Date : **Thursday 30 October 2008**

Title : **Making BIBs Greener**

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Preface:

•After the Performance BIB general meeting, while discussing this presentation with an industry colleague, a few discrepancies between the Scholle and Tetra Pak Franklin Associates' life cycle inventory assessment reports were identified.

•As a result, Franklin Associates was contacted and these discrepancies were rectified.

•While some of the data, figures, and tables in this presentation differ from those originally presented at the Performance BIB general meeting, the overall message is the same.

Presentation outline:

- Initial thoughts
- Weight is king
- Wine BIB
- Additional helpful information
- Acknowledgements
- References

Initial thoughts (reference 1):

•Earth's temperture:

- •Without natural greenhouse effect: - 18 C
- •Present: 14 C

•Human activity = emission of greenhouse gases (carbon dioxide) = enhanced greenhouse affect?

•Greenhouse gas concentration:

- •Pre-Industrial Revolution: 280 ppmv
- •Present: 380 ppmv

•Earth's temperture:

- •Increased 0.74 C over the last ~ 150 years.
- •Mostly in the last ~ 50 years.

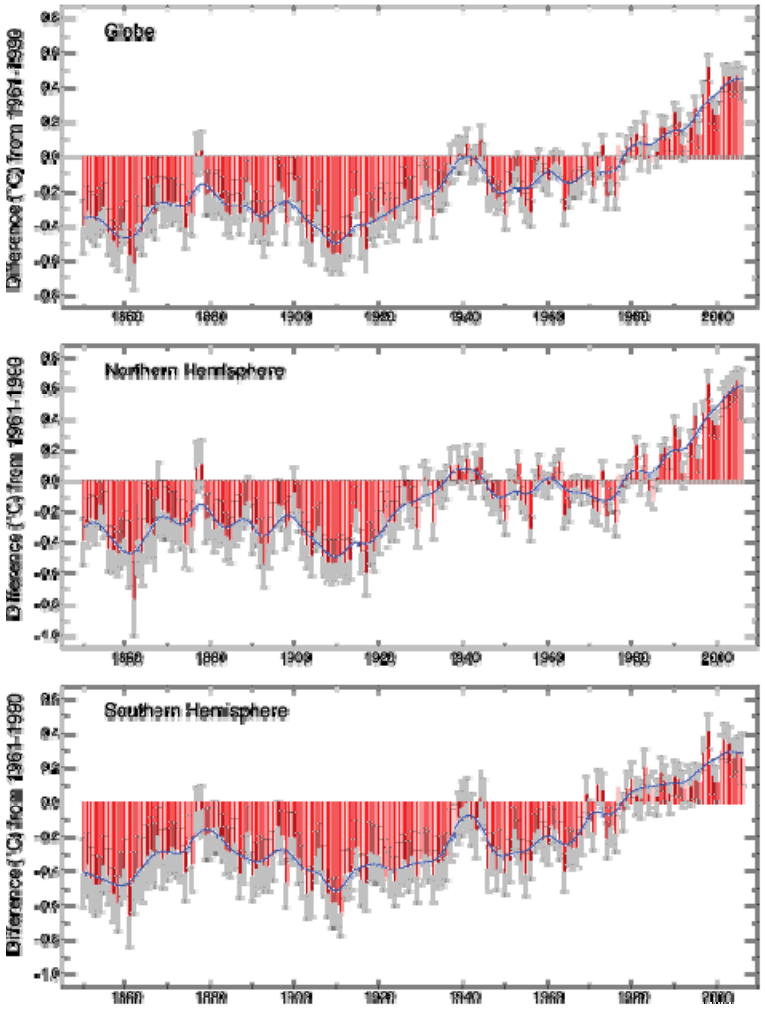


Figure 9.6. Global and hemispheric annual combined land-surface air temperature and SST anomalies (°C) (red) for 1850 to 2005 relative to the 1961 to 1990 mean, along with 5 to 95% error bar ranges, from HadCRUT3 (adapted from Brohan et al., 2006). The smooth blue curves show decadal variations (see Appendix 9.A).

