AUGUST 6, 2024

Efficient electrification workshop #3 Financial analysis with RETScreen Expert

Stephen Dixon, Knowenergy **Kevin Bourque**, RETScreen International



Agenda

- Welcome and introductions
- Quick overview of RETScreen Expert
- Overview of financial parameters and terms
- Overview of how to conduct financial analyses with RETScreen Expert
- Discussion on incorporating other costs (carbon tax, demand charges)
- Activity 1: Demonstration of Level 1 and 2, sensitivity and risk analysis
- Activity 2: Follow along case study
- Wrap-up and questions and answers



Overview of RETScreen Expert



RETScreen Expert

- Intelligent decision support tool to enable stakeholders to rapidly identify, assess, optimize and track the performance of clean energy investments over the entire project life cycle
- 38 languages covering two thirds of the world's population







RETScreen development

- Natural Resources Canada (CanmetENERGY)
- Renewable Energy and Energy Efficiency Partnership
- Independent Electricity System Operator
- United Nations Environment Programme
- National Aeronautics and Space Administration
- Global Environment Facility



latural Resources Canada











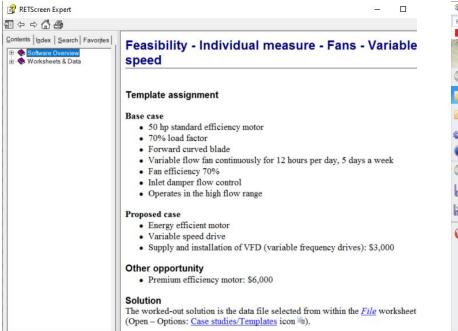


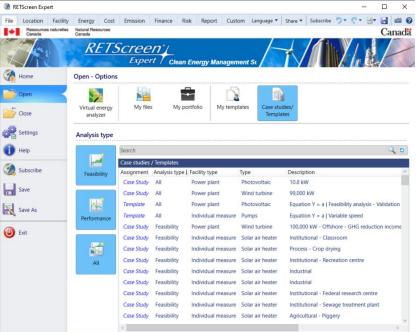
The complete toolbox! Let's take a quick look





Learning resource – case studies and templates

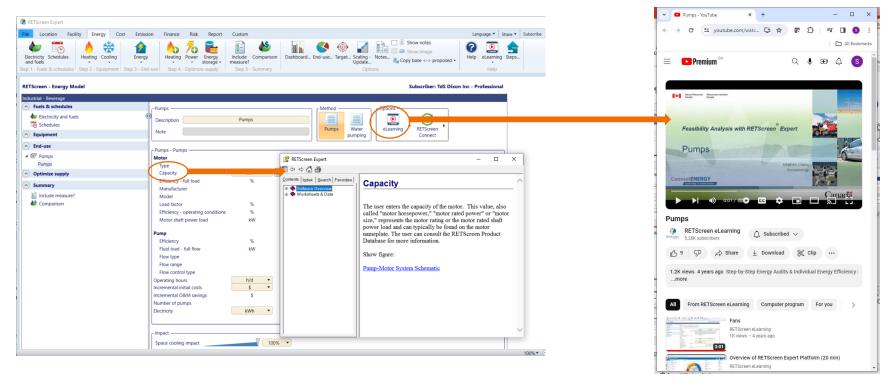








Learning resource – contextual text and video help





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Overview of key financial terms



What information do we need?

