



Implementation strategy for large scale biomass imports

*ELECTRABEL Generation Belgium
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OVERVIEW

1. Introduction about Belgium
2. Legislation
3. Biomass sources and technologies
4. Recent realisations
5. Conclusions

Belgium...

10 million inhab.

30 500 km²

64 km sea side

• Kyoto :

- 7,5% CO₂ by 2010

+6,3% 1990-2003

• Renewable power :

1,1% in 1997

6,0% in 2010





The Green Certificates mechanism in Flanders



The market

Quota (3% 2006) or
penalty 125 €/GC



Regulator for
Flanders

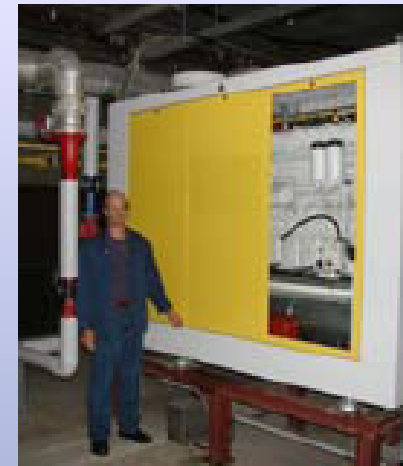
Grant
(1 GC/MWhe)

Min price
85 €/GC

Buying contract
(111 €/GC in 2005)



Electricity suppliers



Green Power

The Green Certificates mechanism in Wallonie



The market



Regulator for Wallonie

Quota (6% in 2006) or penalty (100 €/GC)

Grant (1 GC/456 kg CO₂)

Min price (65 €/GC)

Buying contract (≈ 92 €/GC in 2005)



Electricity suppliers



Green Power

The Green Certificates mechanism

Evolution of the green electricity production (expected...)

FLANDERS



50
TWh

BRU



8
TWh

WAL



22
TWh

Years	Quota/Penalty Green Cert.		Quota/Penalty Cogen Cert.		Quota/Penalty		Quota/Penalty	
2002	0.8%	75 €	-	-	-	-	-	-
2003	1.2%	100 €	-	-	-	-	3%	75 €
2004	2%	125 €	-	-	2%	75 €	4%	100 €
2005	2.5%	125 €	1.19%	40 €	2.25%	75 €	5%	100 €
2006	3%	125 €	2.16%	45 €	2.5%	75 €	6%	100 €
2007	3.75%	125 €	2.96%	45 €	?	100 €	7%	100 €
2008	4.5%	125 €	3.73%	45 €	?	100 €	8%	100 €
2009	5.25%	125 €	4.39%	45 €	?	100 €	9%	100 €
2010	6%	125 €	4.9%	45 €	?	?	10%	100 €
2011	?	125 €	5.2%	45 €	?	?	?	100 €

EXCHANGEABLE

Biomass for CO₂ emission trading scheme

Bio-fuel	Non waste	Green power	CO2-neutral
Biogas (landfill/anaerobic digestion), Syngas	Yes	Yes	Yes
Liquid bio-fuels (oils, (m)ethanol, DME,...)	Yes	Yes	Yes
Biomass from Agriculture & Forestry	Yes	Yes	Yes
Contaminated wood except demolition wood	Yes	Yes	Yes
Cork waste	Yes	Yes	Yes
Vegetal waste from food processing industry	CHP on site	Yes	Yes
Vegetal waste from paper&pulp , black liquor	CHP on site	Yes	Yes
Manure, litter	Waste	Yes	Yes
Animal fat	Waste	Yes	Yes
Road cleaning	Waste	Yes/No	Yes
Municipal Solid Waste and residues	Waste	40 .. 50%	Yes
Biodegradable organic waste from industries	Waste	Yes/No	Yes
Sewage sludge	Waste	via co-firing	Yes
Paper, Cardboard	Waste	No	Yes
Textile	Waste	No	Yes
Peat	Fuel	No	No