Initial thoughts - continue (reference 2):

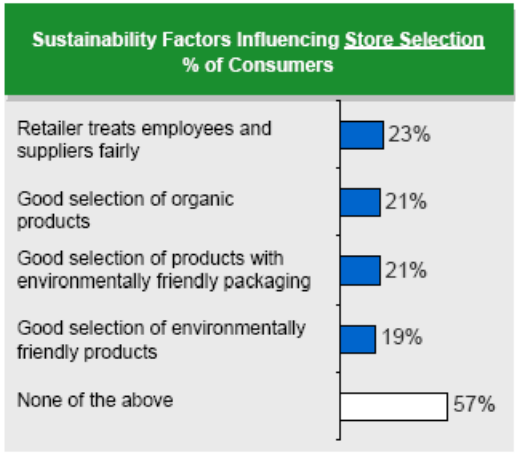
•IRI sustainability definition:

- •Meeting the needs of today without compromising the ability of future generations to meet their own needs.

•IRI survey:

- •~ 50% consider sustainability when selecting brands to buy or stores to shop.
- •29% consider which packaging is better for the environment.

Source: IRI Sustainability Survey; 22,267 respondents



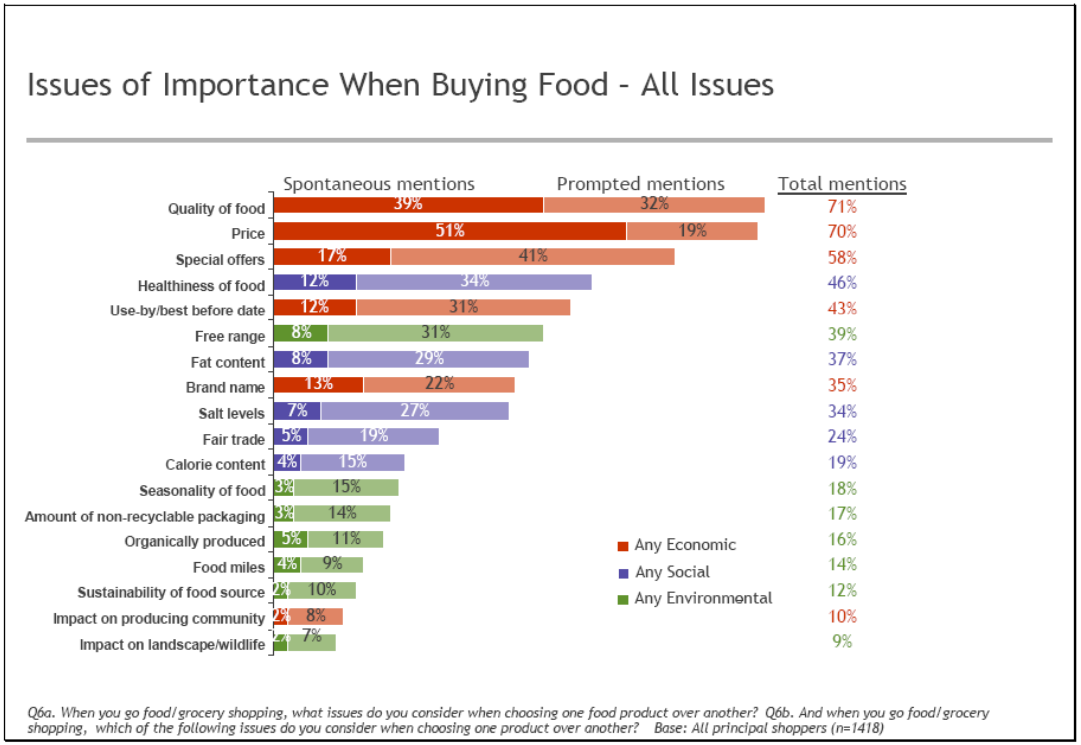
Source: IRI Sustainability Survey; 22,267 respondents

Sustainability-Driven Consumers

Cite at least two sustainability factors as key influences in brand selection (top chart) and at least two in store selection (bottom chart.)