Capital cost

• One time or phased (re-fit)

Savings

• Energy and other

Time horizon

• The period over which the project will deliver value Discount rate

- Minimum rate of return required by investor (hurdle rate)
- Weighted average cost of capital
- Higher risk tends to increase discount rate

Inflation rate

• Energy and other



What information do we need? (con't)

Financial parameter	Where in RETScreen
Capital cost	Incremental initial cost
Savings	<i>Incremental O&M costs/savings</i> (also <i>fuel costs/savings</i> - calculated)
Time horizon	Project life (financial analysis worksheet)
Discount rate	Discount rate (financial analysis worksheet)
Inflation rate	Inflation rate (financial analysis worksheet)





Essential formulas

• Conventionally future amounts are compared (apples to apples) with present value

 $Present \, Value = \frac{Future \, Amount}{(1 + Discount \, Rate)^{years}}$

• Future savings are typically determined by inflating present savings

Future Amount = Present Savings (1 + Inflation Rate)^{years}



Results formulas

• Net present alue (NPV)

Sum of the PV of Cash Inflows (Savings) - PV of Cash Outflows (Investment)

• Savings to Investment Ratio (SIR)

Sum of the PV of Cash Inflows (Savings) PV of Cash Outflows (Investment)

- Internal Rate of Return (IRR)
 - The discount rate that makes the NPV zero.
 - In simple terms similar to an effective interest rate on an investment
 - Complex spreadsheet function for calculation.



Let's walkthrough a financial analysis

Financing Rate (for MIRR) 10.0% Re-Investment Rate (for MIRR) 10.0%

(\$2,000)

Enci	gy Fioj	CULTE	Cycle C	ash Flo	w Analys	515						
Year of Project		0	1	2	3	4	5	6	7	8	9	10
Project Costs		\$1,000										
Inflation Rate	4.0%											
Annual Project Savings		\$500	\$500	\$500	\$500	\$500	\$500	\$500	\$500	\$500	\$500	\$50
Savings with Inflation			\$520	\$541	\$562	\$585	\$608	\$633	\$658	\$684	\$712	\$740
Net Cash Flow		(\$1,000)	\$520	\$541	\$562	\$585	\$608	\$633	\$658	\$684	\$712	\$740
Cumulative Cash Flow		(\$1,000)	(\$480)	\$61	\$623	\$1,208	\$1,816	\$2,449	\$3,107	\$3,791	\$4,503	\$5,243
Discount Rate	10.0%											
sent Value (PV) of Net Cash Flow		(\$1,000)	\$473	\$447	\$423	\$400	\$378	\$357	\$338	\$319	\$302	\$28
Cumulative PV of Net Cash Flow		(\$1,000)	(\$527)	(\$80)	\$342	\$742	\$1,119	\$1,477	\$1,814	\$2,133	\$2,435	\$2,72
Financial Metrics			Year	Year	Year	Year	Year	Year	Year	Year	Year	Year
Simple Payback	2.0 yrs		1	2	3	4	5	6	7	8	9	10
Internal Rate of Return	IRR		-48.0%	4.0%	28.3%	40.3%	46.7%	50.3%	52.4%	53.7%	54.5%	55.0%
Modified Internal Rate of Return	MIRR		-48.0%	5.5%	21.3%	26.4%	27.8%	27.9%	27.5%	26.9%	26.2%	25.4%
Net Present Value	NPV		(\$527)	(\$80)	\$342	\$742	\$1,119	\$1,477	\$1,814	\$2,133	\$2,435	\$2,721
Savings to Investment Ratio	SIR		0.5	0.9	1.3	1.7	2.1	2.5	2.8	3.1	3.4	3.7
Ca	sh Flow	s					Net	Annual	Cash Flo			
\$6,000 Cumulative Cash Flo	ow 🏾 🖉 Dise	ounted Cum	ulative Cash F	low _	\$1,00	0	Net	Annau	cusinno			
\$4,000								_				
41000					\$50	0						
\$2,000					\$							
					11	0	1 2	3 4	5 6	7 8	9	10

(\$1,500)

> ieso Connecting Today. Powering Tomorrow.



