

3.1 Introduction to CMG

Computer modeling group abbreviated as CMG, is a software company that produces reservoir simulation programs for the oil and gas industry. It is based in Calgary, Alberta, Canada with branch offices in Houston, Dubai, Caracas and London. The company is traded on the Toronto Stock Exchange under the symbol CMG. The company offers three simulators, a black oil simulator, called IMEX, a compositional simulator called GEM and a thermal compositional simulator called STARS.

The company began in 1978 as an effort to develop a simulator by Khalid Aziz of the University of Calgary's Chemical Engineering department, with a research grant from the government of Alberta.

Builder is a MS-Windows based software tool that you can use to create simulation input files (datasets) for CMG simulators. All three CMG simulators, IMEX, GEM and STARS, are supported by Builder. Builder covers all areas of data input, including creating and importing grids and grid properties, locating wells, importing well production data, importing or creating fluid models, rock-fluid properties, and initial conditions. Builder contains a number of tools for data manipulation, creating tables from correlations, and data checking. It allows you to visualize and check your data before running a simulation.

3.2 CMG component

3.2.1 Builder

Builder is CMG's Windows' User Interface for preparing reservoir simulation models. With the latest technology and a very efficient model preparation workflow, Builder assists engineers in easily navigating the often complex process of preparing reservoir Simulation models.

Figure 3.1 explains the six major components in builder's tree view.

3.2.2 Generalized Equation-of-State Model Reservoir Simulator (GEM)

GEM is a full equation-of-state compositional reservoir simulator with advanced features for modelling recovery processes where the fluid composition affects recovery.

GEM also models asphaltenes, coal bed methane and the geochemistry of the sequestration of various gases including acid Gases and CO₂.

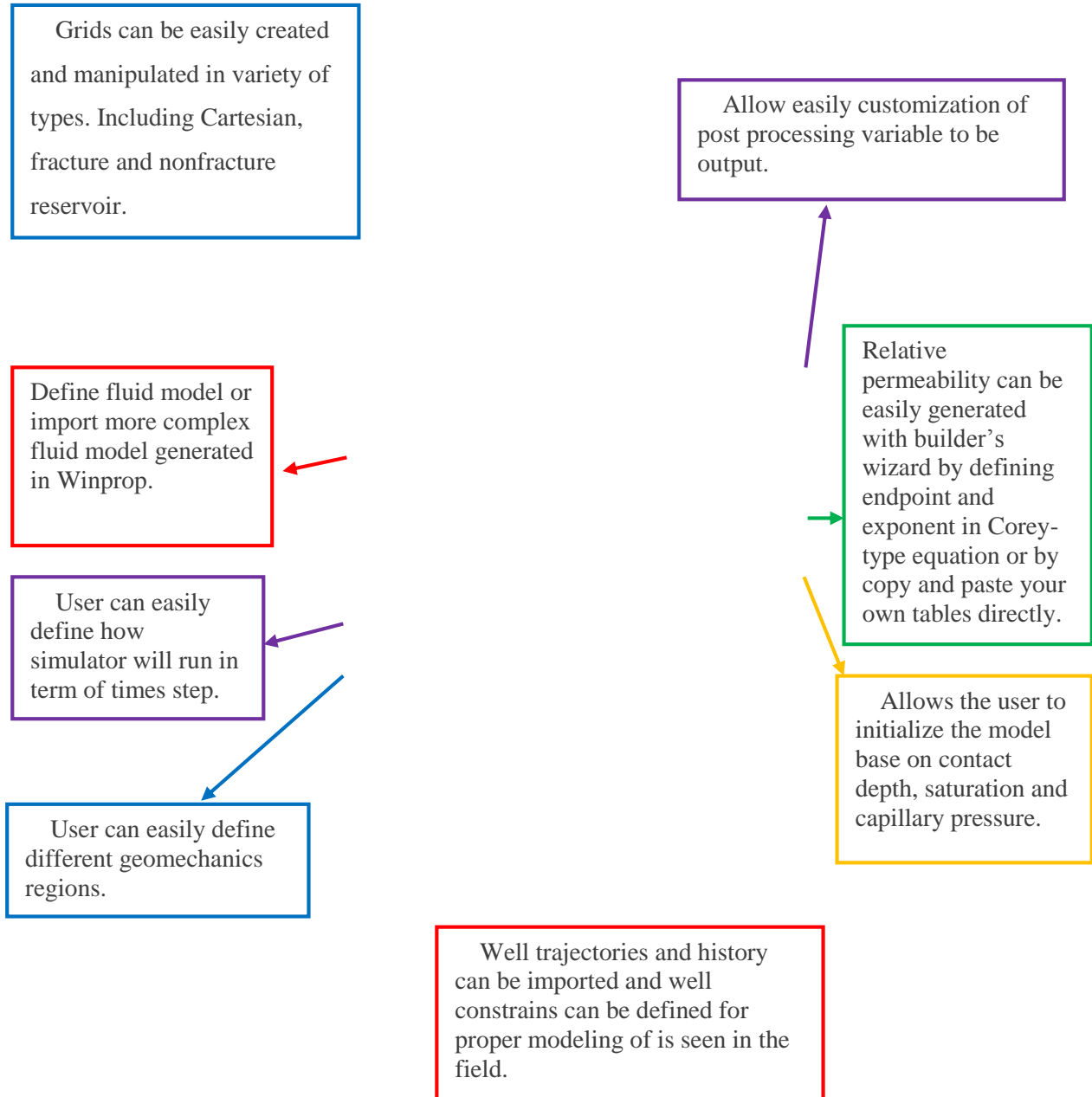
3.2.3 Implicit-Explicit Black Oil Simulator (IMEX)