Initial thoughts - continue (reference 3):

- FSA sustainable development definition:
  - The goal is to enable all people throughout the world to satisfy their basic needs and to enjoy a better quality of life, without compromising the quality of life of future generations.
- FSA survey:
  - Economic issues > social issues > environmental issues
  - Quality of food > price > healthiness of food



Initial thoughts - continue:

•What do I think all of this means to BIB?

- •Package performance is the most important.
  - •No leakers.
  - •Quality preservation.
- •Cost is next.
  - •Over-engineered packages are being identified and elliminated.
- •Sustainability is still behind, but 'gaining ground'.

Alternative material types represent marginal cost and sustainability improvement.

Weight is king for cost and sustainability.

	CO2 Emissions (kg CO2 / kg material)
Plastics	
LDPE	2.1
LLDPE	1.8
HDPE	1.9
PP	2.0
PET	3.3
PS	3.4
PVC	1.6
PVDC	4.4
Renewable Plastics	
PLA (Polylactic Acid)	1.8
Other Materials	
Aluminum (bars)	4.0
Steel (tinplate)	3.0
Glass	0.8
Paper (coated)	0.9
Paper (bleached)	0.9
Paperboard (Duplex/Triplex)	0.6
Corrugated Paper	0.6

Popular 3-L wine BIBs contains ~ 90% of these materials.

Weight is king (reference 4 and 5):

•Countless packaging examples are in the press.

•Nestle:
- •Audit results:
  - •Average water bottle weight: 21 grams
  - •Average soft drink bottle weight: 28 grams
- •Nestle:
  - •1992 water bottle weight: 21 grams
  - •2008 water bottle (EcoShape) weight: 12.5 grams
  - •2009 predicted water bottle weight: 10.5 grams
- •What does 2 grams represent to Nestle per year?
  - •65 million pounds less plastic
  - •10% less energy consumption
  - •8% less green house gas emissions
- •We have the lightest enviromental footprint of any beverage company in the United States. - Kim Jeffery Nestle Waters NA CEO and President

Weight is king - continue:

•Wine BIB:

- •30 wine BIB samples were collected and analyzed from 1992 to 2008.
- •The two ply bags' average thicknesses were:

Year	Outer Ply Thickness (mils / microns)	Inner Ply Thickness (mils / microns)	Total Thickness (mils / microns)	Change Since 1990 - 1994
1990 – 1994	4.0 / 101	2.3 / 57	6.3 / 158	-
1995 – 1999	4.0 / 101	2.1 / 53	6.1 / 154	- 3.0%
2000 – 2004	3.6 / 92	1.9 / 49	5.5 / 141	- 10.6%
2005 – Present	3.3 / 84	1.7 / 43	5.0 / 127	- 19.9%

