Screenshots

MAROS 9

RAM analysis for upstream Oil and Gas industry

1. Logic Network and Reliability Block Diagrams

The first and most important step in the modelling process is to generate a logic network of the system under investigation. A logic network can be considered as a Block Flow Diagram (BFD) which defines the connectivity of nodes and focuses on the production aspects of the system e.g. flow rates and product mass balances. Maros provides a user-friendly interface and many tools that make the process of building the BFDs very efficient and intuitive.

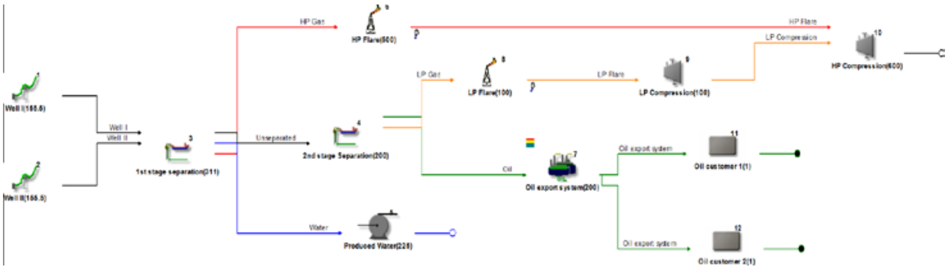


Figure 1: Block Flow Diagram (BFD)

This include typical processes for the upstream industry such as: separation, flaring and customer distribution. Each node within the network will require its own RBD which identifies the system's components and their operating mode.

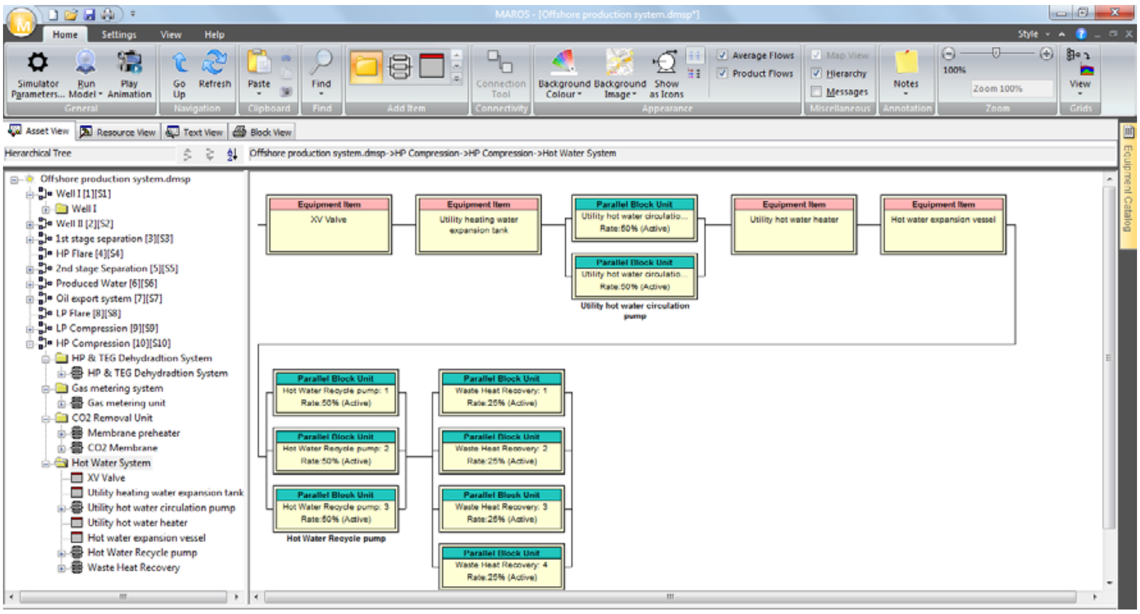


Figure 2: Reliability Block Diagram view of a model in Maros

The classical Reliability Block Diagram can be viewed in its Equipment form at any point during the modelling.

