

The City of Edmonton Experience in Generating and Marketing GHG Offsets from Composting

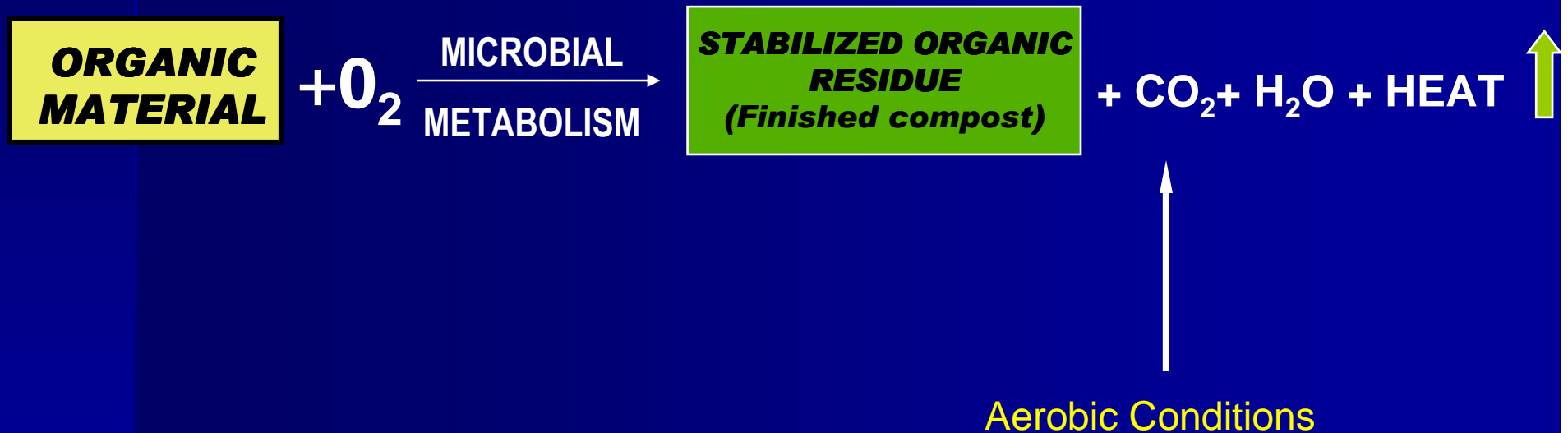
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Outline

- Basic Technical Background
- GHG Offset Quantification – the Edmonton Waste Management Experience
- The Alberta GHG Regulatory and Offset System
- Marketing Offsets in Alberta
- The Way Forward

GHG Generation from Composting



Baseline Alternative to Composting

- Typically, the alternative fate for waste organics is landfilling.
- Landfills $\xrightarrow{\quad}$ anaerobic digesters w/ no mixing.
- Multi-step degradation of organics under anoxic and anaerobic conditions to yield CO_2 , CH_4 , VOCs as GHG products.

Net Emission Reduction

Emission Reduction =

$\text{Emissions}_{\text{Baseline}} - \text{Emissions}_{\text{Composting}}$

Estimation of GHG Production

- Rough estimates
 - stoichiometrically
- More rigorous calculations
 - modelling.
- Estimates/calculations
 - composting versus baseline case.
- GWP of various GHGs
 - CO₂, CH₄, NO_x, CO, SO_x

