PREMIER SIPS
STRUCTURAL INSULATED PANELS

SIPS LIFE CYCLE ANALYSIS

STRUCTURAL INSULATED PANEL IMPACT

Building account for 76% of electricity use and 40% of all U. S. primary energy use and associated greenhouse gas (GHG) emissions. Making it essential to reduce energy consumption in buildings in order to meet national energy and environmental challenges. Premier SIPS EPS Standard & GPS MAX solid insulation cores help drive this reduction by:

- Lowering energy consumption and reducing CO2 emissions (CO2 measures the total green house gas emissions)
- Being naturally inert and stable
- Not producing contaminating leachates
- Being free of CFC, HCFC and HFC, all of which are harmful to the earth's ozone layers

SIPS ENVIRONMENTAL ADVANTAGE: A GAME-CHANGING ENERGY-SAVING SOLUTION

Premier SIPS deliver substantial reductions in greenhouse gas emissions and offer superior insulation with minimal air leakage, outperforming traditional stick framing and fiberglass batt insulation building envelope assemblies. This Environmental Profile, based on a life cycle analysis,* reveals SIPs' remarkable potential in enhancing thermal performance and combating global warming. The results make a compelling case for SIPs, showing their power to create more efficient, comfortable, and sustainable homes and buildings.

PERFORMANCE MODEL

To demonstrate the attributes and performance of SIPs with EPS insulation in comparison to traditional stick-framed construction, a representative single-family home served as the model. The total insulated wall area for this home model was 1,791 sq. ft.

In the stick-framed home, construction involved 2x6 dimensional lumber spaced 24 inches apart, R-19 fiberglass insulation, a vapor barrier, and 7/16" OSB sheathing. Meanwhile, the SIP home was built using 6-1/2" SIPs featuring an EPS core and dimensional lumber plating.

Both homes were externally clad with wood siding and internally finished with 1/2" gypsum drywall. The study aimed to assess the environmental impact of using SIPs as an alternative to traditional stick-framed walls.

THE ENERGY & EMISSIONS EQUATION

In the creation of all manufactured items, energy is a fundamental requirement, with the majority of this energy currently stemming from the burning of fossil fuels. SIPs consist of EPS or GPS MAX solid core insulation, oriented strand board structural wood facings, and a minor amount of structural adhesive. The production of SIPs necessitates the use of fossil fuels in the creation of components, processing, finishing, and transportation, resulting in the emission of greenhouse gases. This amalgamation of energy and emissions can be referred to as the "investment."

When SIPs are incorporated into a building, they substantially augment wall R-values, minimize air leakage, and, as a result, conserve energy. This leads to a decrease in greenhouse gas emissions throughout the building's operational lifespan. These savings and emissions reductions can be considered as the "dividend" or return on investment (ROI) derived from the energy expended and emissions generated during the product's production and delivery.

The life cycle assessment, which evaluated energy and emissions linked to SIPs' production and delivery, encompassed all phases in the process, from raw material extraction to component production, wall assembly, and transportation to the construction site. Calculations regarding energy and emissions reduction encompassed electricity and natural gas consumption for heating and cooling over a 50-year period. Notably, the study did not account for the nominal energy used in product installation, building demolition, or the disposal or recycling of construction waste.

SIPS INNOVATION DELIVERS

The findings from this SIP Life Cycle Analysis underscore the remarkable advantages of using SIPs compared to traditional stick framing for homes in the United States. Over a span of 50 years, on average, the energy savings were 9.9 times greater than the initial energy investment. This transition also translates to a reduction in global warming potential, equivalent to 13.2 times the emissions produced. In practical terms, this signifies an energy payback period of just 5.1 years, with greenhouse gas emissions recaptured in a mere 3.8 years when SIPs are employed for American homes.

Across the border in Canada, the analysis paints an even more impressive picture. Over five decades, the energy savings with SIPs compared to traditional stick framing were a staggering 18.6 times the initial energy input. This led to a reduction in global warming potential, equivalent to 18.2 times the CO_2 emissions produced. In this context, the energy invested is recouped in just 2.7 years, and greenhouse gas emissions are offset in the same period.

It's essential to note that the energy payback period is as low as 2.7 years in U.S. Zone 1 and a mere 1.4 years in the Northwest Territories of Canada. These numbers underscore a truly outstanding return on investment (ROI) from any perspective.

ACHIEVING SWIFT ENERGY PAYBACK

Energy invested is quantified in Btu's by considering the energy content in raw materials and the energy mix utilized during production and transportation, while energy saved is similarly measured in Btu's. This measurement is adjusted based on the fuel mix employed for heating and cooling within homes and the efficiency of the methods and appliances used.

The Global Warming Potential (GWP) is expressed in terms of equivalent units of CO2, encompassing emissions from fossil fuel CO2, methane, and nitrous oxide, with a consideration for the varying impact of each of these contributors.

LIFE CYCLE ASSUMPTIONS & METHODOLOGY

Product Representation: The 6-1/2" SIP was represented as a composition of 5-5/8" EPS insulation, two layers of 7/16" oriented strand board, and laminating adhesive. Additionally, the SIP wall included dimensional lumber plating. The stick-framed wall was depicted as a combination of 2X6 dimensional lumber, R-19 fiberglass insulation, a vapor barrier, and a single layer of 7/16" oriented strand board.