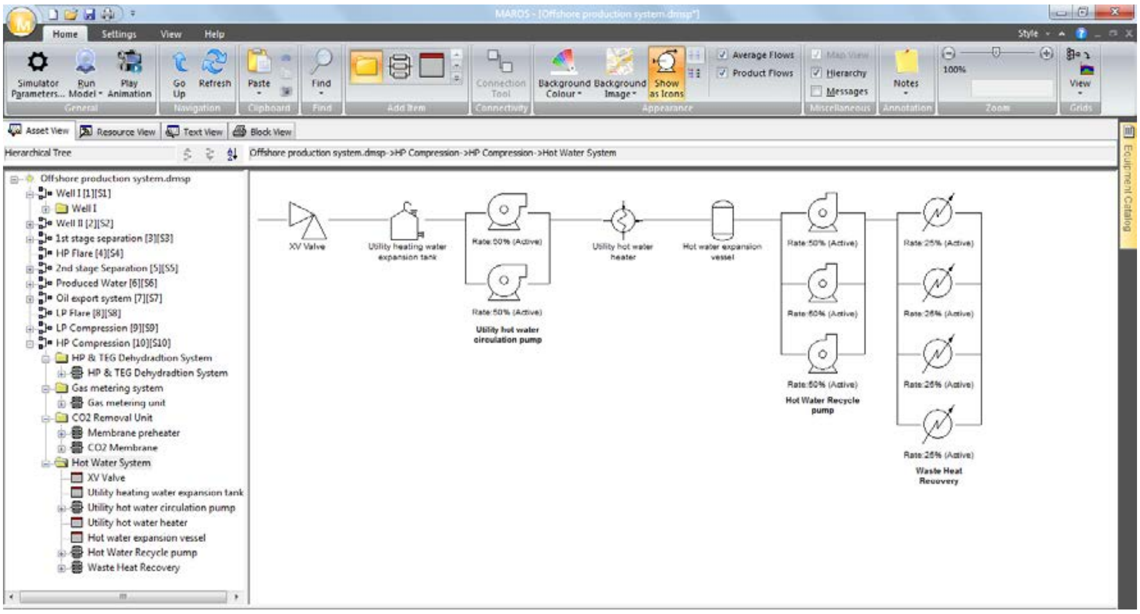


Figure 3: Equipment view underlying the RBD in a model

2. Equipment Catalogue

The Equipment Catalogue is a repository for items used during the construction of a model. In order to build a model, the user must simply drag the items to the workspace. The Equipment catalogue contains a vast range of pre-defined equipment but the user can also add new equipment and create their own catalogue. Catalogues of the most widely manipulated equipment including reliability data (failure and repairs modes) can be shared with other users.

