WTERT
Waste-To-Energy Research
and Technology Council

WTE Carbon Emission Credits

Opportunities Now and for the Future

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SUSTAINABLE ENERGY
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Carbon Emission Credits

Obtained through:

- Renewable Energy Certificate (RPS)
- Carbon Trading Mechanisms (ETS and RGGI)
- Resultant Emissions Reductions (CCX)

Objectives is to increase revenues of WTE plant

Base Plant Specifications

Based on KRV Arnoldstein

Energy (MW)		Inlet Air (m^3/hr)		Flue Gas (m^3/hr)		
Therm.	Elec.	Total	O_2	Total	O_2	H_2O
30	5	25,600	5,376	42,300	3,285	9,510
	17%		21%		7.8%	22.5%

Carbon Management

2.7 t O_2/hr	3.7 t CO_2/hr

REC’s and Portfolio Standards

REC’s can be sold either in the voluntary or compliance markets. A 2005 US DOE report shows prices ranging from $1 to $50 per MWh. A more realistic range would be $5-15 per MWh.

WTE plant feed is ~60% biomass and could produce 24,000 MWh of REC’s per year.

Challenges for REC and RPS

Market is very fragmented with each state having its own targets. Additionally, solar power is usually a premium because it is mandated. (www.dsireusa.org)

New York	New Jersey	Mass.
Biomass/CHP	App. RRF	Biomass

All list Landfill Gas and Anaerobic Digestion

Concerted effort to document performance
Begin approval process

Avoided Emissions

The use of WTE plants avoids methane generation from land filling. Using EPA and "State of Garbage" data we can compare the processes.

Option	CO_{2e}/yr	Tons/yr	CO_{2e}/ton
WTE	19.4 Tg	37.7 Mt	515 kg
Landfill	140.9 Tg	326.4 Mt	432 kg

At 60% biomass WTE saves 226 kg of CO_{2e} per tonne

Carbon Capture and Storage

Preventing the release of CO_2 to the atmosphere through capture from flue gas then sequestration.

Location	Operator	Penalty	Amount
Post	MEA	Thermal	170 kJ_{th}/mol CO_2
Pre	Oxygen	Electrical	25 kJ_e/mol O_2

Choice depends on costs and modifications

Post Combustion Capture - MEA

Established process that can be viewed as modular addition to the plant. Low temperature (120°C) boiler.

Flue Gas Requirements

Compound	SO_2	O_2	Dust	Temp.
MEA	25 mg/m³	>1.5%	15 mg/m³	50°C
WTE	15 mg/m³	7%	0.4 mg/m³	115°C

