Farmer Joe's Energy Solution

Prepared by

Joshua Barnaby

Magdalena Koper

Johanna Owen

Jeremy Taws

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Agenda

- Introduction
- Model Description
- Systematic Problem Solving Flowchart
- Alternative One – Create Own Energy
- Alternative Two – Invest in R/E Company
- Decision Tree
- Conclusion

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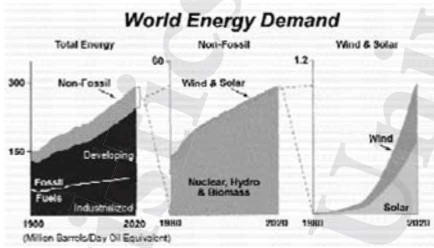
Introduction

- Small Farmer
- Environmentally Conscious
- Globally Aware
- Wants to Make a Difference



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Model Description

- Decision Tree
  - Alternative One
    - Create own energy
  - Alternative Two
    - The investment into a "Green" company

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Assumptions

- Located in Ontario
- Produces Organically Grown Corn
- Farm Size is 30 acres
- Cost per kWh from the Grid:
  - 5.3 cents (<250,000 kWh/year)
  - 6.2 cents (>250,000 kWh/year) (www.ontariotenants.ca)

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Assumptions (cont.)

Energy	Use / Acre*	Conv. Rate to kWh	kWh / Acre	Farm Acres	Yearly kWh Usage
Liquid Propane Gas (gallon)	6.36	37	235.3	30	7,059.6
Electricity (kWh)	77.13	N/A	77.1	30	2,313.9
Natural Gas (feet3)	200	43.962	8,792.4	30	263,773.0
Total			***9,104.9***	***30***	***273,145.5***

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Assumptions (cont.)

System	Cost per Unit	Energy Production per Year (2005)	Resale Value/ kWh
Wind System	$7,015	954.2 kWh	0.11/kWh
Solar System	$9,181	859.76 kWh	0.42/kWh

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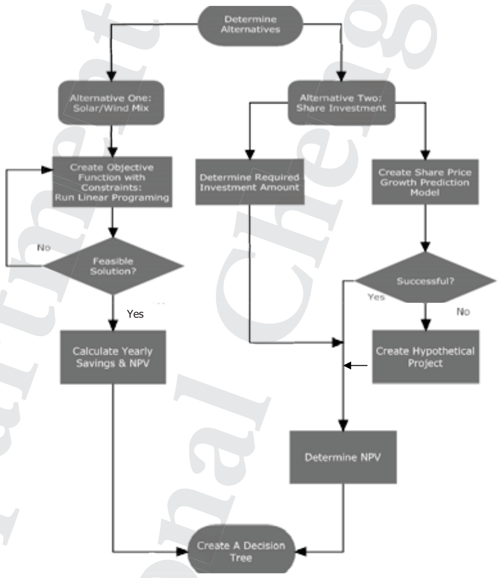
Systematic Problem Solving Flowchart



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Alternative 1

Create Own Energy

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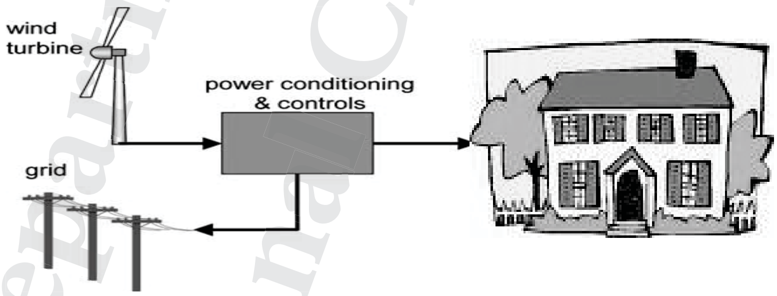
Linear Programming

- Based on
  - data collected from the location area
  - total costs of technologies
  - comparing their output in kWh
- Determine the cost of mix



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Hybrid: Wind and Solar Power

- Compare both technologies
  - cost and energy output
- Depend on weather and light (seasonality)

