Design Project One

Net Present Value and Rate of Return
Computer Application

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PNGE 441 Oil and Gas Property Evaluation

Bevin A. VanGilder
Petroleum and Natural Gas Engineering
West Virginia University

Executive Summary

This design project has accomplished the task of providing a user-friendly interface to calculate three different yardsticks that incorporate the time value of money. Using Visual Basic 6.0, the net present value (NPV) is determined given a net cash flow (NCF). On the same interface, the discount cash flow rate of return (DCFROR) is also calculated. The program also provides a present value profile comparing different interest rates.

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Introduction

Before the computer programming could begin, it was necessary to achieve a superior understanding of the concepts. A definition of each of the individual variables is necessary.

Given the net cash flow of a project, the net present value must for any given interest rate. The net cash flow is more commonly known as "profit". This is the net flow of cash that has been generated by the project, into or out of the treasury. In the cash flow model, revenues are recorded when cash is received and costs are recognized when cash is paid out.

Discounting the future net cash flows to "time zero", the beginning of the investment, and summing those values calculate the net present value of an investment. Using the simplest equation,

$$NPV = \sum_{j=0}^{L} \frac{NCF_j}{(1+i)^j}$$

where L is the project life, NCF_j is the net cash flow for period j, and NPV is the net present value discounted at the interest rate i.

A present value profile compares two projects graphically as the interest rates are altered. The net present value profile may also be used to understand the effects of different interest rates on a single project.

Finally, the discount cash flow rate of return (DCFROR) is the interest rate where the net present value of the project is equal to zero.

Methodology

Once a better understanding of the underlying concepts was attained, the actual computer programming could begin. As stated previously, Microsoft Visual Basic 6.0 was the application used. Using Visual Basic was not only chosen over other programming applications such at C++ or Matlab due to simply the esthetics but also for its less-complicated code. It also allows the programmer to debug the code more frequently, since the program can be run with only code for one small part written. An example of the completed Visual Basic interface is given below with labels identifying the various objects on the form.
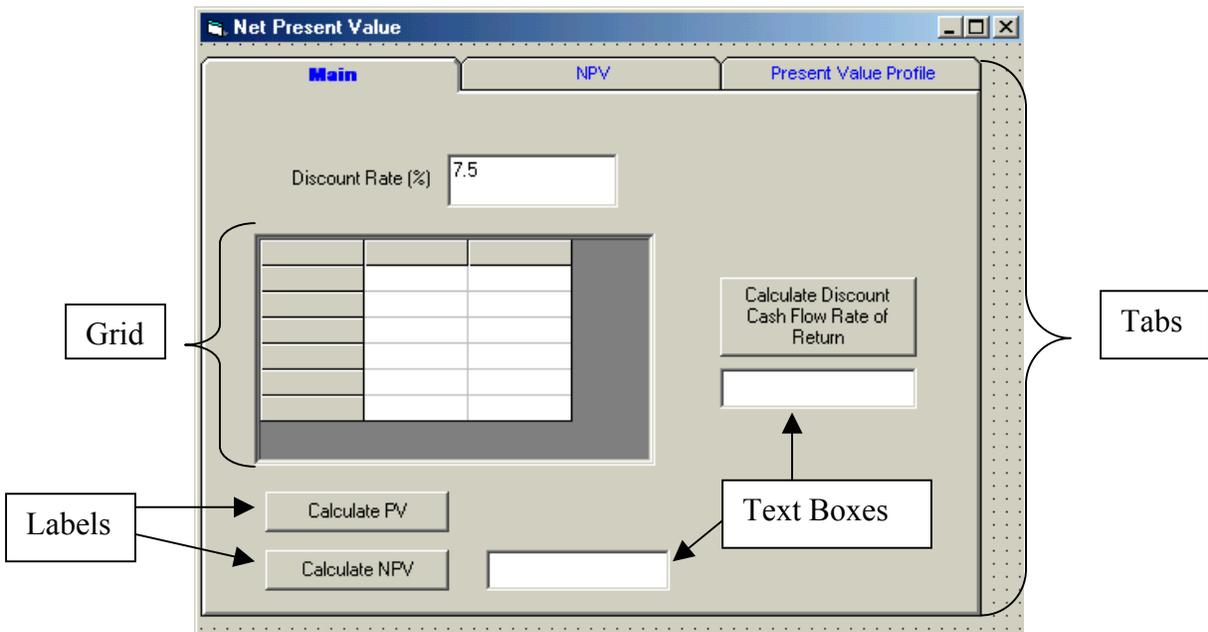
Example

Given the following values for revenue, operating costs and initial investment, the net cash flow was determined using Microsoft Excel. The values calculated for the net cash flow were then used in the Visual Basic program. The net present value was also calculated using Microsoft Excel to use as a comparison to the net present value obtained from the computer program.