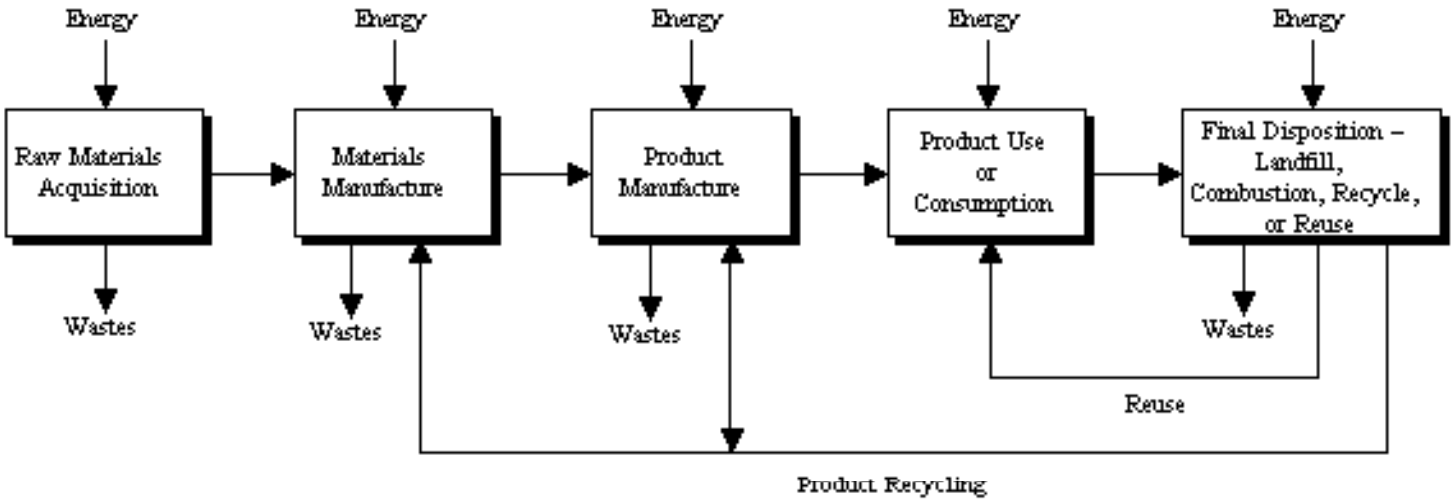
- •The single ply bags' average thickness (all post 2003) has been 4.2-mil / 107-micron.
  - • Compared to 1990 – 1994, this represents a 32.2% reduction.

Wine BIB:

•Life cycle inventory assessment conducted by Franklin Associates, A Division of ERG.

•Prairie Village, Kansas

•Life cycle stages and flow for 'cradle-to-grave' analysis:



Wine BIB - continue:

- Wine BIB for 'cradle-to-grave':
  - Production of the container materials.
  - Fabrication of the container systems.
  - Transportation of empty container from the container producer to a winery.
  - Transportation of filled container from the winery to a distribution center.
  - Postconsumer disposal and recycling of container systems.
- The inventory identifies and quantifies:
  - Material inputs
  - Energy consumption
  - Environmental emissions
    - Atmospheric emissions, waterborne wastes, and solid wastes

Wine BIB - continue:

Table B-1. Energy Requirements for Three-liter Bag-in-Box Wine Packaging (Million Btu per 1,000 Bag-in-Box Packages)

	Process	Transp	Energy of Material Resource	Total Energy	Resin Credit	WTE Credit	Net Energy
DURASHIELD (73.6% wine box recycling; 50% decomposition)							
Bag & Spout	1.32	0.12	1.58	**3.02**	(0.13)		2.88
Tap Assembly	0.60	0.01	0.45	**1.06**	(0.06)		1.00
Box	2.42	0.11	0.11	**2.63**			2.63
Transport to filler	0.00	0.04	0.00	**0.04**			0.04
Production of transport packaging	2.66	0.03	0.59	**3.28**	(0.05)		3.23
Transport to distribution center	0.00	0.54	0.00	**0.54**			0.54
End of life management	0.02	0.07	0.00	**0.09**		(0.11)	(0.02)
Total	**7.01**	**0.92**	**2.73**	**10.66**	**(0.24)**	**(0.11)**	**10.30**
	66%	9%	26%				
HYBAR (73.6% wine box recycling; 50% decomposition)							
Bag & Spout	1.13	0.13	1.61	**2.86**	(0.13)		2.74
Tap Assembly	0.60	0.01	0.45	**1.06**	(0.06)		1.00
Box	2.42	0.11	0.11	**2.63**			2.63
Transport to filler	0.00	0.04	0.00	**0.04**			0.04
Production of transport packaging	2.66	0.03	0.59	**3.28**	(0.05)		3.23
Transport to distribution center	0.00	0.54	0.00	**0.54**			0.54
End of life management	0.02	0.07	0.00	**0.09**		(0.11)	(0.02)
Total	**6.82**	**0.93**	**2.75**	**10.50**	**(0.23)**	**(0.11)**	**10.15**
	65%	9%	26%				

