

Carbon Dioxide

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Abstract

Because of its unique properties, carbon dioxide is a versatile compound with many different applications in gaseous, liquid, and solid states. It is used as a chemical building block (mainly for urea synthesis from ammonia), as an acidifier in beverage and water treatment applications, as a supercritical solvent (e.g., in enhanced oil recovery and caffeine extraction from coffee), as a shielding and inerting gas (e.g., in metalworking or food preservation), and as a chilling and cleaning agent while in a solid state (it sublimates from solid directly to gaseous state).

However, carbon dioxide is regarded as the leading climate issue for its role in accelerating global warming. CO₂ is produced by the burning of fossil fuels (coal, natural gas, crude, or refined oils) to generate electricity and heat, or for transportation purposes; via the production of cement (the transformation from limestone or calcium carbonate to lime or calcium oxide releases CO₂); and by various other industries. In 2020, mainland China was estimated to be the largest CO₂-producing nation (28% of global CO₂ emissions), followed by the United States and India with 16% and 6%, respectively.

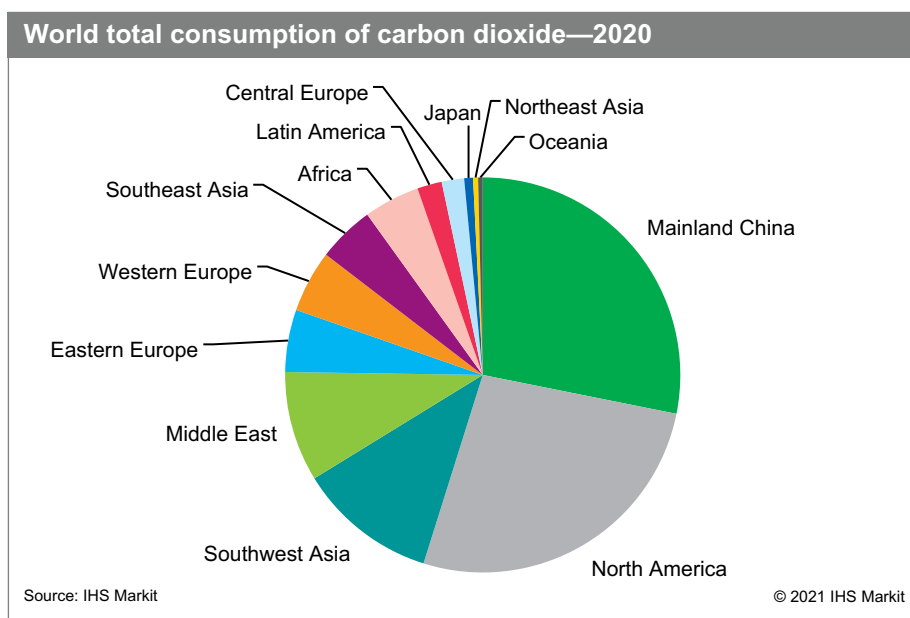
Attempts are ongoing to limit and reduce CO₂ emissions while collecting and sequestering carbon dioxide from the atmosphere. The chemical conversion and fixation of carbon dioxide, however, has limited applications for bulk use. Therefore, long-term geological storage including usage for enhanced oil recovery is probably the only practical way to reduce global carbon dioxide levels in the Earth's atmosphere. As current carbon capture and storage technologies for enhanced oil recovery are not cost-competitive with low oil prices, more than two-thirds of planned carbon capture, utilization, and storage projects have been cancelled over the past five years.

Although atmospheric carbon dioxide has been identified as a contributor to global warming, this is relevant primarily to industries that generate and release carbon dioxide into the atmosphere. The companies covered in this report recover and distribute by-product carbon dioxide or naturally occurring carbon dioxide, but do not produce carbon dioxide.

The following chart shows world consumption of carbon dioxide:

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The carbon dioxide business is traditionally thought of as the recovery and distribution of liquid carbon dioxide, since this is the most commonly traded product. Liquid carbon dioxide is usually recovered as a gaseous by-product of industrial operations, such as hydrogen production by the steam reforming of natural gas or the production of ethanol by fermentation. The gaseous carbon dioxide is liquefied for sale as a merchant product because liquid carbon dioxide can be transported more economically than gas. Many consumers also use carbon dioxide for the physical properties associated with its being a refrigerated liquid. Liquid carbon dioxide reaches end users through a network of highway tankers, resupply depots, and railcars. Carbon dioxide is also traded as dry ice in the solid state, with its main end use being transport refrigeration. As a result of these circumstances, the carbon dioxide business is highly regional.

Mainland China is the major market for carbon dioxide, accounting for about 28% of global demand in 2020, followed by North America, and Southwest Asia, accounting for about 27% and 11%, respectively.

There is a substantial market for gaseous carbon dioxide for use in enhanced oil recovery. Another large use for gaseous carbon dioxide is on-site chemical manufacturing. For example, many ammonia manufacturers generate by-product carbon dioxide and consume it in the same site for urea production.

The major issue in the carbon dioxide market is balancing regional supply and demand. Carbon dioxide sources may or may not exist where demand is greatest. In addition, chemical manufacturing operations that produce a gaseous carbon dioxide by-product run according to demand for the primary product, as opposed to demand for the by-product carbon dioxide. For example, ammonia plants typically operate at full capacity in the fall and winter seasons in preparation for spring fertilizer requirements. Carbon dioxide demand, in contrast, tends to be highest during the warm summer months when ammonia plants may be closed for turnaround, so, supplies are not often balanced with demand.