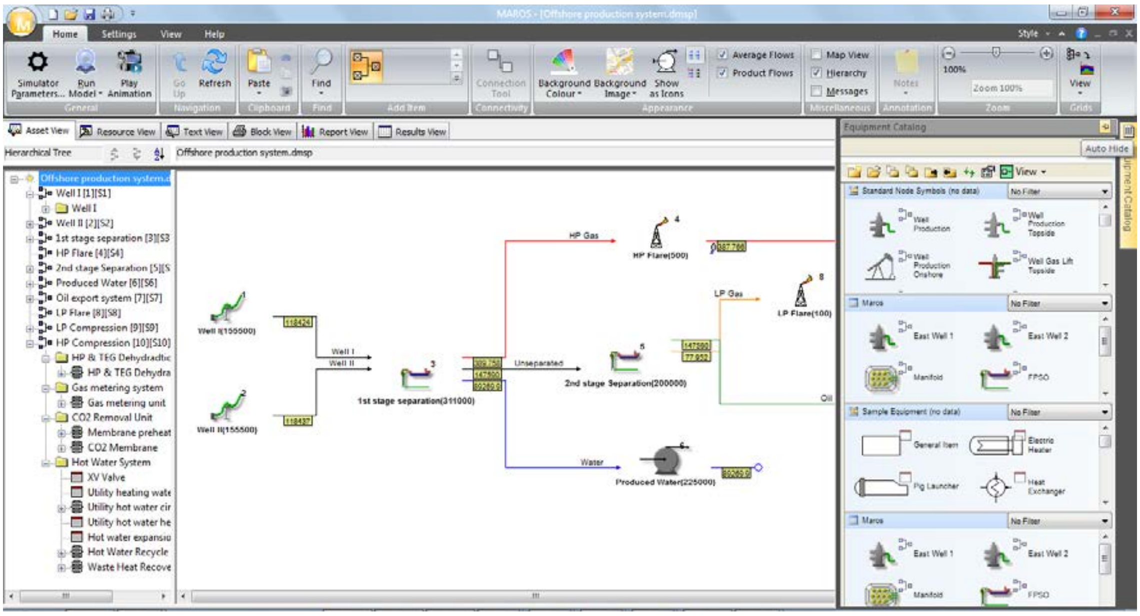


Figure 4: At the right side of the screen, it is possible to see the Equipment Catalogue

3. Data management and grids

Maros provides flexible ways for defining and manipulating input data to allow the user to focus less on input operations