

Comparison of Global Warming Potential and Energy Demand of Eco-Flexx and PVC Billboard Flex

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Summary

Based on global warming potential and energy demand associated with production of the major constituents of the two billboard materials, Eco-Flexx has a global warming potential that is 64% less than that of PVC flex and energy demand that is 61% less, as shown in Figure 1.

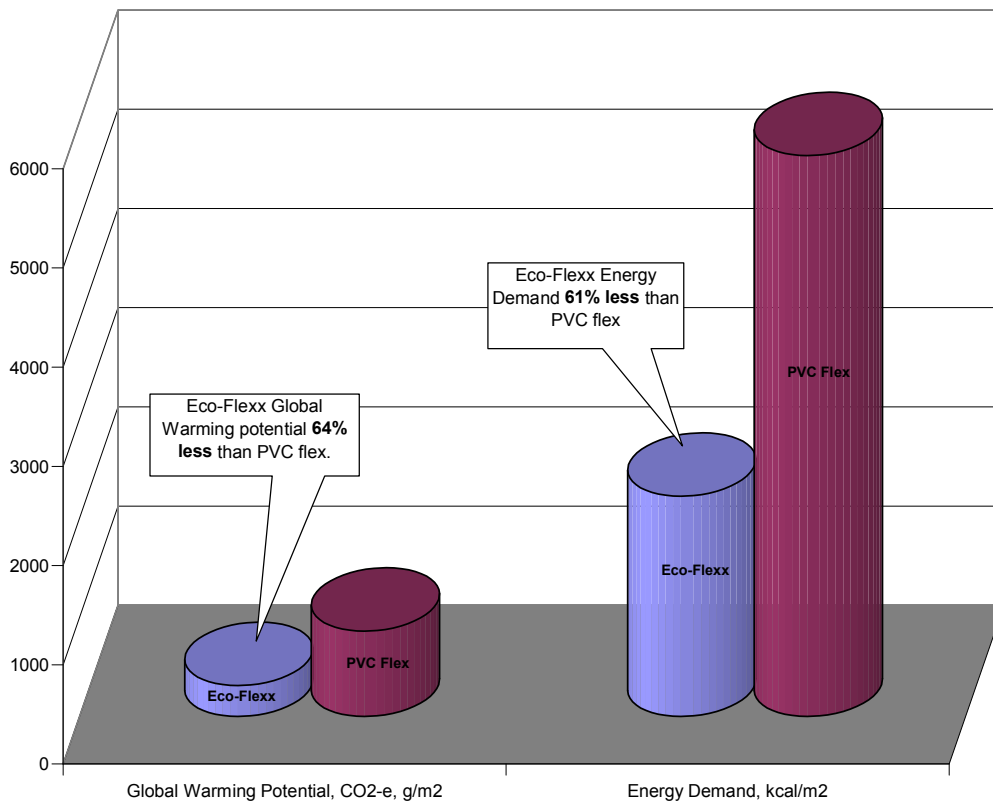


Figure 1: Energy Demand and Global Warming Potential of Eco-Flexx and PVC Flex

Composition of Eco-Flexx and PVC Flex

Eco-Flexx is made of high density polyethylene (HDPE) tapes that are coated on one side with low density polyethylene (LDPE), and it has a weight of 120 g/m².¹ In the absence of exact data, it is assumed in this paper that 1) Eco-Flexx consists of a 1:1 ratio of HDPE and LDPE, and 2) the weight of any additives is negligible.

PVC flex consists of polyester fiber coated with flexible polyvinyl chloride (PVC) plastic. PVC flex weighs 425.2 g/m², with the polyester fiber contributing 78.0 g/m² and the PVC plastic, which consists of PVC resin, phthalate plasticizer and other additives, contributes 347.2 g/m².² In this paper, the average phthalate content of the PVC plastic in PVC flex is assumed to be 37.2 percent by weight, the mean of the values reported by OECD.³ At this concentration, the weight of the phthalate plasticizer in PVC flex is 129.2 g/ m² and that of PVC resin, 218.0 g/m². The weight of other additives is assumed to be negligible. To summarize:

Table 1: Weight of Major Components of Eco-Flexx and PVC Flex

	Weight, g/m ²
Eco-Flexx	
HDPE	60
LDPE	60
Total	120
PVC flex	
PVC resin	218.0
Phthalate	129.2
Polyester fiber	78.0
Total	425.2

Global Warming Potential and Energy Demand for Production of Polyethylene, Polyvinyl Chloride and Phthalates

PlasticsEurope, formerly the Association of Plastics Manufacturers, has assembled a comprehensive, publicly available compilation of data reported by operating polymer production facilities in their series, Eco-Profiles of the European Plastics Industry. Among the data

¹ Information provided by Circle Graphics, Inc.

² Cooley Frontlit Flex 2007

³ OECD 2004

presented in these reports are energy demand and global warming potential, expressed as carbon dioxide equivalents (CO₂-e), for production of high-volume plastic resins. Shown below in Table 1 are the values reported for production of polyvinyl chloride (PVC), high density polyethylene (HDPE) and low density polyethylene (LDPE).