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Totals
Wind Speed	10.8	10.2	10.5	11	8.7	8.4	8.2	8.2	9.5	10.1	12.3	10.7	
Turbine	121	90.1	98.6	110	52.6	44.3	44.2	44.8	63.6	79.2	136	95.7	979.5
Solar	51.8	71.8	89.1	80	88.4	85.3	89.3	90.1	98	57.7	35.2	32.3	868.9
Monthly Total	172	162	187.7	190	141	130	134	134.9	162	137	171	128	1848

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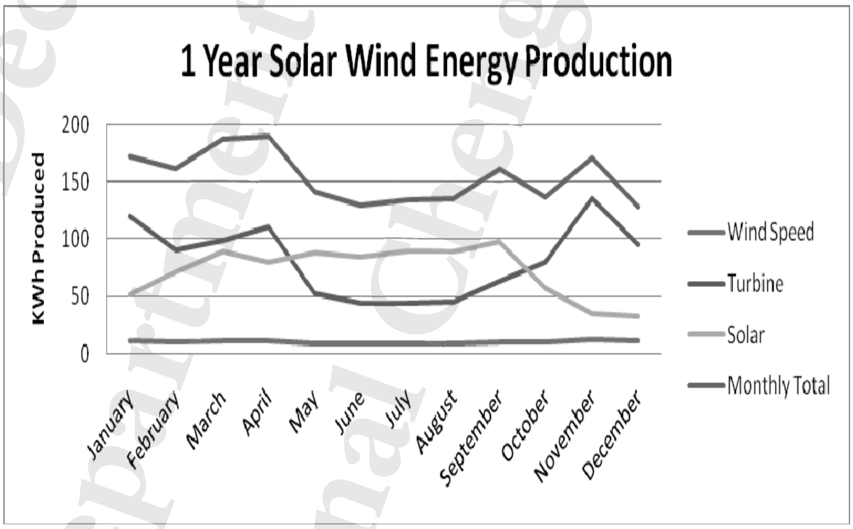
Seasonal Variations



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Selling back to the Grid

- No partial units of turbines/solar panels
  - Must produce a certain amount of excess kWh
  - Sell excess back to grid
    - Solar Power – \$0.42/kWh
    - Other - \$0.11/kWh
- Solution requirement:
  - at least one unit for solar panels

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Linear Programming Model

- System Cost per Unit Energy Production per Year (2005)
  - Wind System \$7,015 954.2 kWh
  - Solar System \$9,181 859.76 kWh
- Objective Function:

  Minimize Cost: 7,015W + 9,181S
- Subject to:

  $954.2W + 859.76S \geq 273,145.5$

  $S \geq 1$

  $954.2W + 859.76S\ S \leq 274,005.26$

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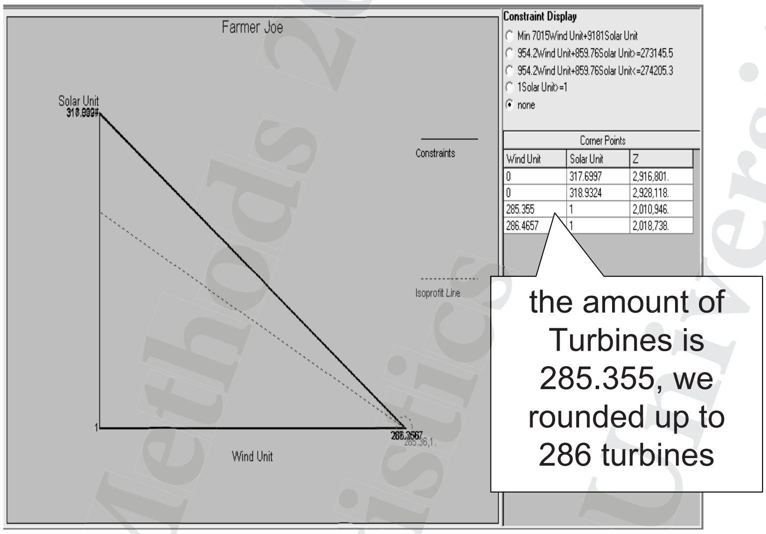
Graphical Solution