Costs & savings (inflated)



\$500

\$500

\$520

\$500

\$541

\$500

\$562

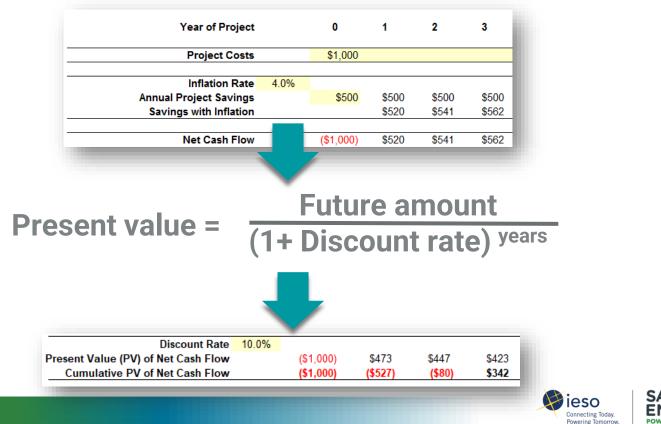
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Annual Project Savings

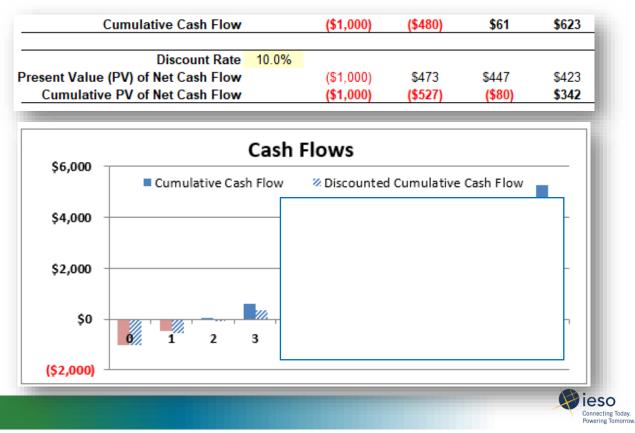
Savings with Inflation



Present value of net cash flow



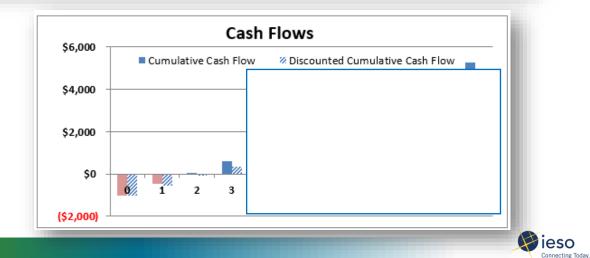
Net present value (cumulative discounted cash flow)





Financial metrics (better & common)

Financial Metrics		Year	Year	Year
Simple Payback	2.0 yrs	1	2	3
Internal Rate of Return	IRR	-48.0%	4 0%	28.3%
Modified Internal Rate of Return	MIRR	-48.0%	5.5%	21.3%
Net Present Value	NPV	(\$527)	(\$80)	\$342
Savings to Investment Ratio	SIR	0.5	0.9	1.3

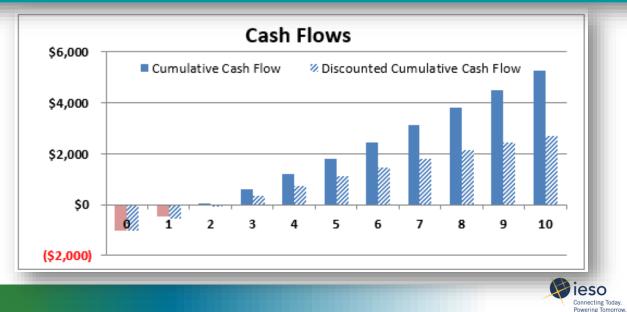




Powering Tomorrow.

Now let's stretch the horizon!

