

Econamine FG PlusSM

Advanced Technology

Proven Expertise

Execution Excellence

FLUOR[®]

Carbon Capture Technology and Execution Partner

Providing Professional and Technical Services

Fluor is building a better world by applying world-class expertise to solve its clients' greatest challenges. Fluor's 41,000 employees provide professional and technical solutions that deliver safe, well-executed, capital-efficient projects to clients around the world. We take pride in our long history of successful execution of thousands of projects and our extensive successful track record in the execution of carbon capture projects.

Fluor provides engineering, procurement, and construction (EPC) services to carbon capture projects including carbon dioxide (CO₂) compression and transportation. Our proprietary Econamine FG Plus technology can be applied to power plants, refineries, chemical facilities, sulfur plants (tail gas), cement, and steel mills.

Our carbon capture project experts focus on the delivery of innovative, reliable, and cost-efficient project solutions built on more than 100 years of EPC and maintenance experience and 30 years' experience in carbon capture.

Proven Carbon Capture Technologies

Fluor is a global leader in CO₂ capture and the only technology vendor with long-term commercial operating experience in CO₂ recovery from flue gas.

Fluor's patented CO₂ recovery technologies help clients reduce greenhouse gas emissions. Our recovery process technologies include:

- ▶ **Econamine FG Plus** technology uses an amine to capture from post combustion sources
- ▶ The **Fluor SolventSM** process uses a propylene carbonate solvent to remove CO₂ from gas streams
- ▶ **Econamine** technology uses diglycolamine as the aqueous solvent for H₂S and CO₂ removal from gas streams

Econamine FG Plus technology provides clients with an energy-efficient and cost-effective process for the removal of CO₂ from low-pressure, oxygen-containing flue gas streams. The solvent formulation is specially designed to recover CO₂ from streams that are at near-atmospheric pressure. It offers a post-combustion CO₂ capture option that is easy to retrofit to existing facilities.



Carbon Capture Technology Demonstration Plant
Wilhelmshaven, Germany



Operational Technology

Fluor Econamine FG Plus is a proprietary carbon capture solution with more than 30 licensed plants and 3 decades of operation at power plants, refineries, and chemical facilities. The technology builds on Fluor’s more than 400 CO₂ removal units in natural gas and synthesis gas processing.



Single Point of Responsibility

We can provide both technology and EPC services, with a single point of accountability for reliable execution.



Cost Efficient Solution

Econamine FG Plus incorporates continuous improvements in solvent formulation resulting in lower energy consumption, capital cost, and solvent costs.



CO₂ Pipeline and Compression

Fluor has the experience to design and build CO₂ compression and pipelines.

Compression

- ▶ In facility
- ▶ Pipeline
- ▶ Booster

Pipeline

- ▶ Hydraulics and flow assurance
- ▶ Pipeline engineering and design
- ▶ Geographical information system and data management



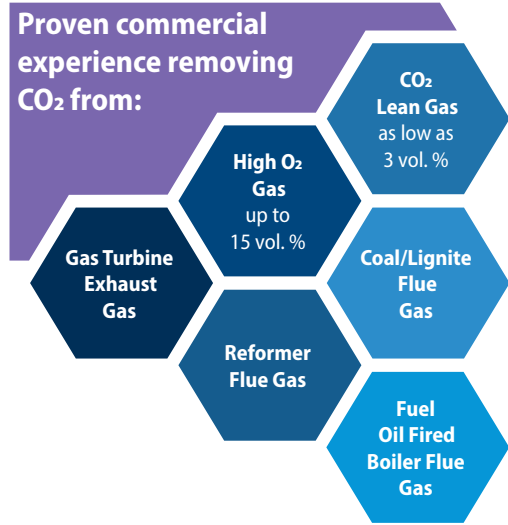
Partnership

Our design teams collaborate with clients to customize a solution to their specific problems. Solvent formulation allows for the option to buy solvent components directly from Fluor approved suppliers.

