The Carbon Impact of Wood Processing

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TABLE 4. *Cradle-to-gate, cumulative energy[1] (MJ/m^3) allocated to one cubic meter of structural wood products manufactured in the Pacific Northwest (PNW) and Southeast (SE) regions. Electricity production is included.*

	PNW					SE				
	Glulam	Lumber, KD	Lumber, green	LVL	Plywood	Glulam	Lumber, KD	LVL	Plywood	OSB
	MJ/m^3					MJ/m^3				
Harvesting	147	143	139	148	148	213	203	189	206	217
Product manufacturing	4,650	3,415	295	3,670	2,700	5,056	3,175	4,700	4,227	7,412
Resin production	409	0	0	755	699	584	0	1,048	1,021	3,126
Transportation[2]	161	147	113	112	90	391	114	219	196	390
TOTAL	5,367	3,705	548	4,684	3,638	6,244	3,492	6,156	5,649	11,145

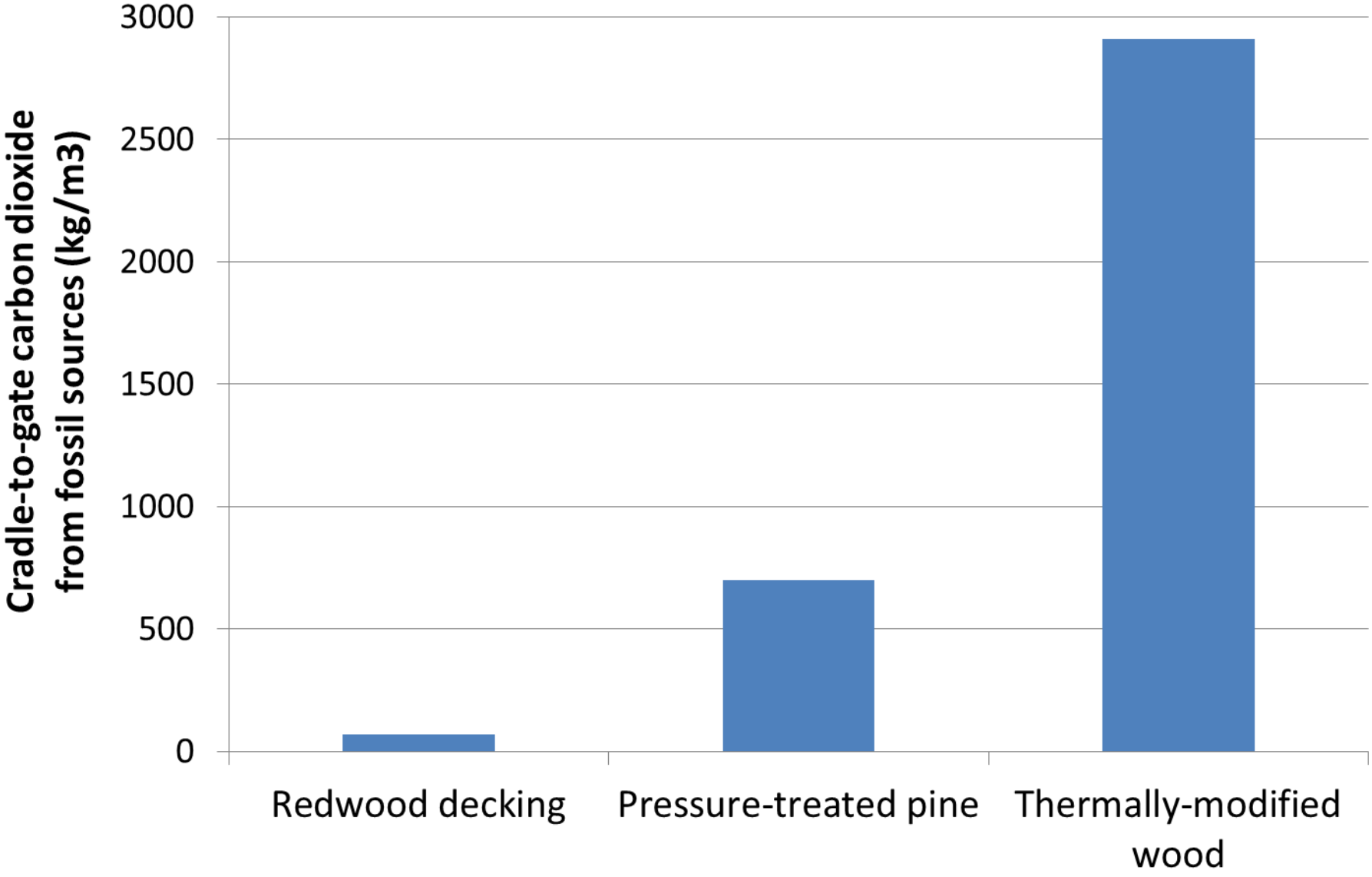
[1] Energy values were determined for the fuel using their higher heating values (HHV) in units of MJ/kg as follows: coal 26.2, diesel 44.0, liquid petroleum gas 54.0, natural gas 54.4, crude oil 45.5, oven dry wood 20.9, and gasoline 48.4. Energy from uranium was determined as 381,000 MJ/kg and electricity at 3.6 MJ/kWh.