Impact Emission Trading Scheme on coal

Fuel	LHV in GJ/ton	Market price in €/GJ	MWhe/ton with reference efficiencies ¹	ton Carbon per ton of fuel	GHG ton eqv CO ₂ per ton of fuel	GHG ton eqv CO ₂ per GJ – MWhe ¹
Coal	27	2,5	2,9	0,75	2,75	0,1019
Crude oil	42	9,0	4,9	0,86	3,15	0,0751
Natural gas	50	9,0	7,6	0,75	2,75	0,0550

¹ coal @ η=38%, crude oil at @ η=42%, natural gas @ η=55%

coal price doubles

Value per ton CO ₂ equivalent	Value per ton pure Carbon	Value per GJ (LHV=32 GJ/ton)	Value per MWhe @ η=40%
10	36,7	1,15	10,35
20	73,3	2,3	20,7
30	110	3,4	30,6
40	146,6	4,6	41,4

*market
value* ←

Which kind of biomass ?

How is it used ?



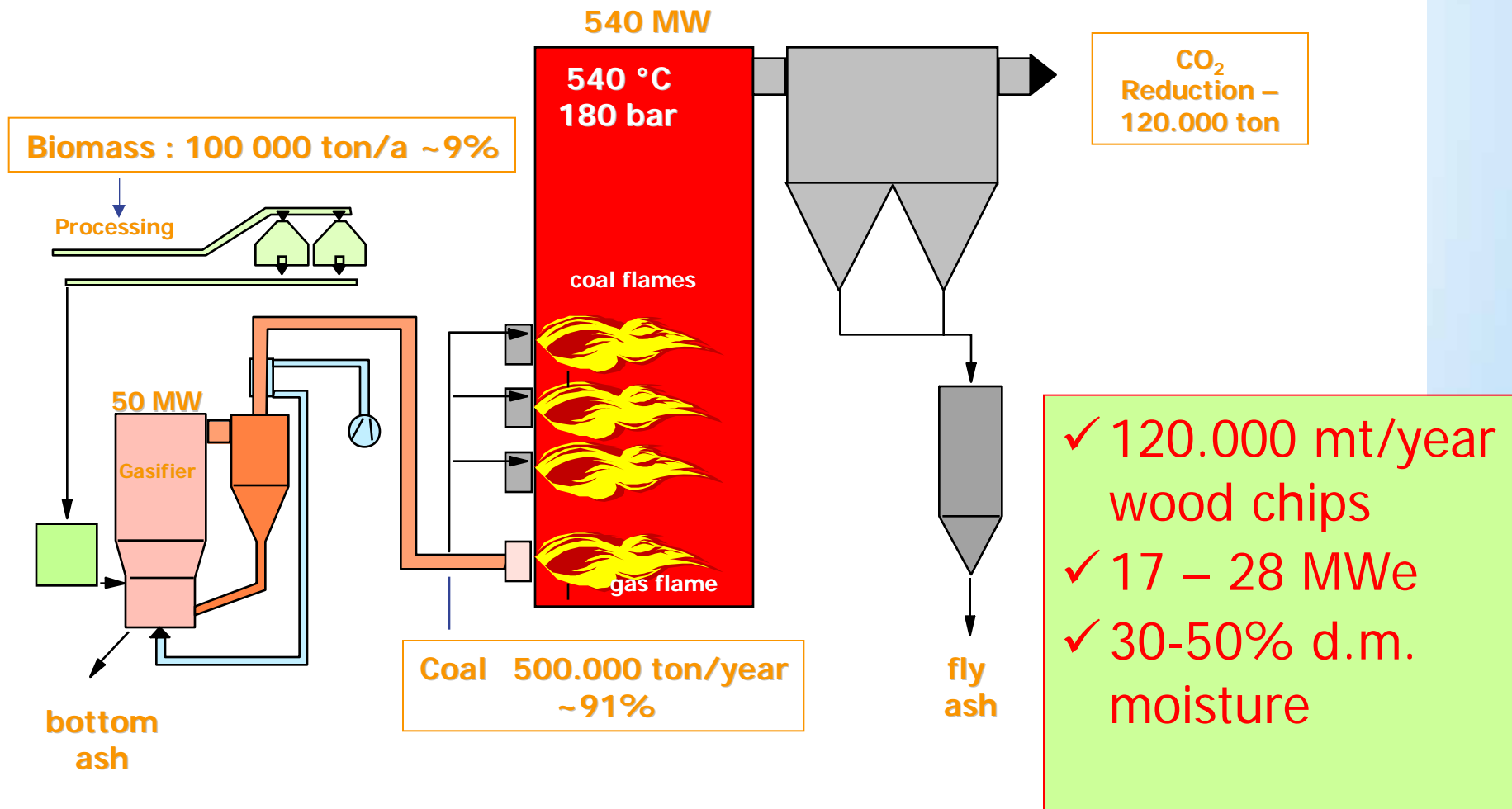
Reference:

With an electrical efficiency of 36 %,
1 ton hardcoal generates approx. 2,5 MWh

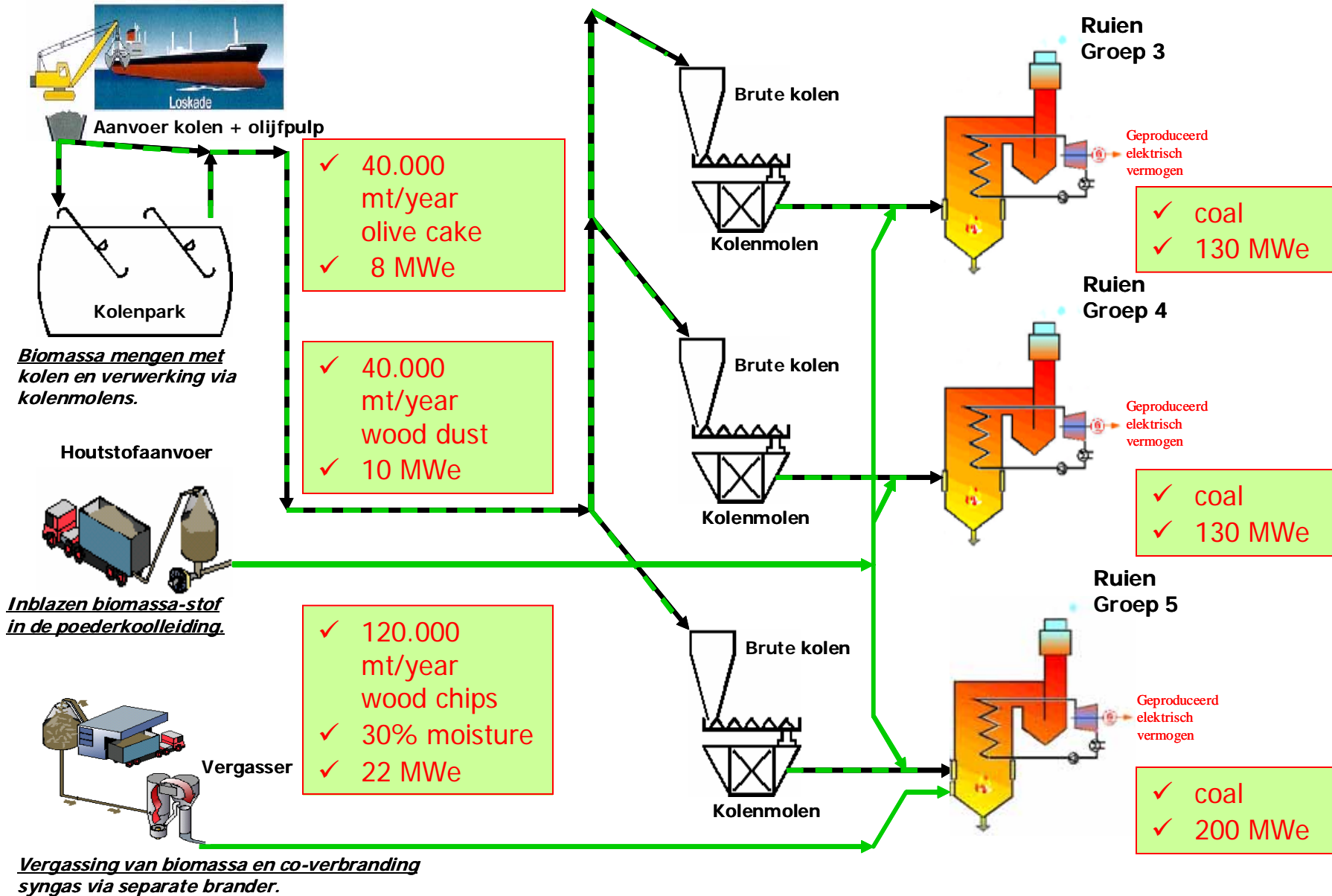
(Co-)firing bio-fuels today :