First Order Decay Model Equation

$$Q_t = \sum_{i=1}^n 2k L_o M_i e^{-kt_i}$$

Where Q_t = total LFG emission rate, volume/time

n = total time periods of waste placement

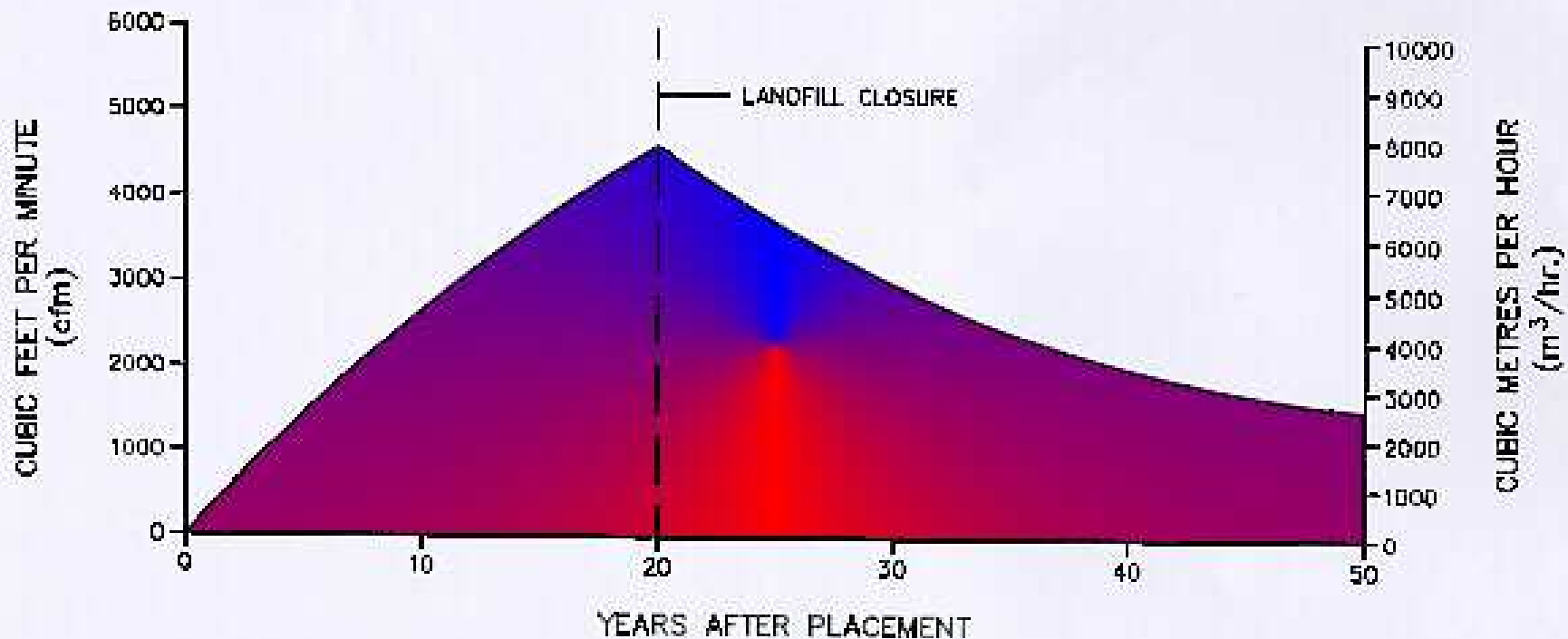
k = LFG emission constant, time⁻¹

L_o = methane generation potential, volume/mass of waste

t_i = age of the i th section of waste, time

M_i = mass of wet waste, placed at time i

Typical Gas Production Estimate



NOTE

BASED ON A 10 MILLION TONNE SITE
FILLED OVER A 20 YEAR PERIOD

Calculation Simplifications

- For ease of calculation, the lifetime generation of CH_4 by a mass of material under baseline landfill conditions reduces to one number.
- The default approach allows for claim of total CH_4 generation potential avoided in the year the material is diverted from landfilling.
- Under both baseline and composting conditions, only quantities of CH_4 and N_2O are calculated.
- CO_2 emissions are considered biogenic and are therefore not considered.



