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# Process Economics Program Consolidated Report

CR001

Wide Range Linear Alpha Olefin  
Processes

By Marianna Asaro



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PEP Report CR001

Wide Range Linear Alpha Olefin Processes

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## Abstract

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This report consolidates and updates the Process Economics Program's technical and economic analyses of wide-range linear alpha olefins (LAO) manufacturing technologies since PEP first reported on the subject in the 1960s. LAO are used as comonomers in polyethylene production and in the plasticizer, detergent, and lubricant markets. The majority of LAO produced worldwide today comes from large-scale processes that make a wide range of LAOs, with carbon numbers in the range  $C_4$ - $C_{30+}$  or  $C_4$ - $C_{20+}$ . Major producers include Shell, Chevron Phillips, and INEOS, each of which has been in commercial operation for several decades. Idemitsu Kosan has also commercialized its wide-range LAO process, on a small scale, and is currently partnering with Mitsui for new production. SABIC (Saudi Basic Industries Corporation) has recently commercialized its technology jointly with Linde AG, on a moderate scale. Several other wide-range technologies are currently ready for commercialization. Among these are processes developed by IFP (Institut Français du Pétrole), DuPont, and UOP. All three processes have been made available for license, although UOP has since withdrawn LAO technology from its licensing list.

Technical descriptions and economic analysis are provided herein for the following technologies:

- Chevron Phillips (High Temperature Process)
- INEOS (Total Butene Recycle)
- Shell (Shell Higher Olefins Process, SHOP)
- SABIC and Linde (alpha-SABLIN<sup>®</sup>)
- UOP and Union Carbide (Linear-1)
- IFP (AlphaSelect<sup>™</sup>) and
- DuPont (Versipol)

The smaller-scale technology of Idemitsu Kosan is also discussed. These and all technologies past, present, and emerging for wide-range LAO are reviewed, with a bibliography and abstracts for patents since the 1960s. The industry status is updated, and a summary is provided of all commercial or commercial-ready intermediate- to large-scale wide-range LAO processes, in terms of comparative economics and the key process indicators (KPI) of carbon efficiency, energy intensity, carbon intensity, and capital intensity. Lastly an interactive module is included in the electronic version of this report, the iPEP Navigator WRLAO tool, which provides a snapshot of economics for each process and allows the user to select the process, units, and region of interest.

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