[2] Transportation of logs and other materials to production facilities.

			MJ/m					MJ/m		
Coal	210	92	49	198	132	854	356	857	676	1,270
Crude oil	534	361	274	706	486	916	337	812	756	1,883
Natural gas	1,957	1,447	108	1,559	898	2,013	279	2,156	1,536	3,809
Uranium	30	7	4	15	10	84	35	63	50	114
Biomass	2,258	1,595	0	1,741	1,800	2,344	2,473	2,205	2,573	3,951
Hydropower	376	200	111	459	308	21	4	45	43	98
Electricity other	2	3	2	7	5	11	8	18	15	20
TOTAL	5,367	3,705	548	4,684	3,638	6,244	3,492	6,156	5,649	11,145

Puettmann and Wilson 2005

Carbon impact of various wood decking options



The wood product
carbon impact equation

A-B-C-D = E

Carbon Impacts of Wood Products			A	B	C	D		A-B-C-D = E
Product	**Units & Notes**		**Carbon[1] released during manufacture**	**Carbon from bio-fuel used in manufacturing** (wood energy)	**Carbon stored in the wood product**	**Substitution carbon** (fossil carbon emissions avoided by using the wood instead of an alternative)		**TOTAL CARBON FOOTPRINT** (Negative values represent a carbon credit)
							Alternative	
Hardwood lumber	One board foot (12"x12"x1")	NE/NC region	0.9	0.6	1.8	2.6	PVC (plastic) molding	-4.2
		Southeast region	1.1	0.8	1.8	2.6		-4.1

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		Southeast region	1.1	0.8	1.8	2.6		-4.1
Softwood lumber	One 2x4 'stud'	NE/NC region	1.8	1.2	6.6	7.0	steel stud	-13.0
		Southeast region	3.9	3.3	8.4	7.0		-14.9
Hardwood flooring	1 ft^2	Solid strip flooring	1.1	0.7	2.1	0.0	vinyl	-1.8
		Engineered wood	1.0	0.5	1.1	-0.1		-0.5
Doors	One door	Solid wood	46.5	29.4	100.4	228.1	steel door	-311.5
Decking	One deck board	ACQ- treated pine	5.2	1.7	16.1	11.9	wood-plastic composite	-24.5
Siding	100 ft^2	Western redcedar	37.7	6.0	77.7	20.4	vinyl	-66.3
Wood treated poles	One 45' pole	Pentachlorophenol-treated wood	454.5	430.9	1160.4	1377.1	concrete pole	-1136.8
OSB	One 4' x 8' sheet 3/8"	Southeast region	19.0	10.7	34.7	-	n/a	-26.3
Plywood	One 4' x 8' sheet 3/8"	PNW	5.7	4.1	25.5	-	n/a	-23.9
		Southeast region	10.1	6.5	30.9	-	n/a	-27.3
I-joist	One 16' long, 10" deep joist	PNW	22.8	18.9	63.9	56.4	steel joist	-59.9
		Southeast region	33.0	22.9	80.0	55.0		-70.0

[1] All "carbon" values are kilograms of CO2. To convert from CO2 to elemental carbon, muliply by 0.27. For comparison, a car produces 8.8 kg of CO2 when it burns one gallon of gasoline.

CARBON IMPACTS OF WOOD PRODUCTS

www.renewablecarbon.org/PDF/CIWPweb.pdf

Minneapolis House

Atlanta House

Table 1 – Environmental performance indices for residential construction.