Edmonton Composting Facility

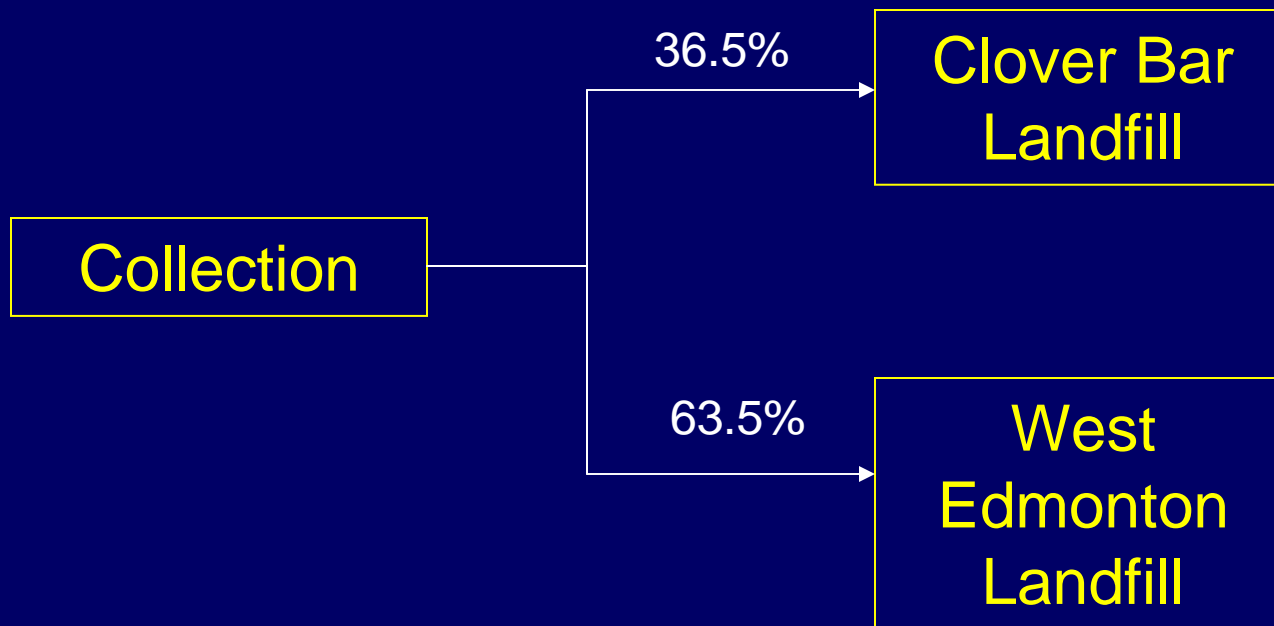
Offset Quantification – Edmonton Waste Management Experience

- Quantification and ownership of offset credits a negotiation issue from original project conception.
- Need identified to quantify offsets from composting after City purchase of facility in 2001.
- Impetus from potential Federal Government consideration of market based approach to managing GHGs in 2005.

Edmonton Approach

- Consultant retained in 2005 to:
 - Develop protocol for quantifying GHG offsets from ECF composting operations; and
 - Quantify ECF GHG offsets for 2002-2005.
- Baseline case developed, protocol developed.
- Data gathered, GHG offsets calculated.
- Draft report prepared, modified IAW ISO 14064.

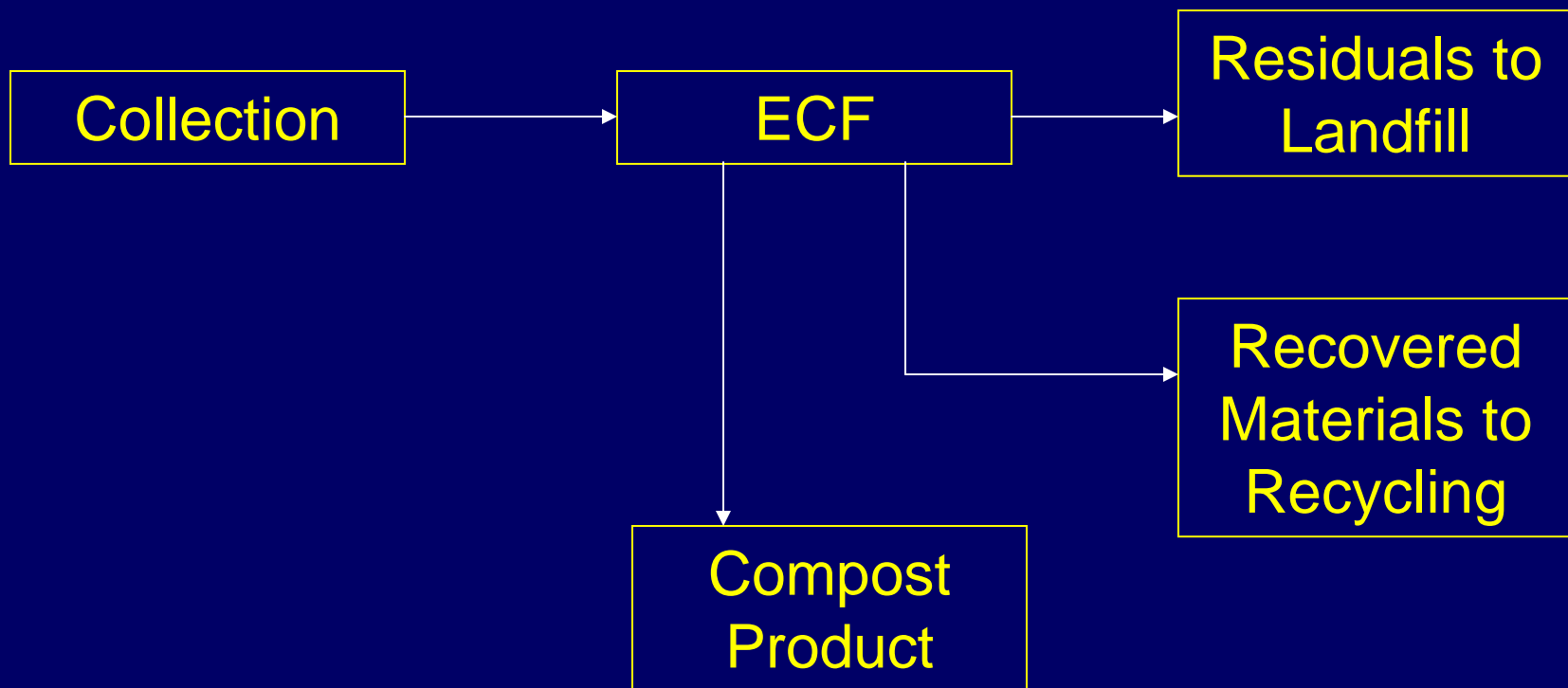
Baseline Landfill Alternative To Composting