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NPV

- Total Cost = 286@$7,015 + Solar 1@$9,181 = $2,015,471
- The farm is not big enough to hold 286 turbines

Total Energy Produced:	286* 954.2kWh+859.76kWh = **273,760.96kWh**
Excess Energy Produced:	273,760.96kWh - 273,145.5kWh = **615.46kWh**
Income When Sold as Excess Solar Energy:	615.46*$0.42 = **$258.49**
NPV of $258.49 over 30 years discounted at 10.79%:	$2,285
NPV of Expected Energy Savings of $0.062 per kWh:	$149,694
Government Subsidies through Tax Savings due to Accelerated Amort.:	$511,805
NPV:	**($1,351,687)**

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Excluding Natural Gas

- **Objective Function:**

  Minimize Cost: 7,015W + 9,181S

  Where: W equals number of wind turbines
  S equals number of solar panels

- **Subject to*:**

  954.2W + 859.76 S $\geq$ 9,373.5

*requirement for 1 solar panel was disproved, excess cost did not outweigh the higher sales price, and so the last two requirements could be excluded for this scenario

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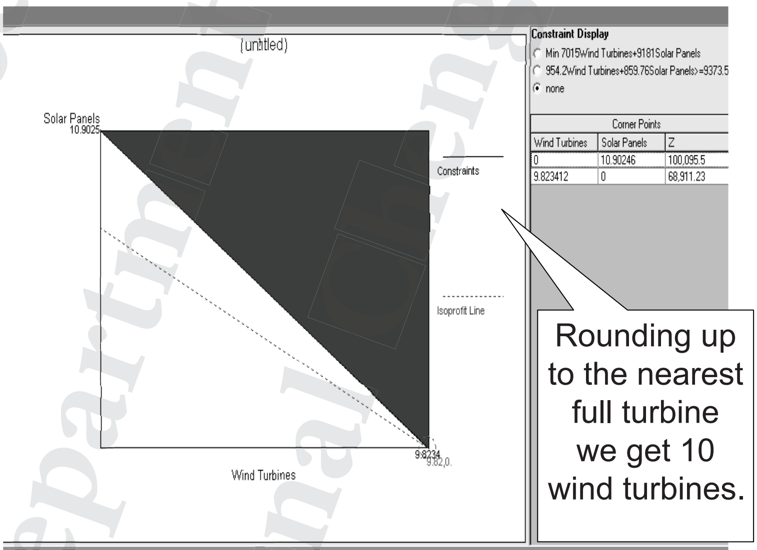
Linear Programming Model
excluding Natural Gas Replacement



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NPV – Scenario 2

- Total Cost = 10 turbines@$7,015 = $70,150

Total Energy Produced:	10* 954.2kWh=**9,542kWh**
Excess Energy Produced:	9,542kWh - 9,373.5kWh = **169.5kWh**
Income When Sold as Excess Wind Energy:	169.5*$0.11 = **$18.65**
NPV of $18.65 over 30 years discounted at 10.79%:	$164.81
NPV of Expected Energy Savings of $0.053 per kWh:	$4,391
Government Subsidies through Tax Savings due to Accelerated Amount.:	$17,814
NPV:	**($47,180)**

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Alternative 2

Investing in Canadian Hydro

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Two Steps

- Determine investment amount
  - Look at Canadian Hydro's current construction projects
- Build a model that will predict the share price
  - Run regressions ($R^2 > 0.8$)
    - know the growth rate
    - built into the utility value
    - it will in effect decrease his cost

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Step 1
Current Construction Projects

MW Capacity	Yearly mWh	Cost ('000)	Fixed Price Contract	Expected Yearly kWh / Capacity	Cost/ Capacity
20	84,000	46,000	20 years BC hydro	4,200,000	$2,300,000
9.9	30,000	22,000	40 years BC hydro	3,030,300	2,200,000
9.6	34,000	22,000	40 years BC hydro	3,541,667	2,300,000
5	20,000	10,000	40 years BC hydro	4,000,000	2,000,000
			Average:	**3,692,992**	**$2,200,000**

