)
  - All design work
  - Purchasing of equipment, delivery control
  - Project management
- Project main scope
  - Project management for the Client to construct a new waste-to-energy plant with a capacity of 120 000 t/year
  - Fuel and slag handling, grate boiler (48+5 MWf), semidry flue gas system, BOP, civil works, electrification, automation and DCS system

Innovation by experience

Oulu Energia, main milestones

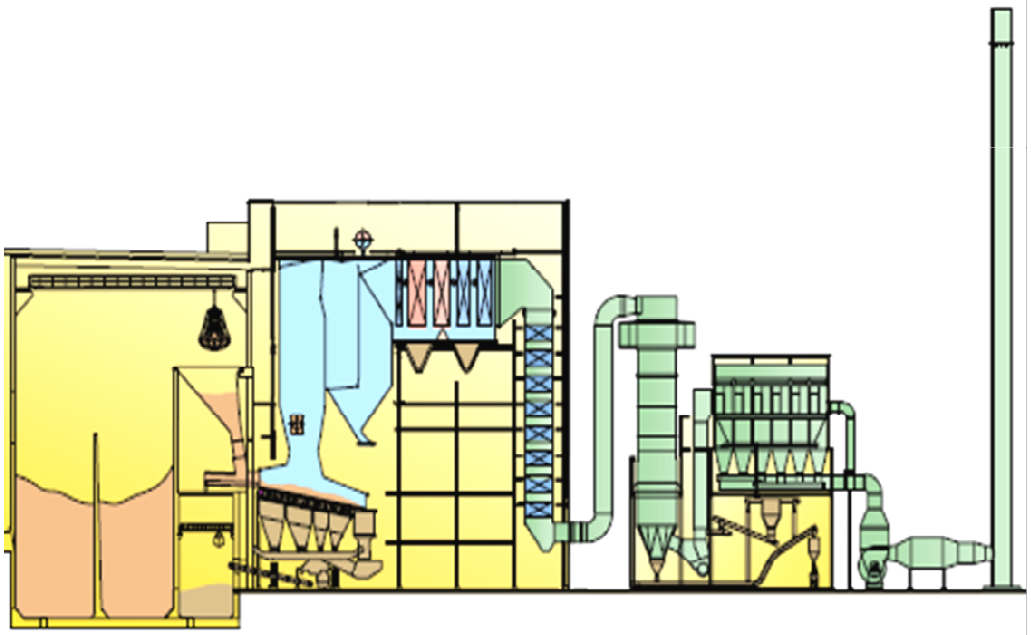
- 12/04 Application of Environmental Permit
- 04/09 Final approval of Environmental permit (>>4 a !!)
- 02/10 Start of plant design
- 05/10 Building permit
- 07/10 Start of civil works

Scheduled:

- 03/11 Start of equpiment erection
- 02/12 Start of commissioning
- 05/12 First fire with waste
- 08/12 Start of commercial operation

Plant characteristics at Oulu

- CHP plant
- Baumgarte grate-boiler
  - 120.000 t/a of MSW
  - Water cooled grate
  - Fuel effiency 48+5 MWf
  - Steam
    - 88 bara,
    - 425/515 C
  - SNCR
- Lühr semidry flue gas treatment+ Metso condenser



