



Fence Energy & Carbon Emissions Footprint

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Introduction

The fencing industry is \$6.6 billion in revenue and growing at 4% p.a.

Fence Materials: Brick, Concrete, PVC, Steel, Wood, Trex

Fence Dimensions:

Height: 1.8 meters

Length: 100 meters

Life: 100 years

Safety Factor for bricks/cement = 1.1/1.3

Transportation footprint:

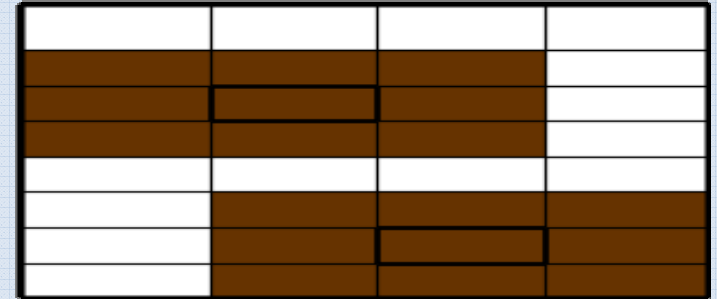
Energy: 1.0 MJ/tonne.km

CO₂: 2.89E-04 kg/kg.km

Brick Fences

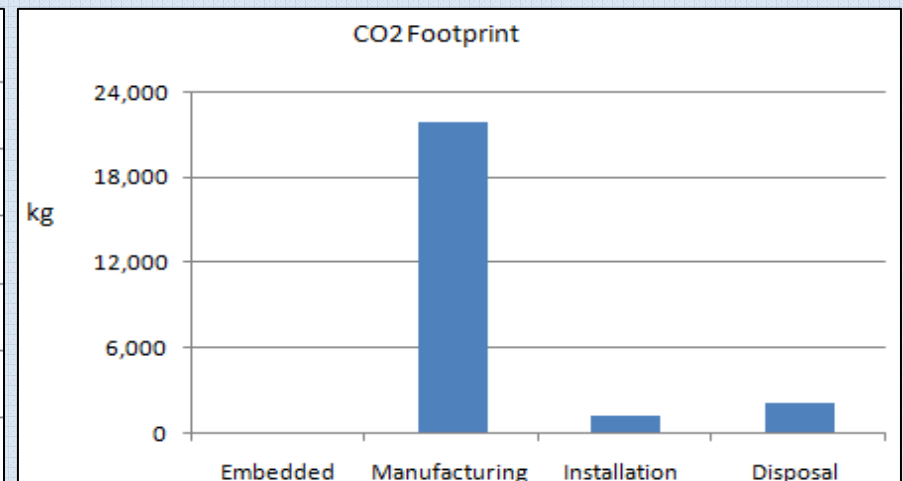
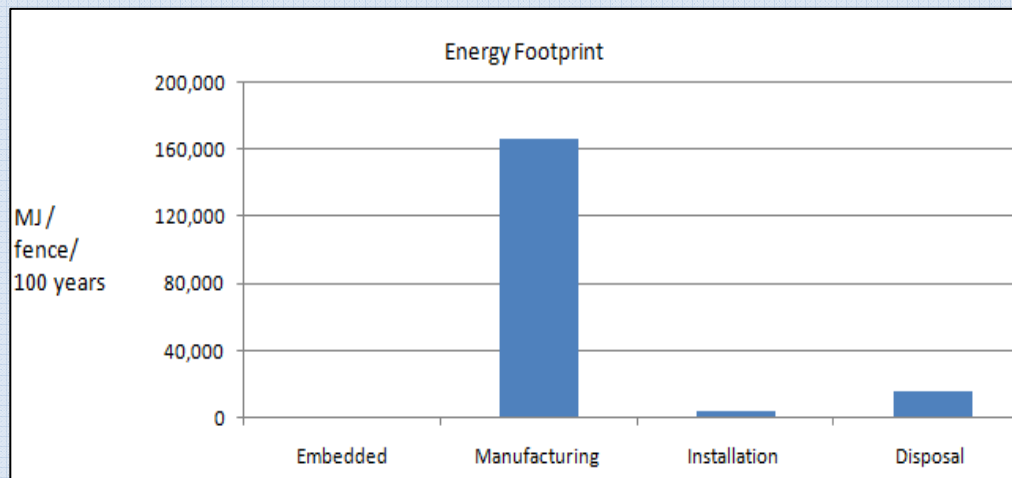
Fence Characteristics:

- Thickness = 1 brick = 10.2 cm
- 5mm of cement on each side of brick
- Transport Distance: 124 km from Illinois Brick Company, IL
- Fence Lifetime: 100 years



Material	Density (kg/m ³)	Embedded & Manufacturing Energy (MJ/kg)	Primary & processing CO2 production (kg/kg)	Amount Needed (kg)	Transport Distance (km)
Brick	1850	2.0	0.15	33,524	124
Cement	2000	8.3	1.40	11,963	30

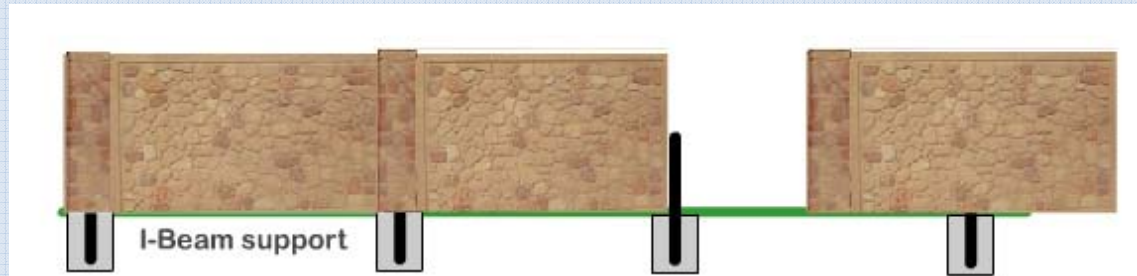
Brick Fence	Embedded	Manufacturing	Installation	Disposal
Energy (MJ/fence/100 years)	0	166,342	4,241	16,634
CO2 (kg/fence/100 years)	0	21,777	1226	2,177



Concrete Fences

Fence Characteristics:

- 23 Panels
 - Thickness = 20.3 cm
 - Width= 4.7 m
- 23 Posts
 - Cross-sectional area = 160 cm²
 - Post height=2.4 m
- Large concrete panels supported by steel I-beams posts in poured concrete
- Transport distance: dependent on location of closest production facilities
- Fence Lifetime: 100 years

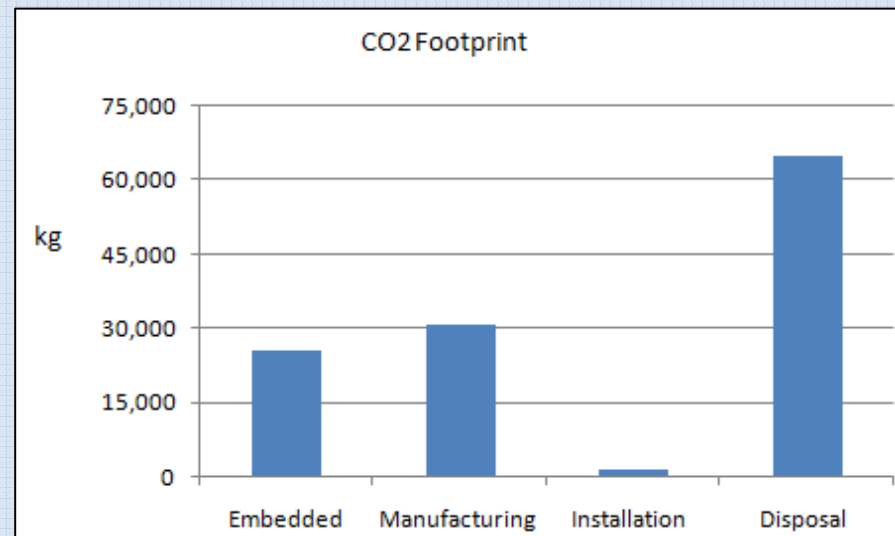
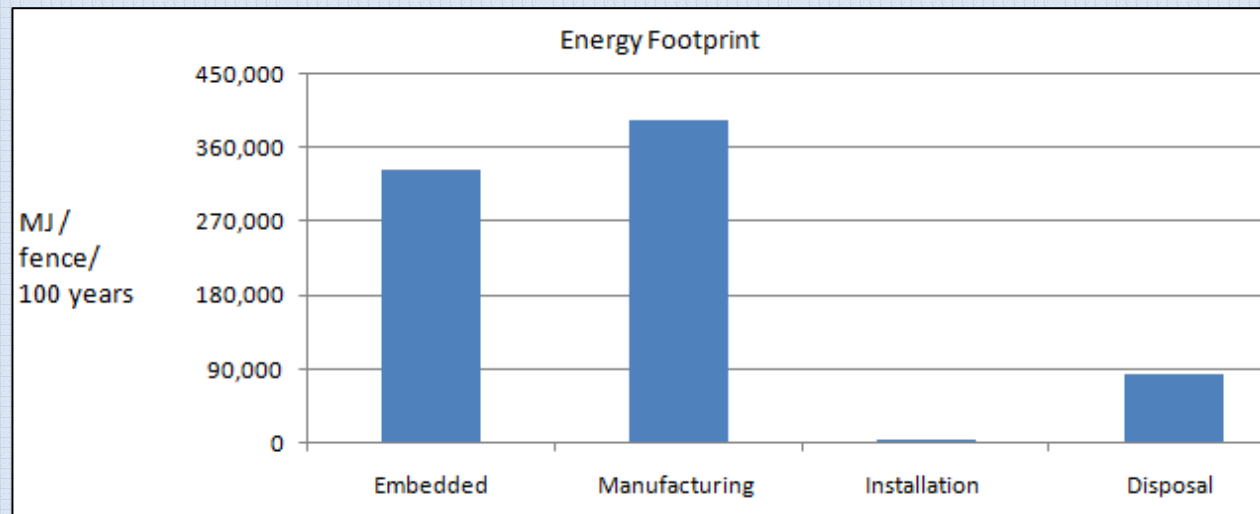