Year	Investment	Revenue	Operating Cost	NCF	PV at i=40%
0	$1,000,000.00			-$1,000,000.00	-$1,000,000.00
1		$540,000.00	$100,000.00	$440,000.00	$314,285.71
2		$400,000.00	$83,000.00	$317,000.00	$161,734.69
3		$380,000.00	$80,000.00	$300,000.00	$109,329.45
4		$350,000.00	$63,000.00	$287,000.00	$74,708.45
5		$300,000.00	$59,000.00	$241,000.00	$44,810.20
6		$200,000.00	$50,000.00	$150,000.00	$19,921.55
7		$185,000.00	$50,000.00	$135,000.00	$12,806.71
8		$160,000.00	$40,000.00	$120,000.00	$8,131.24
9		$100,000.00	$30,000.00	$70,000.00	$3,388.02
10		$56,000.00	$10,000.00	$46,000.00	$1,590.29
				NPV	**-$249,293.68**
				DCFROR	**25%**

Net Present Value

As stated in the introduction,

$$NPV = \sum_{j=0}^{L} \frac{NCF_j}{(1+i)^j} \, .$$

An example of the code used to calculate the net present value is given below:

```
Private Sub cmdNPV_Click()

    Dim myAIR As Single
    myAIR = Val(txtAIR.Text)

    txtNPV.Text = NetPresentValue(myAIR)
End Sub
```

```vb
Private Function NetPresentValue(myAIR As Single) As Single
    Dim i As Integer
    Dim PV As Single
    Dim MyYear As Integer
    Dim MyNCF As Single
    NetPresentValue = 0

    With grdMain

       For i = 1 To NumberofCases
          MyYear = Val(.TextMatrix(i, 0))
          MyNCF = Val(.TextMatrix(i, 1))

          PV = MyNCF / (1 + myAIR) ^ MyYear
          NetPresentValue = NetPresentValue + PV
       Next i
    End With
End Function
```

Discount Cash Flow Rate of Return

The command button used to calculate the discount cash flow rate of return is also located on the first tab labeled "Main". In order to determine the rate of return, a loop was necessary. The loop iterated the interest rate until the net present value was equal to zero. An example of the code is given below.

```vb
Private Sub cmdROR_Click()

Dim i As Long

Dim myNPV As Single

   For i = 1 To 100000

      myNPV = NetPresentValue(i / 100)

      If myNPV < 0.1 Then

         txtROR.Text = i

         Exit Sub

      End If

   Next i

  txtROR.Text = "No Match"

 End Sub
```
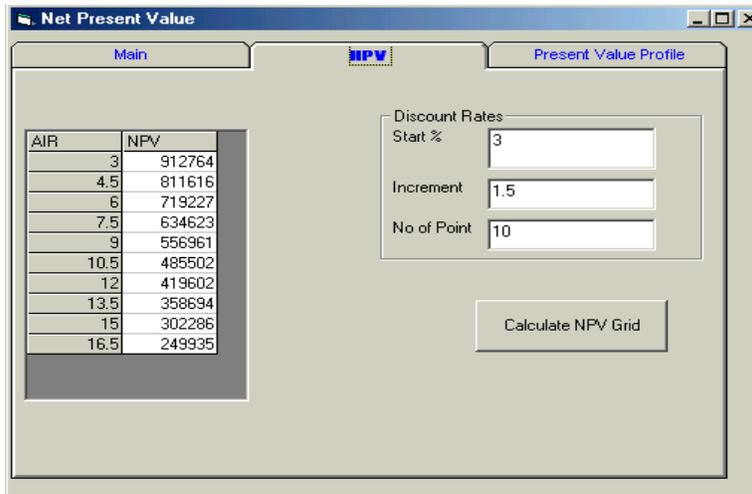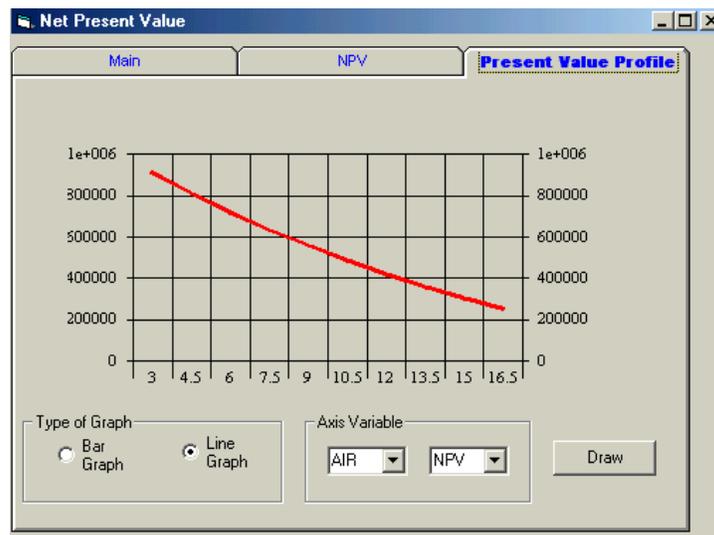
Present Value Profile