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Required Investment Amount

Acres	Yearly kWh Requirement	Required Capacity	Required Investment
30	273,145.50	0.07	**$162,976**
30	9,373.50	0.00254	**$5,593**

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Step 2:
Regressions to Determine Growth

- Weekly, monthly, quarterly
  - longer term (Jan. 2002 to Sept. 2007)
  - shorter term (mid Jan.2006 to Sept. 2007)
  - run against
    - the market
    - oil spot prices
    - oil future prices
- Yearly from 1998 – 2006
  - run against
    - company revenues
    - company operating profits
    - total capital employed

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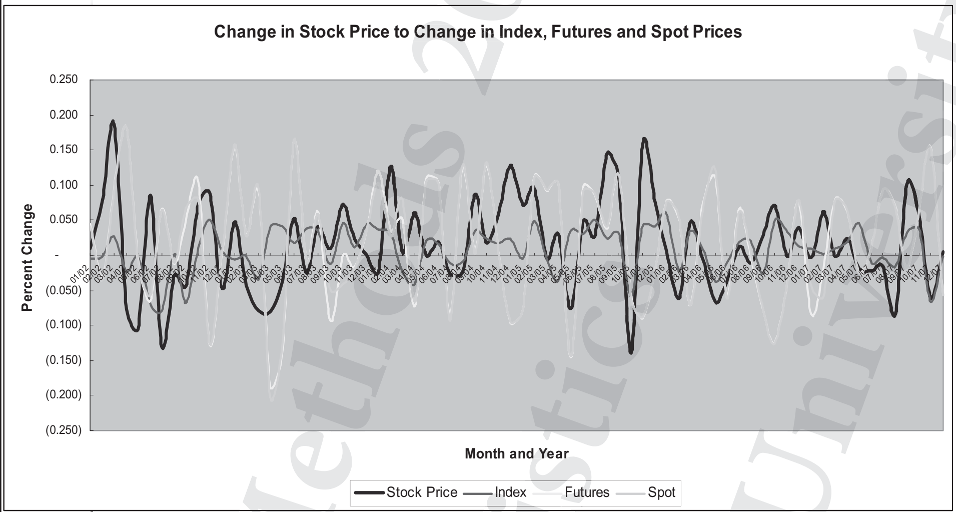
Outside Variables



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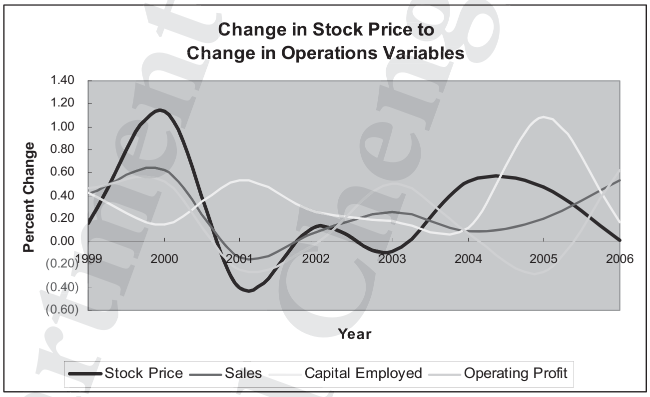
Operations Variables



- Does not look to be a strong model that will emerge from either group of variables

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Confirmed - No Model for Growth

- Largest R^2
  - index, quarterly short: 0.432
  - (next largest: oil spot, monthly short: 0.15)
- Solution
  - Determine the NPV of a hypothetical plant
    - based on
      - typical investment projects
      - information found in financial statements
    - discounted at the firm's cost of equity
      - Farmer Joe is equity holder

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Alternative 2 Results

Yearly kWh Requirement	Required Investment	NPV
273,145.50	$162,976	$9,275
9,373.50	$5,593	$318