	Wood frame	Steel frame	Difference	Steel vs. wood (% change)		Wood frame	Concrete frame	Difference	Concrete vs. wood (% change)
Minneapolis house					**Atlanta house**				
Embodied energy (GJ)	651	764	113	17%	Embodied energy (GJ)	398	461	63	16%
Global warming potential (CO_2 kg)	37,047	46,826	9,779	26%	Global warming potential (CO_2 kg)	21,367	28,004	6,637	31%
Air emission index (index scale)	8,566	9,729	1,163	14%	Air emission index (index scale)	4,893	6,007	1,114	23%
Water emission index (index scale)	17	70	53	312%	Water emission index (index scale)	7	7	0	0%
Solid waste (total kg)	13,766	13,641	-125	-0.9%	Solid waste (total kg)	7,442	11,269	3,827	51%

Lippke and Wilson 2004

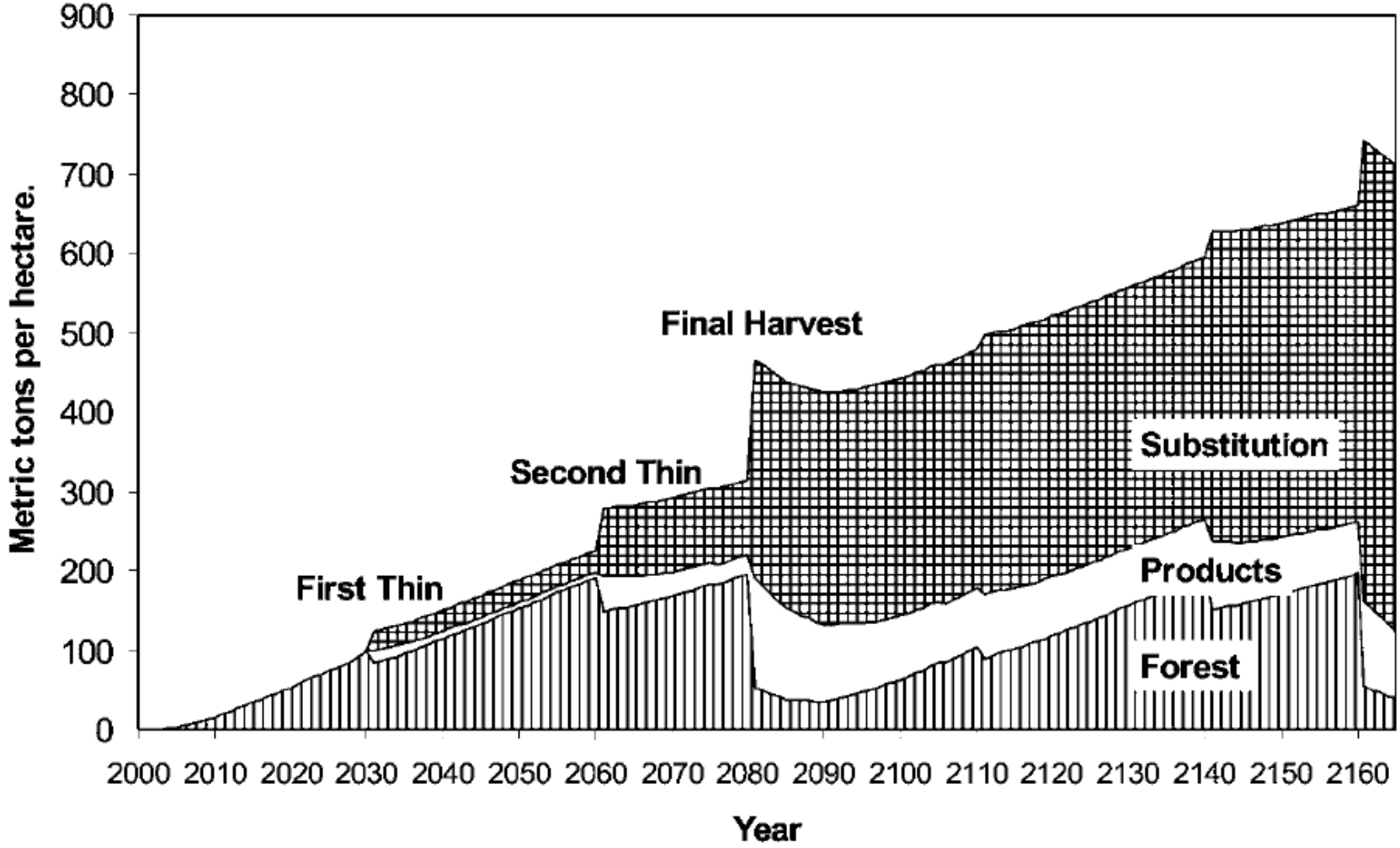

FIG. 2. Carbon in the forest and product pools with concrete substitution for the 80-year rotation.

Perez-Garcia *et al.* 2005

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