and more on using results to improve the performance of the system. The menus and table data views allow the user to browse the different systems and features inside the model very efficiently.

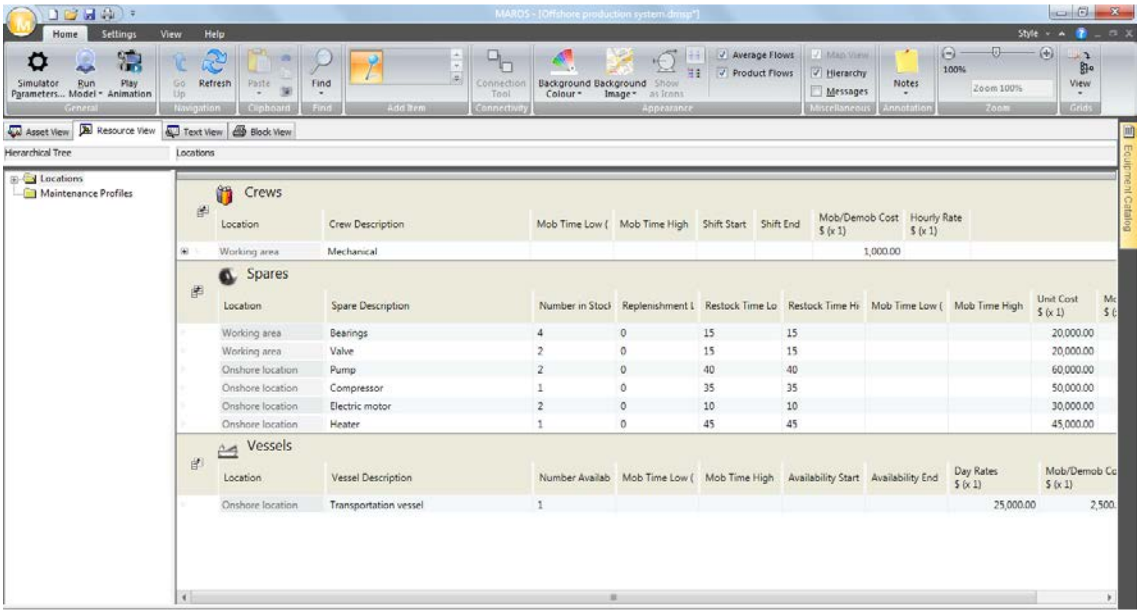
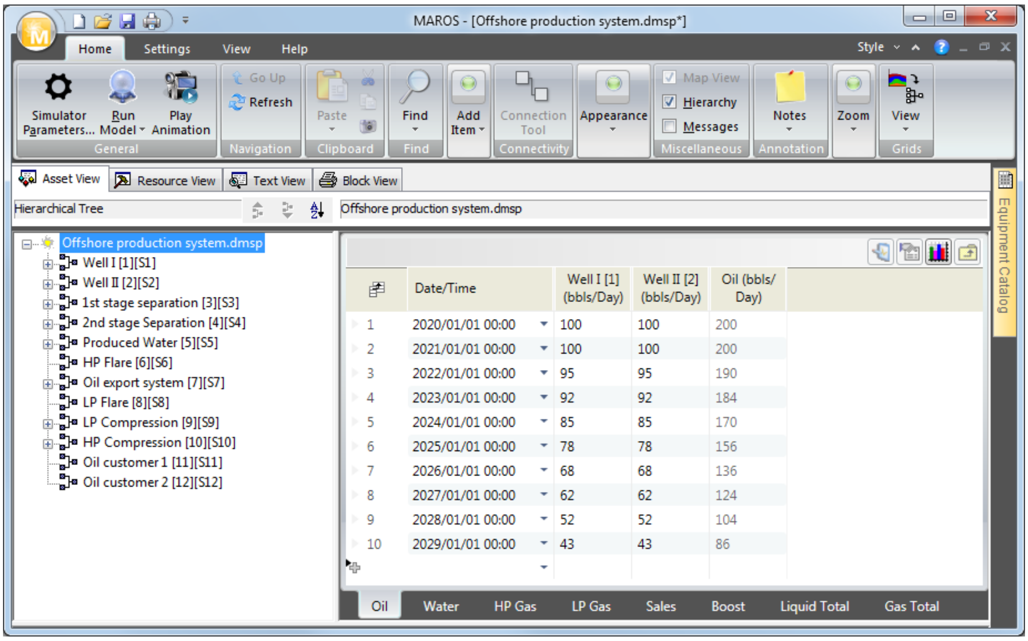