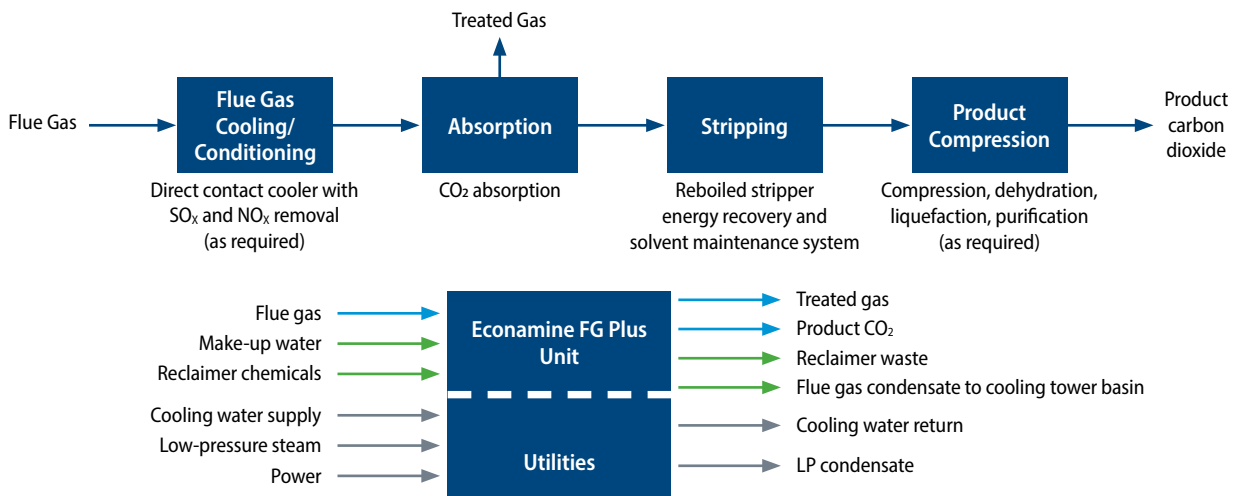
The Technology

Econamine FG Plus offers the following benefits:

- ▶ Technology commercially proven on natural gas, coal, and fuel oil flue gases
- ▶ Operating experience includes using steam reformers, gas turbines, gas engines, and coal/natural gas boilers
- ▶ Generates CO₂ product for use in enhanced oil recovery, methanol and urea production, food, beverage, and underground sequestration
- ▶ Currently being extended to cement and steel mill applications