Financial Metrics		Year	Year	Year	Year	Year	Year	Year	Year	Year	Year
Simple Payback	2.0 yrs	1	2	3	4	5	6	7	8	9	10
Internal Rate of Return	IRR	-48.0%	4.0%	28.3%	40.3%	46.7%	50.3%	52.4%	53.7%	54.5%	55.0%
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Net Present Value	NPV	(\$527)	(\$80)	\$342	\$742	\$1,119	\$1,477	\$1,814	\$2,133	\$2,435	\$2,721
Savings to Investment Ratio	SIR	0.5	0.9	1.3	1.7	2.1	2.5	2.8	3.1	3.4	3.7





The whole picture

Year of Project		0	1	2	3	4	5	6	7	8	9	10
-		•	•	-	, in the second se		•	, in the second se		, in the second s	, in the second s	
Project Costs		\$1,000										
Inflation Rate	4.0%											
Annual Project Savings		\$500	\$500	\$500	\$500	\$500	\$500	\$500	\$500	\$500	\$500	\$500
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Financial Metrics			Year	Year	Year	Year	Year	Year	Year	Year	Year	Year
Simple Payback			1	2	3	4	5	6	7	8	9	10
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Savings to Investment Ratio	SIR		0.5	0.9	1.3	1.7	2.1	2.5	2.8	3.1	3.4	3.7
	ash Flov	vs					Net	Annual	Cash Flo	w		
\$6,000 Cumulative Cash Fl	low 🏾 🖉 Di	scounted Cum	ulative Cash F	low	\$1,00	0						
\$4,000			_									
<i>v</i> 1,000					\$50	0						
\$2,000				<u></u>	\$	0						
					(\$50	0	1 2	3 4	56	78	9 :	10
\$0												
0 1 2 3	4	56	78	9 10	(\$1,00	0)						_
(\$2,000)					(\$1,50	0)						



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RETScreen Expert Financial Analysis Overview

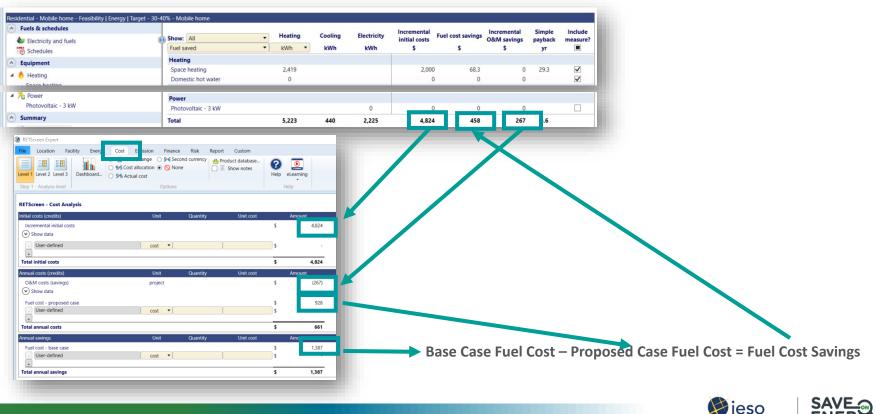
Financial Analysis – Level 1

Financial Analysis – Level 2

Sensitivity and Risk Analysis



Cost & savings from RETScreen technical analysis



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POWER WHAT'S NEXT



Entering cost & savings into RETScreen expert

	llocation 💿 🚫 Non	ond currency	Analytics Report Product database Show notes	
RETScreen - Cost Analysis				
nitial costs (credits)	Unit	Quantity	Unit cost	Amount
Initial cost User-defined	cost 💌	1	\$ \$ 1,000	1,000
Total initial costs	 		\$	1,000
Annual costs (credits)	Unit	Quantity	Unit cost	Amount
O&M costs (savings) User-defined	project		\$	
Total annual costs			\$	
nnual savings	01-34 0-34	Quantity	U-N	Amount
- User-defined	〔 cost ▼〕	1	\$ 500 \$	500
			s	500