In the past few years, there have been growing concerns about greenhouse gases (and the effect of corn-based ethanol production) and profitability that have somewhat dampened interest in corn-based ethanol. However, federal mandates for ethanol blending in gasoline in the United States will continue to support corn-based ethanol production. In the future, the primary sources of carbon dioxide are expected to be ethanol fermentation plants, as ammonia plants are being shut down as a result of less-expensive offshore production or lower-cost import replacements.

For more detailed information, see the table of contents, shown below.

IHS Markit's Chemical Economics Handbook – *Carbon Dioxide* is the comprehensive and trusted guide for anyone seeking information on this industry. This latest report details global and regional information, including



Global summary;
regional coverage



Producers with
annual capacities
and plant sites



Production figures
and trends



Consumption and
forecasts by end use
application



Manufacturing
processes and
environmental issues



Trade – imports
and exports

Key Benefits

IHS Markit's Chemical Economics Handbook – *Carbon Dioxide* has been compiled using primary interviews with key suppliers, organizations and leading representatives from the industry in combination with IHS Markit's unparalleled access to upstream and downstream market intelligence, expert insights into industry dynamics, trade and economics.

This report can help you:

- Identify trends and driving forces influencing chemical markets
- Forecast and plan for future demand
- Understand the impact of competing materials
- Identify and evaluate potential customers and competitors
- Evaluate producers
- Track changing prices and trade movements
- Analyze the impact of feedstocks, regulations, and other factors on chemical profitability

Contents

Executive summary	8
Summary	9
Introduction	12
Conversion factors	13
Manufacturing processes	14
Sources	14
– Industrial by-product	14
– Hydrogen	14
– Ethanol	15
– Substitute natural gas	16
– Ethylene oxide	16
– Other	16
– Natural	17
Production (recovery and purification) processes	18
Transportation and storage	22
Environmental issues	23
Supply and demand by region	31
World	31
– Salient statistics	31
– Consumption	32
United States	36
– Producing companies	36
– Production and shipments	53
– Consumption	54
– Liquid and solid carbon dioxide	55
– Food industry	55
– Beverage carbonation	59
– Oil and gas recovery	61
– Other	62
– Gaseous carbon dioxide	72
– Pipelined for oil and gas recovery	72
– Captive for chemical manufacture	86
– Price	88
– Bulk liquid carbon dioxide	88
– Pipelined gaseous carbon dioxide	89
– Trade	90
Canada	91
– Producing companies	91
– Salient statistics	94
– Consumption	95

– Price	99
– Trade	99
Mexico	100
– Producing companies	100
– Salient statistics	101
– Consumption	103
– Price	104
– Trade	105
Central and South America	106
– Producing companies	106
– Salient statistics	110
Western Europe	111
– Producing companies	111
– Salient statistics	124
– Production	126
– Consumption	128
– Gaseous carbon dioxide	131
– Urea	131
– Power-to-X	131
– Chemicals	132
– Biological conversion	132
– CO2 capture from flue gas	133
– Carbon capture, utilization, and storage (CCUS)	133
– Liquid carbon dioxide	135
– Beverage carbonation	135
– Food industry	135
– Water treatment	136
– Mixed gases/aerosols	136
– Welding and cutting	137
– Firefighting	137
– Medical applications	137
– Foundry	137
– Rubber and plastics	138
– Other	138
– Solid carbon dioxide	140
– Price	141
– Trade	143
– Imports	143
– Exports	143
Central Europe	144
– Producing companies	144
– Salient statistics	148
– Production	150

– Consumption	151
– Price	154
– Trade	155
– Imports	155
– Exports	155
Eastern Europe	156
– Producing companies	156
– Salient statistics	162
– Production	164
– Consumption	165
– Price	167
– Trade	168
– Imports	168
– Exports	169
Middle East	169
– Producing companies	169
– Salient statistics	177
– Production	178
– Consumption	180
– Price	182
– Trade	183
– Imports	183
– Exports	184
Africa	184
– Producing companies	184
– Salient statistics	191
– Production	192
– Consumption	194
– Price	196
– Trade	197
– Imports	197
– Exports	197
Southwest Asia	198
– Producing companies	198
– Salient statistics	201
– Production	201
– Consumption	202
– Trade	203
Mainland China	204
– Producing companies	204
– Salient statistics	210
– Production	211
– Consumption	212

– Liquid carbon dioxide	215
– Welding and cutting	216
– Beverage carbonation	216
– Food industry	216
– Oil and gas recovery	216
– Cigarettes	216
– Rubber and plastic processing	217
– Firefighting	217
– Other	217
– Solid carbon dioxide	217
– Gaseous carbon dioxide	217
– Urea	217
– Sodium carbonate	217
– Ammonium bicarbonate	218
– Precipitated calcium carbonate	218
– Other	218
– Price	218
– Trade	219
Japan	220
– Producing companies	220
– Salient statistics	223
– Production	224
– Consumption	225
– Gaseous carbon dioxide	227
– Carbon capture, utilization, and storage (CCUS)	227
– Liquid carbon dioxide	229
– Welding and cutting	229
– Beverage carbonation	230
– Food industry	230
– Steelmaking	230
– Other applications	230
– Solid carbon dioxide	231
– Price	231
– Trade	232
Northeast Asia	233
– Producing companies	233
– Salient statistics	236
– Production	237
– Consumption	237
– Trade	238
Southeast Asia	239
– Producing companies	239
– Salient statistics	242

– Production	243
– Consumption	244
– Trade	244
Oceania	246
– Producing companies	246
– Salient statistics	247
– Production	248
– Consumption	248
– Trade	250
Additional resources	252
Revisions	254
Data Workbook	255

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