IMEX is a full -featured three-phase, four-component black oil reservoir simulator for modelling primary depletion and secondary recovery processes in conventional oil and gas reservoirs. IMEX also models pseudo-miscible and polymer injection in conventional oil reservoirs, and primary depletion of gas condensate reservoirs, as well as the behavior of naturally or hydraulically fractured reservoirs.

3.2.4 Steam, Thermal and Advanced processes Reservoir Simulator (STARS)

STARS is a thermal, K-value compositional, chemical reaction and geomechanics reservoir simulator ideally suited for advanced modelling of recovery processes involving the injection of steam, solvents, air and chemicals.

Fig. 3.1: Builder's Model Tree View



3.3 Steps to Get Results

Results Graph is typically used to plot curves of well properties that vary over time (“Timeseries properties”). Examples of Timeseries property are Cumulative- Oil, Gas and Water; Oil-, Gas- and Water Rates, etc. These Timeseries properties are read from a simulation output file. The plot can contain as many wells, groups, sectors, leases, or layers that vary with time as you wish data from several different files More than one parameter versus time curves More than one parameter versus parameter curves. Parameters from all those available in the selected simulation results files (SR2), field history files (FHF) or PA Load Format files In addition, you can Plot spatial property (e.g. oil saturation) versus distance curves. Currently you can specify three types of distances: Along a well trajectory Along a well “path” (perforation-to-perforation as defined in the simulation input file) and Between two blocks specified by their UBAs (Universal Block Address, e.g. 5,3,2) Create “Special History” by reading spatial property data at the available time records in the SR2 file. These parameters can then be used just like any other Special History parameter that is output in the SR2 file. Create “difference property” parameters. A difference property is created from two files with identical property and well names. These parameters can be used just like any other parameters to create curves.

- **Step 1**

Click Components in the menu bar then select Process Wizard (figure 3.2).

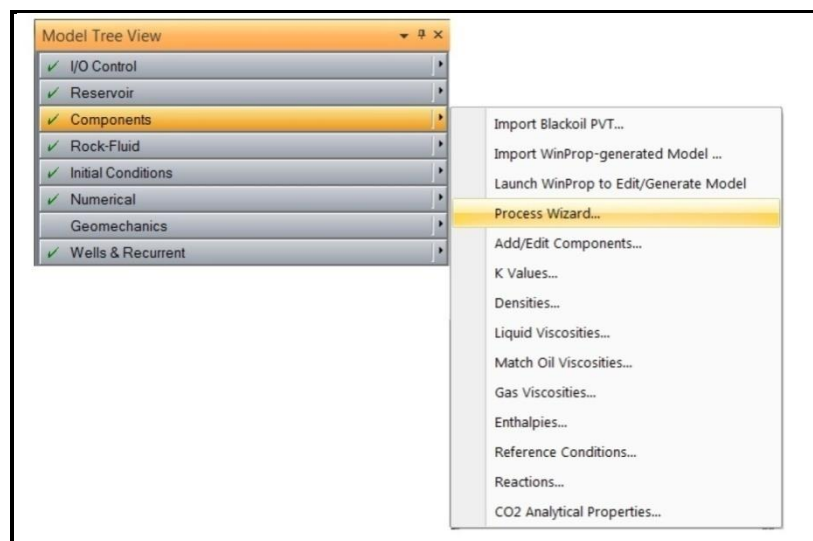


Fig. 3.2: Selection of Process Wizard

- Step 2

In process wizard window, click on Alkaline, surfactant, foam, and/or polymer model (figure 3.3).