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Results Summary & Utility

	Alternative 1 (Utility 0.3)		Alternative 2 (Utility 0.7)	
	3 Energy Types Replaced (Utility 0.8)	2 Energy Types Replaced (Utility 0.2)	3 Energy Types Replaced (Utility 0.8)	2 Energy Types Replaced (Utility 0.2)
Total Cost	$2,008,456	$72,316	$162,976	$5,593
Utility	0.1	0.9	0.4	0.6
NPV	(1,351,687)	(65,269)	9,275	318
Utility	0.4	0.6	0.6	0.4

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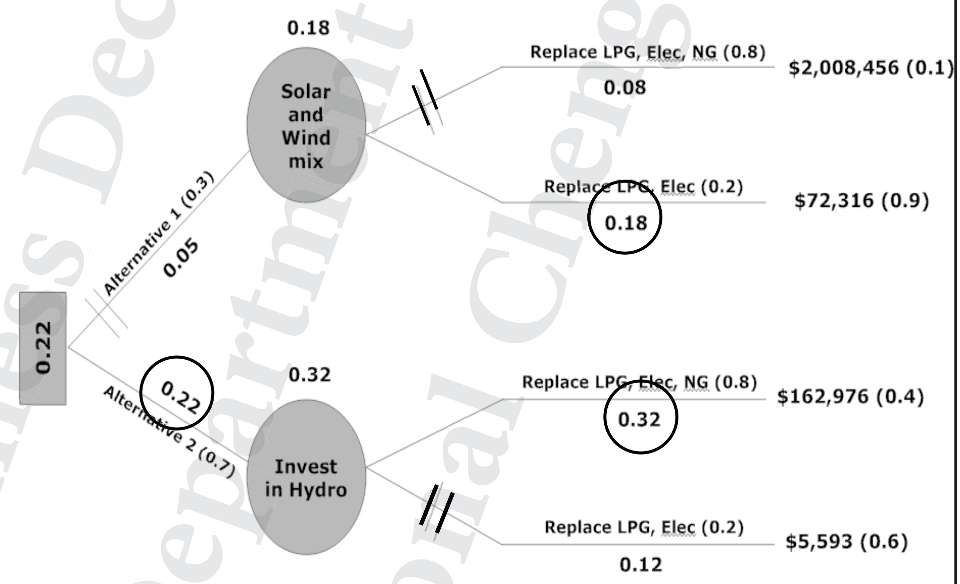
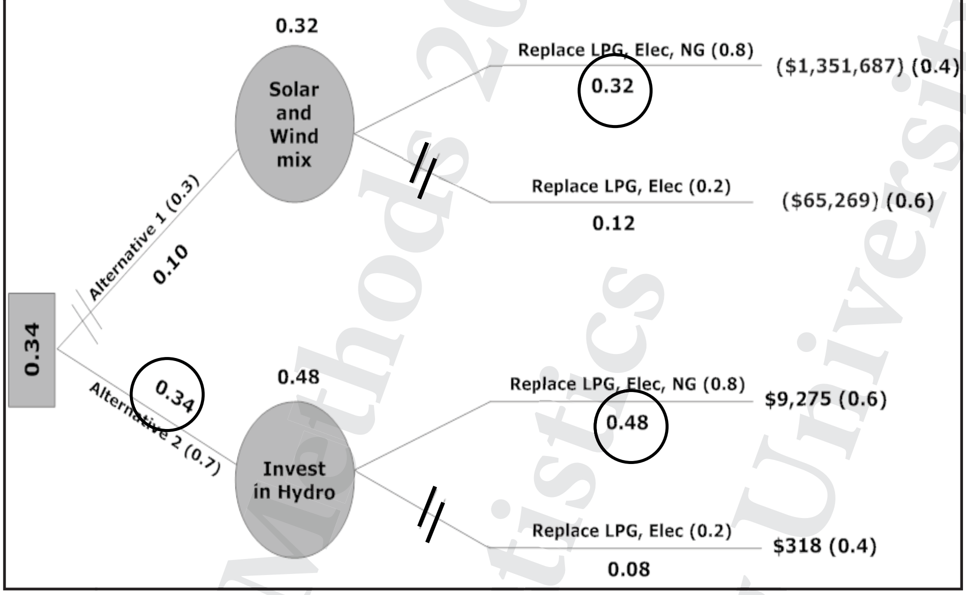
Utility Decision Tree (Cost)



Utility Decision Tree (NPV)



Conclusion

- Farmer Joe should invest in Canadian Hydro
  - investment amount: $162,976
  - hurdle rate: 10.79%
  - NPV: $9,275
- Sensitivity Analysis
- Investment will contribute to growth in this industry
- Savings on time, money, and land
- Most importantly: GREEN ENERGY

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Thank You

Questions?