Raw Material Production: The production of EPS insulation relied on a Life Cycle Analysis performed by Franklin Associates, Inc. for the EPS Industry Alliance. Other components for both SIP and stick walls were modeled using the U.S. Life Cycle Index (LCI) Database and Franklin Associates' private LCI database.

Transportation: Calculations for fuel consumption and emissions during transportation were based on a full truckload of SIPs traveling an average distance of 300 miles to the construction site, with a fuel efficiency rating of 6.5 miles per gallon.

Energy Savings for Heating and Cooling: The thermal performance of the walls was assessed using Oak Ridge National Laboratory's Whole Wall R-Value Calculator. Radiant heat was considered when calculating heating and cooling loads for the walls. Additionally, heating, and cooling loads resulting from air infiltration were factored in. Air exchange rates for the walls were based on Manual J: Residential Load Calculation, Eighth Edition,

provided by the Air Conditioning Contractors of America. The stick wall was modeled with "average" air tightness, while the SIP wall was modeled as "tight."

CLIMATE MATTERS

The impact of insulation is influenced by the climate, and its advantages tend to be more significant in colder regions where substantial energy is consumed for heating. To define climate zones in North America, Heating Degree Days (HDD) and Cooling Degree Days (CDD) are typically employed, using a base temperature of 65°F. The annual HDD for a region is determined by summing the daily temperature differences between 65°F and the average daily temperature (ADT) on days when it falls below that benchmark.

For instance, if the ADT on March 14 is 58°F, it would contribute 7 HDD. This calculation is repeated for each day when the ADT is below 65°F, and the total yields the HDD for that region. Similarly, CDD is calculated for days when the ADT exceeds 65°F. The average performance for a U.S. home was established by considering the number of building permits issued in 2006 for single-family homes in each climate zone. This method offers an average weather condition based on the actual locations of home construction.

In the case of Canada, each Province and Territory was treated as a distinct region, with no calculation conducted for CDD because cooling energy consumption comprises less than 1% of the total energy used for heating homes in Canada. The average performance for a Canadian home was weighted using a similar approach to that used in the United States, considering building activity in each region.

Energy Savings Provided by using SIPS Single Family Homes - U.S.				Energy Investment		Millions Btu's
				SIP		177.1
				Stud Wall		110.4
				Add'l Energy Invested		66.7
Energy Savings (compared to Stud Walls)	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	U.S. Average
Conductive Energy Loss	4.2	3.6	3.0	2.3	2.4	2.7
Air Leakage Energy Loss	14.6	12.4	10.0	6.9	5.7	8.0
Total (including energy production & delivery)	24.8	20.7	16.8	11.2	8.6	13.2
Payback Period in Years	2.7	3.2	4.0	6.0	7.8	5.1
Savings Over 50 Years	1242	1037	839	562	431	660

Global Warming Potential (GWP) Reductions Provided by using SIPs Single Family Home - U.S.				GWP Investment		Tons CO^2 Eq.
				SIP		9.63
				Stud Wall		5.87
				Add'l Energy Invested		3.75
GWP Reductions (compared to Stud Walls)	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	U.S. Average
Total	1.83	1.49	1.25	0.84	0.67	0.99
Payback Period in Years	2.0	2.5	3.0	4.4	5.6	3.8
Savings Over 50 Years	91.4	74.4	62.3	42.1	33.6	49.6

Energy Savings Provided by using SIPS Single Family Homes - Canada				Energy Investment		Millions Btu's
				SIP		167.4
				Stud Wall		105.8
				Add'l Energy Invested		61.7
Energy Savings (compared to Stud Walls)	B.C	Alberta	Ontario	Quebec	N.W. Terr.	CAN Average
Conductive Energy Loss	2.8	4.8	3.4	4.3	7.8	4.0
Air Leakage Energy Loss	10.0	17.5	12.2	15.5	28.2	14.5
Total (including energy production & delivery)	15.8	27.5	19.3	24.4	44.4	22.9
Payback Period in Years	3.9	2.2	3.2	2.5	1.4	2.7
Savings Over 50 Years	791	1377	963	1218	2222	1145

Global Warming Potential (GWP) Reductions Provided by using SIPs Single Family Home - Canada				GWP Investment		Tons CO2 Eq.
				SIP		8.05
				Stud Wall		4.50
				Add'l Energy Invested		3.55
GWP Reductions (compared to Stud Walls)	B.C.	Alberta	Ontario	Quebec	NW Terr.	CAN Average
Total	0.89	1.55	1.09	1.37	2.51	1.29
Payback Period in Years	4.0	2.3	3.3	2.6	1.4	2.7
Savings Over 50 Years	44.6	77.7	54.3	68.7	125	64.6

* The Canadian (CAN) tables reflect a sample range of the Provinces and Territories evaluated. The CAN Average is the weighted average of all Provinces and Territories.

PREMIER SIPS

Website: premiersips.com **Toll Free:** 800-275-7086

PREMIER BUILDING SYSTEMS
FASTER. STRONGER. GREENER.™

 Ver. 11/23