LEVEL 1 Financial analysis

Level 1 L vel 2 sis level 0	ption		Emiss													
ETScreen - Financial Analysis												Sub	oscriber: T	dS Dixon	Inc - Profe	essional
nancial analysis			0	Cumulativ	e cash fl	ows grap	bh									
inancial parameters																
nflation rate	%	4			7,000	_										
Project life	yr	1	0													
Debt ratio	%				6,000	-										
fotal initial costs	\$	1,00	0		5,000											
ncentives and grants	\$															
Annual costs and debt payments				ws (\$	4,000	-										
Debt payments	\$		0	h flo	3,000	_										
Total annual costs	\$		0	c cas												
Annual savings and revenue				Cumulative cash flows (\$)	2,000	1										
User-defined	s	50	00	nur	1,000	-										
GHG reduction revenue	\$		0	ŭ												
Other revenue (cost)	\$		0		0											
Total annual savings and revenue	\$	50	00		-1,000											
inancial viability					-2,000											
Pre-tax IRR - assets	%	55	%		2,000	0	1	2	3	4	5	6	7	8	9	10
Simple payback	yr		2								Year					
Equity payback	yr	1	.9													



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LEVEL 2 Financial analysis

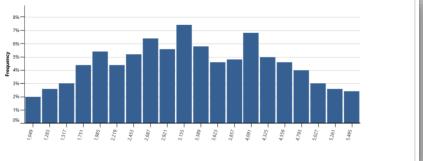
Lev I 1 Level 2 Dashboard.	En Copy -								
ETScreen - Financial Analysis nancial parameters			Costs Savings Revenue				Subscribe Yearly cast		nc - Professional
Seneral			Initial costs				Year	Pre-tax	Cumulative
Fuel cost escalation rate		4%		100%	s	1.000	#	s	s
Inflation rate	%	4%					0	-1,000	-1,000
Discount rate	%	10%	Total initial costs	100%	\$	1,000	1	520	-480
Reinvestment rate	%	10%	Yearly cash flows - Year 1				2	541	60.80
Project life	yr	10	Annual costs and debt payments				3	562 585	623 1,208
inance			Debt payments		s	0	5	608	1,208
Incentives and grants	s						6	633	2,449
Debt ratio	%	0%	Total annual costs		\$	0	7	658	3,107
			Annual savings and revenue				8	684	3,791
ncome tax analysis			User-defined		s	500	9 10	712 740	4,503 5,243
			GHG reduction revenue		\$	0	10	740	5,243
			Other revenue (cost)		\$	0			
			Total annual savings and revenue		s	500			
			Net yearly cash flow - Year 1		s	500			
			Financial viability						
			Pre-tax IRR - equity		%	55%			
nnual revenue			Pre-tax MRR - equity		76 %	25.5%			
GING reduction revenue Gross GHG reduction	100 /	0	Pre-tax IRR - assets		%	25.5%			
Gross GHG reduction Gross GHG reduction - 10 yrs	tCO ₂ /yr tCO ₃	0	Pre-tax MIRR - assets		%	25.5%			
GHG reduction revenue	\$	0				201070			
ono reduction revenue	\$	0	Simple payback		yr	2			
Other revenue (cost)			Equity payback		yr	1.9			
			Net Present Value (NPV)		s	2.721			
			Annual life cycle savings		⇒ 5/yr	443			
				-	<i>י</i> ע <i>י</i> י	445			
			Benefit-Cost (B-C) ratio Debt service coverage			3.7			