Typical Econamine FG Plus CO₂ Recovery Unit Block Flow Diagram

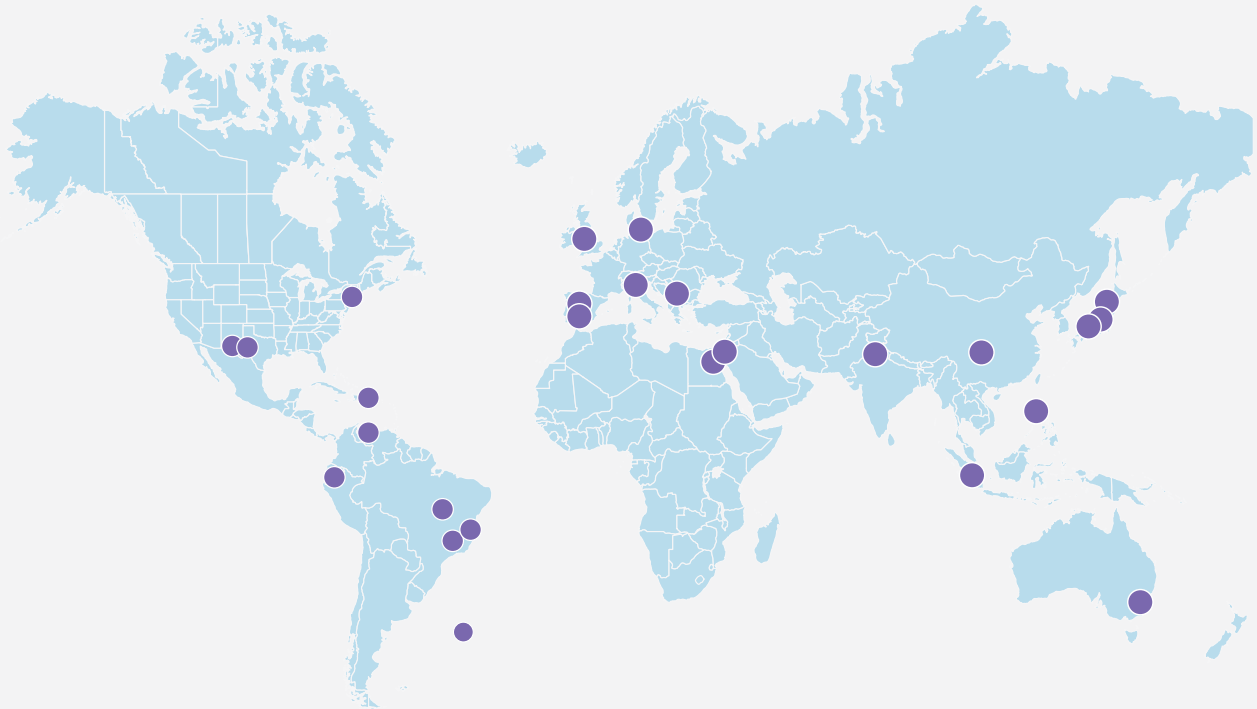


Cost Savings and Schedule Predictability

The Econamine FG Plus uses a concentrated solvent formulation designed to reduce heat requirements and circulation rates to capture post-combustion CO₂ from large single-point emission sources. Some of the improvements that differentiate the Econamine FG Plus technology by lowering capital costs and energy demands include the following:

- ▶ Advanced solvent formulation
- ▶ Absorber intercooling
- ▶ Lean vapor compressor
- ▶ Solvent maintenance system
- ▶ Large diameter column design
- ▶ Heat recovery and integration
- ▶ Low solvent make-up cost
- ▶ Ultra low absorber emissions

Econamine FG Plus Deployed Globally



The Econamine FG Plus technology is the only process that has extensive and proven operating experience in the removal of carbon dioxide from the following:

- ▶ High oxygen content flue gases (up to 15 volume percent)
- ▶ Low CO₂ content flue gases (as low as 3 volume percent)

Delivering Results on Your Carbon Capture Project

From licensing to construction, Fluor adds value to critical aspects of carbon capture, utilization and storage projects to produce viable project plans that can be delivered on time and within budget. We offer:

- ▶ An unwavering commitment to health, safety, and environmental principles through all phases of execution
- ▶ Experience gained from 30 years of carbon capture projects
- ▶ Seamless execution through single point of responsibility
- ▶ Capital efficiency and schedule predictability without compromised quality
- ▶ Total installed cost reduction through innovative solutions
- ▶ Strong project execution team, supported by subject matter experts
- ▶ Industry leading project execution practices
- ▶ Technology expertise, including our own patents

These attributes will contribute to the successful execution of a carbon capture project.

Project Profile

E.ON Kraftwerke Econamine FG Plus Demonstration Plant

Fluor and E.ON Kraftwerke (E.ON) were partners in developing a slipstream carbon capture pilot plant in Wilhelmshaven, Germany.

E.ON is one of the world's largest private gas and electricity companies. More than 85,000 E.ON employees supply some 17 million customers with electricity, gas and other energy-related services. E.ON brings to the partnership its essential experience in operating and engineering coal-fired power plants.

E.ON's Wilhelmshaven plant located north of Bremen, Germany burns hard coal and has a net output of 757 MW. The primary objectives of the Fluor/E.ON partnership were to enhance the Fluor Econamine FG Plus technology and demonstrate its application in removing carbon dioxide from the flue gas of a coal-fired power plant.

Several recent advancements in Econamine FG Plus technology were verified and the new enhancements were tested as a part of Fluor's ongoing research and development activities on carbon capture technology.