Located on the second tab labeled "NPV" is the grid shown here:

In the upper right-hand side are the beginning interest rate, the increment, and also the number of interest rates necessary. Using the NCF located on the first tab and the discount rates provided, the grid on the left is generated. This grid is then used to plot the present value profile of the project. An example is given below.
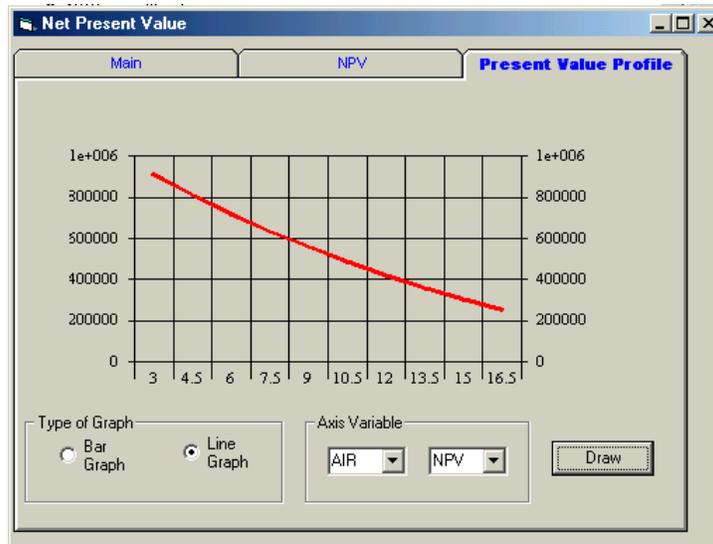
Results and Discussion

