Manual: 4.3. Goal Function

The purpose of process optimization is to tell you what set-points to modify in order for your plant to reach its best operating point. In order for this to be possible, you must define what you mean by best. Any numerical quantity will do, e.g. efficiency, yield, profit and so on.

APO will maximize the goal function and so it is important how you formulate your goal. If you want APO to minimize some quantity, e.g. cost, then all you need to do is to put a minus sign in front. Then maximization will turn into minimization.

All pieces of information needed to evaluate the goal function must be available in the database. Let's take the example of the revenue due to the sale of electricity. On the one hand, we need a tag that measures the amount of electricity produced. That is usually part of the process model anyway. We also need, however, the financial value of one unit of electricity sold. This is generally not part of the process model. In order to include it as part of the goal function, you must include this tag in the database as well. Please note that financial prices are generally tags of their own as prices do tend to change over time. That is to say, prices are generally not static numbers.

The goal function of APO is the sum of as many terms as you like with each term having three elements that are multiplied together:

1. The factor is a number that is intended to convert any units that might need converting or to include any static multiplier needed for chemical reasons. It also offers the possibility to include a minus sign so that this term is subtracted instead of added to the goal function.
2. The first tag is the main element of this term.
3. The second tag is optional. Its main use is for a goal function that computes profit and so we need to multiply volume by price in every term.

It is very important that each term evaluate to the same physical units so that adding all the terms up into a sum makes sense. In the interface, you may also add a comment for each term in order to document your input.

The input form allows you to specify a time period over which to evaluate the goal function's terms and add them up to their total. This is just for checking and will not influence the model in any way. Please use this feature in order to check the plausibility of the values. In practice, we often find that tags are recorded in different units than expected (for example tons instead of kg) and this causes rather large deviations in numerical values. In addition, sometimes a corrective factor is needed for the molar mass of a substance.

Each tag used in the goal function should ideally be semi-controllable. If a tag is controllable, then the optimizer can simply set it to its maximum value. If a tag is uncontrollable, there is nothing that can be done about that aspect of the goal anyway. This is a guideline and not a strict requirement however. If it is necessary, for the correct computation of profits, for example, to include some uncontrollable tags, then that is necessary.

The goal function is the centerpiece of APO that guides every decision. This must be

specified with great care. If this function corresponds to your true business goals, then APO will get you there.