Material	Density (kg/m ³)	Embedded & Manufacturing Energy (MJ/kg)	Primary & processing CO2 production (kg/kg)	Amount Needed (kg)	Transport Distance (km)
Concrete (panels)	1479	2.0	0.16	71,120	68
Concrete (poured)	1500	2.0	0.16	1,182	109
Steel 1080	7800	82.6	6.36	7,750	35

Concrete Fence	Production	Manufacturing	Installation	Disposal
Energy (MJ/fence/100 years)	334,765	393,600	5,169	85,291
CO2 (kg/fence/100 years)	25,469	30,834	1,493	64,454

Concrete Fences

Energy & CO₂ impact



PVC Fences

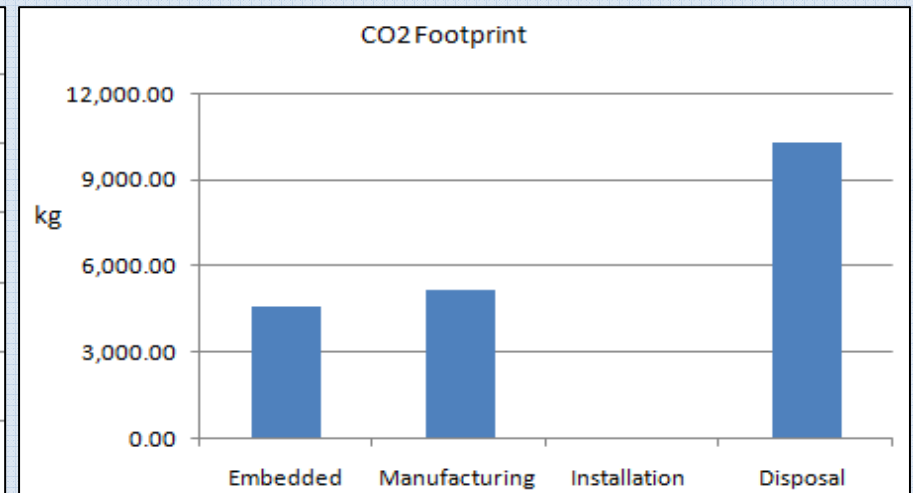
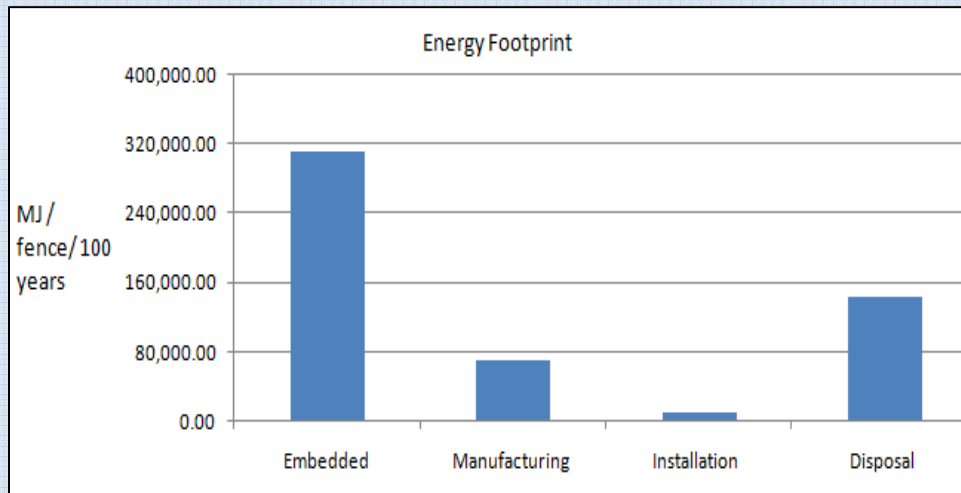
Fence Characteristics:

- Post= 2.7 meters
- Wall thickness= 2.54 cm
- Transport Distance: 74 km from Spears PVC, IL
- Fence Lifetime: 25 years



Material	Density (kg/m ³)	Embedded & Manufacturing Energy (MJ/kg)	Primary & processing CO ₂ production (kg/kg)	Amount Needed (kg)	Transport Distance (km)
PVC	1300	65.3	0.80	4,699	74
Concrete	1800	1.1	0.17	5,185	30

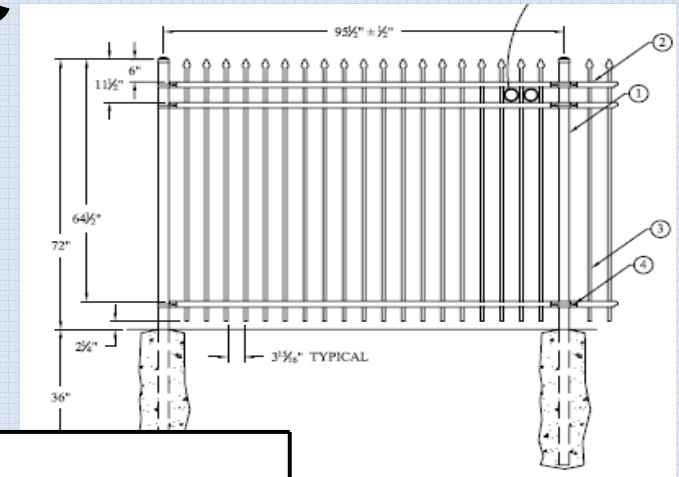
PVC Fence	Embedded	Manufacturing	Installation	Disposal
Energy (MJ/fence/100 years)	312,548	70,500	10,800	145,000
CO₂ (kg/fence/100 years)	4,558	5,171	29	10,300



Steel Fence

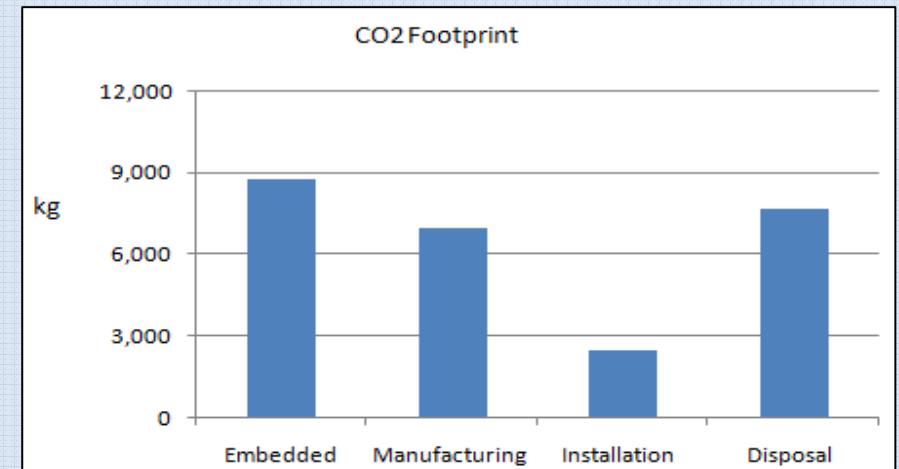
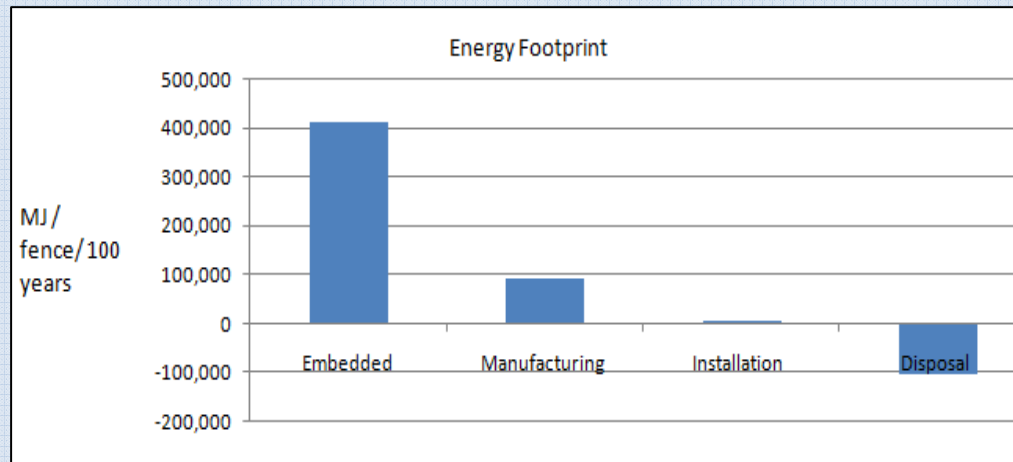
Fence Characteristics:

- Transport distance: 702 km form Ameristar Fencing, OK
- Lifetime: 75 years



Material	Density (kg/m ³)	Embedded & Manufacturing Energy (MJ/kg)	Primary & processing CO2 production (kg/kg)	Amount Needed (kg)	Transport Distance (km)
Steel	7806	33.3	2.76	9,146	702
Zinc	7141	72.1	3.97	46	702
Concrete	1800	1.1	0.17	2,340	30

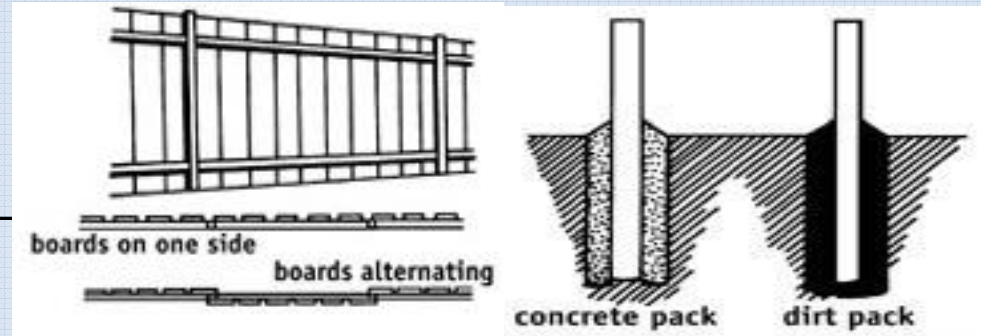
Steel Fence	Embedded	Manufacturing	Installation	Disposal
Energy (MJ)	413,972	91,920	8,720	-101,192
CO2 (kg)	8,720	6,986	2,520	7,683



Wooden Fence

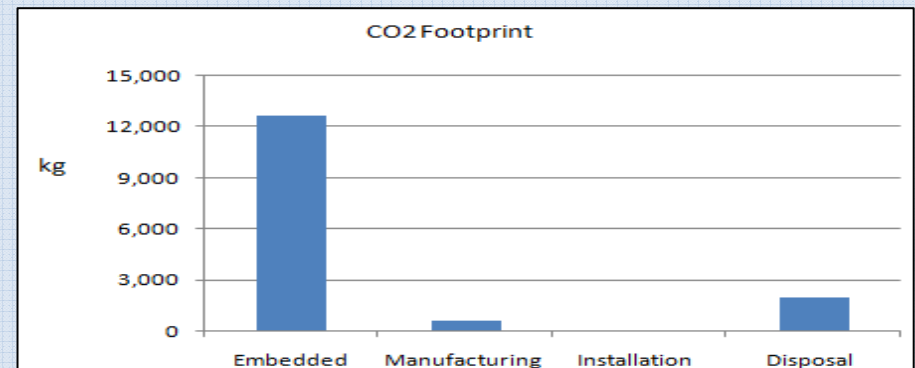
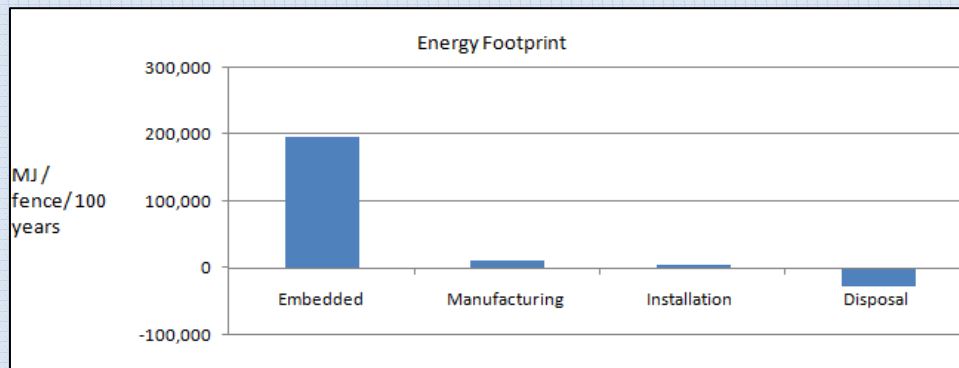
Fence Characteristics:

- Wall thickness = 10 cm Posts, Rails & 2.5 cm planks
- Transport Distance: 30 km from Georgia-Pacific, IL
- Fence Lifetime: 15 years



Material	Density (kg/m ³)	Embedded & Manufacturing Energy (MJ/kg)	Primary & processing CO ₂ production (kg/kg)	Amount Needed (kg)	Transport Distance (km)
Wood	520	8.0	0.46	3598	30
Concrete	1800	1.1	0.17	1800	30

Wood Fence	Embedded	Manufacturing	Installation	Disposal
Energy (MJ/fence/100 years)	196,399	12,321	4,551	-26,959
CO ₂ (kg/fence/100 years)	12,608	632	43	1,936



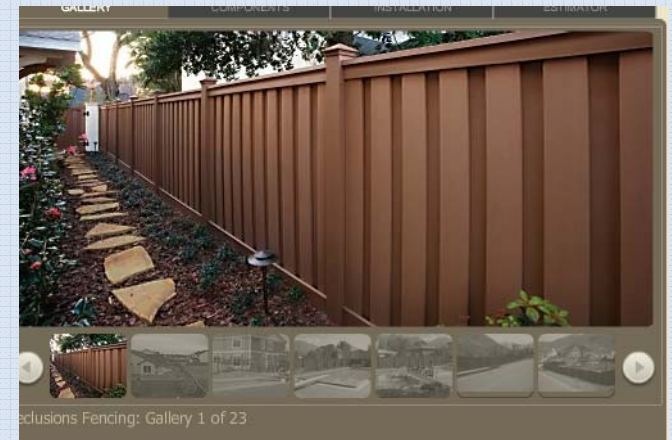
Trex Fence

Trex Characteristics:

- 45% PE and 55% Wood fibers
- Transport distance: 1207 km from Trex factory, VA

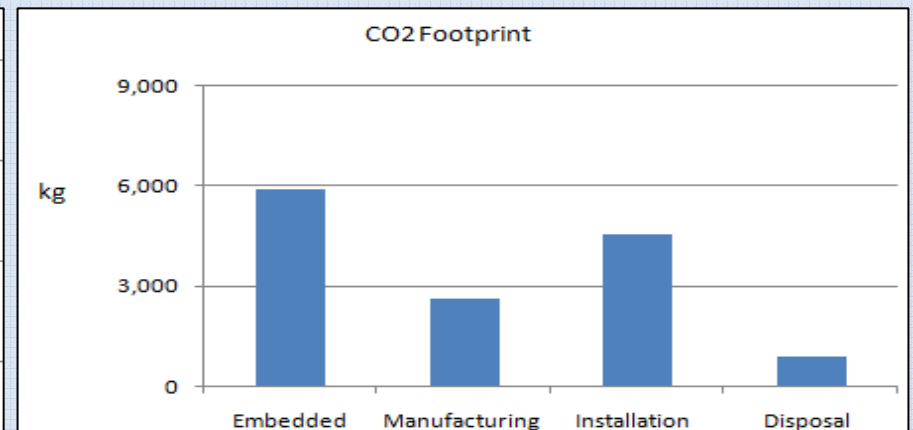
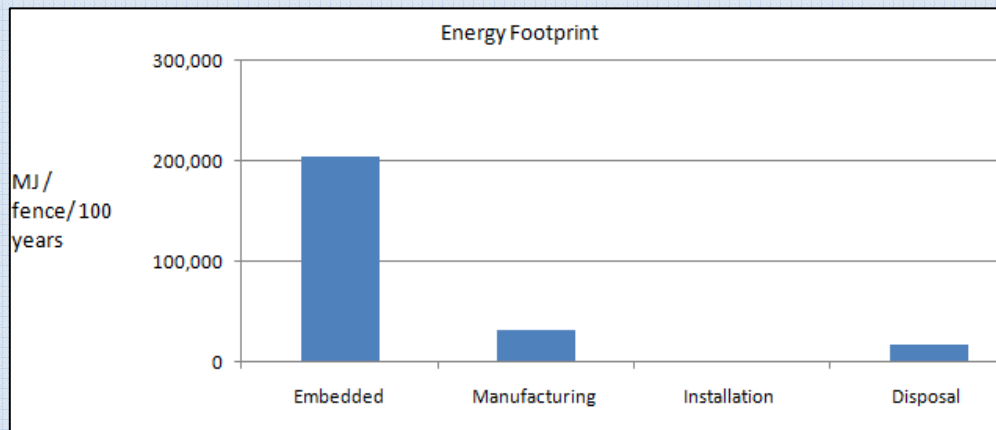
Fence Characteristics:

- Same structure as wooden fence.
- Fence life = 25 years



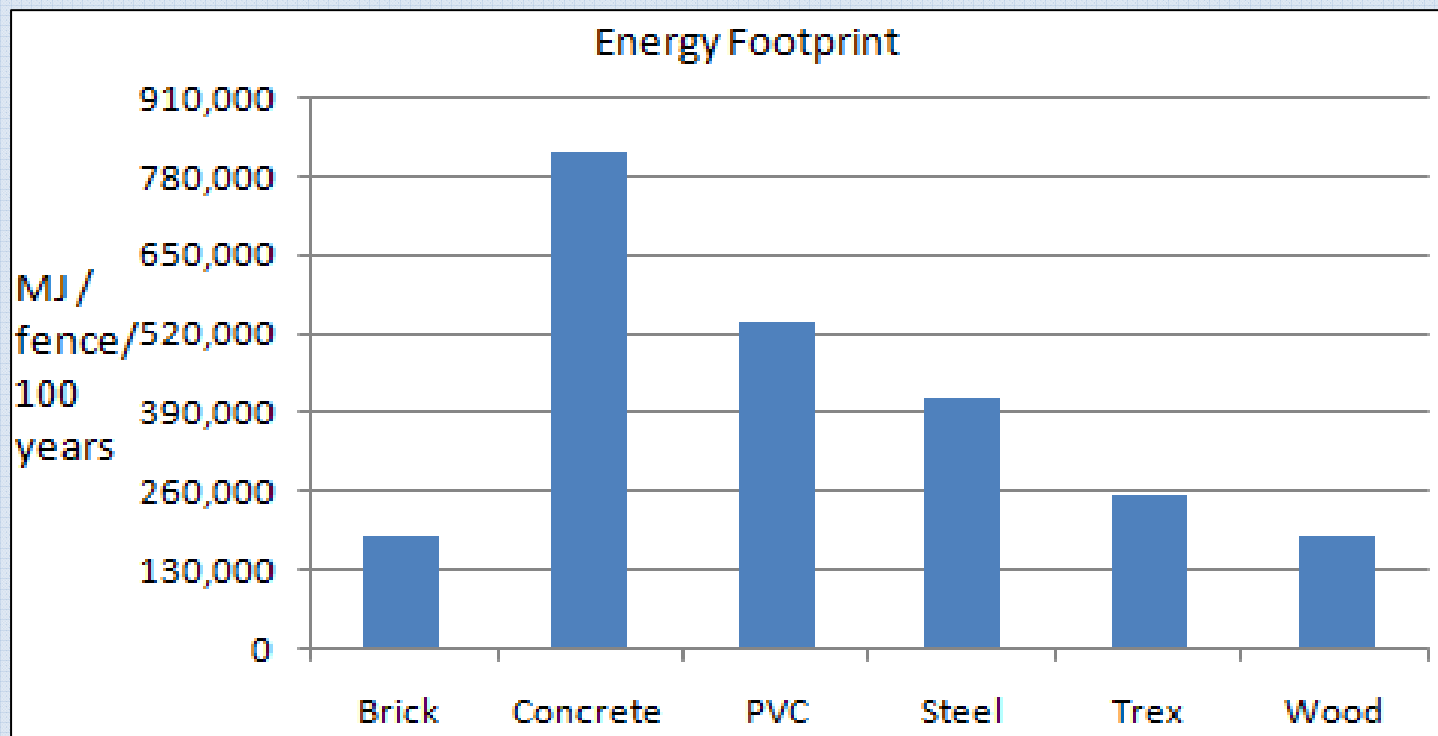
Material	Density (kg/m ³)	Embedded & Manufacturing Energy (MJ/kg)	Primary & processing CO2 production (kg/kg)	Amount Needed (kg)	Transport Distance (km)
Trex	714	64.0	2.03	898	1207
Concrete	1800	1.1	0.17	1,800	30

