



## Biorenewable Insights: Butanediol (BDO)

Butanediol (BDO) is one in a series of reports published as part of NexantECA's 2020 Biorenewable Insights program.

### Overview

The commercialization of biorenewable butanediol (BDO) has been extensively pursued over the past decade in an effort to improve the environmental footprint of the chemicals industry. Today, a commercial 1,4-BDO facility operates in the tens of thousands of tons per year range with additional announced capacity on the way, and multiple developmental routes have been extensively piloted and studied and are on the cusp of commercialization. The emergence of the direct route from sugar has been coupled with the sector recently been rocked by lower oil prices increasing the competitiveness of petrochemical BDO and has led to the exit of major technology developers, particularly of the developers of the succinic acid intermediates, in the space. Despite these developments BDO technologies remain commercially operating and constitute a small but growing fraction of global production.

While the majority of capacity and attention has focused on the 1,4 isomer of butanediol, new production of 2,3-BDO and 1,3-BDO from bio-renewable sources has also emerged at a commercial level. However, these other isomers have much smaller market size due to functional differences. This can be further confused by the fact that some of these isomers are also referred to as butylene glycol (BG) by their downstream industries (e.g., cosmetics).

As the bio-renewable BDO sector matures, technology cost competitiveness, capacity, and markets remain at the forefront of potential players' concerns. This report aims to answer these key strategic questions:

- What technologies are available for production of renewable BDO, and what is their potential for cost competitiveness relative to petrochemical competitors?
- What are the major players and their existing partnerships?
- What is current global capacity and what announced capacity is likely to be produced?
- What are the potential addressable markets of 2,3-BDO or 1,3-BDO and where will new applications come from?

### Technologies

This report covers renewable 1,4-BDO technology with a focus both on direct fermentative routes from sugar and indirect production from the hydrogenation of fermentative succinic acid and hydrolysis of fermentation-based polyhydroxyalkanoates (PHAs), including players that have recently exited the space. In addition, the major route to 2,3-BDO from syngas fermentation is covered.

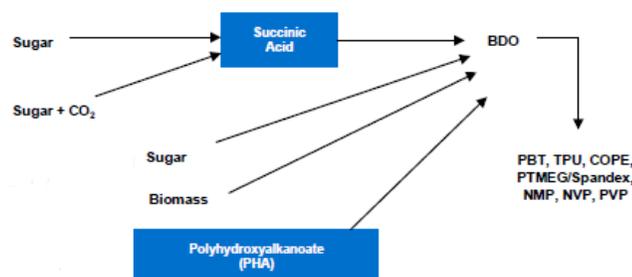
### Process Economics

This report covers economics of major technologies in four location scenarios (US, Western Europe, Brazil, and China) with regional pricing on a Q2 2020 basis. All major routes to BDO are included, with reference to specific technology developers if applicable. Due to the exit of major players using indirect routes to BDO and the higher numbers of technology developers in the space, generic process economic models are presented for indirect routes to 1,4-BDO.

### Commercial Impact

This report covers existing capacity vis-à-vis petrochemical capacity. In addition it examines the likelihood of success of announced capacity additions in light of recent business movements and covers the current status of major players.

Major Renewable Routes to 1,4-BDO



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