

## Solver Example

An optimized DDP “proof of concept” (POC) case study model relaxes two fundamental constraints in traditional planning models: that of a fixed supply chain and that of a fixed forecast. Adding response functions to a POC model to relax the assumption of a fixed forecast increases the number of scenarios that would have to be run if the solution was to be determined by scenario analysis (i.e., descriptively) (NOTE: These scenarios are **in addition** those required to evaluate the supply chain scenarios.)

That is the only way to determine, descriptively, which of the various scenarios (which answer the question: “What would happen if we do X?”) answers the much more important question: “What is the best X?”

There are three factors in the model which determine the answer to the question. They are Products (P), Objective functions (OF) and Customers (C)

The number of products and objective functions increases the number of scenarios multiplicatively. Unfortunately, the number of customers increases the number of scenarios exponentially. This is because every customer has 2 possible “states:” that of having more demand purchased for them by the model or not having had demand purchased. Thus, the total number of customer demand configurations is 2 to the number of customers.

Two examples demonstrate, overwhelmingly, when descriptive solutions MUST yield to prescriptive solvers for anything like a realistic, actionable model.

1. This yields for the McCoy POC model where  $P=2$ ,  $OF = 2$  and  $C = 9$ ,  $2 \times 2 \times 2$  to the  $9^{\text{th}}$  (= 512) or 2048 scenarios.
2. For a more realistic model where  $P = 10$ ,  $OF = 2$  and  $C = 50$ , the answer is  $10 \times 2 \times 2$  to the  $50^{\text{th}}$  (= 10 to the  $15^{\text{th}}$ ) or  $2 \times 10$  to the  $16^{\text{th}}$ .
3. When the numbers of possible solutions are expanded to include relaxing the assumption of a fixed supply chain, the case for scenario analysis becomes just that much more absurd. In this case, the integer variables are not absence of presence of a customer responding to a response function. Rather it is the absence of presence of a facility, product, activity, etc in the solution. This increases the possible solutions to, literally, more stars than there are in the cosmos which is 10 to the 24th.