Table B-3. Solid Waste for Three-liter Bag-in-Box Wine Packaging Systems (Pounds per 1,000 Bag-in-Box Packages)

	Process	Fuel-related	Post-consumer	Total	By Component
DURASHIELD (73.6% wine box recycling; 50% decomposition)					
Bag & Spout	2.43	11.3	44.3	**58.0**	14%
Tap Assembly	0.79	8.09	27.2	**36.1**	8%
Box	31.5	35.8	198	**265**	62%
Transport to filler	0	0.086	0	**0.086**	0%
Production of transport packaging	3.96	8.86	55.4	**68.3**	16%
Transport to distribution center	0	1.29	0	**1.29**	0%
End of life management	0	0.22	0	**0.22**	0%
Total	**38.6**	**65.6**	**325**	**429**	**100%**
	9%	15%	76%		
HYBAR (73.6% wine box recycling; 50% decomposition)					
Bag & Spout	2.83	10.2	44.3	**57.3**	13%
Tap Assembly	0.79	8.09	27.2	**36.1**	8%
Box	31.5	35.8	198	**265**	62%
Transport to filler	0	0.086	0	**0.086**	0%
Production of transport packaging	3.96	8.86	55.4	**68.3**	16%
Transport to distribution center	0	1.29	0	**1.29**	0%
End of life management	0	0.22	0	**0.22**	0%
Total	**39.0**	**64.5**	**325**	**429**	**100%**
	9%	15%	76%		

Table B-4. Global Warming Potential for Three-liter Bag-in-Box Wine Packaging Systems (Pounds of CO2 Equivalents per 1,000 Bag-in-Box Packages)

	Process	Fuel-related	Net End of Life	Total	By Component
DURASHIELD (73.6% wine box recycling; 50% decomposition)					
Bag & Spout	22.6	212	0	**234**	30%
Tap Assembly	6.18	93.6	0	**99.7**	13%
Box	1.69	328	0	**330**	43%
Transport to filler	0	6.38	0	**6.38**	1%
Production of transport packaging	7.55	113	0	**120**	16%
Transport to distribution center	0	95.6	0	**95.6**	12%
End of life management	0	15.8	(134)	**(118)**	-15%
Total	**38.0**	**864**	**(134)**	**768**	**100%**
	5%	112%	-17%		
HYBAR (73.6% wine box recycling; 50% decomposition)					
Bag & Spout	24.2	186	0	**210**	28%
Tap Assembly	6.18	93.6	0	**99.7**	13%
Box	1.69	328	0	**330**	44%
Transport to filler	0	6.38	0	**6.38**	1%
Production of transport packaging	7.55	113	0	**120**	16%
Transport to distribution center	0	95.6	0	**95.6**	13%
End of life management	0	15.8	(134)	**(118)**	-16%
Total	**39.6**	**839**	**(134)**	**744**	**100%**
	5%	113%	-18%		

	Energy Million BTU per 1,000 Bag-in-Box Packages	**Solid Waste** Pounds per 1,000 Bag-in-Box Packages	**GWP** Pounds of CO2 Equivalents per 1,000 Bag-in-Box Packages
Bag-in-Box Systems			
DuraShield / FlexiTech (3 liter)	10.30	429	768
HyBar / FlexiTech (3 liter)	10.15	429	744

Wine BIB - continue (reference 6):

•Add these wine BIB results to Franklin Associates' previous Tetra Pak study:

TABLE ES-1

Weight Summary for Wine Container Systems
(All weights are expressed in grams)

	Container weight	Closure weight	Secondary and Tertiary Packaging	Total weight per container (1)	Total weight per liter (2)
Paperboard Systems					
Tetra Brik (1 liter)	31.4	2.18	23.2	56.7	56.7
Tetra Prisma (1 liter)	34.5	2.18	27.2	63.9	63.9
Tetra Prisma (500 milliliters)	20.3	2.18	15.9	38.4	76.8
Tetra Prisma (250 milliliters)	12.0	(3)	12.5	24.5	98.0
Tetra Prisma (200 milliliters)	8.52	(3)	11.1	19.6	98.0
Glass Systems					
Glass bottle (750 milliliters)	527	(3)	47.7	574	765
Glass bottle (187 milliliters)	150	1.91	10.9	163	872
PET Systems					
PET bottle (750 milliliters)	54.0	4.59	28.6	87.2	116
PET bottle (187 milliliters)	22.2	1.91	20.4	44.6	239

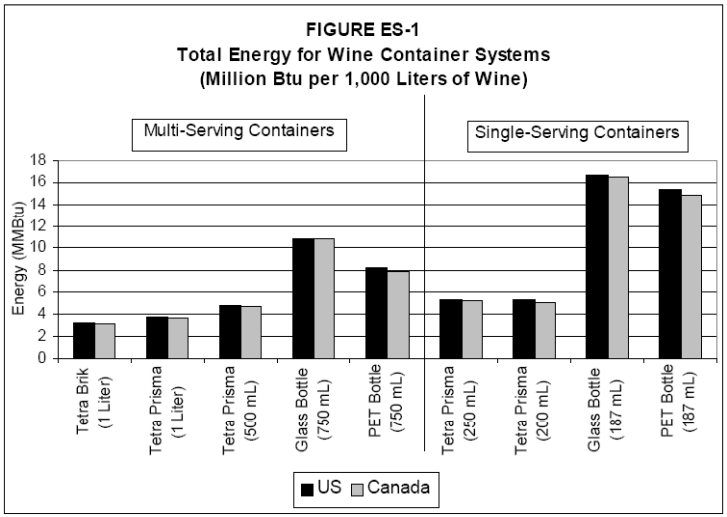
(1) Total weight per container is the sum of the container, closure, and secondary/tertiary packaging. Due to rounding errors, the total weights in this table do not agree exactly with the sum of component weights.

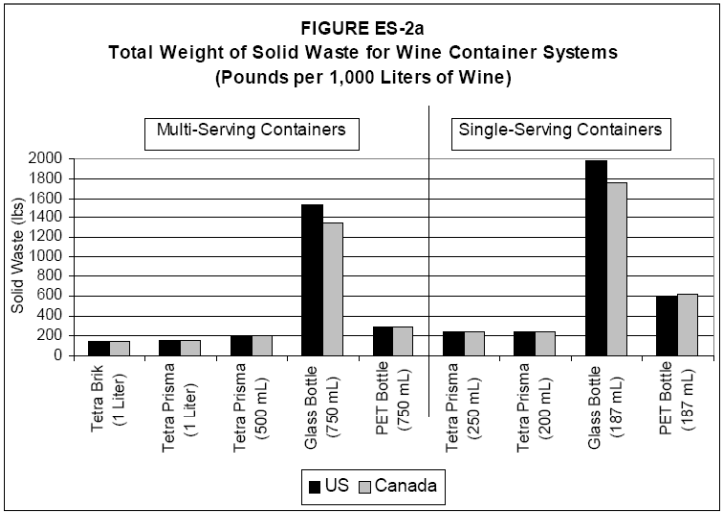
(2) Total weight per liter expresses the weights of all container systems in this table on the basis: the delivery of 1 liter of wine.

