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Header 2

List View

General Information | Contact | Default Values | Discount | Document Information | Clarification Request

Procurement Folder: 1377104

SO Doc Code: CRFQ

Procurement Type: Central Contract - Fixed Amt

SO Dept: 0313

Vendor ID: VS0000045250

SO Doc ID: DEP2400000029

Legal Name: Computer Modelling Group Ltd

Published Date: 2/21/24

Alias/DBA: CMG

Close Date: 3/6/24

Total Bid: \$33,100.05

Close Time: 13:30

Response Date: 03/04/2024

Status: Closed

Response Time: 17:12

Solicitation Description: DWWM Injection Reservoir Modeling Software

Responded By User ID: CMG-Soraya

Total of Header Attachments: 2

First Name: Soraya

Total of All Attachments: 2

Last Name: Fears

Email: soraya.fears@cmgl.ca

Phone: 4794392451



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 Purchasing Division
 2019 Washington Street East
 Post Office Box 50130
 Charleston, WV 25305-0130

**State of West Virginia
 Solicitation Response**

Proc Folder: 1377104
Solicitation Description: DWWM Injection Reservoir Modeling Software
Proc Type: Central Contract - Fixed Amt

Solicitation Closes	Solicitation Response	Version
2024-03-06 13:30	SR 0313 ESR03042400000004545	1

VENDOR
 VS0000045250
 Computer Modelling Group Ltd

Solicitation Number: CRFQ 0313 DEP2400000029
Total Bid: 33100.05000000000291038304567 **Response Date:** 2024-03-04 **Response Time:** 17:12:48
Comments: Please do not hesitate to contact me if you need any clarification, or if you have any additional questions - Soraya Fears (479)439-2451

FOR INFORMATION CONTACT THE BUYER
 Joseph E Hager III
 (304) 558-2306
 joseph.e.hageriii@wv.gov

Vendor Signature X **FEIN#** **DATE**

All offers subject to all terms and conditions contained in this solicitation

Line	Comm Ln Desc	Qty	Unit Issue	Unit Price	Ln Total Or Contract Amount
1	Injection Reservoir Modeling Software License Year 1	3.00000	EA	3333.340000	10000.02

Comm Code	Manufacturer	Specification	Model #
43230000			

Commodity Line Comments: 3 annual network GEM licenses with 6 parallel tokens, and 3 copies of Builder, Results, and Winprop for a total of \$10,000 for year 1.

Extended Description:

INJECTION RESERVOIR MODELING SOFTWARE FOR CLASS 6 CCUS UIC WELLS

Line	Comm Ln Desc	Qty	Unit Issue	Unit Price	Ln Total Or Contract Amount
2	Injection Reservoir Modeling Software License Renewal Year 2	3.00000	EA	3666.670000	11000.01

Comm Code	Manufacturer	Specification	Model #
43230000			

Commodity Line Comments: 3 annual network GEM licenses with 6 parallel tokens, and 3 copies of Builder, Results, and Winprop for a total of \$11,000 for year 2.

Extended Description:

Three (3) Licenses and Six (6) Tokens

INJECTION RESERVOIR MODELING SOFTWARE FOR CLASS 6 CCUS UIC WELLS

Line	Comm Ln Desc	Qty	Unit Issue	Unit Price	Ln Total Or Contract Amount
3	Injection Reservoir Modeling Software License Renewal Year 3	3.00000	EA	4033.340000	12100.02

Comm Code	Manufacturer	Specification	Model #
43230000			

Commodity Line Comments: 3 annual network GEM licenses with 6 parallel tokens, and 3 copies of Builder, Results, and Winprop for a total of \$12,100 for year 3.

Extended Description:

Three (3) Licenses and Six (6) Tokens

INJECTION RESERVOIR MODELING SOFTWARE FOR CLASS 6 CCUS UIC WELLS



September 8, 2023

To Whom it May Concern:

CMG provides industry-leading reservoir simulation software, especially for carbon capture and storage (CCS) applications. CMG has done several independent and client-involved benchmarking studies to demonstrate CMG as the fastest simulator for a variety of recovery processes.

Speed without accuracy and correct physics is not a reliable option to model such advanced processes. With CMG, all of these are realized. Unlike some of our competitors, the CCS components of the software are well developed, as it was first used for this application over 20 years ago.

20% of the company's revenue is dedicated to R&D continuous development, and over 50% of CMG personnel has a master's or doctorate degree. CMG has an excellent track record in providing technical support to our customers. Our average turnaround time to answer any support questions is less than 24 hours.

I sincerely believe we offer more value to our clients, at every level, both technically and personally, due to our client-service focus, and our emphasis on the fundamental physics of the processes we are asked to simulate.

