

DevTreks –social budgeting that improves lives and livelihoods

Net Present Value Calculation 2

Last Updated: July 26, 2018 First Released: 2012

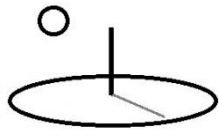
Author: Kevin Boyle, President, DevTreks

Version: DevTreks 2.1.4

A. Capital Budget Net Present Value (NPV) Introduction

The introductory *Net Present Value 1* tutorial summarizes the main price adjustments, or discounting, used in NPV calculators. That reference explained the calculations associated with Operating Budgets. This reference explains the calculations for Capital Budgets (1*). Discounting is identical in both budgets, but Operating Budgets only use an Input's operating and allocated overhead costs while Capital Budgets can contain capital costs as well (2*).

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B. Data URLs

This reference uses irrigation capital data taken from the Kansas State Cooperative Extension Irrigation Capital Requirements reference (Obrien et al, 2016). That reference documents the capital and energy costs for flood, center pivot, and subsurface drip, irrigation systems. This capital budget data is owned by the Core Sample Economics Datasets club and can be found at the following URLs.

NPV Calculators:

[https://www.devtreks.org/agtreks/preview/crops/linkedviewgroup/Net Present Value Calculators Group/5/none/](https://www.devtreks.org/agtreks/preview/crops/linkedviewgroup/Net%20Present%20Value%20Calculators%20Group/5/none/)

[http://localhost:5000/agtreks/preview/crops/linkedviewgroup/Net Present Value Calculators Group/5/none](http://localhost:5000/agtreks/preview/crops/linkedviewgroup/Net%20Present%20Value%20Calculators%20Group/5/none)

Inputs

[https://www.devtreks.org/agtreks/select/crops/inputgroup/Irrigation, Sample Investment Analyses/2126771763/none/](https://www.devtreks.org/agtreks/select/crops/inputgroup/Irrigation,%20Sample%20Investment%20Analyses/2126771763/none/)

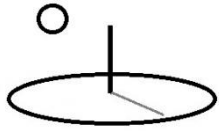
[http://localhost:5000/agtreks/select/crops/inputgroup/Irrigation, Sample Investment Analyses/2126771761/none](http://localhost:5000/agtreks/select/crops/inputgroup/Irrigation,%20Sample%20Investment%20Analyses/2126771761/none)

Components

[https://www.devtreks.org/agtreks/select/cropsconservation/componentgroup/Irrigation Examples/551/none/](https://www.devtreks.org/agtreks/select/cropsconservation/componentgroup/Irrigation%20Examples/551/none/)

[http://localhost:5000/agtreks/preview/cropsconservation/componentgroup/Irrigation, Examples/549/none](http://localhost:5000/agtreks/preview/cropsconservation/componentgroup/Irrigation,%20Examples/549/none)

Capital Budgets (Investments)



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[https://www.devtreks.org/agtreks/preview/cropsconservation/investmentgroup/Capital Budgets, Irrigation Examples/275505672/none](https://www.devtreks.org/agtreks/preview/cropsconservation/investmentgroup/Capital%20Budgets,Irrigation%20Examples/275505672/none)

[http://localhost:5000/agtreks/preview/cropsconservation/investmentgroup/Capital Budgets, Irrigation Examples/275505670/none](http://localhost:5000/agtreks/preview/cropsconservation/investmentgroup/Capital%20Budgets,Irrigation%20Examples/275505670/none)

Story (owned by the DevTreks Help club in the commons network)

[http://localhost:5000/commontreks/preview/commons/linkedviewpack/Capital Budget Tutorials/83/none](http://localhost:5000/commontreks/preview/commons/linkedviewpack/Capital%20Budget%20Tutorials/83/none)

Dictionary entry (owned by Core Sample Economics Datasets club):

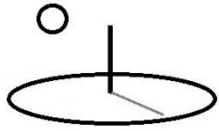
[http://localhost:5000/agtreks/preview/crops/linkedviewpack/Capital Investments/21/none](http://localhost:5000/agtreks/preview/crops/linkedviewpack/Capital%20Investments/21/none)

These examples do not use Outputs or Outcomes, only costs are calculated. DevTreks discourages cost-only analysis. Benefits are just as important as costs and should be included in all analyses, even if the benefits must use nonmonetary indicators, as demonstrated in the Resource Stock, Monitoring and Evaluation, Performance Analysis, and Social Performance Analysis, tutorials.