The construction phase included demonstration of new materials and techniques for erection of process columns, installation of several energy saving process systems, installation of extensive instrumentation suitable for testing and R&D and incorporation of remote monitoring capability. These and other enhancements planned during the ensuing test program were used to drive additional energy efficiency into Fluor's Econamine FG Plus process. In addition to verifying and enhancing the technology, the project was designed to demonstrate that conventional power plants can be readily retrofitted with Fluor's Econamine FG Plus technology.



Econamine FG Plus Demonstration Plant
Wilhelmshaven, Germany

Recent and Relevant Experience

Fluor helps clients mitigate CO₂ emissions globally through our long history of flue gas carbon capture as both a licensor and as an engineering and construction company.

*30+ Licensed Econamine FG Plus Plants
Design/Build of 400+ CO₂ Removal Plants*

Minnkota Power Cooperative, Project Tundra, North Dakota, U.S.

Front-end engineering and design (FEED) for a carbon capture, utilization, and storage retrofit project of the Milton R. Young Station.

Confidential, United Arab Emirates

FEED to capture 2.25 million tonnes per year of CO₂ from sulfur plant tailgas.

Carbon Capture Technology Demonstration Plant, Wilhelmshaven, Germany

Partnering with E.ON Kraftwerke, developed a slip stream carbon capture pilot plant in Northern Germany.

Confidential, U.S.

FEED for a 6.5 MM tonnes per year (on two trains) CO₂ capture from a coal-fired power station.

North East Associates, Bellingham, Massachusetts, U.S.

EPC, operations, and maintenance for the world's only commercial carbon capture plant on a gas turbine exhaust.

California Resources Corporation Elk Hills Project, California, U.S.

FEED for a 550-megawatt natural gas power plant.



Bellingham Stripper (left), Absorber (middle), and Direct Contact Cooler (right)
Bellingham, Massachusetts, U.S.

Select Econamine FG Plus Projects

91 Offices in 30 Countries on 6 Continents

Americas

Aliso Viejo, California, U.S.
Arlington, Virginia, U.S.
Buenos Aires, Argentina
Calgary, Alberta, Canada (3)
Carlsbad, California, U.S.
Charlotte, North Carolina, U.S. (2)
Corvallis, Oregon, U.S.
Costa Mesa, California, U.S.
Dallas, Texas, U.S.*
Deer Park, Texas, U.S.
Greenville, South Carolina, U.S. (3)
Houston, Texas, U.S. (3)
Lake Charles, Louisiana, U.S.
Lima, Peru
Long Beach, California, U.S.
Mexico City, Mexico (2)
Morrisville, North Carolina, U.S.
North Charleston, South Carolina, U.S. (2)
Portland, Oregon, U.S.
Reston, Virginia, U.S.
Richland, Washington, U.S. (3)
Richmond, Virginia, U.S.
Rockville, Maryland, U.S.
San Francisco, California, U.S.
San Juan, Puerto Rico
Santiago, Chile
Tampico, Mexico
Texas City, Texas, U.S.
Vancouver, B.C., Canada (2)
Washington, D.C., U.S.

Europe/Africa/Middle East

Aberdeen, United Kingdom
Abu Dhabi, U.A.E.
Al Ahmadi, Kuwait
Al Khobar, Saudi Arabia
Amsterdam, The Netherlands (3)
Antwerp, Belgium
Bergen-op-Zoom, The Netherlands (2)
Cork, Ireland
Dubai, U.A.E.
Dublin, Ireland
Durban, South Africa (2)
Farmborough, United Kingdom
Gaborone, Botswana
Gliwice, Poland
Johannesburg, South Africa (2)
London, United Kingdom (3)
Madrid, Spain
Mannheim, Germany (2)
Maputo, Mozambique
Rotterdam, The Netherlands (2)
Secunda, South Africa
Tarragona, Spain

Asia Pacific

Atyrau, Kazakhstan
Bangkok, Thailand
Beijing, China
Jakarta, Indonesia
Kuala Lumpur, Malaysia (2)
Melbourne, Australia
Manila, Philippines
New Delhi, India (2)
Perth, Australia (2)
Seoul, South Korea
Shanghai, China
Tokyo, Japan
Zhuhai, China

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