Trex Fence	Embedded	Manufacturing	Installation	Disposal
Energy (MJ/fence/100 years)	205,120	32,723	1,288	17,128
CO2 (kg/fence/100 years)	5,897	2,618	4,551	914



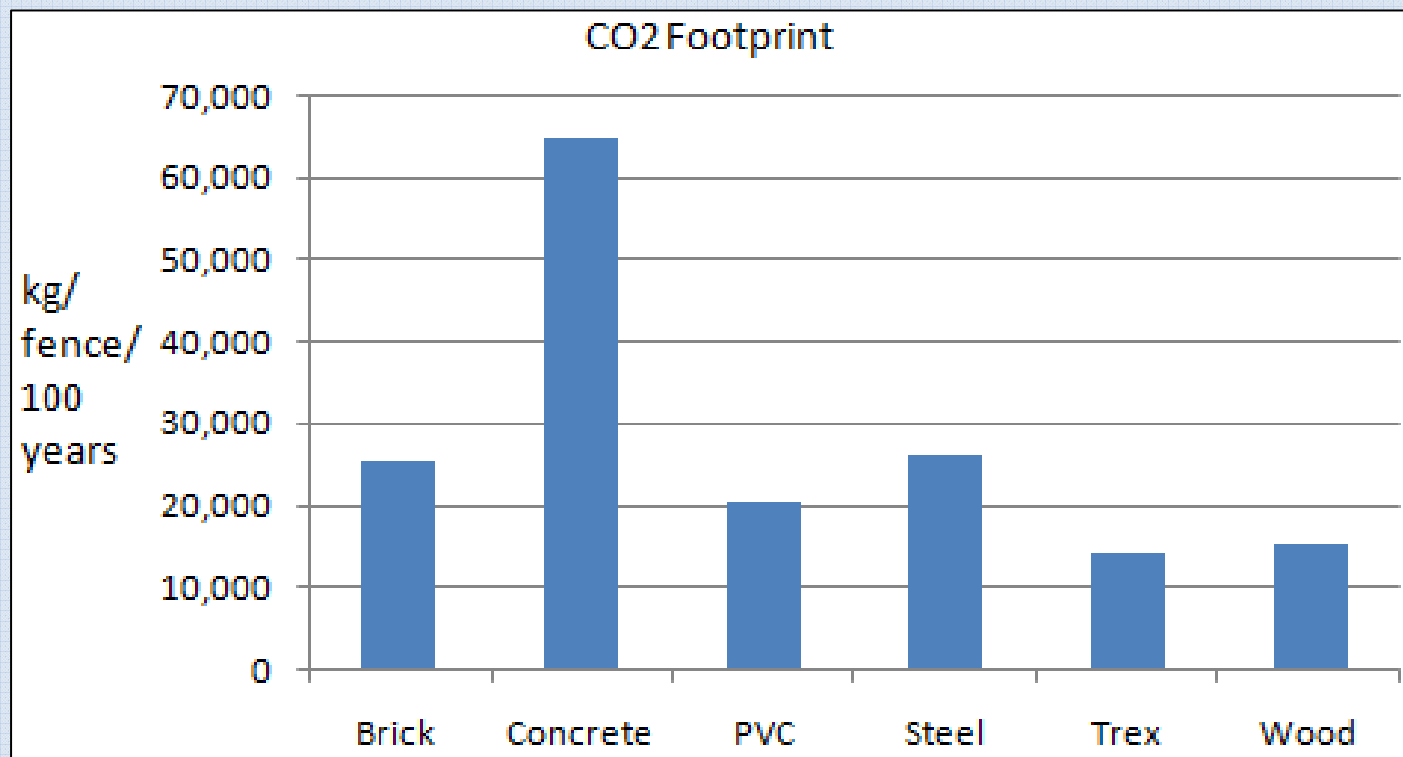
Net Energy Footprint

	Brick	Concrete	PVC	Steel	Trex	Wood
Energy (MJ/fence/100 years)	187,217	818,824	538,848	413,420	256,259	186,312



Net CO₂ Footprint

	Brick	Concrete	PVC	Steel	Trex	Wood
CO ₂ (kg/fence/100 years)	25,180	64,455	20,058	25,909	13,980	15,219



Analysis & Conclusions

- Wooden and Brick fences are the best options
- Concrete fences have a high footprint
- Trex fences have a high footprint partly attributable to longer shipping distance

Questions