Lifecycle (Full Cycle) Analysis

- ECF GHG emission analysis includes quantification of emissions from:
 - Project construction activities - discounted;
 - Project decommissioning activities – insubstantial; and
 - Ongoing facility operations:
 - Process conversion of MSW to compost;
 - Fuel used in transporting MSW and residuals;
 - Natural gas consumption; and
 - Power consumption.

ECF Composting Scenario



Calculated ECF GHG Offsets

	2002 (Tonnes CO ₂ -e)	2003 (Tonnes CO ₂ -e)	2004 (Tonnes CO ₂ -e)	2005 (Tonnes CO ₂ -e)
Baseline GHG Emissions	89,352	75,822	78,738	87,720
GHG Emissions w/ ECF	13,087	9,634	10,945	11,859
Calculated GHG Offset	76,265	66,188	67,793	70,861

Regulated and Unregulated GHG Emission Environments

- Europe (*regulated* emissions) – value of offsets = 20-30 Euros(?)/tonne CO₂-e
- North America (largely *unregulated* emissions) – value of offsets = \$2-\$5/tonne CO₂-e through voluntary exchanges (CCX)
- Alberta (*regulated* emissions) – value of offsets capped at \$15/tonne CO₂-e

Alberta GHG Regulatory System

- Spring 2007: Bill 3 – Climate Change and Emissions Management Act & Specified Gas Emitters Regulation.
- Starting 1 July 2007, large emitters (>100,000 tonnes CO₂-e/yr) required to:
 - Reduce emissions intensity by 12%;
 - Pay \$15/tonne into Alberta based technology fund; or
 - Purchase offset emission credits from Alberta based operations.

Alberta Offset System

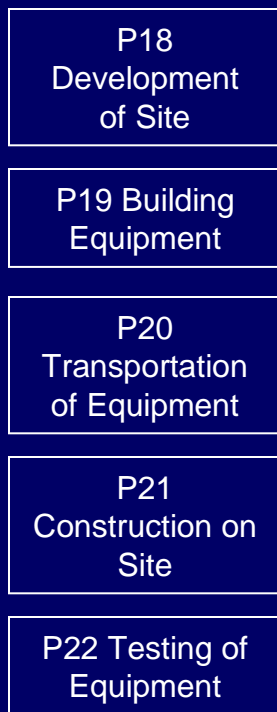
- Draft GHG offset protocols developed for various offset activities/projects in support of Alberta based carbon offset market.
- The emission and project statements developed by Edmonton for ECF used as source documents for the draft Alberta protocol on composting.
- Composting Protocol approved by Alberta government in Sep 2007 after public review.