C. Inputs

a. Data Structure

The following image demonstrates that 31 irrigation inputs are used to calculate input costs.



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AgTreks Search Preview Select

Edit Pack Views Club

Preview Edit

Row Row of 31 0 Row

Irrigation, Sample Investment Analyses

Connectors

Input Date =Apr 12 2012 12:00AM OC Pric...

Equipment Rental, Drip Installation

Input Date =Apr 12 2012 12:00AM OC Pric...

Filter

Input Date =Apr 12 2012 12:00AM OC Pric...

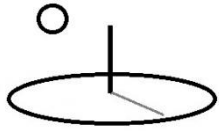
Filter Assembly

Input Date =Apr 12 2012 12:00AM OC Pric...

Fittings, Miscellaneous Bulk

Input Date =Apr 12 2012 12:00AM OC Pric...

b. Calculations

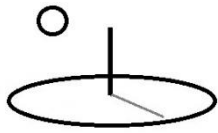


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The only input requiring custom, or domain-specific, calculations is the irrigation pump. The *Capital Input* tutorial explains how these calculations work.

<https://www.devtreks.org/agtreks/preview/crops/input/Power Unit, electric, 500 foot lift/2147377333/none>

<http://localhost:5000/agtreks/preview/crops/input/Power Unit, electric, 500 foot lift/2147377345/none>



Irrigation, Sample Investm... X +

← <https://www.devtreks.org> Search »

Irrigation Power Calculat

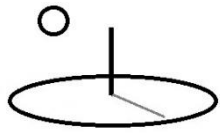
Media Mobile Desktop

Intro	1	2	3
4		Help	

Step 3 of 4. Calculate

Operating Costs

Total Engine Flywheel Power (hp) : 261.3866	Water Horsepower (hp) : 172.5152	Brake Horsepower (hp) : 261.3866
Actual Fuel Amount (per acre inch): 93.7500	Fuel Cost (per acre inch): 8.4375	Fuel Unit: kwh
Required Fuel Amount (per acre inch): 81.2364	Water pumped (acre inches/hour) : 2.6667	Pumping Plant Performance: 86.6522
Season Applied Amount (acre inches) : 28.7500	Water Cost (per acre inch): 0.0000	Pump Hours Needed per Season (per acre) : 10.7813
Irrigation Labor Price (per hour): 8.00	Irrigation Labor Amount (per acre): 0.0445	Water Price (per acre inch): 0.0000
Irrigation Labor Cost (per acre inch): 0.3562	Equipment Labor Price (per hour): 12.00	Irrigation Labor Amount (per acre): 0.0445
Equipment Labor Amount (per acre) : 0.0022	Equipment Labor Cost (per acre inch): 0.0267	Equipment Labor Price (per hour): 12.00
Lube Amount (gallons) : 0.0323	Lube Oil Cost (per acre inch) : 0.1294	Equipment Labor Cost (per acre inch): 0.0267
Repair Cost (per acre inch) : 0.2609	Extra Energy (standby) Cost (per acre inch) : 0.0000	Lube Oil Cost (per acre inch) : 0.1294
Total Operating Cost (per acre inch) : 9.211		Extra Energy (standby) Cost (per acre inch) : 0.0000
Capital Recovery Cost (per acre inch) : 1.6537	Total Allocated Overhead Cost (per acre inch) : 1.691	Taxes, Housing, Insurance Cost (per acre inch) : 0.0375
Capital Cost: 12500.000	Capital Unit: each	Taxes, Housing, Insurance Cost (per acre inch) : 0.0375

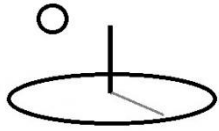


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D. Components

a. Data Structure

The following image demonstrates that 4 irrigation Components are used to calculate capital costs.