Figure 5: Example of usability of Maros

Currently, there are seven table views available: Asset, Flow grid, Equipment grid, Scheduled Activities, Conditional grid, Parallel Blocks grid and Resource grid.

4. Flow Profile

Maros allows the user to provide information about the reservoir profiles which will, normally, change over time. It also includes a product demand profile; giving results of whether a certain demand requirement is met for a certain configuration of the system.



	Date/Time	Well I [1] (bbls/Day)	Well II [2] (bbls/Day)	Oil (bbls/ Day)
1	2020/01/01 00:00	100	100	200
2	2021/01/01 00:00	100	100	200
3	2022/01/01 00:00	95	95	190
4	2023/01/01 00:00	92	92	184
5	2024/01/01 00:00	85	85	170
6	2025/01/01 00:00	78	78	156
7	2026/01/01 00:00	68	68	136
8	2027/01/01 00:00	62	62	124
9	2028/01/01 00:00	52	52	104
10	2029/01/01 00:00	43	43	86

Figure 6: Flow grid with two wells

This powerful feature set is invaluable in designing and operating a system which meets business demands during variable oil and gas reservoir behaviour.

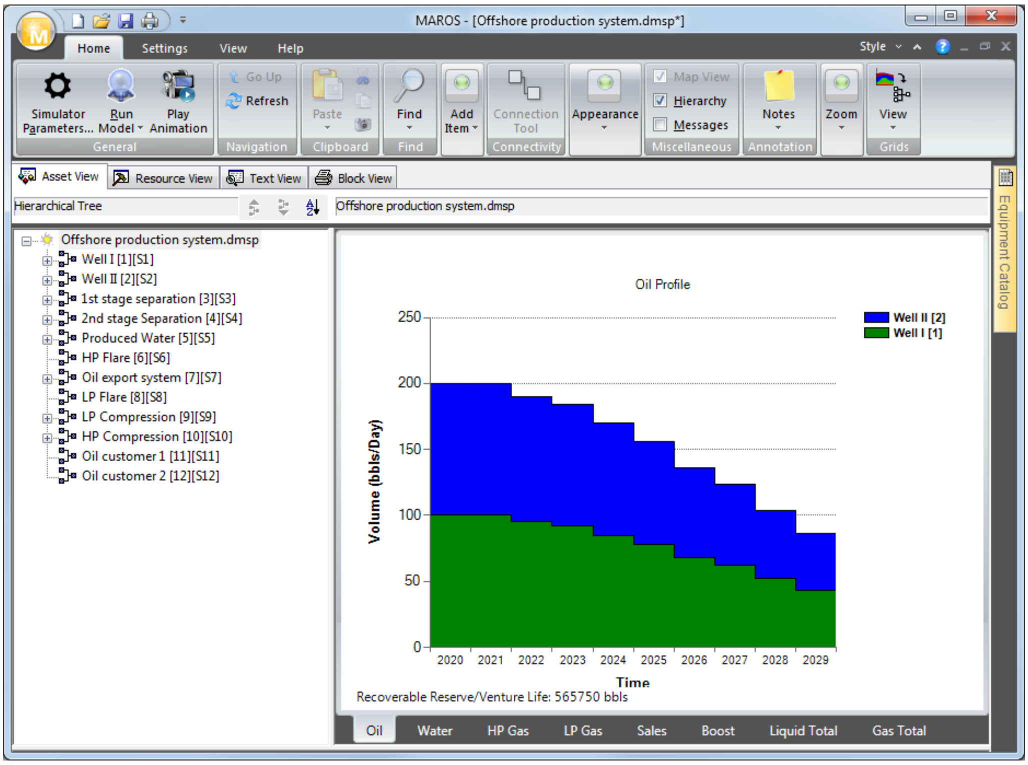


Figure 7: Example the transient life of a well modelled in Maros

5. Failure Distribution and Repair Distribution

The software comprises the analysis-critical failure and repair distributions commonly used in RAM analysis.

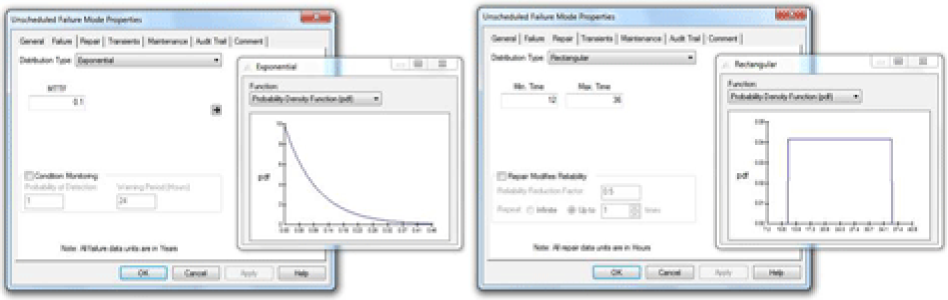


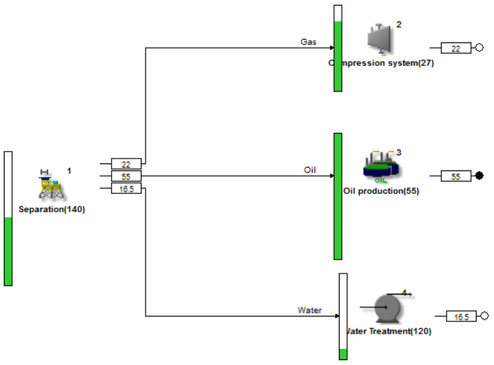
Figure 8: Examples of Exponential and Rectangular failure probability distribution profiles shown from the extensive library

6. Animation mode

Maros graphically presents progress of the simulation and offers your tools for managing and illustrating the results. The animation feature allows you to replay details of the simulation activities to observe the complex behaviour of your asset under theoretical lifecycles.

(I) Start of system life:

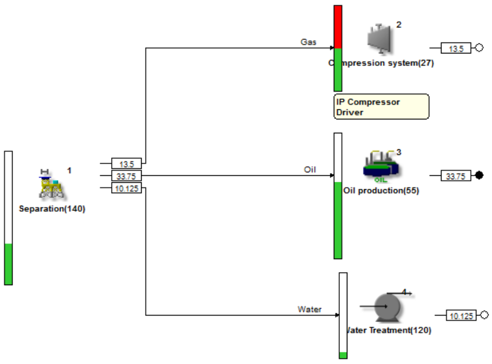
At the beginning of the system life, the production rates for the different systems can be seen. For instance, there is a full production capacity of oil during the first two years (check the flow table) and a small production rate of water



(II) Failure at the compression system:

The IP compressor driver fails which reducing the compression capacity. Each compressor is designed to take 50% of the peak capacity of gas -13.5mmcf/day. Hence, when one of the compressions train fails, the second train takes full production.