Using the given values for investment, revenue, and operating costs, the net cash flow (NCF) was calculated using Microsoft Excel. That file was then input into the Visual Basic Program to calculate the net present value using an interest rate of 40%. The net present value (NPV) was determined to be -$246,700.00. This value varied from the Microsoft excel version that calculated it to be $249,293.68. This is due to rounding errors when totaling the present values, because the present values obtained from Excel and Visual Basic are identical except for the tenths place of the decimal is not included on the computer program. The discount cash flow rate of return (DCFROR) was also calculated using the Visual Basic program. The rate of return is approximately 26%. This also varies slightly from the Excel calculation of 25%, due to the loop not terminating at exactly zero on the program. The user interface with the NPV and DCFROR calculated is located below.
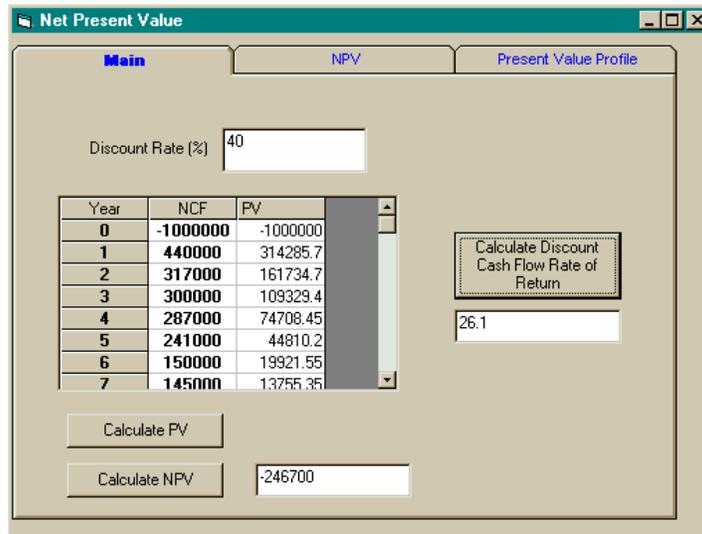
On the next tab labeled "NPV" a grid was created in order to plot the present value profile with varying interest rates. For example, for interest rates of 5% through 10% with an increment of 1%, the net present values were calculated in the grid below.
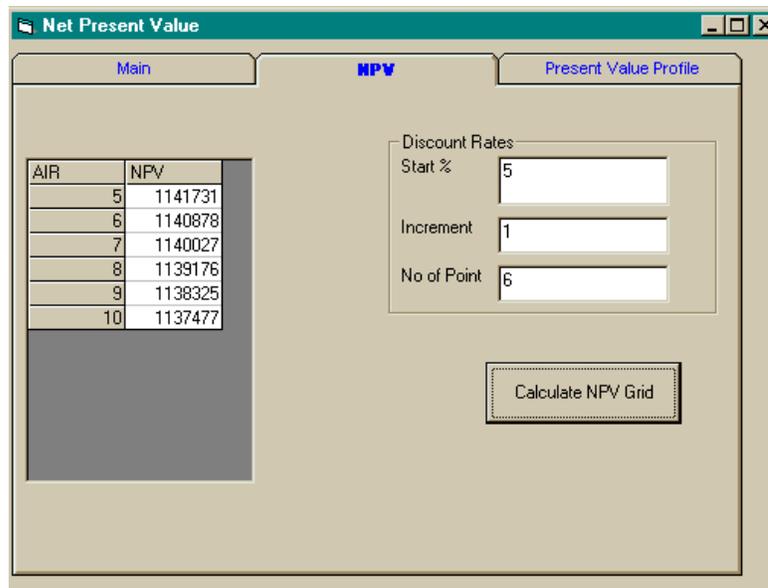
The present value profile could then be graphed on the third tab labeled "Present Value Profile". This is presented below.

Net Present Value

Main | NPV | **Present Value Profile**

1e+006   1e+006

800000   800000

500000   600000

400000   400000

200000   200000

0   0

3   4.5   6   7.5   9   10.5   12   13.5   15   16.5

Type of Graph
- Bar Graph
- Line Graph

Axis Variable: AIR ▼   NPV ▼   Draw

Conclusions

This design project incorporated concepts from oil and gas property evaluation and computer programming skills. After participating in Visual Basic classes, the language became easier to use. Programming the equations for net present value and creating a loop to calculate rate of return attained a better understanding of the equations. This was a worthwhile project both from petroleum engineering and computer programming standpoints.

References

Mohaghegh, Shahab. *Visual Basic for Engineers & Scientists*. West Virginia

   University, 2002.

Thompson, Robert S. and John D. Wright. Oil Property Evaluation. Colorado,

   1985.