- sewage sludge : mixed with coal 1 kg → ~ 1,0 kWh
- olive cake : mixed with coal 1 kg → ~ 1,3 kWh
- coffee ground : mixed with coal 1 kg → ~ 1,6 kWh
- wood dust : injected after mills 1 kg → ~ 1,8 kWh
- wood chips : syngas injected 1 kg → ~ 0,8...1,5 kWh
- wood “pellets” : hammer mills 1 kg → ~ 1,8 kWh

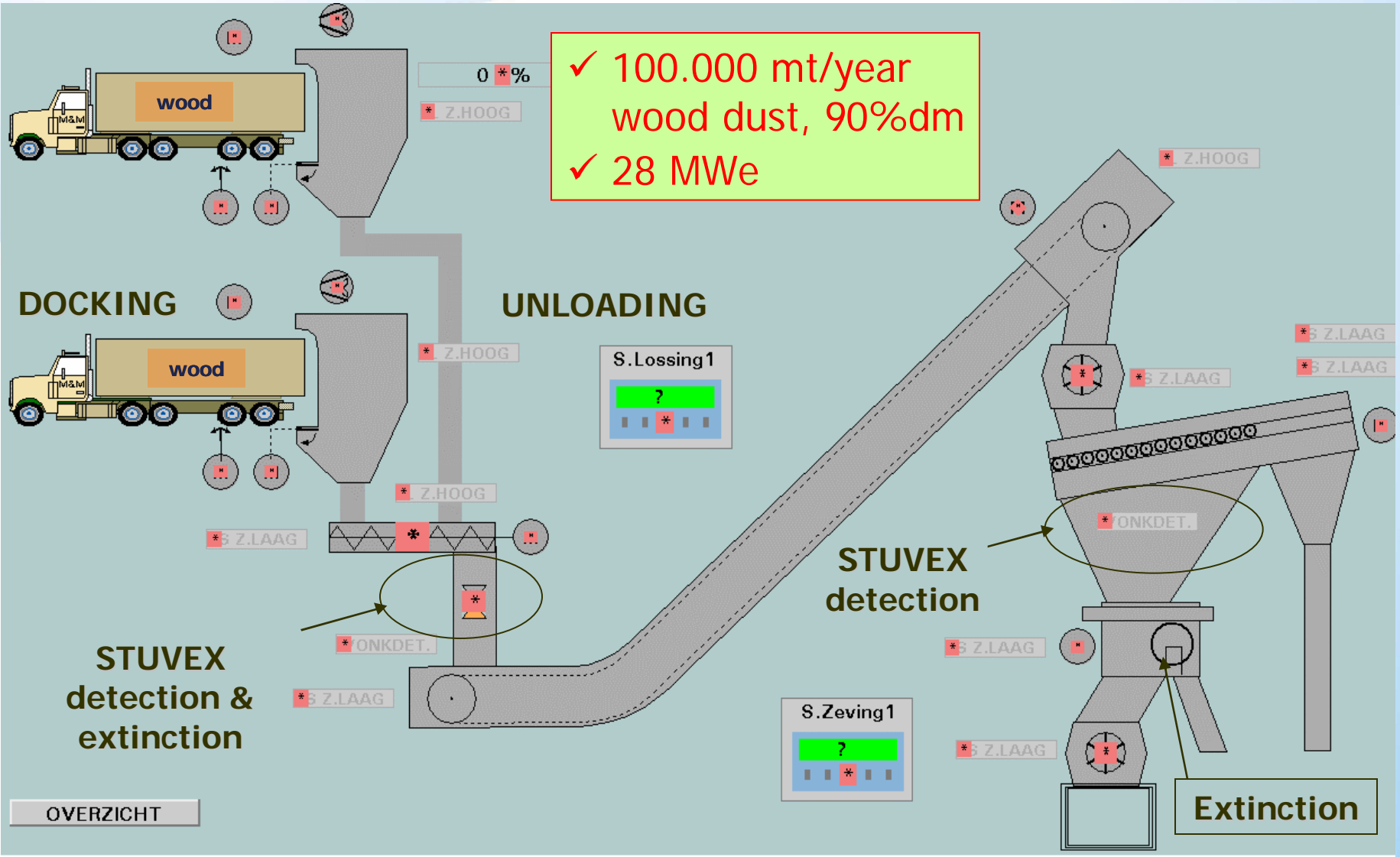
WOOD CHIPS CFB GASIFIER RUIEN



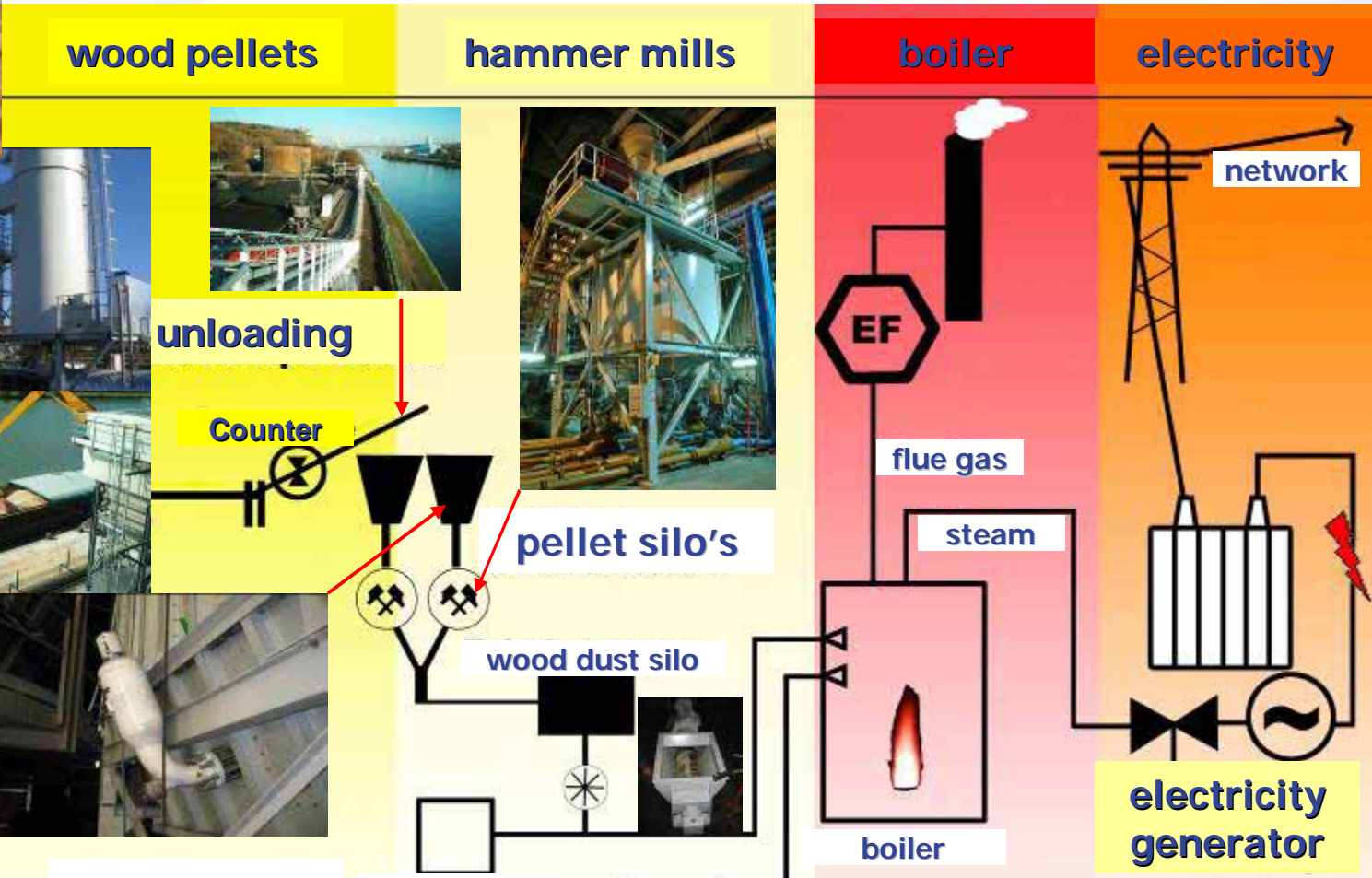
Concept of biomass co-firing in Ruien PP