At this point int time, the production rate of gas is 22 mmscf/day so the production loss when the compressor driver fails is 8.5 mmscf/day. This will proportionally impact the other systems – 8.5 mmscf/day represents 38.63% of the compression capacity at this point in time – so the all other units will have its capacity reduced by 38.63%.
Taking the export node as a reference, the production capacity of oil is 55 mbbls i.e. 38.63% of the 55mbbls = 33.75 mbbls/day.



(III) Failure on the Water production system:

The Produced Water Pump A fails. The produced Water pumps are designed to take 50% of the peak capacity of Water which is 120mbbls/day. Therefore, each pump can take up to 60 mbbls/day.

At this point in time, the water production rate is 16.5 mbbls/day so losing one pump will not impact the overall production of the system since the second train can take full production without any problem.

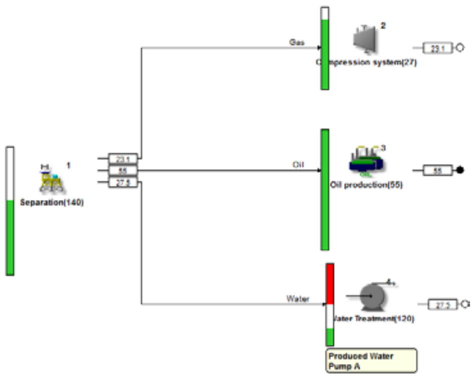


Figure 9 - Results animation

7. Result Viewer

Maros offers a large range of results which can be used to drill down into detail. Additionally, Expert View provides access to raw results data for specific lifecycle event investigation.

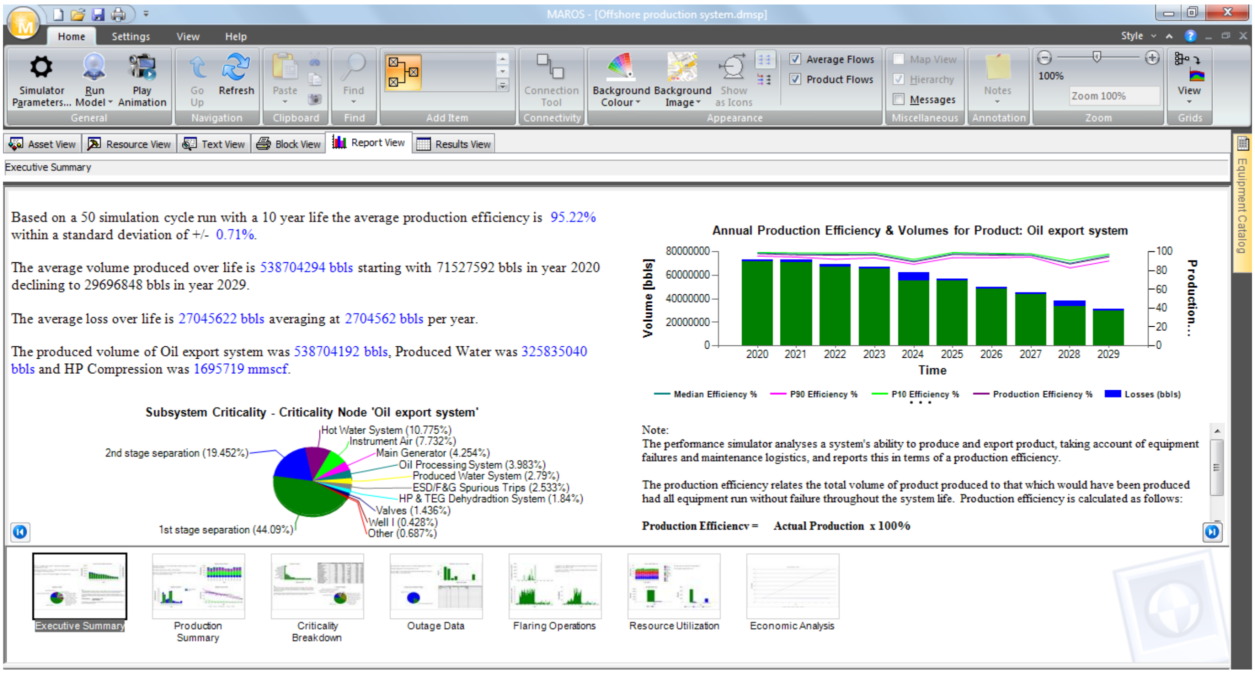


Figure 10: Results Viewer showing summary production efficiency and criticality results. Note the textual hyperlinks for intuitive drill down into underlying results