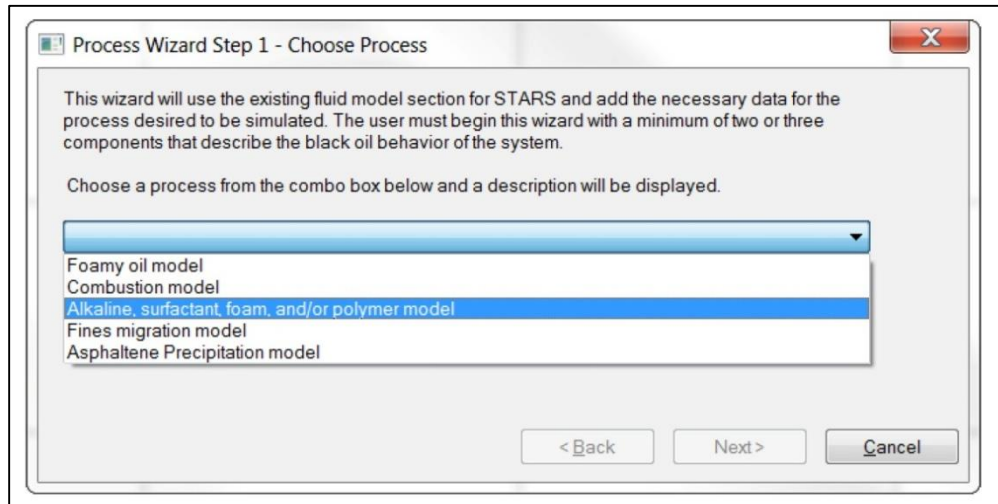


Fig. 3.3: Choosing of process

- Step 3

Click Next on the Process screen (figure 3.4).

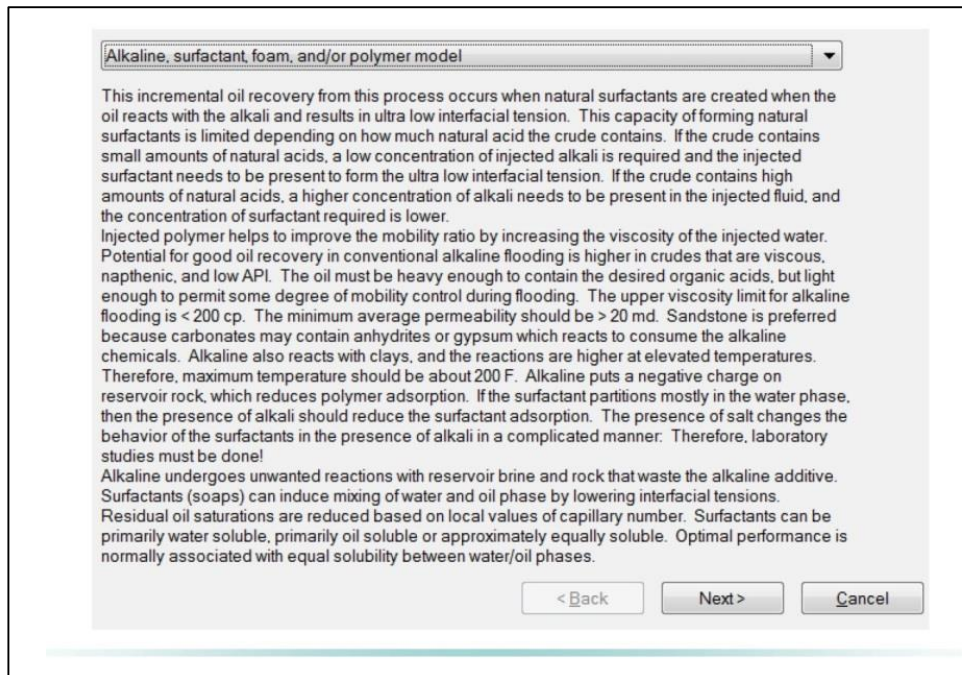


Fig. 3.4: Process screen

- **Step 4- Flood Models**

In Flood models screen select Surfactant flood (add 1 component) (figure 3.5).