WOOD DUST IN LANGERLO



WOOD PELLETS IN AWIRS-4



✓ 350.000 mt/year wood pellets
 ✓ 80 MWe

WOOD PELLETS



RODENHUIZE

WOOD
PELLETS
TRANSPORT



SILO'S



GHENT COAL
TERMINAL

metal sep

transfert points

balance

KANAAL

coal
conveyor

DAY
SILO

ELECTRABEL
RODENHUIZE

milling

boiler unit
4

4 hammer
mills

burners

4 primary air
lines



- ✓ 350.000 mt/year wood pellets
- ✓ 80 MWe

Installed capacity with co-firing

2004 : 60 MW

- Ruien : wood dust ~ 8 MW
- Ruien : gasification of clean wood chips ~ 17 MW
- Langerlo, Rodenhuize, Ruien : olive cake ~ 31 MW
- Langerlo : sewage sludge ~ 4 MW

2005 : 246 MW

- Ruien wood dust ~ 10MW
- Ruien : gasification of clean wood chips ~ 20 MW
- Langerlo : wood dust ~ 28 MW
- Langerlo, Rodenhuize, Ruien : olive cake ~ 34 MW
- Langerlo : sewage sludge ~ 4 MW
- Mol : coffee ground ~ 2 MW
- Awirs wood pellets ~ 80 MW
- Rodenhuize wood pellets ~ 66 MW

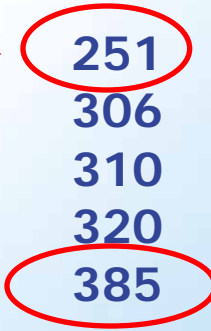
2007 : 261 MW

- Ruien wood pulverisation (Biostof) ~ 14 MW

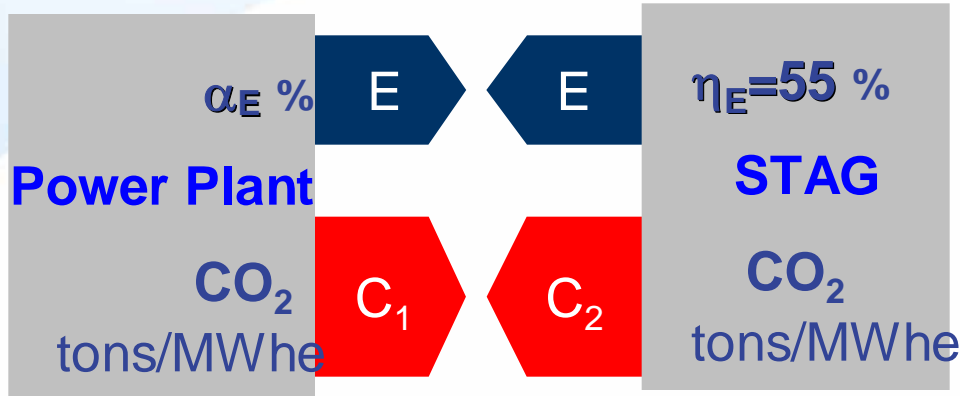
Specific rate of fossile GHG generation in kg CO2eq/MWh primary energy (CWaPE-WAL)