Sincerely,

Sheldon Harbinson

Sheldon Harbinson

Vice President, Western Hemisphere

CMG for CCS

CMG has been most widely used reservoir simulation software in the industry for enhanced oil recovery processes, unconventional reservoirs, and in conventional oil recovery processes. There are numerous companies that are now using CMG's GEM simulator for their CCS/CCUS needs, primarily for its complete and validated-to-be accurate physics, but also for CMG's technical support and ongoing development.

History:

CMG has a 40+ years of history on reservoir simulation. Our simulators were initially developed in the late 1980's, to simulate thermal reservoirs in the Canadian Heavy Oil industry, but rapidly expanded into chemical EOR, Unconventionals, and other complex simulation scenarios. Thus, we have been simulating subsurface thermal processes with coupled geochemistry and geomechanics, for more than 40yrs. CO2 sequestration is simply one of many types of advanced processes in which CMG specializes. CMG provides reservoir simulation software for almost any type of reservoir, fluid system, drive mechanism and recovery process. In fact, CMG simulators can be used to model a wider range of recovery processes than can be performed using the products from any other commercial software vendor.

CMG has been involved with CO2 sequestration work since the late 1990's. A lot of the functionality was developed as part of a research project with the Japanese back in the early 2000's. It was initially aimed at saline aquifer disposal but then branched out to more general CO2 EOR and Low Salinity Waterflood.

Physics:

Specific to CCS/CCUS modelling, CMG has the tools to model the most advanced physics required to for carbon capture and underground storage applications. The following list of functionalities play a vital role for modelling a successful CCS project, and GEM can accurately model all such mechanisms.

• Modelling of Trapping Mechanisms:

- Structural trapping
- Residual Gas trapping (hysteresis of Krg curves)
- Carbon Dioxide Solubility in Aqueous phase
- Mineralization phenomena via chemical reactions

• Geomechanics

- Cap rock integrity
- Induced fracturing
- Fault activation

• Geochemistry

- Gas solubility in aqueous phase (Function of Pressure, temperature, and salinity)

- Aqueous chemical equilibrium reactions
- Mineral dissolution and precipitation reactions
- Accurate calculation of brine density and viscosity
- Mineral Equilibrium Reactions
- Convective and Dispersive flow
- Diffusion and Dispersion
- Water phase vaporization
- Thermal module
- K-Value formulation

Clientele:

The last couple of years has seen a renewed interest in CCS simulation and has led to several of the global majors and some independent operators, benchmarking CMG, versus other simulators in terms of both functionality and performance for CCS. Europe being the forefront of energy transition, several independent benchmarking CCS studies from Companies such as BP, ENI, EBN, Wintershall-DEA, has concluded in favour of CMG.

In North America, as of March 2022, the following companies have been using CMG for their CCS needs and the list has been growing.

E&P Operators	Service Companies	Other Organizations
ExxonMobil	Baker Hughes	UND's EERC (PCOR DOE Project since 2008)
Talos Energy	Lonquist	Battelle (MRCSP DOE Project since 2011)
Denbury	RESPEC	UT-Austin's BEG (since 2010)
Devon	GHD	Illinois State University (since 2020)
BP	Next-Decade	National Renewable Energy Lab(now called Alliance for Sustainable Energy, since 2017)
OXY	Ryder-Scott	
AERA Energy	Vault 44.01	
CRC		
Shell		

State Regulators

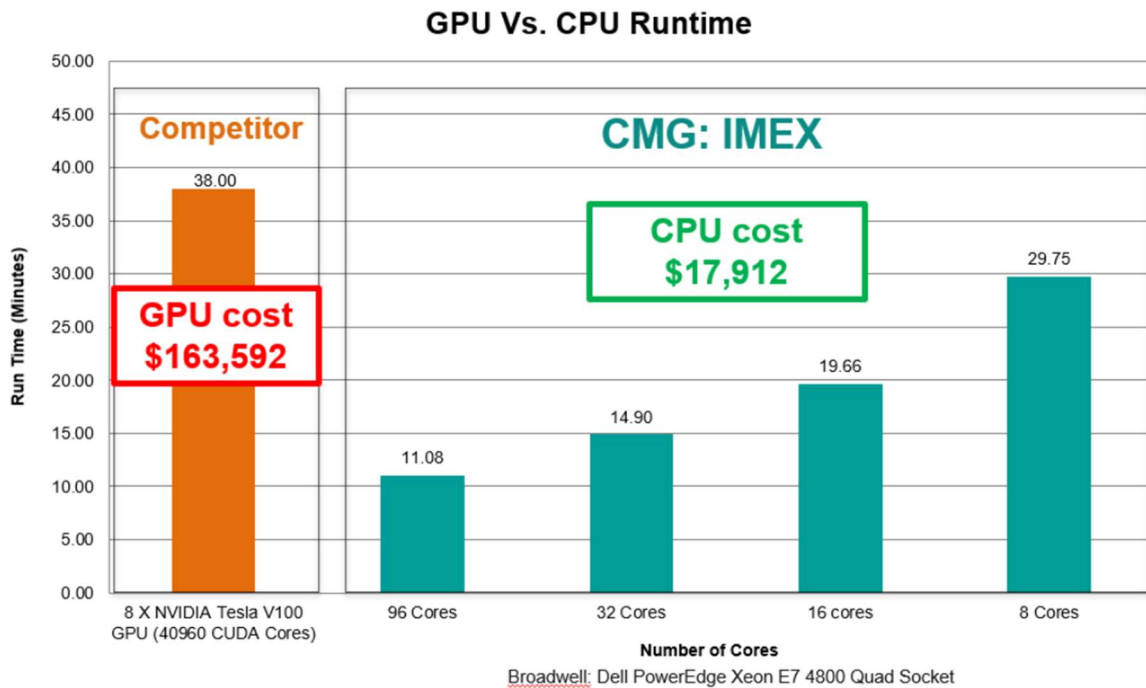
The following list is the State regulators, some with Class VI primacy, have selected GEM as their software for modelling CCS/CCUS or are evaluating it currently.

