

**FlexUP™** FlexUP™ Technology is a brand for a novel desulfurization and upgrading process that removes sulfur, nitrogen, metals and increases API on all sour oil feeds. FlexUP™ is a brand for a catalytic process that offers the disruptive ability to upgrade heavy-sour crude oil, providing an increase in value as high as 5% -20%. Because FlexUP™ has a small physical and carbon foot print; oil producers can field upgrade heavy-sour oil while drastically improving their economics. FlexUP™ has been successfully tested on many heavy-sour crude oils as well as bitumen and asphaltene feeds.

At the core of Auterra's FlexUP™ Technology are the FlexOX™ family of catalysts, the FlexDS™ chemical package, and FlexUP Support Services. The first stage of the process uses FlexOX™ catalysts to provide highly selective and reactive oxidation of sulfur and nitrogen moieties in hydrocarbon streams. The second stage of the process uses the FlexDS™ chemical package which cleaves these oxidized species away from the hydrocarbons and removes them as by-products.

### FlexOX™ Catalyst Overview

The FlexOX™ family of proprietary catalysts enables oxidative desulfurization as an attractive alternative to hydrodesulfurization processes. It's low energy requirements and immunity to traditional catalyst poisons makes it ideal for heavy-sour feeds. Used with the FlexDS™ chemical package, FlexOX Catalysts are effective on upstream heavy-sour crude oil, bitumen and coal liquefaction products, and on all downstream oil feeds including gas oils and vacuum residues.

### FlexDS™ chemical package Overview

FlexDS™ incorporates standard process equipment to support the cleaving chemical reactions. The chemical package is removed from the oil in a final wash process that delivers upgraded, higher quality oil.

FlexUP™ Technology's elegant chemistry enables the efficient and selective chemical upgrading of heteroatom rich hydrocarbon streams. Efficient recycle loops makes the process economically competitive with hydrogen-based alternatives.

### FlexUP™ Support Services Overview

FlexUP Support Services provides engineering and technical services for plant design, technical services and support to ensure optimal operation and return on investment.

A robust patent portfolio protects the primary catalysts and process elements of the FlexUP Technology, the novel FlexOX™ catalyst which oxidizes only heteroatoms and the proprietary FlexDS™ chemical package which selectively cleaves away the oxidized moieties.

### For more information, contact:

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Below is a high level view of the FlexUP™ process.