Alberta Composting Protocol: Project Element Life Cycle Chart

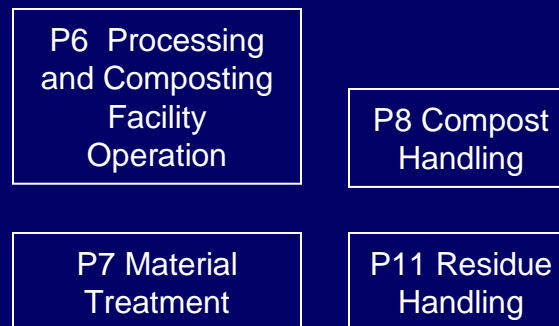
Upstream SS's During Project



Upstream SS's Before Project



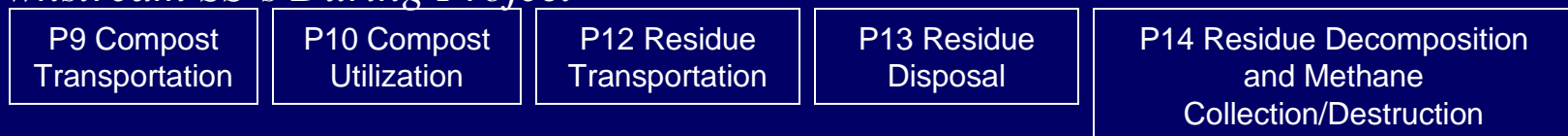
On Site SS's During Project



Downstream SS's After Project



Downstream SS's During Project



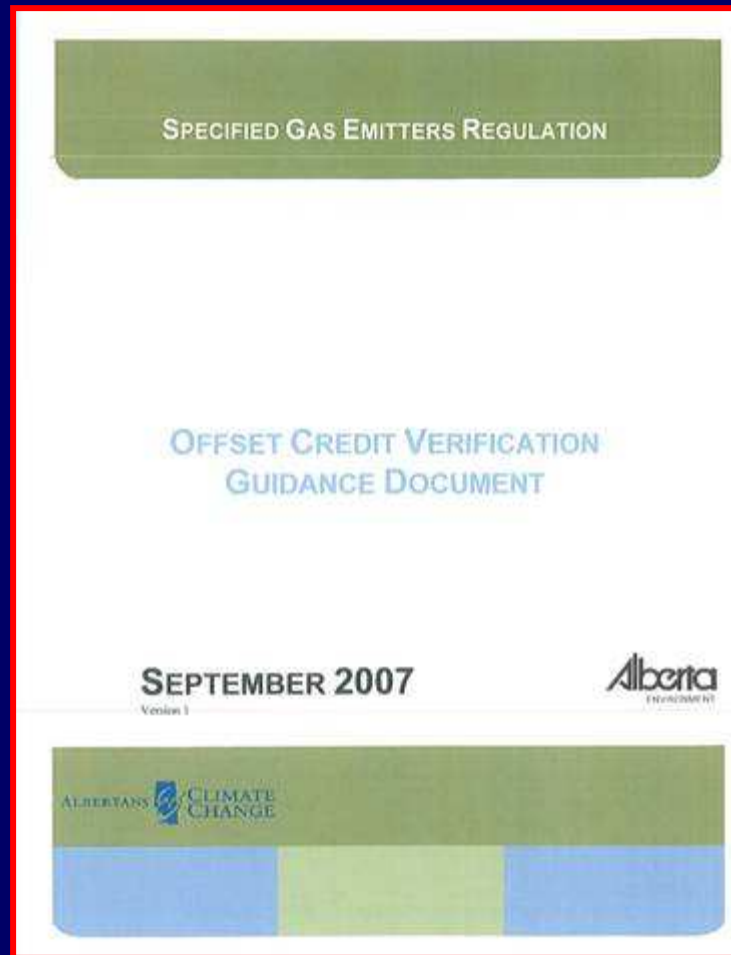
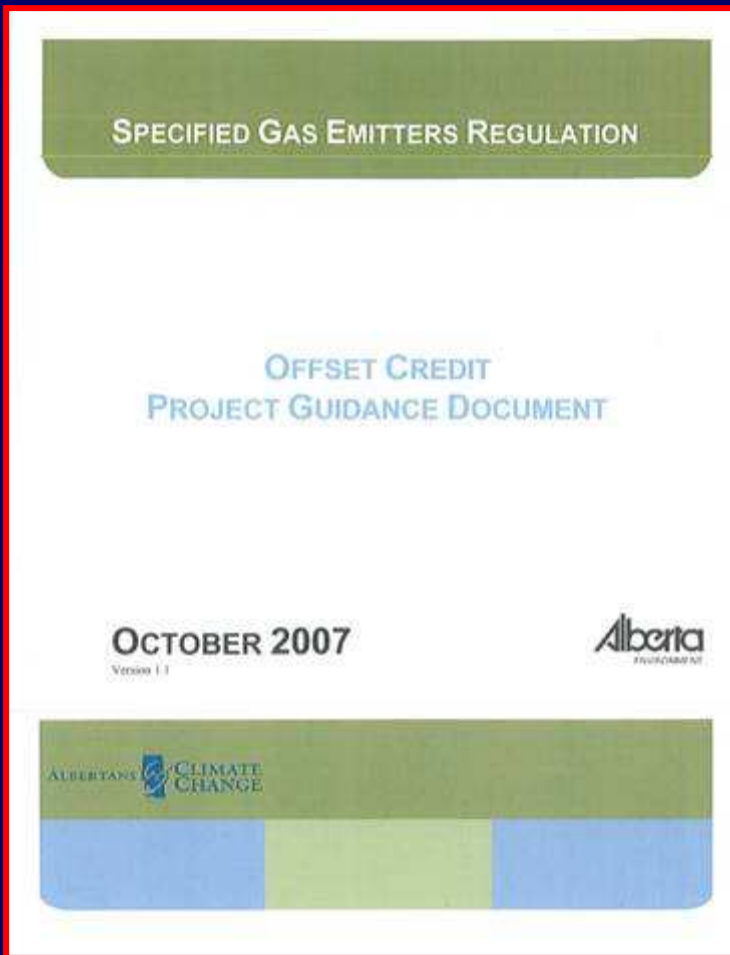
Additional Adjusted Baseline Approach Nuances