Risk & Sensitivity Analysis

sitivity analysis						
form analysis on	Net Present V					
sitivity range	25	%				
eshold	0	\$				
Remove analysis			Initial	costs	• \$	- +
Fuel cost - base case	•	3,618	4,221	4,824	5,427	6,030
\$		-25.0%	-12.5%	0.0%	12.5%	25.0%
1,040	-25.0%	730	175	-379	-934	-1,488
1,213	-12.5%	2,586	2,031	1,477	922	368
1,387	0.0%	4,442	3,887	3,333	2,778	2,224
1,560	12.5%	6,298	5,743	5,189	4,634	4,080
1,733	25.0%	8,154	7,599	7,045	6,490	5,936
- + Remove analysis			Initial	costs	▼ \$	- +
Fuel cost - proposed cas	e 🔹	3,618	4,221	4,824	5,427	6,030
\$		-25.0%	-12.5%	0.0%	12.5%	25.0%
696	-25.0%	6,927	6,372	5,818	5,263	4,709
812	-12.5%	5,684	5,130	4,575	4,021	3,466
928	0.0%	4,442	3,887	3,333	2,778	2,224
1,044	12.5%	3,199	2,645	2,090	1,536	981
1,160	25.0%	1,957	1.402	848	293	-261

Risk analysis Perform analysis on Net Present Value (NPV) • Number of combinations 500 • Random seed No • Parameter Unit Value Range (+/-) Minimum Maximum Initial costs \$ 4,824 25% 3,618 6,030 O&M -267 25% -200 -334 s Fuel cost - proposed case 928 25% 696 1,160 \$ Fuel cost - base case 1.387 25% 1.040 1.733 ¢ Debt ratio 70.0% 25% 52.5% 87.5% % Debt interest rate 7.00% 25% 5.25% 8.75% 94 Debt term 11 19 15 25% Impact - Net Present Value (NPV) Fuel cost - base case Fuel cost - proposed cas Initial costs O&M Debt interest rate Debt ratio Debt term -0.4 -0.2 0.2 0.4 0.6 0.8 Relative impact of parameter (standard deviation) Distribution - Net Present Value (NPV) 8% 7% 6%







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Databases Supporting Financial Analysis

Cost data (initial installed costs and ongoing O&M)

Hot water - Typical installed cost (\$/unit)				Our at the	8
Hot water measure Showerhead - regular flow (9 - 18 L/min)	Minimum 40	Average 60	Maximum 80	Quantity	Amount (\$)
Showerhead - low flow (4 - 6 L/min)	70	105	140		
Lavatory or kitchen faucet (9 - 18 L/min)	130	1,360	2,585		
Low flow aerator or laminator restrictor (4 - 6 L/min)	150	40	2,505	3	120
Lavatory automatic flow sensor (4 - 6 L/min)	460	535	610		120
Drainwater heat recovery - Commercial gravity film heat exchanger (GFX)	1,145	2,305	3,460		
Drainwater heat recovery - Residential gravity film heat exchanger (GFX)	740	1,310	1,875		
Adjustment factor 1.0000 Currency \$					
Cumulative inflation rate 0% Symbol \$ (Begin: January 1, 2022) Exchange rate 1.00000 \$/\$				8	

Including Demand Charges – O&M savings per measure

ommercial/Institutional - Elementary school,	I/Primary school - Feasibility Energy Targ	et - 30-40% - Education			
> Fuels & schedules	C Lights		CLevel	c Options	
 Electricity and fuels Schedules 	Description	Classroom		eLearning RETScreen	
> Equipment	O&N	Demand Savings 2.2 kW x 1	2 months x \$10/kW	Connect	
🔺 💧 Heating					
Space heating Domestic hot water	Lights - Level 2		Base case	Proposed case	Energy saved
End-use	Lamp & fixture type		Eluorescent T5 - electronic ballast	 Light emitting diode (LED) 	· 🗛
Building envelope	Efficiency	lm/W	90.6	100	
Classroom	Electricity load per lam		28	15	
Gymnasium	Number of lamps per fi		4	4	
S Roof - Steel	Miscellaneous losses	W -	3	0	
Walls - Concrete block	Electricity load per fixtu	re W	115	60	
Ventilation	Number of fixtures		10	10	
Office	Number of lamps - tota	1	40	40	
Cafeteria	Operating hours	h/yr 🔻	1,600	1,600	
	Costing method			Level 1	•
Optimize supply	Incremental initial costs	\$		2,320	<u> </u>
4 🖕 Heating	Incremental O&M savir	igs		264	
Solar water heater	Number of units		20	20	
🔺 🏂 Power	Electricity	kWh 🔻	36,800	19,200	17,600
Photovoltaic - 126 kW					47.8%
Summary	- Impact				
Include measure?					
🌢 Comparison	Space cooling impact		0% -		
	Space heating impact		70% -		





