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Argus White Paper:

Adiponitrile: Growing supply glut, sluggish demand forces a Texas plant closure

There have been a number of ups and downs to the adiponitrile (ADN) market in the last decade. The most recent blow is a closure at a site in Texas. We will walk you through major events that led to this decision.

Demand outlook was quite bullish from about 2015 to 2020, so ADN producers added capacity to fill the gap. These included modernization projects, expansions and the startup of new facilities.

By the end of 2022 and early 2023, signs of oversupply started to emerge. The latest loss is when Invista on 5 October announced it would immediately cease production at its 250,000 t/yr ADN facility in Orange, Texas. The company cited "lower-than-anticipated growth and an increase in global supply."

ADN is used in carpets, airbags, "under the hood" applications in the automotive industry, and apparel.

It takes 0.62t of BD to produce 1t of ADN, so the implied amount of BD demand is 155,000 t/yr on a nameplate basis. Our estimate though is the Orange site has been running at very low rates for many months, ahead of the decision to shut. With only three months remaining on 2023 term contracts, we anticipate the company will run its 440,000 t/yr Victoria site at higher operating rates to compensate for Orange. Invista also has a new 400,000 t/yr ADN plant in Shanghai, China, which commenced production at the end of 2022.

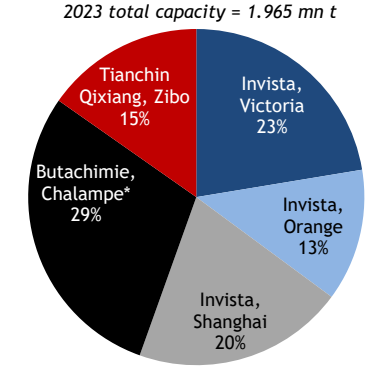
In short, there is likely little impact to supply in the short term. The US currently has two BD production constraints. Two Texas BD producers issued term allocations in October.

Term volumes for 2024 is likely to see a small reduction. Also US BD producer TPC Group will bring expanded capacity online at mid year. If demand in North America continues the current trend coupled with the new BD production, the magnitude of supply length will be greater. For much of 2023, US BD demand has been low throughout the year as downstream needs continue to lag across sectors. There is new styrene block copolymer production that is slated to start up in 2024, but this alone will not be able to absorb the hole left by Invista Orange and the new BD capacity.

ADN manufacturing using the butadiene route in other regions

France's Butachimie, whose nameplate capacity is 575,000 t/yr, is a joint venture between Invista and BASF in Chalampe. Butachimie's demand forecast took a radical turn following the start of the conflict between Russia and Ukraine in February 2022. The driver was the sudden surge in European natural gas and ammonia prices. In August 2022, Dutch TTF natural gas prices escalated to €308/MWh ($325/MWh) on 25 August 2022 and averaging €230/MWh for the month, according to *Argus* data. The month average was €41.16/MWh in August 2021 and €7.43/MWh in August 2020. In August 2023, prices averaged €33.45/MWh.

Global Adiponitrile cap. based on butadiene feedstock



**Butachimie is a joint venture between Invista and BASF*

— Argus Butadiene Services

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World derivative demand growth		%
Butadiene derivative	**CAGR 2018-22**	**CAGR 2022-27**
ABS	2.1	3.1
ADN	-4.0	5.2
PBR	-1.5	3.9
SB latex	-0.7	1.0
SBR	0.5	2.9
SBC	3.1	4.1
NB latex	22.3	4.7
Other - BD	0.8	0.7
Total CAGR	0.8	3.2

— *Argus Butadiene services*

Prior to the geopolitical conflict, it was believed that US ADN production would be scaled back while Butachimie and the new China plant would run at full rates. Then economics quickly deteriorated in Europe, squeezing ADN production margins there. Beginning around the second quarter of 2022, ADN operating rates in northwest Europe sank to 20-25pc. The working theory then became that the US and China instead would run at higher rates as Butachimie slashed rates. Unfortunately, though, the cutbacks in Europe were insufficient to compensate for increasing ADN supply and lackluster demand.

Even with the closure of Invista's Orange asset, we still do not anticipate any major shift away from Butachimie's current operating rate, because there is ample enough new capacity available. In the world BD derivative demand growth table, we can see the effects of Butachimie's lower operating rates on CAGR. With the idling of the Invista Orange site plus the new units on alternative processes starting up, the global CAGR for ADN will be adjusted in our next *Argus* Butadiene Analytics update.

In China, two new ADN facilities using BD as a feedstock began operations: Invista with its 400,000 t/yr unit in Shanghai and Tianchen Qixiang's 300,000 t/yr asset in Zibo. These two new plants, in addition to the debottlenecks by other existing plants, meant that global ADN production using BD as a feedstock from 2018 to early 2023 jumped 65pc to 1.2mn t/yr.

Alternative production processes add to the supply excess

Supply additions in China did not stop with Invista and Tianchen Qixiang. The quiet storm that has been brewing is competing production routes have also been gaining traction. These two alternatives include propylene and adipic acid via cyclohexane.

In 2019, Ascend Performance Materials said it added 90,000 t/yr of ADN capacity to its plant in Decatur, Alabama. An additional 90,000 t/yr expansion was slated to come onstream in 2021, but it is unclear if this project came to fruition. Ascend uses propylene as a feedstock.

The biggest expansion has been in China. If these ADN producers ramp up production according to plan, it would result in more than 1mn t/yr of capacity, on top of what Invista and Tianchen Qixiang can manufacture.

Where do we go from here?

Global light vehicle sales are expected to increase as Europe and China incentivize purchases of electric vehicles. This will require air bags and under the hood components, which require ADN as a raw material. The setback to ADN growth has been the rapid expansion by competing technologies.

The shutdown at Orange also means that Invista will no longer be the largest consumer of BD on a nameplate capacity in North America. Goodyear with its derivative assets in Houston and Beaumont, both in Texas, respectively, now is the biggest buyer of BD in the region. Butachimie has also fallen from the top consumer in western Europe, because of oversupply, volatile energy and a slow demand rebound.

Timeline

2014 Invista deploys the latest ADN technology at Orange, Texas

2018 Invista's Orange, Texas site reaches a 12-month ADN production record

2019 Butachimie completes its ADN retrofit at Chalampe, France

2019 Ascend Performance Materials expands capacity at Decatur, Alabama by 90,000t/yr via propylene

2020 BASF becomes a new shareholder of Butachimie, along with its joint venture partner Invista

2021 Invista launches its technology upgrade at its 440,000t/yr site in Victoria, Texas

2022 Tianchen Qixiang starts up a new 300,000 t/yr unit in Zibo, China

2022 Invista starts up its new 400,000t/yr ADN plant in Shanghai, China

2023 Invista announces the permanent shutdown of 250,000t/yr ADN capacity in Orange, Texas

Data for this white paper was taken from *Argus* Butadiene Analytics and *Argus* Butadiene Outlook services. Both publications will closely monitor and reflect the changes in its updates. Click here to request additional information or for a free trial.

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