

Foams Sector “Cheat Sheet”

This document summarises the methods and assumptions used to (a) develop bottom-up bank estimates and (b) assess technical and economic feasibility in the foams sector. References cited refer to those listed in the draft report prepared by ICF International for the European Commission, *Identifying and Assessing Policy Options for Promoting the Recovery and Destruction of Ozone Depleting Substances (ODS) and Certain Fluorinated Greenhouse Gases (F-Gases) Banked In Products and Equipment* (March 2010). For more detailed information on methodology/assumptions, please see Annex A of the draft report.

Methods & Assumptions Used to Develop Bottom-Up Bank Estimates

The following methodology was used to develop bottom-up estimates of foam banks:

- (1) Confidential EU market data provided by global foam manufacturers¹ for 2001 and 2008 by end use (in metric tonnes) was used to develop historical annual consumption estimates by chemical;
- (2) Historical consumption by chemical and end use were in turn used to estimate installed bank quantities based on equipment lifetimes;
- (3) Banks were disaggregated by Member State based on qualitative market information (on usage patterns) and/or GDP;
- (4) Banks by Member State were projected to 2050 based on actual or projected phaseout dates by chemical type and end use; and
- (5) Banks reaching EOL were projected based on change in installed base from the previous year.

The assumptions used in each of the above steps are presented below:

- 1) Translating 2001 and 2008 EU consumption by end use into historical annual EU consumption by chemical:**
 - To estimate annual consumption, linear growth was assumed from start date to known 2008 consumption level.
 - Annual BA consumption was estimated based on percent by weight, then disaggregated by chemical types based on phase-in/phase-out dates and estimated market shares.
 - Specific assumptions used are summarised in Table 1 (page 3)
- 2) Translating annual EU consumption into EU banks**
 - Quantity of blowing agent installed in products and equipment was estimated using a decay function, based on product/equipment lifetimes:
 - Appliance foam: 15 years
 - Construction foam: 50 years
- 3) Translating EU banks into Member State banks**
 - Installed banks were allocated by country as follows:
 - *Appliance foams*: disaggregated based on GDP
 - *Construction PU rigid spray foams*: 75% of the banks assumed to be installed in Spain and Italy; prior to 1990, the remaining 25% was apportioned to other EU-15 countries based on GDP; beyond 1990, the remaining 25% was apportioned to the other EU-27 countries based on GDP.

¹ These data were developed by Dr. Mike Jeffs based on information from the European Diisocyanate & Polyol Producers Association (ISOPA) and EXIBA (XPS industry association).

- *Other construction foam applications*: consumption pre-1990 assumed to occur in EU-15, with banks apportioned to those 15 countries based on GDP. Beginning in 1990, banks allocated to the whole EU-27 according to GDP.

4) Projecting Banks by Member State to 2050

- The following market growth rates were used to project blowing agent banks in short- and long-terms:
 - CFC/HCFCs: 0% (since phaseout is complete)
 - HFCs:
 - Appliances: 0% (since transition to climate-friendly alternatives is complete)
 - Construction: decline linearly from 2009 to reach 0 by 2020.

5) Projecting Banks Reaching EOL

- Annual disposal for each year estimated as change in installed base from the previous year

Methods & Assumptions to Assess Technical & Economic Feasibility

1) Projecting Banks Reaching EOL

- QTY of BA available at EOL calculated based on the % of BA by weight by chemical type, and known emission factors (in year 1 and annually thereafter), based on IPCC (2006)

2) Estimating BA Recoverable at EOL

- Percent of remaining BA recoverable estimated based on available qualitative and quantitative data—e.g., TEAP (2009), Japanese Technical Committee on Construction Materials (2005), Spray Polyurethane Foam Alliance (2009)

Assumptions are summarised below:

End-Use	Blowing Agent Remaining at EOL ^a	Blowing Agent Technically Recoverable at EOL ^b	Total Potentially Recovered at EOL ^c
PU Rigid: Domestic R&F	92.5%	95%	87.9%
PU Rigid: Commercial Refrigeration	90.5%	85%	76.9%
PU Rigid: Sandwich Panels – Continuous	70.5%	90%	63.5%
PU Rigid: Sandwich Panels – Discontinuous	69.5%	90%	62.6%
PU & PIR Rigid: Boardstock (FFL)	45%	70%	31.5%
PU Rigid: Spray foam	11.5%	50%	5.8%
XPS Foam Boards	11.5%	70%	8.1%

^a Calculated by multiplying estimated original charge size by lifetime emissions assumptions from IPCC (2006).

^b Estimated based on assumptions of blowing agent losses from separation and removal at EOL.

^c Calculated by multiplying charge remaining at EOL percent by blowing agent technically recoverable at EOL.

Table 1. Assumptions Used to Translate Sales Data (2001, 2008) by End Use Into Annual Historical Consumption by Chemical

Foams End Use	CFC Consumption			HCFC Consumption			HFC Consumption			% by weight			Assumed Chemical		
	Start (EU-15) ^a	End	% of Market	Start (EU-15) ^b	End	% of Market	Start*	End	% of Market	CFC	HCFC	HFC	CFC	HCFC	HFC
PU Rigid: Domestic R&F	1959	1994	100%	1994	1998	20%	NA	NA	NA	12%	10%	NA	CFC-11	141b, 141b/22, 142b/22	NA
PU Rigid: Commercial Refrigeration	1959	1995	100%	1995	2000	80%	2000	2020	40%	12%	10%	6%	CFC-11	141b, 141b/22, 142b/22	245fa, 365mfc/227ea
PU Rigid: Sandwich Panels – Continuous	1969	1994	100%	1994	2003	70%	2003	2020	7.5%	12%	10%	6%	CFC-11	141b, 22, 22/142b	245fa, 365mfc/227ea
PU Rigid: Sandwich Panels – Discontinuous	1969	1994	100%	1994	2003	80%	2003	2020	50%	12%	10%	5%	CFC-11	141b	245fa, 365mfc/227ea
PU & PIR Rigid: Boardstock (FFL)	1965	1994	100%	1994	2003	30%	2003	2020	1%	12%	10%	5%	CFC-11	22, 141b/22	245fa, 365mfc/227ea
PU Rigid: Spray foam	1965	1994	100%	1994	2003	90%	2003	2020	95%	12%	10%	7%	CFC-11	141b	245fa, 365mfc/227ea
XPS Foam Boards	1965	1994	100%	1994	2001	90%	2001	2020	15%	12%	10%	10%	CFC-12	142b, 142b/22	134a, 152

^a It is assumed that CFC start dates in construction foam applications began 10 years later in EU-12.

^b It is assumed that HCFC consumption in construction foam applications in EU-12 began only six years prior to the end (phase-out) dates.