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AgTrek Search Preview Select

Edit Pack Views Club

Preview Edit

Irrigation Examples

Irrigation, Center Pivot

This example comes from OBrien, Dumle...

Irrigation, Flood

This example comes from OBrien, Dumle...

Irrigation, Pumping Plant

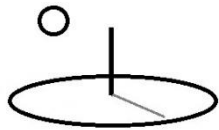
This example comes from OBrien, Dumle...

Irrigation, Subsurface Drip

This example comes from OBrien, Dumle...

Search IRIs:
<https://www.devtreks.org/agtreks/select/cropsconservation/componentgroup/Irrigation Examples/551/none>

b. Calculations

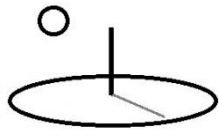


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A Net Present Value Component Calculator was run for each Component and produced the cost data shown in the following image. These costs summed each Input's Capital Cost in their calculation.

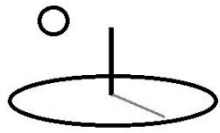
Why does the Annual Column include a negative Allocated Overhead Cost when the Inputs show zero Allocated Overhead Costs? Because a rule enforced in the NPV calculations documented in the introductory reference is to take discounted Salvage Value out of Allocated Overhead Costs and not Operating Costs or Capital Costs. The Component's negative Allocated Overhead Cost reflects discounted salvage value. Operating Budgets treat all annual amortized costs as Allocated Overhead only (as do the full Capital Budget costs shown next), and may be a better approach.

At the time this rule was enforced, a requirement for NPV calculations in DevTreks was to match the Operating Budget calculations in the *Handbook*. This is an example of a calculation that a social network might not agree with. If not, the coordinator of a social network should contact their their social network's technical support staff explaining the preferred calculations (i.e. same calculations in Operating and Capital Budgets). If the case is made, the next upgrade will include the recommendations. DevTreks' social networks are never perfect.



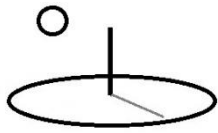
Component							
Date Applied	Label 1	Label 2	Amount	Eff. Life	Salv. Value	Incent. Amount	Incent. Rate
Irrigation, Center Pivot (4/12/2012 12:00:00 AM)							
12/31/2012	4.3.1	none	1	20	7000.0000	0.0000	0
Component Unit:each			ResourceWeight	0	Rates (R and N)		0.0100 0.0350
Description	This example comes from OBrien, Dumler and Rogers. Irrigation Capital Requirements and Energy Costs, Department of Agricultural Economics. Kansas State, 2011						
Total Costs - Component	Total Cost		Annual Cost		Interest Portion		
Total Operating Costs	0.00		0.00		0.00		
Total Allocated Overhead Costs	0.00		-317.91		0.00		
Total Capital Costs	73,646.73		4,081.16		1,827.83		
Total Costs - Component	73,646.73		3,763.25		1,827.83		
Total Costs - Component w. Incentives	73,646.73		3,763.25				
Inputs							
Input Name	Date Applied	Times	Incent. Amount	Incent. Rate			
Pipe, Underground, 8 inch							
	04/12/2012	1	0.0000	0			
Total Costs - Input	Amount	Unit	Price	Total	Interest	Total Cost	
Total Operating Costs	0	none	0.0000	0.00	0.00	0.00	
Total Allocated Overhead Costs	0	none	0.0000	0.00	0.00	0.00	
Total Capital Costs	1301	feet	3.9000	5,073.90	129.13	5,203.03	
Total Costs with Incentives						5,203.03	

Version 2.1.0 linked 3 NPV Analyzers to this Component Group on localhost for testing purposes. The Benefit Cost Analysis tutorial explains how NPV Analyzers work. The following image demonstrates a resultant Change By Id analysis. Two analyzers had been already been



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linked to this group, but they used deprecated analyzers. They were deleted and then replaced. This type of data maintenance is an ongoing chore for any club.