- Default IPCC default emission factors unless project/site specific factors generated.
- Projects with start dates prior to 2002 will only be able to claim offsets from 2007 on.
- Projects with start dates after 2002 can claim offsets from their start date onwards.

Alberta Offsets Trading

- 2008-09: approximately 5,000,000 tonnes of CO₂-e sold to regulated emitters.
- Approved offset protocols published on www.carbonoffsetsolutions.ca/aeor.
- Offsets quantified using approved protocols do not require validation.
- Registry also hosted on this website.

Two On-line Guides Available



Market Realities

- Offset sale price range currently in \$11-\$14/tonne CO₂-e price range.
- Pricing ∞ on quality of offsets which further ∞ quality of data management chain and number of discrepancies/leakages.
- Regulated emitters likely interested in quantities of 20,000 tonnes CO₂-e and over.
- Aggregation a viable strategy to permit smaller operations to participate.

Edmonton Status

- 2007 and 2008 offsets from ECF quantified in early 2009, project statement generated.
- Offsets verified by consultant in Feb-Apr 2009.
- Registration and serialization of offsets on Alberta Registry completed in early June.
- Sale to purchaser negotiated, contract documents currently being developed.

The “Bigger Picture”

- Mid 2008 announcement of federal “Fast Track” approach to develop and approve offset protocols for 30 industrial activities. IPOG appointed to develop protocols.
- CCC as sponsor for development of national offset protocol for aerobic composting, hiring of Blue Source Canada as project consultant through IPOG.



Crystal Balling

- New U.S. government desire to develop cap & trade system as an emission reduction strategy.
- USEPA in midst of 2 year process to develop regulatory framework for same.
- May 2009: vague announcement by Canadian government of intentions to develop national cap & trade system. Currently in consultation stage.
- Need for Alberta to harmonize with Canada.
- Need for Canada to harmonize with U.S.
- Value of offsets to increase.

Thank You