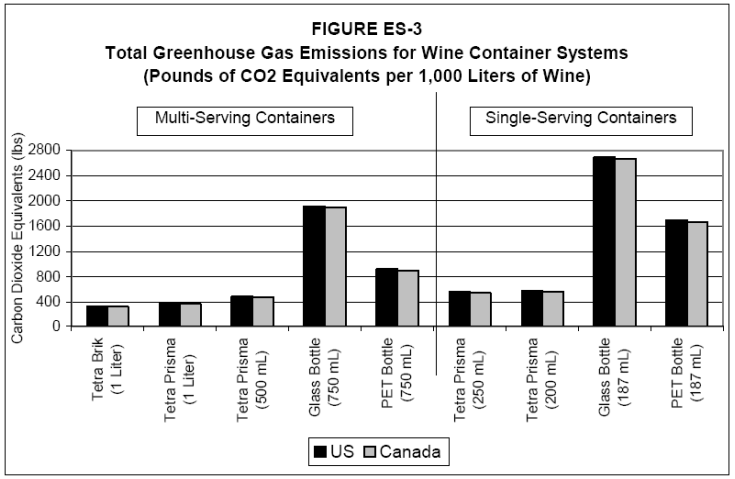
(3) The weights of closures for some systems account for a negligible percentage of total system weight and are thus not included in this analysis.

	Bag, spout, and tap weight	Box weight	Secondary and Tertiary Packaging	Total weight per container	Total weight per liter
Bag-in-Box Systems					
DuraShield / FlexiTech (3 liter)	37.7	154.2	45.0	236.9	79.0
HyBar / FlexiTech (3 liter)	37.7	154.2	45.0	236.9	79.0

Wine BIB - continue (reference 6):