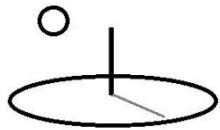
Introduction, Basic Capit

NPV Comp Change Id Analyz

Intro	1	2	3	Help	
Your analysis has been saved. The analysis can be viewed whenever this analyzer addin is opened.					
Component Group : Irrigation, Examples ; none					
Component	All	Alt. 0	Alt. 1	Alt. 2	Alt. 3
Name	Irrigation, Center Pivot	Irrigation, Flood	Irrigation, Pumping Plant	Irrigation, Subsurface Drip	
Date	12/31/2012	12/31/2012	12/31/2012	12/31/2012	
Label	4.3.1	4.3.2	4.3.4	4.3.3	
Observations	1	1	1	1	
Alternative					
OC Total	0.00	0.00	19.59	0.00	
OC AmountChange	0.00	0.00	0.00	-19.59	
OC PercentChange	0.00	0.00	0.00	-100.00	
OC BaseChange	0.00	0.00	19.59	0.00	
OC BasePercentChange	0.00	0.00	0.00	0.00	
AOH Total	-317.91	-22.71	-493.40	-908.31	
AOH AmountChange	0.00	0.00	-470.69	-414.91	

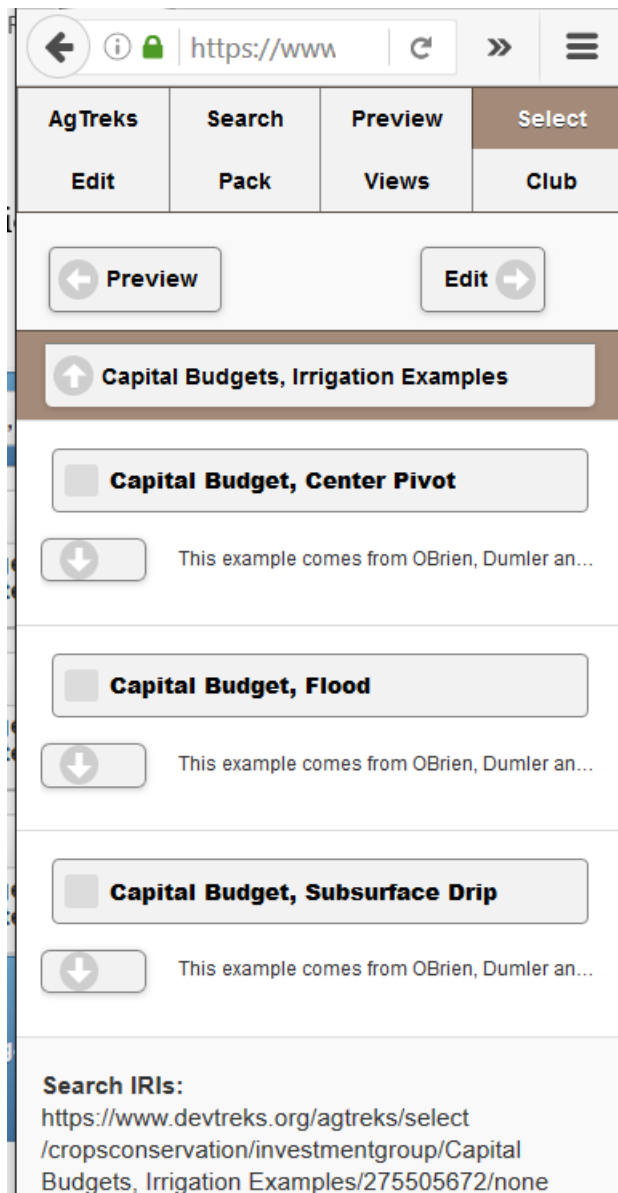
E. Capital Budgets

a. Data Structure



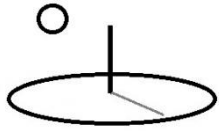
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The following image demonstrates that 3 irrigation Capital Budgets are used to calculate investment costs.



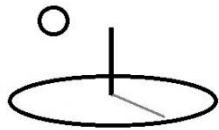
b. Calculations

A Net Present Value Capital Budget Calculator was run for each investment and produced the cost data shown in the following image. DevTreks recommends that Capital Budgets also document the performance of investments by including Outcome and Output data.



