Strategic Planning Optimizer for Votorantim Cimentos

This system was developed in AIMMS for Votorantim Cimentos® Directors in Strategic Planning. It uses a model based on Mixed-Integer Linear Programming techniques. The objective is to evaluate investment initiatives, over a long term horizon (20 to 30 years), besides optimizing the raw materials supply chain and the cement distribution plan.

Problem Description

Portland cement is a hydraulic binding agent produced from various raw materials such as limestone, gypsum and other additions. Basically the production process is divided into two stages: calcination of limestone, previously crushed to form clinker (raw material essential for cement production) and, subsequently, the grinding of clinker with an adequate plaster and/or other additions (limestone filler, steel slag and pozolanas).

The Brazilian market for cement in 2007 was approximately 46.4 million tonnes and has grown in size and complexity. The supply network is growing and the production allocation possibilities are many.

Votorantim Cimentos has an investment plan of about R$ 3,2 billion by 2011. Therefore, it is essential that the company optimize its strategic planning, to avoid unnecessary expenses and at the same time, ensure market supply.

The tool formerly used by the Strategic Planning Board at Votorantim Cement was a linear programming model based on spreadsheets (What's Best®). This model allowed the development of scenarios for the supply of raw material and distribution of cement. However, it did not allow more complete analysis, such as analyzing several possible investments simultaneously. Rather, each setting of expansions was set in advance, so as to verify the impact on total cash flow of the company. The delay in the analysis of each new situation, made more extensive and complete studies impossible. In addition, because of the volatility of markets, new scenarios and assumptions are presented frequently, demanding rapid and robust analysis.

The Challenge

Seeking a more comprehensive and robust solution, Votorantim Cement invited UniSoma to develop a tool that would allow the simulation of various scenarios of possible configurations of their industrial park. This optimizing model should incorporate the entire "supply chain" of the company, from raw material supplement to the distribution of finished product, including the production mix of cement and the transfer of raw materials between the units. Besides the technical challenge, Votorantim Cimentos established a development and delivery time goal: a record of 21 days.
The Solution

To face the challenge, UniSoma developed VCPLAN, a model based on Mixed-Integer Linear Programming techniques. This type of methodology was chosen due to the need of globally optimal solutions and with the objective of maximizing the return on the assets of the company.

To facilitate the work of business analysts (system users) a friendly graphical interface was incorporated. This interface (a) allows the user to include new vendors, production units and demand centers, (b) complete parameterization of the scenario, (c) export comparison of cases in external tools and (d) tables, charts and maps presenting various aspects of the optimized solution.

The solution was developed through the AIMMS language, a state of the art tool for applications of this nature. The various scenarios are solved by CPLEX, which is the highest performance commercial solver available on the market. Through him, typical scenarios with models containing 200.000+ variables and 60.000+ constraints are solved in regular laptops in less than 1 minute.

Customer Quote

"Globalization of the economy has significantly increased market volatility and the need for developing tools to support dynamic strategic analysis. On that basis, we sought UniSoma to develop a strategic simulator, which enabled us to construct scenarios and perform complex analysis of alternative investments. With the Simulator (VCPLAN), we gained in speed and reliability of information."

Alexander Capela Andras - General Manager of Planning - 31st October, 2008

About Votorantim Cimentos

Votorantim Cimentos is one of the ten largest cement, concrete and aggregates companies in the world. The company has 38 cement, aggregates and additions production units (30 units in Brazil, 7 in North America - United States and Canada - and 1 in Bolivia), 60 distribution centers and 105 concrete plants in Brazil as well as over 150 concrete plants and 12 cement terminals in North America. There are over 12 thousand employees and 72 years of successful history - the company was founded in 1936 with the inauguration of the factory Saint Helena, in the city of Votorantim, interior of Sao Paulo.

Domestic market leader with 40% of market share, the company sells more than 40 products in the segments of cement, mortar, lime, agricultural limestone, concrete and aggregates, with important brands such as Votoran, Itaú, Poty, Tocantins, and Aratu Engemix. In 2007, Votorantim Cimentos has a net income of $ 5.6 billion and EBITDA of $ 1.6 billion.

Recently, the company announced the most ambitious expansion plan in its history: US$ 3,2 billion is being invested in Brazil for a 60% increase in cement production capacity, which will jump from the current 25 million tonnes per year to 39 million tonnes per year by 2011. This investment includes upgrades to various factories and mills, reactivation of units Pinheiro Machado / RS and Cocalzinho / GO, construction of four new integrated factories in Xambioá / TO, Baraúna / RN, Porto Velho / RO and Vidal Ramos / SC, the operation of five new mills in Barcarena / PA, Pecém / EC, Aratu / BA, Sepetiba / RJ and Imbituba / SC, and four new production lines in Salto / SP, Rio Branco do Sul / PR, Noble / MT and Sobradinho / DF.