8. Sensitivity Manager

Sensitivity Manager allows users to manage all the scenarios that need to investigate to ensure optimum performance. The application comes with a batch run functionality which empowers users to run multiple projects. Computers with multi-core processors will have the option to run multiple project files in parallel saving potentially a lot of time, depending on the number of processor cores available to be used and the number of projects to be simulated.

The base case can visualise using Maros and Taro Viewer – a read-only version of Maros and Taro. This ensures that the user has access to identify potential problems before changing any specific set of parameters.

Upon selection of the base case, a number of sensitivities can be defined. The sensitivities range from storage tank sizes to modification of reliability data.

Upon completion of the multi-core run, users have two options to visualise the results:

- The traditional Results Viewer in both Maros and Taro which compile all the key performance indicators of the base case
- A comparison view which compared the main KPIs of all the sensitivity models pre-defined by the user

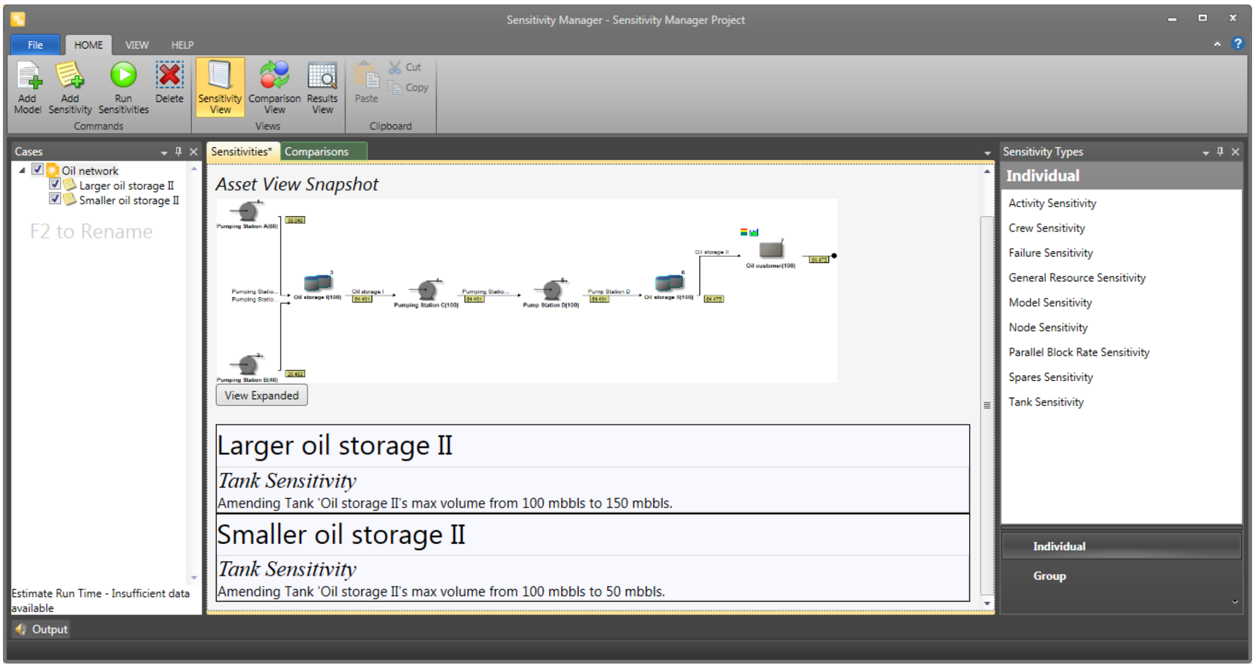


Figure 11: Sensitivity Manager