

# Project Selection at Ewing Natural Gas

Ewing Natural Gas is a large energy company with headquarters in Dallas, Texas. The company offers a wide variety of energy products and has annual revenues of approximately \$50 billion. Because of the diverse nature of the company, its Manager for Project Development, Cliff Erland, is under continual pressure to manage project proposals from the functional areas of the company. At any point in time, there might be dozens of projects at various stages requiring a wide variety of capital expenditures, promising widely varying future revenue streams, and containing varying degrees of risk. Cliff has a difficult balancing act. The company's CEO, J.R. Bayer, is very concerned about keeping capital expenditures within a fixed budget and managing risk. The heads of the company's functional areas are less worried about budgets and risks; they are most concerned that their pet projects are approved.

Cliff is currently about to meet with all parties involved to discuss project proposals for the next three years. He has proposals from the various functional areas for projects they would like to undertake. Each of these is accompanied by a schedule of capital expenditures over the next three years and a financial analysis of the expected revenue streams. These lead to an NPV for each proposal, using the company's discount rate of 12%. (See Table 1.) J.R. Bayer has stated in no uncertain terms that the total of capital expenditures (capex) for the approved projects can be no more than \$10 billion and that no more than \$4 billion should be spent in any single year. Unfortunately, the capital expenditures for the potential list of projects is well over \$10 billion, so Cliff knows that some of these very promising projects will not be approved.

Project Index	Functional Area (FA)	Partnership Percentage	Capex Year 1	Capex Year 2	Capex Year 3	NPV
1	FA1	100%	250	100	100	60
2	FA1	33%	500	300	300	180
3	FA1	50%	100	200	400	80
4	FA1	100%	750	500	300	310
5	FA1	75%	200	400	800	220
6	FA2	50%	1,000	300	300	180
7	FA2	100%	750	750	300	410
8	FA2	100%	800	700	600	280
9	FA2	67%	400	600	800	380
10	FA3	100%	100	200	400	100
11	FA3	50%	700	500	300	260
12	FA3	100%	1,500	400	400	340

**Table 1. Financial Estimates for Potential Projects (in \$ millions)**

Several of the projects, if approved, must be undertaken in joint partnership with another company. For example, if project 3 is approved (see Table 1), Ewing will take a 50% share in the project, and the other 50% will be shared by a partner. In this case, Ewing incurs only 50% of the expenditures and receives only 50% of the revenues.

Each functional area wants as many of its projects to be approved as possible, but it certainly does not want to be shut out altogether.

Cliff would like you to model the problem and find the optimal set of projects to approve.

**Please prepare a case report and a spreadsheet model that address the following:**

1. Formulate an IP mathematical model in the case report. Explain the model's decision variables, the objective function, and the constraints. The solution should maximize the total NPV from the approved projects, and it should satisfy the constraints imposed by CEO J. R. Bayer and the functional areas: (1) capital expenditures over the three years should not exceed \$10 billion; (2) capital expenditures in any single year should not exceed \$4 billion; and (3) at least one project must be approved for each functional area. (15 points)
2. Implement the model from question 1 on Excel spreadsheet. Use Excel Solver to find the optimal set of projects to approve. Present and explain your solution. (10 + 5 = 15 points)
3. Cliff looks at the optimal solution from question 1 and sees that it is under budget in each year and in total for all three years. This seems to be a good sign, and he interprets it to mean that the budget limitations aren't important after all. Explain why his interpretation is wrong. Then use SolverTable to help him see how NPV could increase with larger budgets. Specifically, vary each of the four budget limits in question 1 (total budget, budget for year 1, budget for year 2, and budget for year 3) in separate SolverTable runs over reasonable ranges. (10 points)
4. The optimal solution in question 1 still might not satisfy the functional areas. They will each get at least one project, but they will probably want more. Find the implications of promising each functional area *at least two projects*. (5 points)
5. Another aspect of the optimal solution in question 1 bothers Cliff. He believes it is approving too many joint partnerships. Use SolverTable to find the implications of limiting the number of joint partnerships to  $n$ , where  $n$  can vary from 3 to 6. (5 points)

**Format of the deliverables:**

1. The typed case report must be in Microsoft Word or PDF format and uploaded on Blackboard by the due date. Each group must upload only one report.
2. Model implementation, solution and analysis must be done in Excel and the Excel file must be uploaded on Blackboard as well.
3. Please do not copy the questions from the case to your report. You should just answer the questions without typing the questions in your report. All the questions must be answered separately and sequentially.
4. You must mention your group number on the first page of your report.
5. The report must be in Times New Roman font with font size 12 and single-line space.
6. The number of pages in the report must not exceed three (3) excluding any cover page.