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Technology and Costs

# TECH 2023S1: Isoprene Derivatives

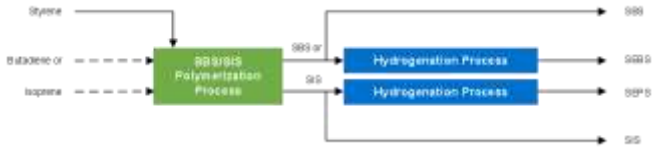
**Isoprene Derivatives is one in a series of reports published as part of NexantECA's 2023 Technoeconomics – Energy & Chemicals (TECH) program.**

## Overview

Isoprene is an important intermediate that is primarily consumed in the production of three polymers: polyisoprene (also known as isoprene rubber or IR), styrene block copolymer (SBC) and butyl rubber (also known as isobutylene-isoprene rubber or IIR). Polyisoprene (IR), which is similar in structure and properties to natural rubber, is mainly used in tire production. SBC, specifically the styrene-isoprene-styrene (SIS) and styrene-ethylene/propylene-styrene (SEPS) copolymers are mainly used in the manufacture of pressure-sensitive adhesives and coatings. Butyl rubber (IIR) has major applications in the inner tubes and inner liners of tires.

These polymers are relatively resistant to substitution by other synthetic rubber/plastics due to their unique properties. However, isoprene availability is one of the primary considerations for new entrants into these businesses.

The production process for IR is well known, and process developments have focused on incremental improvements. As to the SBCs, there are a number of common commercial SBCs, of which SIS and SEBS are covered in this report.




The production process for SBC is also relatively well know; the processes for SIS and SEPS are covered in this report.

While there are commercial applications for IIR, the more commonly used material is the brominated version (BIIR) since it vulcanizes faster than IIR itself. The slurry process for producing butyl rubber technology is well-established and commercially proven. However, it is widely recognized that a number of steps in this production process are energy and capital-intensive. The slurry process and recent improvements are discussed in the report, as is a solution process.

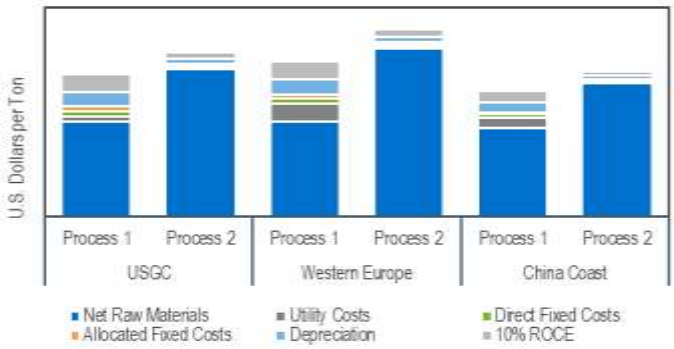
## Commercial Technologies

This TECH report provides a generalized description of the commercial production processes for IR, SIS, SEPS, IIR and BIIR. Recent developments (i.e. patents) related to process technology are also reviewed.

## Process Economics

For this report, NexantECA evaluated generalized processes for producing IR, SIS, SEPS, IIR and BIIR. The evaluation provides:

- Investment and cost of production (COP) estimates for a grassroots facility
- Estimates are made for plants located in the USGC, Western Europe, and the China Coast




## Commercial Overview

Polyisoprene has a molecular structure and properties similar to natural rubber. The primary use of polyisoprene is in the production of tire and tire products. Other IR applications include gloves and mechanical goods such as engine mounts.

SBCs are used adhesives and sealants, as a modifier in bitumen, as a modifier in polymers, in footwear, and in lubricating oil additives.

The main use for butyl rubber (including halogenated butyl rubbers) is in tire applications for inner tubes and liners. Other applications include medical products and mechanical goods.

Capacity tables for IR, SBCs and IIR are also provided in this report.

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**Technology@NexantECA.com or www.NexantECA.com**

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**Americas**
Tel: +1 914 609 0300
44 S Broadway,
5th Floor White Plains
NY 10601-4425
USA

**Europe, Middle East & Africa**
Tel: +44 20 7950 1600
110 Cannon Street
London EC4N 6EU
United Kingdom

**Asia Pacific**
Tel: +662 793 4600
22nd Floor, Rasa Tower I
555 Phahonyothin Road
Kwaeng Chatuchak
Khet Chatuchak
Bangkok 10900
Thailand


**For more information. please contact**
**Technology@NexantECA.com or www.NexantECA.com**