M4L20. Biodiesel Business Case with Utility Function

Slide #1

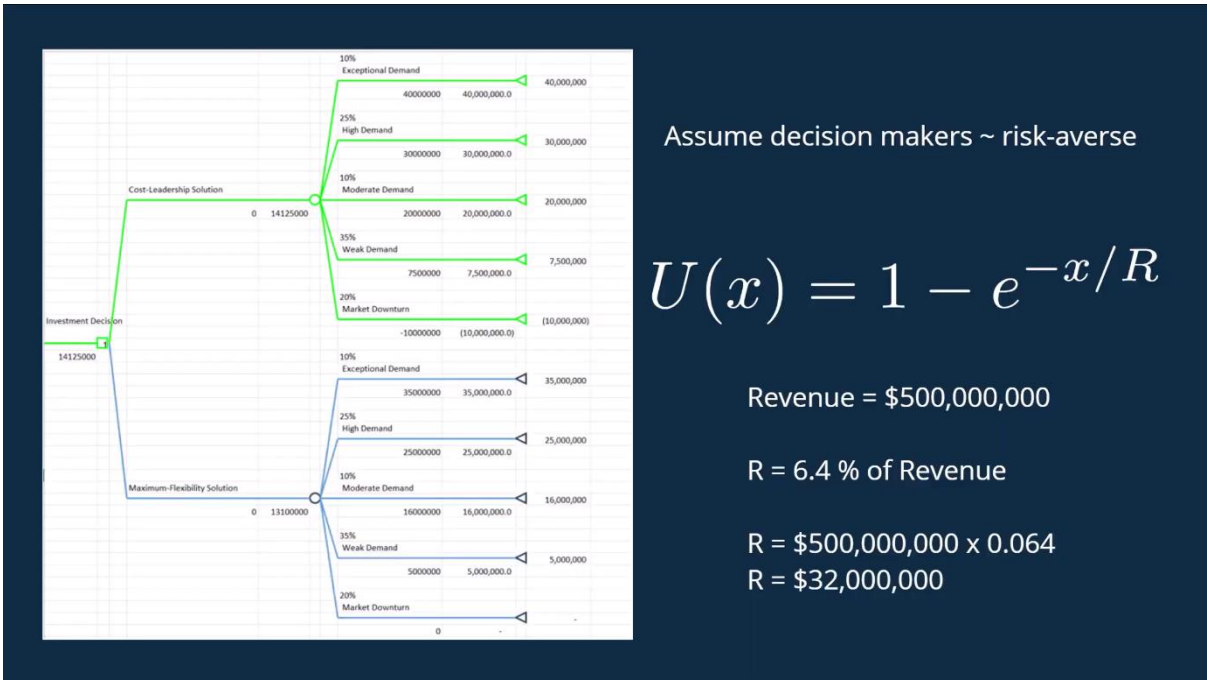
Let us revisit the biodiesel decision case and discuss how to incorporate the utility function into the decision-making process.

Slide #2

The case showed that the company has a revenue of 500 million dollars.

So with this piece of information, we should be able to estimate the risk tolerance parameter of the company.

Slide #3



The chart is the decision tree that we built for the company's two decisions, or two options. The renewable energy company's evaluation of two investment options for new production plants.