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Q&A

- Farmer Joe's Utility Function
- Regression Results
- Hypothetical Investment Background
- Estimated Earnings Calculations
- Cash Flow to NPV
  - Scenario 1
  - Scenario 2

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Farmer Joe's Utility Function

- Utilities for Alternatives
  - investing > developing the energy
    - believes the global impact per dollar spent would be higher for the company, due to their economies of scale
  - Alternative 1: utility of 0.3
  - Alternative 2: utility of 0.7
- Utilities for Scenarios
  - greater environmental impact > less impact
  - Scenario 1: utility of 0.8 (replacing 3 energy sources)
  - Scenario 2: utility of 0.2 (replacing 2 energy sources)

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Utilities (Cont.)

- Utilities for Cost
  - "green" impact of his actions > money it would cost him,
  - Indifferent up to about $200,000
  - above that amount, his utility drops drastically as he has limited funds
- Utilities for NPV
  - Almost indifferent between NPV losses
    - a loss as a bad business decision and unnecessary
  - should break even at hurdle rate as bare minimum for the action to be acceptable
  - above a break even, indifferent up until about $50,000, after which his utility would rise sharply

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Regression Results

Run Against	Time period	# of Data Points	R^2	Adj R^2
Index	Quarterly Short	7	0.526	0.432
Oil Spot Prices	Monthly Short	21	0.193	0.151
Oil Futures Prices	Monthly Short	21	0.151	0.107

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Regression Results
Operating Variables

Run Against	Time period	# of Data Points	R^2	Adj R^2
Revenue	1998 – 2006	8	0.31	0.195
Operating Profit	1998 – 2006	8	0.039	(0.121)
Capital Employed	1998 – 2006	8	0.007	(0.159)

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Hypothetical Environment

Cost	Required investment amount ($162,975 and $5,593)
Expected Yearly kWh Produced	Required energy production for Farmer Joe (273,145.5 kWh and 9,373.5 kWh)
Fixed price contract	40 years with BC Hydro
Fixed price/kWh	$0.08
Funding	Assumed 100% through credit facility which is closed shortly before or after operations start; repayment of credit facility is assumed to be with new 10-year debenture at then effective current pre-tax interest rate of 6.21%
Debt repayment	Interest paid semi-annually with principle repaid at maturity
Amortization	Straight-line over 40 years
Fixed costs	10% of projected revenues
Variable costs	Negligible
Marginal tax rate	34.34%
Cost of Equity	10.79%

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Estimated Earnings

Year	Scenario 1	Scenario 2
Production mWh	273,145.50	9,373.50
Price	$0.08	$0.08
Revenue	21,852	750
Fixed Cost	(2,185)	(75)
Depreciation	(4,074)	(140)
Operating Income	15,592	535
Interest Expense	(10,121)	(347)
EBT	5,471	188
Tax	(1,879)	(64)
Net Income	3,592	123

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Scenario 1
Three Energy Types

Year	0	1 to 30	Debt Repayment at Maturity (yr 10)
Net income		$3,592	
+ depreciation		4,074	
- cap exp	($162,976)		
+new debt	162,976		($162,976)
CF to equity	-	7,667	
Cost of Equity	10.79%		
PV(CFs)	-	67,770	(58,495)
NPV to equity	**$9,275**		

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Scenario 2
Two Energy Types

Year	0	1 to 30	Debt Repayment at Maturity (yr 10)
Net income		$123	
+ depreciation		140	
- cap exp	($5,593)		
+new debt	5,593		($5,593)
CF to equity	-	263	
Cost of Equity	10.79%		
PV(CFs)	-	2,326	(2,007)
NPV to equity	**$318**		

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