Including Demand Charges – for all measures

iHG reduction savings		
Gross GHG reduction	tCO ₂ /yr	37
Gross GHG reduction - 20 yrs	tCO ₂	740
GHG reduction savings	\$	0
ther revenue (cost)	\checkmark	
Capacity	kW 🔻	36
Rate	\$/kW ▼	120
Other revenue (cost)	\$	4,320
Duration	yr	20
Escalation rate	%	

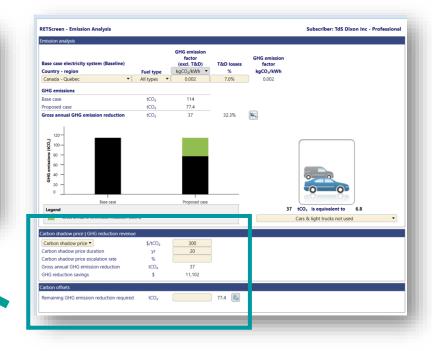
	Cost		Finance Risk Report	Custom	
Level 1 Level 2 Dashboard	🛃 Copy - Le	vel 1->2	Help eLear	ning	
tep 1 - Analysis level	Opt	ions	Help		
RETScreen - Financial Analysis					
Financial parameters			Costs Savings Revenue		
General			Initial costs		
Fuel cost escalation rate	%	2%	Incremental initial costs	100% \$	82.45
Inflation rate	%	2%			
Discount rate	%	9%	Total initial costs	100% \$	82,45
Reinvestment rate	%	9%	Yearly cash flows - Year 1		
Project life	yr	20	Annual costs and debt pa	yments	
Finance			O&M costs (savings)	s	-5.50
Incentives and grants	s		Fuel cost - proposed case	s	20,41
Debt ratio	%	70%	Debt payments - 15 yrs	\$	6,33
Debt	s	57,718	Total annual costs	s	21,24
Equity	\$	24,736	Total annual costs	•	21,24
Debt interest rate	%	7%	Annual savings and reven	ue	
Debt term	yr	15	Fuel cost - base case	\$	30,68
Debt payments	\$/yr	6,337	GHG reduction savings	\$	
Income tax analysis			Other revenue (cost) - 20 y	rs \$	4,32
		Total annual savings and	revenue \$	35,00	
			Ne yearly cash flow - Year	1 s	13,75
Annual savings and revenue			Fine cial viability		
GHG reduction savings					59.2
Gross GHG reduction	tCO ₂ /yr	37	Pro tax IRR - equity Pro tax MIRR - equity	%	59.25
			Pro tax MIRK - equity	70 %	19.0
Gross GHG reduction - 20 yrs	tCO ₂	740	Pro tax IRR - assets	76 %	12.6
GHG reduction savings	\$	0	A WINTY - assets	76	12.0
Other revenue (cost)		v	Sir ble payback	yr	4.
Capacity	kW 🔻	36	Eq ty payback	yr	1.
Rate	\$/kW -	120	Ne Descent Value (NDLC	s	132.55
Other revenue (cost)	s	4,320	Ne Present Value (NPV) Are ual life cycle savings	\$ \$/vr	132,55
Duration	yr (20	Arruar me cycle savings	\$/yr	14,52
Escalation rate	%		Be efit-Cost (B-C) ratio		6.
			De t service coverage		3
			GH reduction cost	\$/tCO;	-37





