# Dryvit Systems' EIFS Cladding Products

## Product Selection and Description

In 1969, Dryvit Systems, Incorporated, currently owned by RPM International Inc. of Medina, OH, introduced North America to its exterior wall cladding system with insulation installed as part of the outside wall. Since that time, Dryvit's Exterior Insulation and Finish Systems (EIFS) have been used on commercial and residential buildings in the United States..

Four of the most widely used Dryvit EIFS cladding systems, Outsulation, Outsulation Plus, and Stratum Guard I & II, are evaluated in BEES. Outsulation and Outsulation Plus, used for the commercial market, are comprised of an expanded polystyrene (EPS) insulation board, a fiberglass mesh which is used for reinforcement, a polymer-modified cement based adhesive/basecoat, and a polymer-based textured finish used as a top coat. Outsulation Plus is a next generation cladding that has an added layer of air and moisture barrier which is intended to protect the wall from accidental moisture and provide better insulation by stopping air infiltration. Produced by Dryvit Systems Canada, Stratum Guard I & II are used for the residential market and, similar to the Outsulation products, are comprised of EPS, fiberglass mesh, a polymer modified cement based adhesive/basecoat, a polymer based textured finish used as a top coat, a primer, and flashing. The main difference between Stratum Guard I and Stratum Guard II is the grooved edging on the Stratum Guard II EPS. Since the EPS thickness is the same for both, and the grooved edge does not significantly affect the product mass on a functional unit basis, these two products are modeled in BEES as one. All of these cladding systems can be installed in new and existing buildings.

Dryvit operates four manufacturing plants in the U.S., including one at its headquarters in West Warwick, RI, and has subsidiary operations in Canada, Poland, and China. The data for the Outsulation systems are based on the West Warwick, RI facility while the data for the Stratum Guard systems are based on the Stouffville, Ontario, Canada facility.

Siding is generally specified in terms of 'squares' of siding, or 9.29 $m^2$ (100 $ft^2$) of siding. For the BEES system, the functional unit is 0.09 $m^2$ (1 $ft^2$) of siding. All the Dryvit EIFS cladding systems are installed onto sheathing, and are evaluated in BEES with the other exterior wall covering products on the functional basis of one square foot of exterior wall area covered. Even though these products are thermally efficient, a building still requires insulation. According to Dryvit, the EIFS systems provide a thermal resistance value of about R-6. Thermal performance differences among exterior wall finish alternatives are not accounted for in BEES, but should be considered when interpreting BEES results.

## Flow Diagram

The flow diagrams below show the major elements of the production of these products as they are currently modeled for BEES.