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The positive Operating Costs and Allocated Overhead Costs in the cash flow column result from the way the irrigation power calculations are run (see the Inputs section). Note the difference in how Components are calculated now. All annual amortized costs are treated as Allocated Overhead, not Capital and Allocated Overhead Costs. The responsibility of social networks is to recommend improvements and to ask the technologists supporting DevTreks to implement those recommendations.



Capital Budgets, Irrigation... X +

https://www.de Search >> ≡

Investment : Capital Budget, Center Pivot

+ Investment Details

Total Ben : 0.00	Ann Ben : 0.00
Total OC Cost : 264.81	Ann OC Cost : 0.00
Net OC Returns : -264.81	Ann Net OC Returns : 0.00
Total AOH Cost : 48.59	Ann AOH Cost : 6,350.20
Net AOH Returns : -313.40	Ann Net AOH Returns : -6,350.20
Total CAP Cost : 115,668.90	Ann CAP Cost : 0.00
Net Returns : -115,982.30	Ann Net Returns : -6,350.20
Incent Ben : 0.00	Ann Incent Ben : 0.00
Incent Cost : 115,982.29	Ann Incent Cost : 6,350.20
Net Incent Cost : -115,982.29	Net Ann Incent Return : -6,350.20
Equiv Ann Ann : -115982.29	

+ Time Period : Center Pivot, 2011

Investment : Capital Budget, Flood

+ Investment Details

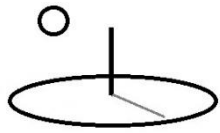
Total Ben : 0.00	Ann Ben : 0.00
Total OC Cost : 264.81	Ann OC Cost : 0.00
Net OC Returns : -264.81	Ann Net OC Returns : 0.00
Total AOH Cost : 48.59	Ann AOH Cost : 2,949.54
Net AOH Returns : -313.40	Ann Net AOH Returns : -2,949.54
Total CAP Cost : 48,975.00	Ann CAP Cost : 0.00
Net Returns : -49,288.40	Ann Net Returns : -2,949.54
Incent Ben : 0.00	Ann Incent Ben : 0.00
Incent Cost : 49,288.39	Ann Incent Cost : 2,949.54
Net Incent Cost : -49,288.39	Net Ann Incent Return : -2,949.54
Equiv Ann Ann : -49288.39	

+ Time Period : Flood Irrigation, 2011

Investment : Capital Budget, Subsurface Drip

+ Investment Details

Total Ben : 0.00	Ann Ben : 0.00
Total OC Cost : 264.81	Ann OC Cost : 0.00

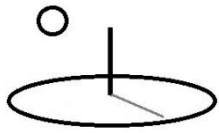


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F. Analyses

The *Benefit Cost Analysis 1* tutorial demonstrates how to aggregate and analyze net present value calculations. The following image shows that several analyses and a Story have been linked to this group of Capital Investments. As mentioned in several tutorials, base elements can be calculated and analyzed in thousands of ways. The Social Budgeting tutorial demonstrates how to develop a market for these services. In the long term, markets for data services can provide clubs with the incentives they need to build these tools.

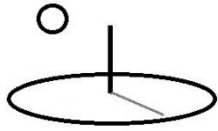
Version 2.1.0 tests required deleting the NPV Analyzers shown in this image and then linking 2 new ones. That usually means that deprecated, or old versioned, Analyzers had originally been used with this data. Data maintenance is an important ongoing responsibility for any serious club.