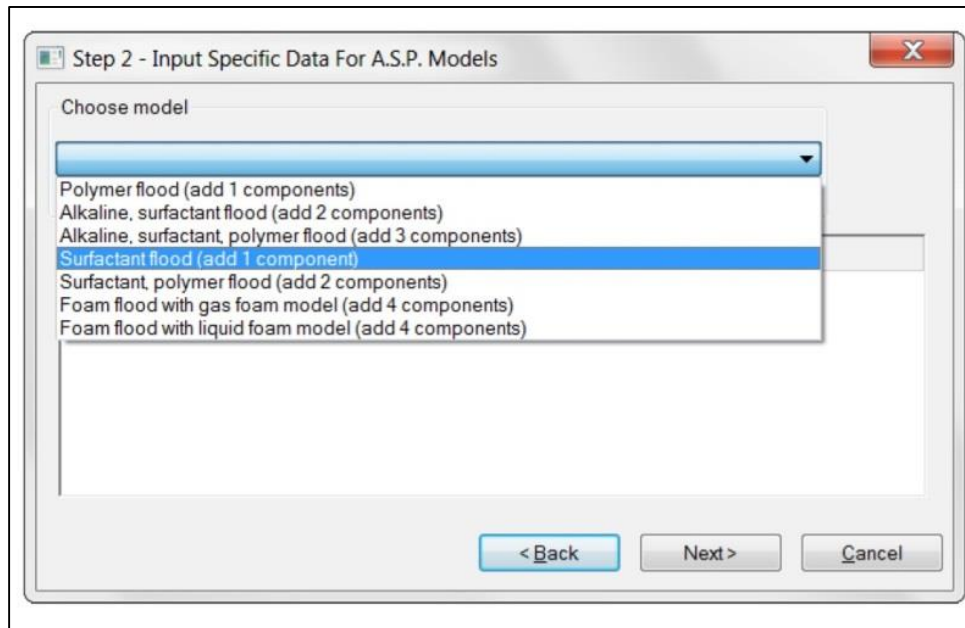


Fig. 3.5: Flood model selection

- **Step 5- flood Models**

In flood model screen, select options for the selected model (figure 3.6).

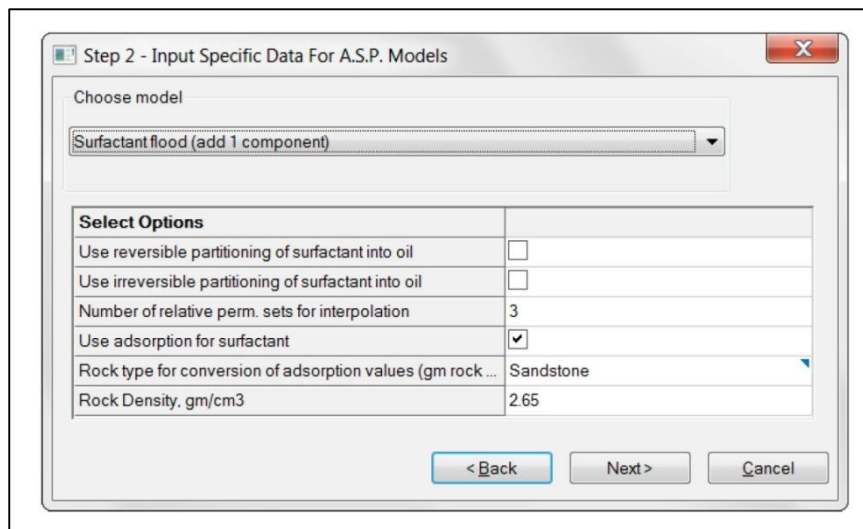


Fig. 3.6: Select Options for flood model

- **Step 6 - Component Selection:**

In Component Selection window, add a new surfactant component if one has not been defined, or just select the component that has already been defined (figure 3.7).