- North Dakota Industrial Commission
- Louisiana Department of Natural Resources
- Wyoming Department of Environmental Quality
- The Railroad Commission of Texas)
- Alaska Department of Natural Resources

With growing list of regulators using GEM, it would be ideal to simply submit the models in GEM format directly to the respective governing bodies of the state.

Runtime Comparison:

Speed without accuracy and correct physics is not a reliable option to model such advanced processes. CMG has done several independent and client-involved benchmarking studies to demonstrate CMG as the fastest simulator for a variety of recovery processes. One such performance comparison data point that can be shared is a competitor vs IMEX comparison we did using a competitor's model format provided to us by a USA-based independent E&P firm. In this case, the run times were about the same, with IMEX only running on a single 96-core CPU-based node/computer versus other simulator running on tens of thousands of GPU cores. That E&P firm was "impressed with IMEX" to say the least.



Another recent comparison is from a model given to us by an E&P operator based in DFW. The following table describes the model details and a 16-core run time comparison between the two simulators. Please note we have used our AI based AUTOTUNE, meaning no manual intervention was needed to numerically tune the model. As you can see CMG ran significantly faster than competitor’s simulator.

Model Description	
Total Number of Blocks	815,424
Number of Active Blocks	448,002
Number of well	5
Years of Production	5
PVT Regions	14
Rel Perm Tables	14

	Competitor’s	CMG	MB Error
# of Cores	Run time	Run Time (min)	%
16 Cores	2 hrs. 45 min (165 min)	22.59	0.03g

CMG experimented with GPU-based parallel processing several years ago and found that although it looked promising for speeding up some simple black oil models it could not handle the more complex fluid systems and recovery processes our clients model with GEM and STARS. I don’t think that anyone using GPU-based parallel processing is running compositional, thermal, geomechanical or geochemical based problems for that reason.

Therefore, in summary, at CMG we have found that running in parallel mode on CPUs is still the fastest way for us to run CMG’s reservoir simulators. We are getting ready to release our new “distributed memory” parallel processing feature in all three of CMG’s simulators, which will allow bigger models to be spread amongst multiple (i.e., distributed) nodes.

We are open to doing any benchmarking studies with your models to prove CMG is not only the fastest but also an accurate simulator.

Technical Support:

CMG has an excellent track record in providing technical support to our customers. Our average turnaround time to answer any support questions is less than 24 hrs. We have 5 full time Support team members based in Houston that are available to answer any questions. When you have a question, your CMG Houston technical team is only a phone call or email away.

Training:

Our reservoir simulation training program teaches how to effectively use the entire CMG software suite to model all major recovery processes and solve reservoir challenges. We have created our lab-based training courses to provide the ultimate immersive

experience using the CMG technology, so you can learn faster (most of our courses are one or two days long) and immediately apply skills at your workplace. With our hands-on approach you will make more progress in less time than you would in a traditional classroom. Our CO₂ Sequestration online class is taught every month.

Licensing:

CMG provides a range of perpetual/maintenance/lease/CLOUD options. Importantly, we do not break our applications into separately priced modules. If you lease GEM, it will come with all functionalities, including geochemistry and geomechanics, LGR, thermal option etc., in the single price. The exception is parallel processing, which is a separate item.

Value:

I sincerely believe we offer more value to our clients, at every level, both technically and personally, due to our client-service focus, and our emphasis on the fundamental physics of the processes we are asked to simulate. Business-wise, we have a reputation of being easy to deal with and highly responsive, and clients appreciate the fact that there are no hidden costs or extras. For these reasons, we feel CMG is your best and most cost-effective source for all of your reservoir simulation requirements! I would be happy to further discuss what CMG can offer, different recovery techniques that CMG can model, and how we can benefit you and your company to successfully model CO₂ storage applications.