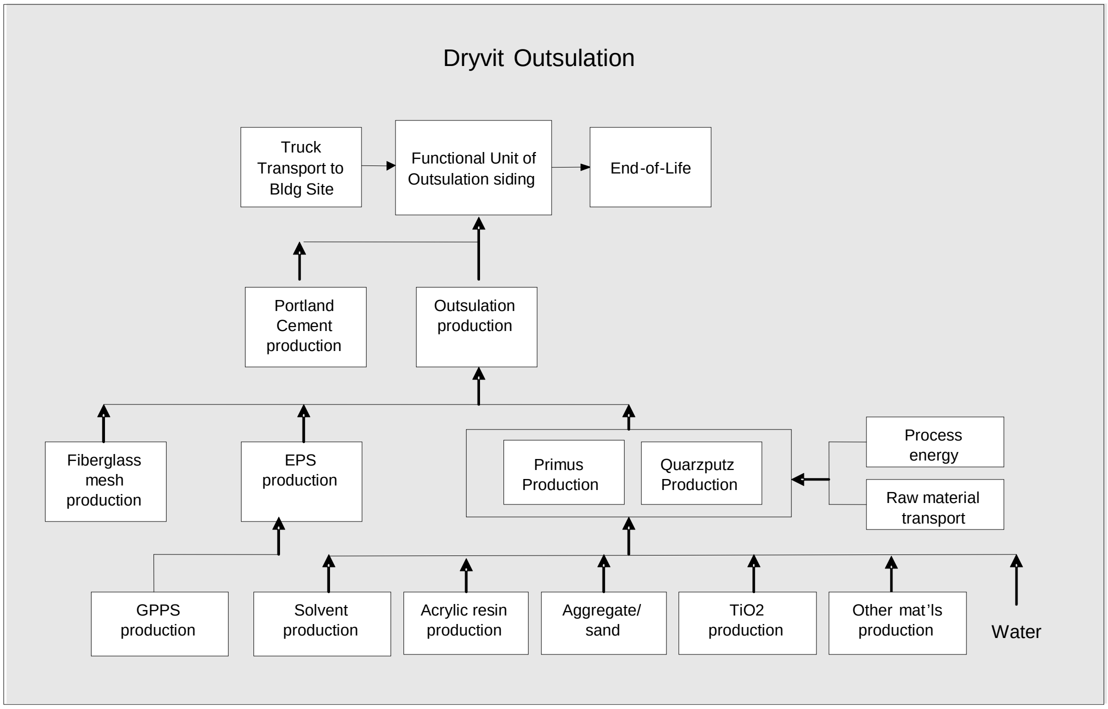


*Figure 1: Dryvit Outsulation System Boundaries*

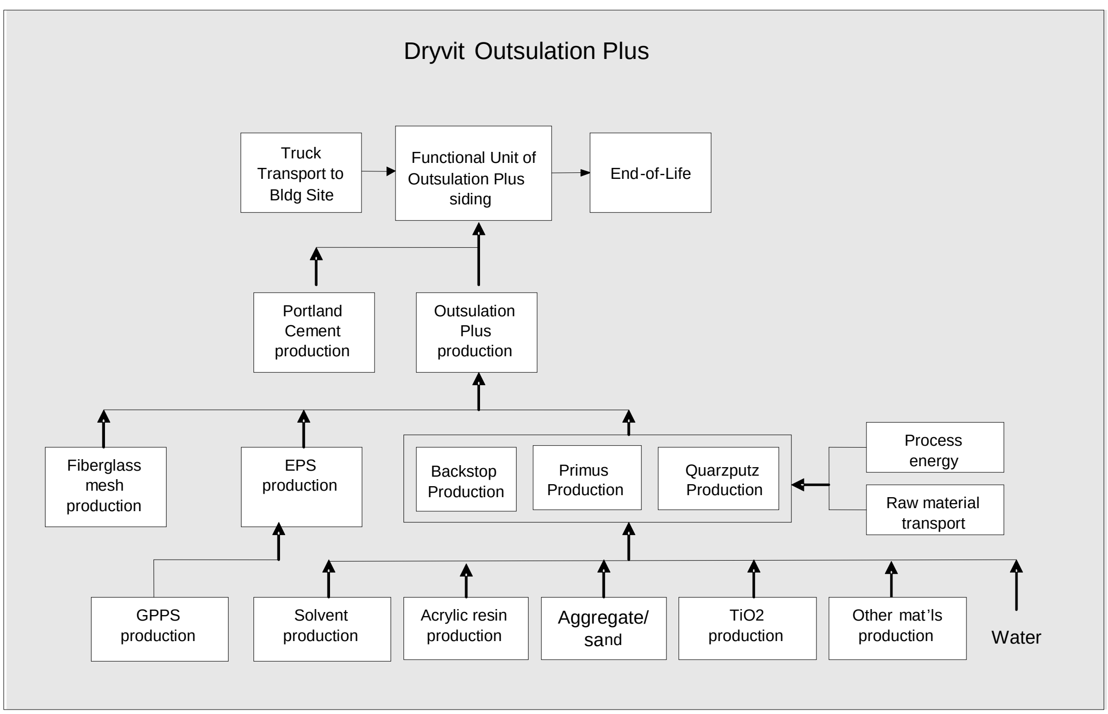


*Figure 2: Dryvit Outsulation Plus System Boundaries*

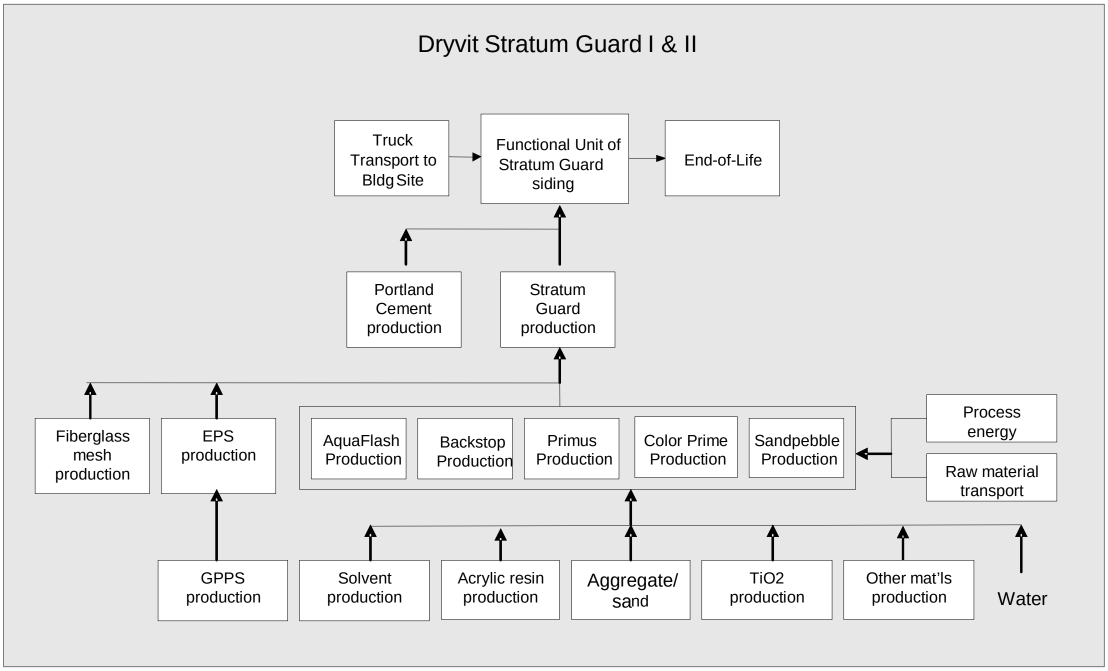


*Figure 3: Dryvit Stratum Guard I & II System Boundaries*

## Raw Materials

**Product Constituents: Outsulation and Outsulation Plus.** Outsulation's basecoat, the textured finish top coat, and the barrier layer offered as part of Outsulation Plus are mixed and packaged at Dryvit's Rhode Island facility. The Outsulation layers modeled for BEES are presented in the table below along with a listing of their materials:

***Table 1: Outsulation and Outsulation Plus Product Constituents***

| *Constituent* | *Adhesive /Basecoat (Primus)* | *Topcoat (Quarzputz)* | *Barrier (Backstop)* |
|---|---|---|---|
| Solvent | Yes | Yes | Yes |
| Resins | Yes | Yes | Yes |
| Aggregate | Yes | Yes | Yes |
| Fine filler | | Yes | Yes |
| Titanium dioxide slurry | | Yes | Yes |
| Other materials | Yes | Yes | Yes |
| Water | Yes | Yes | Yes |

***Product Constituents: Stratum Guard I & II***. The material constituents in Stratum Guard I and II are mixed and packaged at Dryvit's Ontario facility. The Stratum Guard I and II layers modeled for BEES are presented in the table below along with a listing of their materials:

***Table 2: Stratum Guard I & II Product Constituents***

| *Constituent* | *Barrier (Backstop NT Texture)* | *Adhesive / Basecoat (Primus)* | *Flashing (AquaFlash)* | *Primer (Color Prime)* | *Topcoat (Sand-pebble)* |
|---|---|---|---|---|---|
| Solvent | Yes | Yes | Yes | Yes | Yes |
| Resins | Yes | Yes | Yes | Yes | Yes |
| Aggregate | Yes | Yes | | | Yes |

| | | | | | |
|---|---|---|---|---|---|
| Fine filler | Yes | | Yes | Yes | Yes |
| TiO2 slurry | Yes | | Yes | Yes | Yes |
| Water | Yes | Yes | Yes | Yes | Yes |

***Materials Data and Modeling.*** The solvent, considered to be mineral spirits, is modeled as naphtha, whose data comes from the refining model in a U.S. Department of Agriculture and U.S. Department of Energy study on biodiesel and petroleum diesel fuels.[1] The fine filler is modeled as lime, which is based on the U.S. LCI database. The resin is modeled as an acrylic-based resin. Data for this resin, plus the aggregate and titanium dioxide slurry, are based on elements of the SimaPro database which is comprised of a mix of U.S. and European data. Water makes up much of these products: it is over 23 % of Quarzputz and Backstop, nearly 25% of the Sandpebble topcoat, nearly 30% of Primus, and 40% Color Prime.

Packaging for these products (5-gal polypropylene pails) is included in the model, with the data for polypropylene coming from American Chemistry Council 2006 data developed for submission to the U.S. LCI Database.

**Manufacturing**

***Energy Requirements and Emissions***. Energy use at the Dryvit plants is primarily electricity to blend the systems' constituents in large vessels and package them into 5-gal pails. The quantity of electricity for each product produced in Rhode Island is provided in the table below:

***Table 3: Energy Requirements for Mixing Dryvit Outsulation and Outsulation Plus Materials***

| ***Outsulation Products*** | ***kWh/lb*** | ***kWh/ft2 Outsulation*** |
|---|---|---|
| Primus | 7.47 E-4 | 4.21 E-4 |
| Quarzputz | 6.26 E-4 | 3.45 E-4 |
| Backstop | 1.28 E-3 | 2.86 E-4 |
| **Total** | **2.65 E-3** | **1.05 E-3** |

No data were available to disaggregate electricity data for the Stratum Guard I & II products blended at the Ontario facility, so average blending energy was used: 5.6 E-4 kWh per pound of product, or 7.1 E-4 kWh per square foot of Stratum Guard I & II. Electricity production fuels and burdens come from the U.S. LCI Database. Any fine material particulates released during blending is captured by a dust collection system, so no particulates or other emissions are released. No manufacturing waste is produced.

***Transportation***. Transportation distances of the product components were provided by both Dryvit plants. The distances to Warwick, RI range from 1 770 km (1 100 mi) for the fillers and 1 086 km (675 mi) for the aggregate, down to 80 km (50 mi) for the solvent. For Stratum Guard I & II, all of the materials except the aggregates are transported 26 km (16 mi) to Stouffville, Ontario. The aggregates are transported 363 km (227 mi) to Stouffville, Ontario. These are transported by diesel truck, as modeled in the U.S. LCI Database.

**Transportation**

The Outsulation products plus the EPS and fiberglass mesh (neither of which are produced by Dryvit) are modeled as transported an average of 402 km (250 mi) by diesel truck to the building site. The Stratum Guard products are transported by both diesel truck (average of 143 km, or 89 mi) and rail (average of 3 444 km, or 2 150 mi). When factoring the quantity transported by truck and rail (84% and 16%, respectively), the weighted average transported comes to 721 km (450 mi). These numbers are based on actual customer transportation records. The EPS and fiberglass mesh are assumed to be transported 400 km (250 mi) by diesel truck to the building site.

[1] Sheehan, J. et al., Life Cycle Inventory of Biodiesel and Petroleum Diesel for Use in an Urban Bus, NREL/SR-580-24089 (Washington, DC: US Department of Agriculture and US Department of Energy, May 1998).

**Installation**

Dryvit's components described above, plus the EPS and fiberglass mesh, are installed together at the building site to produce the Outsulation, Outsulation Plus, and Stratum Guard I & II products. These materials are specified in the following three tables. Note that while sheathing, weather resistive barriers, and other ancillary materials are required to complete the exterior wall system, these materials are not included in the system boundaries for BEES exterior wall finishes.