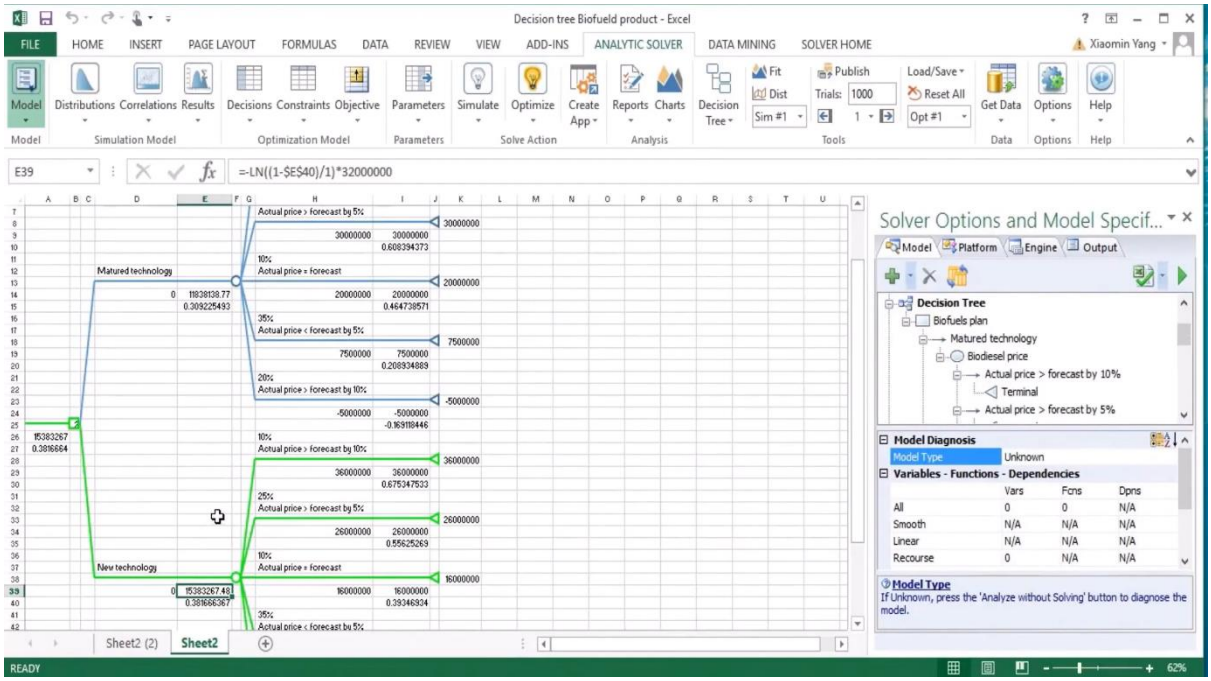
Option one, build a plant with innovative solutions optimized for minimum biodiesel production cost, cost leadership strategy.

Option two, build a plant with alternative technology to diversify product offerings and maximize flexibility, differentiation strategy.

There are five possible market scenarios and corresponding investment outcomes for each decision. The decision makers at the renewable energy company are risk averse.

Therefore, an exponential utility function is appropriate for modeling their risk tolerance behavior. The company has a revenue of 500 million dollars. Based on Ronald Howard's empirical relationship, the risk tolerance parameter is R is 6.4% of the company's revenue. R equals 6.4% times 500 million dollars equals 32 million dollars.

Slide #4



Next, we integrate the risk utility function into the decision tree. This video clip demonstrates how to set up the analytic solver to maximize utility rather than expected value and choose the best course of action accordingly.

Incorporating the utility function into the decision-making tree in Analytics Solver is very straightforward.

We go to the Solver option and the Model window. Select Platform. Go down the menu.

We see Utility Parameter. Change the number to 32 million, the number that we picked for the company.

And then we change from expected value to decision function. You notice that the analytic solver automatically updates the decision tree.

Replace expected value with certainty equivalent value and the utility numbers.

Click highlight the best. The solver chooses the best option for us based on the utility function and the certainty equivalent value rather than expected value.

Slide #5

Risk Tolerance	Cost-Leadership Platform	Maximum-Flexibility Platform	Perceived Incremental Value of Flexibility
Risk-averse expected CEV	$10.06	$11.05	$0.99
Risk neutral expected value	$14.13	$13.10	-$1.03

The decision tree automatically calculates certainty equivalent values of the two options given decision makers risk utility functions.

The best option is highlighted in green color.

A risk-averse decision maker would prefer the maximum flexibility solution due to the predictability and stability it offers, although option 1 generates a slightly higher expected value.

Also, we include the expected values and the certainty equivalent values of those options in the summary table.

The table shows the different perceptions of value between risk averse and risk neutral managers.

Risk averse managers value the alternative technology for its ability to mitigate losses, in worst case scenarios, adding 1 million dollars to its perceived value.

Conversely, risk neutral managers view flexibility as leading to a 1 million dollar loss due to lower overall returns.

Slide #6

The Reality of Human Perception in Data-Driven Decisions

- In real-world decisions, perception plays a significant and recognizable role.
- While objective analysis provides critical insights, the final decision is shaped by the decision-maker's comfort with risk.
- Integration of human judgment into decision trees ensures that decisions are aligned with the decision-maker's risk tolerance and strategic goals.

In real world decisions, perception plays a significant and recognizable role.

Human judgment, influenced by individual risk tolerance, often determines the perceived value of various options.

While objective analysis provides critical insights, the final decision is shaped by the decision maker's comfort with risk.

This integration of human judgment ensures that decisions are not only analytically sound but also align with the decision maker's risk tolerance and strategic goals.

By incorporating risk utility functions into decision trees, companies can better balance objective data with subjective preferences, leading to more robust and satisfactory decision-making outcomes.

This approach ensures that the human element, particularly the decision maker's risk perception, is accounted for in the analytical process, thereby enhancing the practical relevance and acceptance of the decisions made.