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The screenshot shows a web browser window with the URL <https://www>. The interface has a top navigation bar with tabs: **AgTreks**, **Search**, **Preview**, and **Select**. Below these are sub-tabs: **Edit**, **Pack**, **Views**, and **Club**. The main content area features several interactive buttons: **Search** (left arrow), **Views** (right arrow), **Select** (right arrow), and **Edit Linked Views** (left arrow). The first result is titled **Capital Budget Tutorials** and includes an image of a large agricultural irrigation system. Below the image is the text: "Tech Story: Capital Budgeting Tutorial 1. This linked view introduces a six part video tutorial introducing the most basic capital budgeting that can be completed using DevTreks." followed by a [view IRI](#) link. Below this result are **Views** and **Select** buttons. The second result is titled **Machinery Capital Budget Analyzer Pack** and includes the text: "Dataset: Machinery Totals Analyzer. These analyzers analyze the fuel, repair, lube, labor, capital recovery, and thi costs for capital budgets that use machinery calculators for inputs and a net present value calculator for the budget." followed by a [view IRI](#) link. Below this result are **Views** and **Select** buttons. The third result is titled **NPV Capital Budget Analyzer Pack** and includes the text: "Dataset: NPV Aggregate Statistics. This analyzer generates adaregate cost".

The following image shows the results for the Machinery Analysis.



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Investment Group : Capital Budgets, Irrigation Examples

+ Benefits

- Costs

Market Value : 12500.000	Salvage Value : 1000.000
Cap Recov Cost : 47.544	THI Cost : 1.078
Starting Hrs : 0.000	Planned Use Hrs : 1000.000
Useful Life Hrs : 2000.000	Fuel Amount : 93.750
Fuel Price : 0.090	Fuel Cost : 242.578
Extra Energy (standby) Cost : 0.0000	Labor Amount (per acre or hectare) : 0.045
Labor Price (per hour) : 8.000	Labor Cost : 10.241
Irrigation Times : 8.0000	Irrigation Duration Per Set : 10.0000
Irrigation Duration Labor Hours Per Set : 2.0000	Equipment Labor Amount (per acre or hectare) : 0.0022
Equipment Labor Price (per hour) : 12.000	Equipment Labor Cost : 0.7676
Season Water Need : 25.0000	Season Water Extra Credit : 5.0000
Season Water Extra Debit : 3.0000	Distribution Uniformity : 80.0000
Season Applied Amount : 826.5625	Water Price : 0.0000
Water Cost : 0.0000	Lube Amount (gallons or liters) : 0.032
Lube Oil Price : 4.000	Lube Oil Cost : 3.720
Water Horsepower (hp or kW) : 172.5152	Brake Horsepower (hp or kW) : 261.3866
Engine Flywheel Power (hp or kW) : 261.3866	Flow Rate (gpm or l/s) : 1200.0000
Static Head (feet or meters) : 500.0000	Pressure Head (psi or kPa) : 30.0000
Water pumped (acre inches/hour or m3/hour) : 2.6667	Pump Efficiency : 66.0000
Required Fuel Amount : 81.2364	Pump Performance : 86.6522
Unit of Measurement : see	Repair Cost : 7.501

Summary



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Capital investments are a basic requirement for modern society. They allow bridges to be built, factories to expand, sewers to remove wastes, climate change to be mitigated, and patients to be cured. This basic Capital Budgeting data may help people to improve their lives and livelihoods.

Footnotes

1. References in DevTreks also use the term *Investments* for Capital Budgets.
2. The *Life Cycle Calculator 1* reference demonstrates that Capital Budgets can include capital costs, allocated overhead costs, and operating costs. DevTreks leaves it up to networks to define the data standards and rules to be followed by clubs in their network. Those data standards should be documented in professional publications. The *Handbook* does not explicitly document calculations for Capital Investments, so other documentation, such as that found in the LCA tutorial, is needed.

References

O'Brien, Dumler, and Rogers. Irrigation Capital Requirements and Energy Costs. Farm Management Guide MF-836. Department of Agricultural Economics. Kansas State. 2011

References Note

We try to use references that are open access or that do not charge fees.

Improvements, Errors, and New Features

Please notify DevTreks (devtrekkers@gmail.com) if you find errors or can recommend improvements.

A video tutorial explaining this reference can be found at:

[https://www.devtreks.org/commonstreks/preview/commons/resourcepack/NPV Calculation 2, Capital Budgets/445/none/](https://www.devtreks.org/commonstreks/preview/commons/resourcepack/NPV%20Calculation%20Capital%20Budgets/445/none/)