Including Carbon Charges (Shadow Carbon Price - Tax)

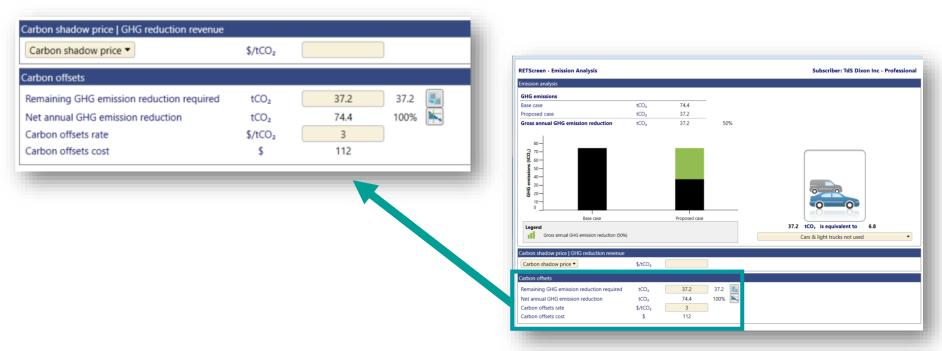
Gross annual GHG emission reduction tCO ₂ 37	
Gross annual GHG emission reduction tCO ₂ 37	
SHG reduction savings \$ 11.102	
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Including Carbon Charges (Carbon Credits)



https://carboncredits.com/how-do-carbon-offset-credits-work-2023-guide/





Activity 1: Demonstration of a case study



Case Study Situation

- HVAC operational & capital improvements
- We'll use an individual measure archetype from the Virtual Energy Analyzer – Ventilation Control
- Using all default parameters
- We'll adjust and tune the financial analysis



Activity 2: Follow along case study



Case Study Situation

- Roof-top Unit from Gas to Air Source Heat Pump retrofit
 - 70% efficiency to seasonal COP of 2.0 (200%)
- Ventilation scheduling
- Optional addition of on-site photovoltaic array.
- Electricity price \$0.12/kWh (marginal)
- Natural gas of \$0.45/m³



Financial Analysis Applied to Net Zero Planning



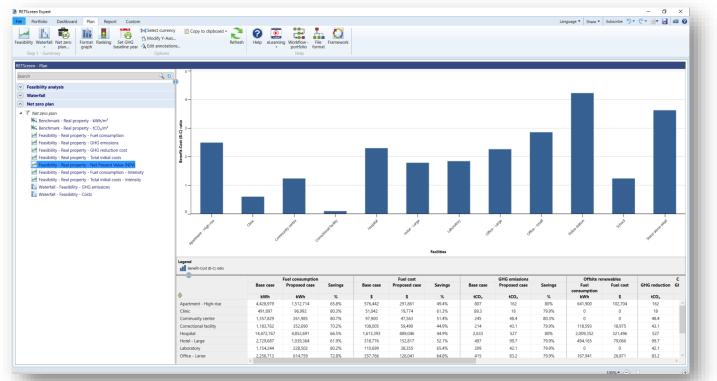
Previous Net Zero Planning







Financial Indicators in the Net Zero Plan







Efficient Electrification Toolkit and Helpdesk

The webinar materials will be shared with you by email.

The webinar recording can be accessed at <u>SaveonEnergy.ca/Training-and-</u> <u>Support</u>. Select your Sector and then "Efficient Electrification".

For questions and technical support regarding the Efficient Electrification Toolkit, including RETScreen, contact <u>trainingandsupport@ieso.ca</u>.

Please use "EE toolkit helpdesk" as your email subject line. Requests will be triaged and addressed in the order they are received.



Post-Webinar Support

One-on-one coaching: tailored support for managing energy resources effectively

Post-webinar support intake form

Coaching sessions conducted virtually: phone, video calls, and email Designed for organizations, new or old, seeking guidance.



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