Require 4 MW of thermal energy to capture 3.7 t CO_2/hr

Consumes 80% of electricity or 13% of heat
at \$80/MWh need \$86/t CO_2

Oxygen Combustion with CO_2

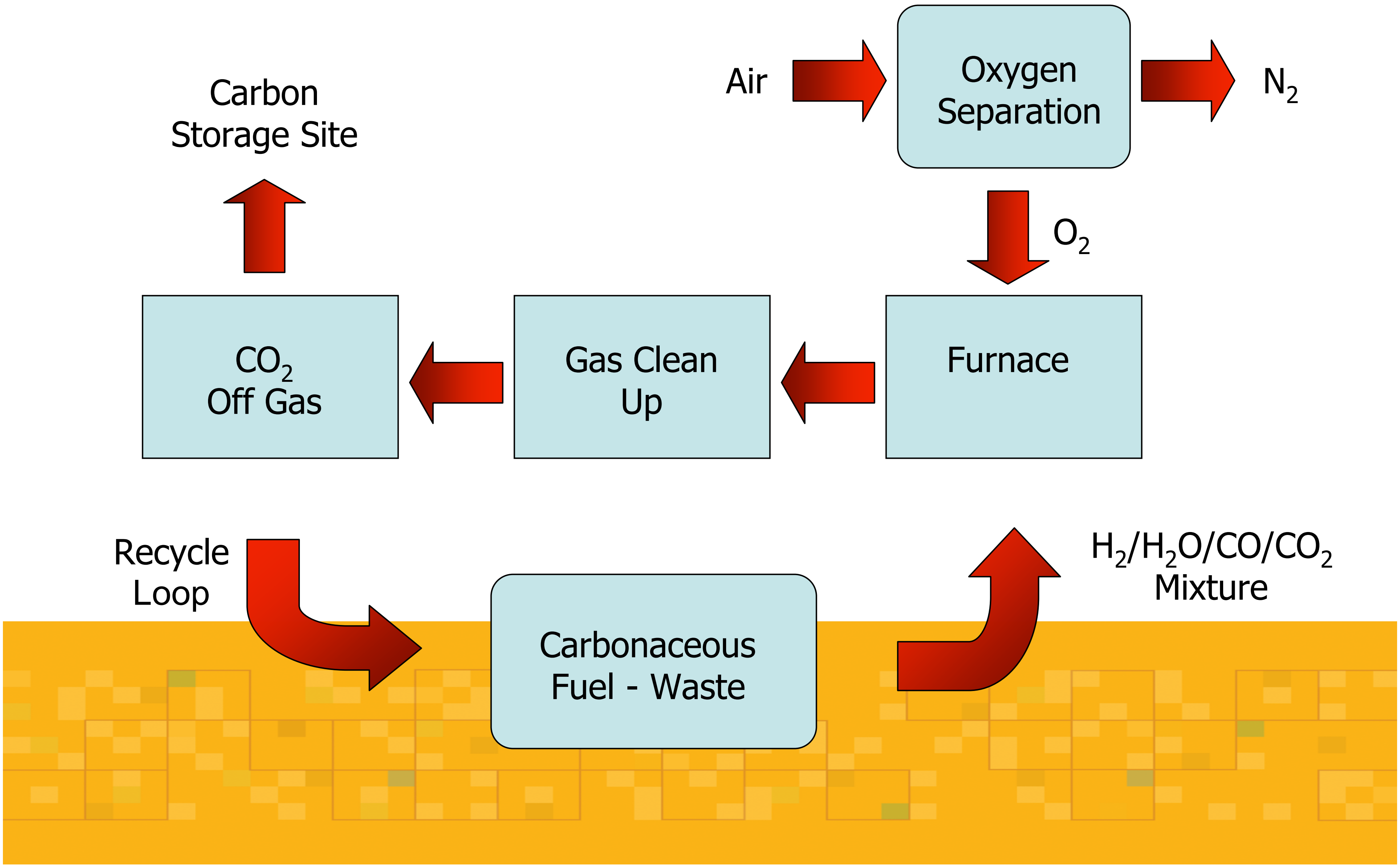
A version of Oxyfuel combustion where air is replaced with O_2 and CO_2. Penalty associated with production of 2090 m^3/hr of O_2 through cryogenic separation.

Requires 600 kW of electricity to produce 2.7 t O_2/hr

Gas clean up will depend on corrosion and erosion in furnace. Off site gas is reduced by 80%. Liquid water will be recovered during compression of CO_2. SCR omitted.

Consumes 12% of electricity
at $80/MWh need $13/t CO_2

O_2/CO_2 System Schematic



Markets for CO_2

There is no current market for CCS emission reductions within the Kyoto Accord. Both the ETS and CDM are reviewing methodologies for projects awaiting approval.

CCX doesn't list CCS but accepts CDM credits. Value of CO_{2e} is lower as it is a voluntary market. Currently about \$4/t CO_{2e} vs. \$20/t at ETS.

CO_2 for EOR is variable but in demand (~\$15/t CO_2)

Need regulatory work incl. negatonnes
Linkages to oil producers and transportation

Considerations for CCS

The necessity for CCS is either profit or regulation. Regulations are unlikely for several years.

The EOR market will be valuable as long as oil prices stay high but CCS planning is too long for volatile markets.

A benefit can be obtained by going beyond regulations to establishing a zero emission plant.

We know things have to change
Why not lead rather than follow?