Oulu site fall 2009

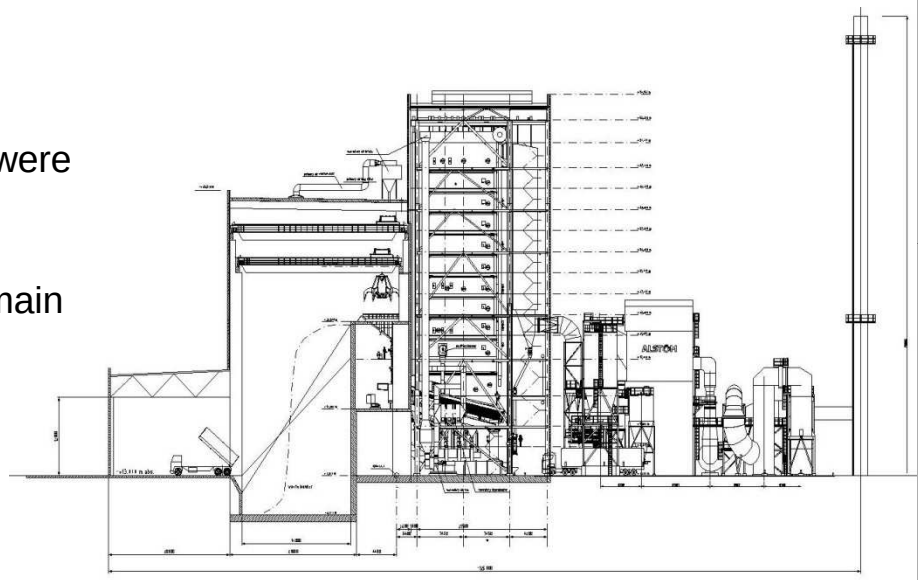
Basement for bunker ready 10.8.2010

Site 21.1.2011

Fortum Klaipeda, Lithuania

EPCM contract for a new waste-to-energy cogeneration plant

- Project period 2007-2012
- Services provided
  - Feasibility study (grate and fluidized bed were evaluated)
  - Environmental Impact Assessment
  - Pre-engineering including purchasing of main equipment
  - All design work
  - Purchasing of equipment, delivery control
  - Project and site management
  - Commissioning supervision
- Project main scope
  - Project management for the Client to construct a new waste-to-energy plant with a capacity of 272 000 t/year
  - Fuel and slag handling, grate boiler (85 MWf), semidry flue gas system, turbine, BOP, civil works, electrification, automation and DCS system



Innovation by experience

Iru Waste to Energy CHP Unit, Estonia

OE contract for building new waste incineration Unit in Tallin

- Project period 2008-2013
- Feasibility and Pre-Engineering
- EPC tendering & OE Consulting
  - Preparing ITT´s for binding EPC tenders; Tender evaluation and Preparation of contract, Owners Engineer for the construction of the WtE Unit
- Project main scope
  - OE services to construct a new waste-to-energy plant with a capacity of 240 000 t/year
  - Fuel and slag handling, grate boiler (80 MWf), semidry fluegas system, turbine, BOP, civil works, electrification, automation and DCS system

Kenertec and later Hudigm, Korea 2007 – 2009

Modification of 130 t/h PC boiler with back pressure turbine to BFB for biofuels, sludge and RDF

Pre-Engineering for local detailed engineering and purchasing of

- New Fuel handling
- New Convective Boiler
- New Air and FGR system
- New Flue Gas Cleaning
- New Ash Handling system
- DeNOx by SNCR
- New Combustion Control
- Turbine modifications

Detailed Engineering for the rebuilding of the existing PC boiler to BFB

Project development

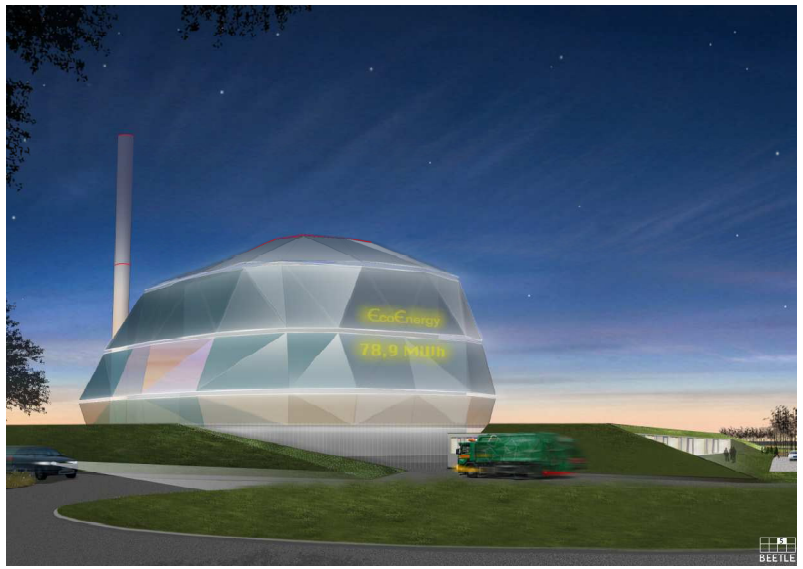
Examples of international cases:

- Ukraine
- P.R. of China
- Russia

Donetsk, Ukraine

Waste to Energy Project, Proletarskij District

- Project main scope
  - Client: Swedish company ,build and operate
  - WtE plant 450 000 ton/year of MSW
  - Electricity production 30MW
  - District Heating 70MW
  - Commercial operation Q1 2014
- ÅF Services provided
  - Project Management
  - Technical, legal and commercial support
  - Preparation of tender documents and EPC turn-key contract negotiations
  - Owners Engineer



Innovation by experience

Changzhou, China

Waste to Energy Plant Project

- Project main scope
  - Client: Swedish company ,build and operate
  - WtE plant for a district in Changzhou
  - >1.350 kton MSW/a
  - CHP Plant
- ÅF Services provided
  - Prefeasibility study
  - Feasibility study
  - Environmental Impact Assesment

Moscow Zavod No 1, Russia

Owner's Engineer Services for Waste-to-Energy Plant

- Project period 8/2006-12/2007

- ÅF Services provided
  - Review of pre-design (TEO) by TEP Moscow
  - Preparation of tender doscuments and EPC turn-key contract negotiations

- Project main characteristics
  - 2*200 000 t/a of MSW
  - Grate Boiler Plant (2*57 MWf)
  - SNCR
  - Semidry FGT
  - Condensing Power Plant (2*13,7 MWe)