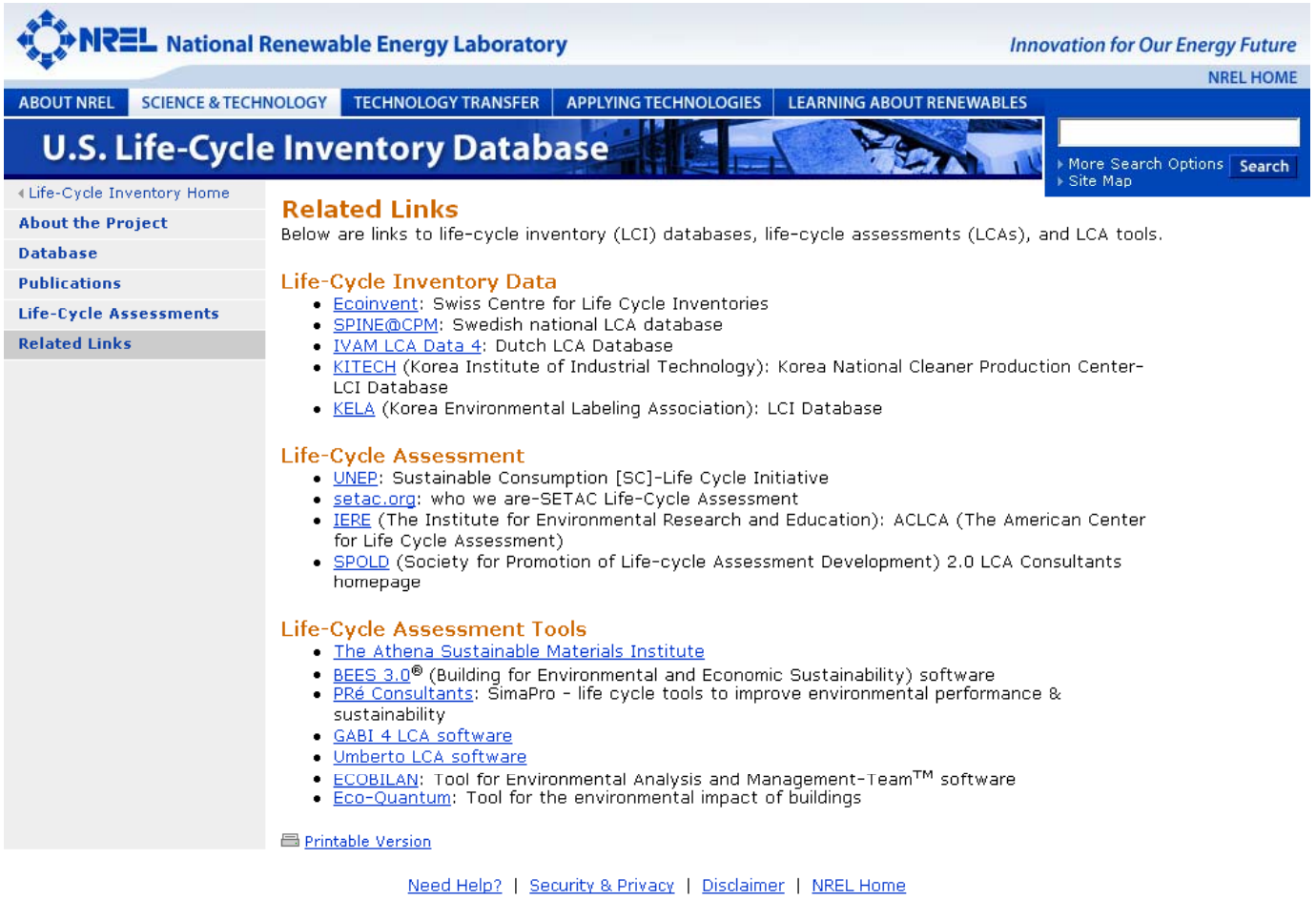


	Energy Million BTU per 1,000 Liters of Wine	Solid Waste Pounds per 1,000 Liters of Wine	GWP Pounds of CO_2 Equivalents per 1,000 Liters of Wine
3-L BIB	3.38 – 3.43	143	248 – 256
Tetra	3.26 – 5.38	143 – 244	333 – 571
PET	8.17 – 15.4	286 – 593	922 – 1,699
Glass	10.8 – 16.7	1,545 – 1,988	1,916 – 2,690

Wine BIB - continue:

- BIB is green, but how do we make it greener?
  - Weight is king.
    - Bag and box dimensions.
      - Bag: length, width, and thickness
      - Box: length, width, height, and thickness
    - Often requires technical creativity and the use of higher performance materials to maintain package performance (i.e. no leakers / quality preservation).
    - Simply put, sustainability must be balanced with function.
  - Bigger is (usually) better.
    - 5-L BIB is greener than 3-L BIB.

Additional helpful information (reference 7):



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Life-Cycle Inventory Data

- Ecoinvent: Swiss Centre for Life Cycle Inventories
- SPINE@CPM: Swedish national LCA database
- IVAM LCA Data 4: Dutch LCA Database
- KITECH (Korea Institute of Industrial Technology): Korea National Cleaner Production Center-LCI Database
- KELA (Korea Environmental Labeling Association): LCI Database

Life-Cycle Assessment

- UNEP: Sustainable Consumption [SC]-Life Cycle Initiative
- setac.org: who we are-SETAC Life-Cycle Assessment
- IERE (The Institute for Environmental Research and Education): ACLCA (The American Center for Life Cycle Assessment)
- SPOLD (Society for Promotion of Life-cycle Assessment Development) 2.0 LCA Consultants homepage

Life-Cycle Assessment Tools

- The Athena Sustainable Materials Institute
- BEES 3.0® (Building for Environmental and Economic Sustainability) software
- PRé Consultants: SimaPro - life cycle tools to improve environmental performance & sustainability
- GABI 4 LCA software
- Umberto LCA software
- ECOBILAN: Tool for Environmental Analysis and Management-Team™ software
- Eco-Quantum: Tool for the environmental impact of buildings

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