***Table 4: Dryvit EIFS Constituents for Outsulation***

| *Constituent* | *Quantity per 9 $m^2$ (100 $ft^2$)of EIFS* |
|---|---|
| EPS | 5.67 kg (12.5 lb) |
| Fiberglass Mesh | 1.35 kg (2.98 lb) |
| Primus | 25 kg (55 lb) |
| Quarzputz | 24.43 kg (53.85 lb) |

***Table 5: Dryvit EIFS Constituents for Outsulation Plus***

| *Constituent* | *Quantity per 9 $m^2$ (100 $ft^2$)of EIFS* |
|---|---|
| EPS | 5.67 kg (12.5 lb) |
| Fiberglass Mesh | 1.35 kg (2.98 lb) |
| Primus | 25 kg (55 lb) |
| Quarzputz | 24.43 kg (53.85 lb) |
| Backstop NT Texture | 9.89 kg (21.8 lb) |

***Table 6: Dryvit EIFS Constituents for Stratum Guard I & II***

| *Constituent* | *Quantity per 9 $m^2$ (100 $ft^2$)of EIFS* |
|---|---|
| EPS | 5.67 kg (12.5 lb) |
| Fiberglass Mesh | 1.35 kg (2.98 lb) |
| Backstop NT Texture | 9.89 kg (21.8 lb) |
| Primus | 25 kg (55 lb) |
| Flashing (AquaFlash) | 0.302 kg (0.665 lb) |
| Primer (Color Prime) | 1.5 kg (3.33 lb) |
| Topcoat (Sandpebble) | 24.43 kg (53.85 lb) |

EPS is produced by licensed EPS molders to a specification that has been established by Dryvit and ASTM, International. Fiberglass mesh also is produced to Dryvit specification and ASTM, International standard. The Dryvit basecoats, weather barriers, and finishes are used on the jobsite by trained plasterers. The process of applying EIFS cladding begins once the stud walls are constructed and sheathing is up. The EPS is applied to the sheathing with Primus as the adhesive and then again coated with Primus for a basecoat. In the field, Primus is mixed with equal amounts of cement. The fiberglass mesh is then embedded into the basecoat. After 24 hours of drying time, the textured finish, Quarzputz or Sandpebble, is placed as the top coat. Outsulation Plus installation includes the layer of Backstop for the added layer of air and moisture barrier. Stratum Guard I & II include a primer and a layer for flashing.

Data for EPS resin and blowing in foam insulation and fiberglass are based on the SimaPro database. For the BEES system, these are included with the raw material acquisition stage data since they are considered part of the main product. Portland cement (mixed with Primus) is included with the use stage of the product model, and its data comes from the U.S. LCI Database. For more detailed information on the latter material, see Generic Portland Cement Concrete Products

According to the manufacturer, installation waste can run from 1 % to 5 %; 2.5 % is modeled for BEES. This waste is assumed to go to landfill.

**Use**

Any maintenance or cleaning over the life, if needed, is done manually and with relatively few materials. Because maintenance can vary from owner to owner based on frequency and degree, representative data was neither available nor included in the model.

**End of Life**

Dryvit products are assumed to have useful lives of 50 years. At end of life, it is assumed that the products' materials are waste and sent to a landfill.

**References**

**Life Cycle Data**


National Renewable Energy Laboratory (NREL): *U.S. Life-Cycle Inventory Database*. 2005. Golden, CO. Found at: http://www.nrel.gov/lci/database.

PRé Consultants: *SimaPro 7.0 LCA Software*. 2005. The Netherlands.

Sheehan, J. et al., *Life Cycle Inventory of Biodiesel and Petroleum Diesel for Use in an Urban Bus,* NREL/SR-580-24089 (Washington, DC: U.S. Department of Agriculture and U.S. Department of Energy, May 1998).


**Industry Contacts**

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