❖ NON FOSSILE	kgCO2/MWhp
• wind/solar/hydraulics	0
• organic biodegradable matters	0
❖ milling	4
❖ transport on max. 100 km	5
❖ transport on more than 200 km	25
❖ drying	10
• corn crops	22
• wood	23
• wood pellets with residues from the forestry	30
• cultivated wood (short rotation coppices)	45
• rapeseed oil	65
• bio-diesel	80
❖ FOSSILE	
• natural gas	251
• gas-oil	306
• light fuel oil	310
• heavy fuel oil	320
• coal	385

the reference →



Green certificates in Wallonia : [CO2eq]



CO₂ emission rates (CWAPE)

- ✓ $C_{NG} = 251 \text{ kgCO}_2/\text{MW hp}$,
- ✓ $C_{coal} = 385 \text{ kgCO}_2/\text{MW hp}$,
- ✓ $C_{PP} = C_1 =$
 $= C_{wood} = 25 \text{ kgCO}_2/\text{MW hp}$,
 $= C_{BEL.pellet} = 35 \text{ kgCO}_2/\text{MW hp}$
 $= C_{imp.pellet} = 55 \text{ kgCO}_2/\text{MW hp}$,

$$k = \frac{C_2 - C_1}{C_2}, E \text{ MWhe},$$

$$\#cert = k * E = E - \frac{C_1}{C_2} E = E - \frac{C_{PP} / \alpha_e}{C_{NG} / \eta_e} * E$$

Awirs4 $\alpha_E = 38\%$
Belgium $k = 0,80$
World $k = 0,68$

Flanders: wood pellets Canada



1 ton wood pellet
 = 5 MWhp
 = 1,77 MWhe – 0,446 MWhe
 = 1,324 MWhe

$$\begin{aligned} \# cert &= k * E \\ &= 1,324 / 1,77 \\ &= 0,75 * E \end{aligned}$$

Subtractions :

- 1) Electricity consumption pelleting : **100 kWe/ton**
- 2) Electricity consumption drying : **6 kWe/ton**
- 3) Train transport :
 700 km per train
 or **108 kWhp/ton**
- 4) Sea transport :
 750 ton diesel/40 000 ton
 = **232 kWhp/ton**
446 kWh/ton

CERTIFICATION WOOD PELLETS

- extension of the **permit** requires information about sourcing
- « **renewable** » status according to manufacturing process
 - OVAM in Flanders → green+emissions
 - CWaPE in Wallonia → green
- guaranteed **sustainability** through FSC forests certificate or audit made by independent body (SGS)
- balance of fossil energy use and net green electricity generation according to production and transport (checked by SGS)



- ✓ **Technical file per fuel**
→ **permit, emissions**
- ✓ « **Electrabel Wood Supplier Declaration** »
 - **fuel specifications**
 - **sustainability criteria**
- ✓ **Transport scheme**
- ✓ **SGS audits (6 month)**
 - **production unit**
 - **forestry**

MAJOR DIFFICULTIES

ELECTRABEL is active and creative, but : three conditions to fulfill : S-T-A :

- S : Supply : market growing, prices rise
 - T : Technical : specific technical adaptations
 - A : Administrative : stability of regulations ?
 - Permit
 - Emissions regulations
 - Green Certification
- ➔ *If long delays, then loss of opportunities...*

- **In Flanders : future of existing coal power plants ??**
biomass = « co-firing with coal »
- **In Wallonia : new limit of 20 MW shall be implemented for new biomass projects**

Questions ?



You've got the energy.

Electrabel 