Appendix A: Visual Basic Code

```
Option Explicit

Dim NCF(11) As Single

Dim NumberofCases As Integer


Private Sub cmdCalculateNPVGrid_Click()

Dim i As Integer

Dim AIR As Single

Dim Increment As Single

Dim Noofpoints As Integer


Increment = Val(txtincrement.Text)

Noofpoints = Val(txtpointAIR.Text)

AIR = Val(txtstart.Text)


With grdNPV

  .Rows = Noofpoints + 1


  For i = 1 To Noofpoints

    .TextMatrix(i, 0) = AIR

    .TextMatrix(i, 1) = NetPresentValue(AIR / 100)

      AIR = AIR + Increment

 Next i

End With

End Sub


Private Sub cmdDraw_Click()

  Dim NoDataSets As Integer

  Dim i As Integer


  If cmbYaxis.Text = "NPV" Then

    NoDataSets = Val(txtpointAIR.Text)

  Else

    NoDataSets = NumberofCases
```

```
End If

ReDim Xaxis(NoDataSets) As Single

ReDim Yaxis(NoDataSets) As Single


With grdMain


  For i = 1 To NoDataSets
    Select Case cmbXaxis.Text
      Case "Year"
        Xaxis(i) = Val(.TextMatrix(i, 0))
      Case "AIR"
        Xaxis(i) = Val(grdNPV.TextMatrix(i, 0))


    End Select


    Select Case cmbYaxis.Text
      Case "NCF"
        Yaxis(i) = Val(.TextMatrix(i, 1))
      Case "PV"
        Yaxis(i) = Val(.TextMatrix(i, 2))
      Case "NPV"
        Yaxis(i) = Val(grdNPV.TextMatrix(i, 1))



    End Select



  Next i

End With

With chrMain

  If optBar.Value = True Then
```

```vb
      .chartType = VtChChartType2dBar


   Else

      .chartType = VtChChartType2dLine

   End If


      .ColumnCount = 1

      .RowCount = NoDataSets


   For i = 1 To NoDataSets

      .Row = i

      .RowLabel = Xaxis(i)

      .Data = Yaxis(i)


   Next i

   End With

End Sub


Private Sub cmdNPV_Click()


   Dim myAIR As Single

   myAIR = Val(txtAIR.Text)


   txtNPV.Text = NetPresentValue(myAIR)

End Sub


Private Function NetPresentValue(myAIR As Single) As Single

   Dim i As Integer

   Dim PV As Long

   Dim MyYear As Integer

   Dim MyNCF As Long

   NetPresentValue = 0


   With grdMain
```

```vb
    For i = 1 To NumberofCases

        MyYear = Val(.TextMatrix(i, 0))

        MyNCF = Val(.TextMatrix(i, 1))


        PV = MyNCF / ((1 + myAIR) ^ MyYear)

        NetPresentValue = NetPresentValue + PV

    Next i

  End With

End Function


Private Sub cmdPV_Click()

Dim i As Integer

Dim MyYear As Integer

Dim MyNCF As Long

Dim myAIR As Single

Dim PV As Single


myAIR = Val(txtAIR.Text) / 100

  With grdMain

    For i = 1 To NumberofCases

        .Row = i

        .Col = 0

        MyYear = Val(.Text)


        .Col = 1

        MyNCF = .Text


        PV = MyNCF / (1 + myAIR) ^ MyYear


        .Col = 2

        .Text = PV


    Next i

  End With

End Sub
```

```vb
Private Sub cmdROR_Click()

Dim i As Long

    Dim myNPV As Single


    For i = 1 To 100000
        myNPV = NetPresentValue(i / 100)
        If myNPV < 0.01 Then
            txtROR.Text = i
            Exit Sub
        End If
    Next i


 txtROR.Text = "No Match"


End Sub


Private Sub Form_Load()
    NumberofCases = 11
    Call OpenNcfFile
    Call PrepareGrid
    Call PutNcfInGrid
    Call PrepareNPVgrid
End Sub


Private Sub OpenNcfFile()

    Open "A:NCF.txt" For Input As #1
    Dim i As Single
        For i = 1 To NumberofCases
            Input #1, NCF(i)
        Next i
```

```vb
    Close #1
End Sub


Private Sub PrepareGrid()
grdMain.Col = 0
grdMain.Row = 0
grdMain.CellAlignment = 4
grdMain.Text = "Year"


grdMain.Col = 1
grdMain.Row = 0
grdMain.CellAlignment = 4
grdMain.Text = "NCF"


grdMain.Col = 2
grdMain.Row = 0
grdMain.Text = "PV"


End Sub


Private Sub PutNcfInGrid()
    Dim i As Integer
    With grdMain
        For i = 1 To NumberofCases
        .Row = i
        .Col = 0
        .CellAlignment = 4
        .CellFontBold = True
        .Text = i - 1


        .Col = 1
        .CellAlignment = 4
        .CellFontBold = True
        .Text = NCF(i)
    Next i
```

```
    End With


End Sub


Private Sub PrepareNPVgrid()

grdNPV.Col = 0

grdNPV.Row = 0

grdNPV.Text = "AIR"


grdNPV.Col = 1

grdNPV.Row = 0

grdNPV.Text = "NPV"

End Sub
```