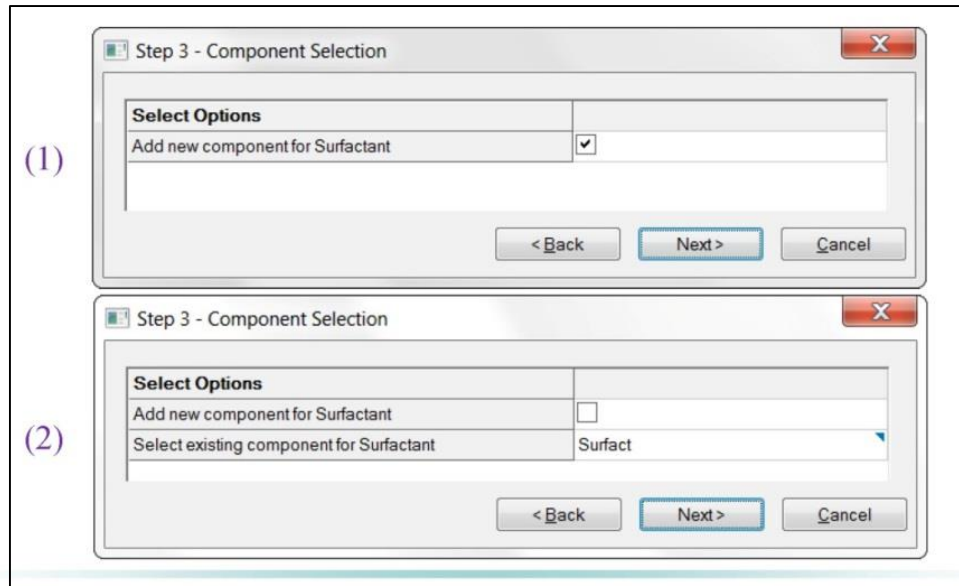


Fig. 3.7: Component Selection

- **Step 7- Set Rock Fluid Regions:**

This option allows the selection of which relative permeability curves will be used for the interpolation option (figure 3.8).

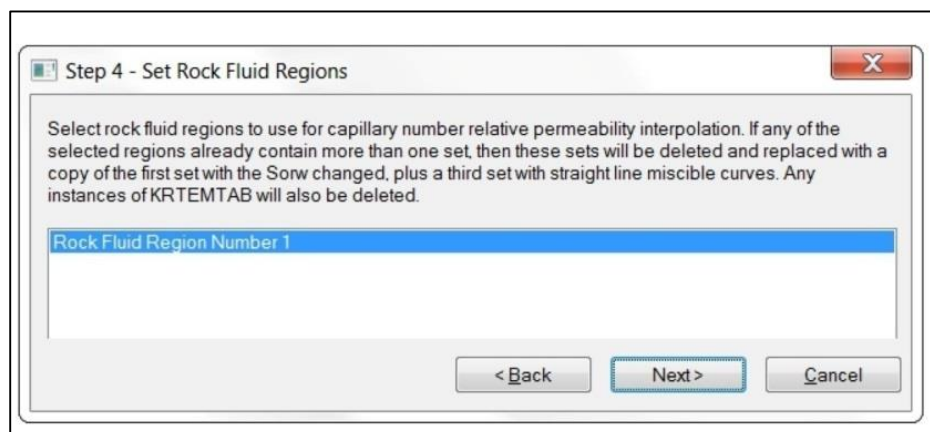


Fig. 3.8: Set Rock Fluid Regions

- **Step 8 - Set Interfacial Tension Values**

This is where the weight % vs. Interfacial Tension table from the lab is entered (figure 3.9).

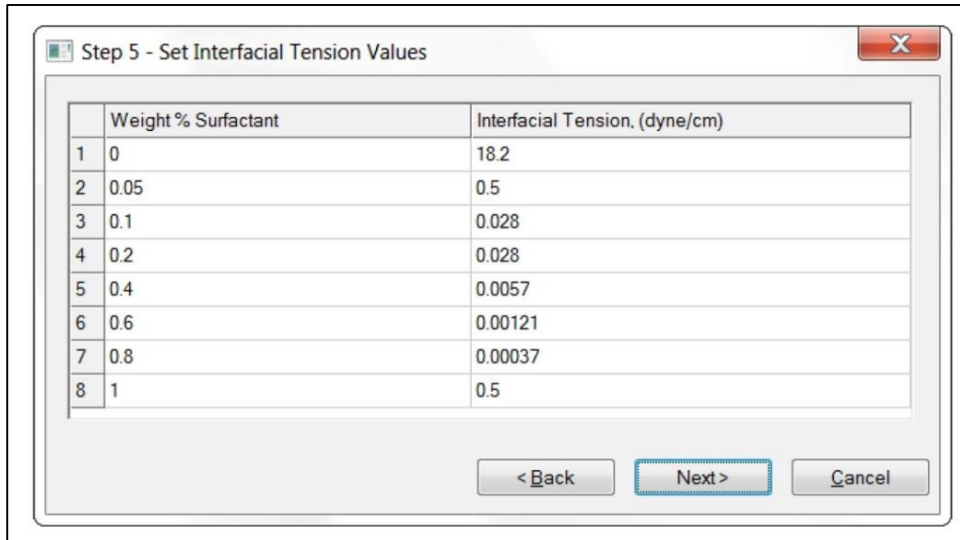


Fig. 3.9: Set Interfacial Tension Values

- **Step 9 - Set Adsorption Values**

This is where the weight % vs. Surfactant adsorption table from the lab is entered (figure3.10).