Table 2: Energy Demand and Global Warming Potential for the Production of PVC, HDPE and LDPE

	Energy demand, MJ/kg	CO₂-e, mg/kg (20 year equiv.)	Reference
PVC	65.86	2,700,000	4
HDPE	76.71	2,500,000	5
LDPE	78.08	2,700,000	6

The European Council for Plasticisers and Intermediates prepared a similar report for production of phthalates, which are used as plasticizers in PVC products. According to this report, energy demand for phthalate production is 71.9 Megajoules per kilogram (MJ/kg). Associated emissions of greenhouse gases are shown below in Table 2, along with their global warming potential factors and carbon dioxide equivalents (CO₂-e).

Table 3: Greenhouse Gas Emissions and Associated Global Warming Potential for the Production of Phthalates

Phthalates	Greenhouse Gas	Air emissions, mg/kg⁷	Global warming potential factor, 20 year equivalent⁸	CO₂-e, mg/kg
	CO ₂	1,836,300	1	1,836,300
	CH ₄	4,618	56	258,608
	N ₂ O	3	280	840
			Total	2,095,748

Energy Demand and Global Warming Potential of Eco-Flexx and PVC Flex

⁴ Ostermayer and Giegrich 2006

⁵ Boustead 2005a

⁶ Boustead 2005b

⁷ Ecobilan 2001

⁸ U.S. Environmental Protection Agency 2002

Included in Table 4 are energy demand and global warming potential of the major constituents of Eco-Flexx and PVC flex. These values are derived from data collected from facilities that produce these materials and compiled as described earlier in this paper.

Table 4: Energy Demand and Global Warming Potential of the Production of Eco-Flexx and PVC Flex

	Energy Demand		Global Warming Potential, CO ₂ -e g/m ²
	MJ/m ²	Kcal/ m ² ⁹	
Eco-Flexx			
HDPE (60 g/m ²)	4.60	1098.7	150
LDPE (60 g/m ²)	4.69	1120.2	162
Total	9.29	2218.9	312
PVC Flex			
PVC resin (218 g/m ²)	14.37	3432.2	588.6
Phthalate (129.2 g/m ²)	9.29	2218.9	271.3
Total	23.66	5651.1	859.9

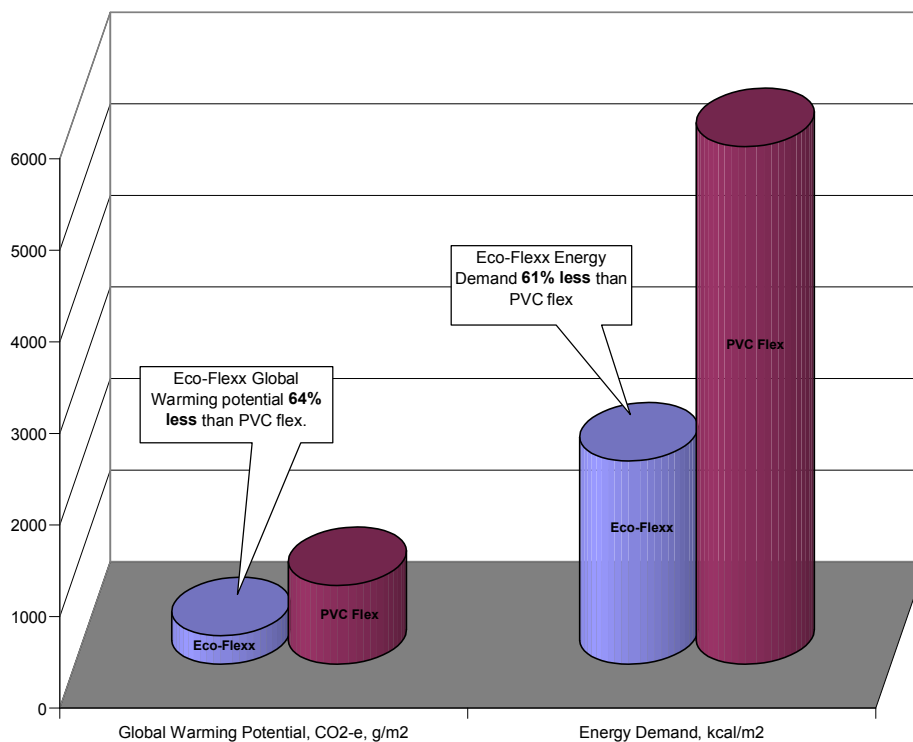


Figure 2: Energy Demand and Global Warming Potential of Eco-Flexx and PVC Flex

As these data show, energy demand and global warming potential associated with production of the major constituents of Eco-Flexx are markedly smaller – 61% and 64% less, respectively -- than for those of PVC flex.

⁹ Energy demand is expressed as MJ/m² as well as Kcal/m² for ease of graphing.

References

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