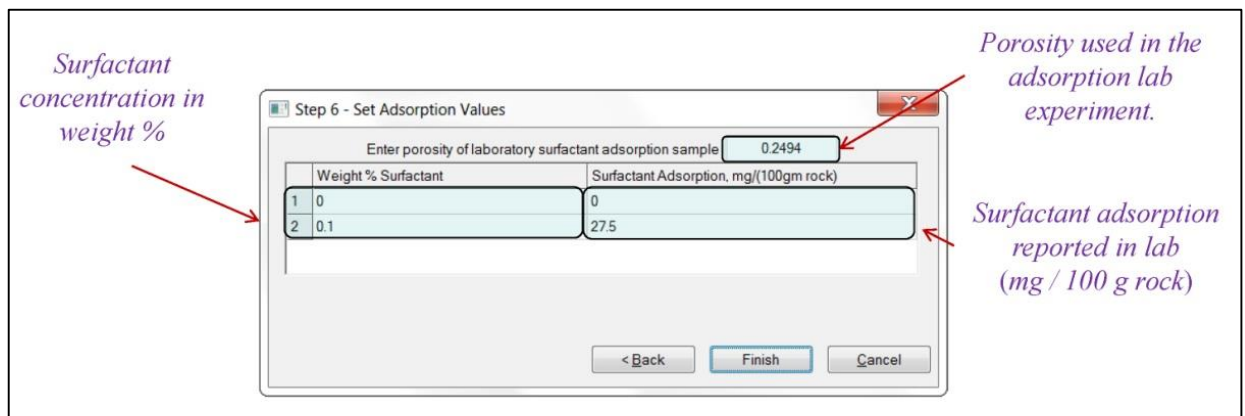


Fig. 3.10: Set Adsorption Values

3.4 Result and Finishing

This is the final step where a report is delivered to make the best decision. CMG generates various informative graphs, prepare 2D and 3D plots, and prepare tables of required information to be included in a study report (figure 3.11).

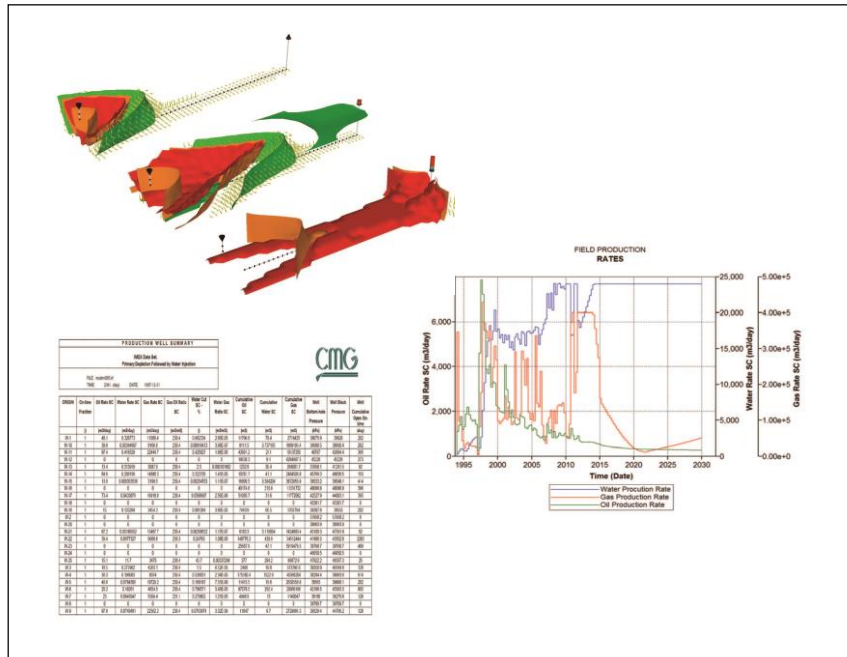


Fig. 3.11: Various Report Types