

Appendix 4

About

Title: Energy Efficiency Project Economics and Financing Model

Project: CTCN Project

Last Updated: February 8, 2018

Instructions

The purpose of this document is to model project economics for 4 hypothetical energy-efficient equipment upgrades in a hypothetical steel plant.

Models and all input cells for the the below four technologies are available in this document:

1. Regenerative Burner for Ladle Heating (EAF)
2. Scrap Pretreatment (EAF)
3. Air Conditioning with Absorption Type Refrigeration (RHF)
4. Fiber Block Insulation (RHF)

For any other technologies, there is also a sheet entitled "**Model for Plant Managers**" that has a blank model which plant managers may use to estimate the cash flows of a potential improvement they wish to consider for their plant. The following assumptions were made about the output and costs of the hypothetical steel plant, and the equipment upgrades:

500000	tons/yr	Assumed Output of Hypothetical Steel Plant
14.4	\$/GJ	Assumed Cost of Energy in Thailand
0.097	\$/kWh	Assumed Cost of Energy in Thailand
14	years	Estimated Useful Life (EUL) of the Technology
5%	%	Assumed Discount Rate of Project Owner
O&M	\$	Annual operations & maintenance costs were assumed to be 3% of the total investment cost
Emissions	tons-CO2	Assumed carbon content based on conversion factors listed in Factors sheet

Other input cells were populated with data collected in steel plant surveys that were previously conducted as a part of this CTCN project.

All input cells are on sheets 1-4 and are highlighted in yellow, e.g. **input**

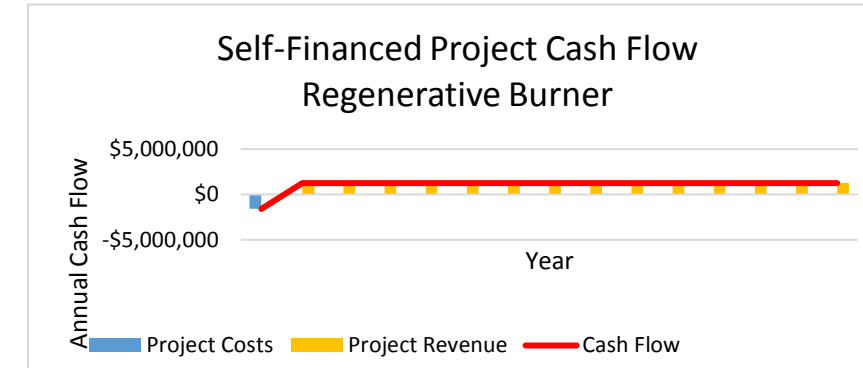
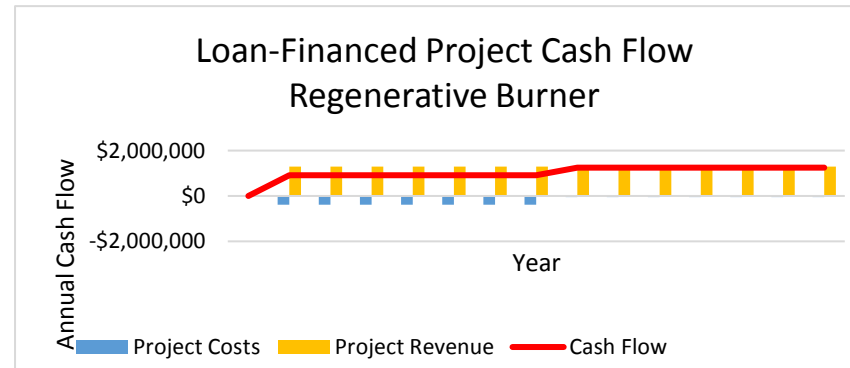
All outputs and graphs are available on the Output Summary Sheet.

Modulating the inputs on sheets 1-4 changes the outputs of the models and the graphs on sheets 1-4, and the outputs on the Outputs Summary sheet.

This model does not account for any taxes.

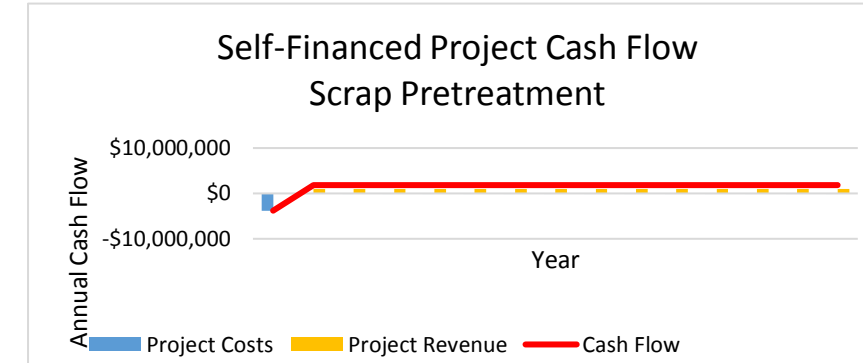
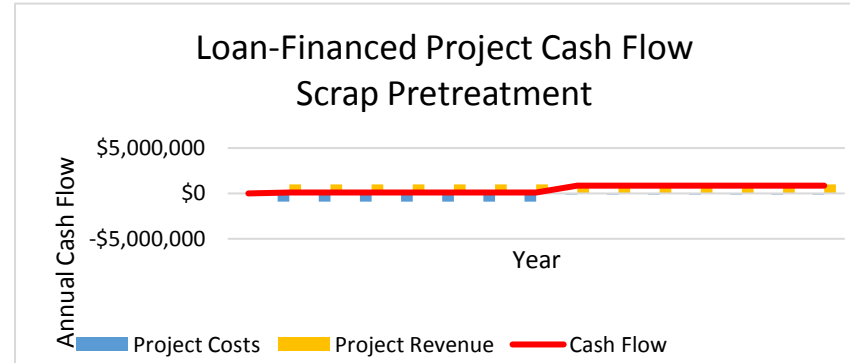
1) **Regenerative Burner for Ladle Heating (EAF)**

Investment Cost	\$1,600,000
Annual Savings	\$1,296,000
Payback Period	1.23
NPV of Self-Financed Project	\$10,241,432
NPV of Loan-Financed Project	\$9,954,114
Term	7
Interest Rate	10%
Energy Saved (GJ)	1260000
CO2 Emissions Reduced (tons)	70686



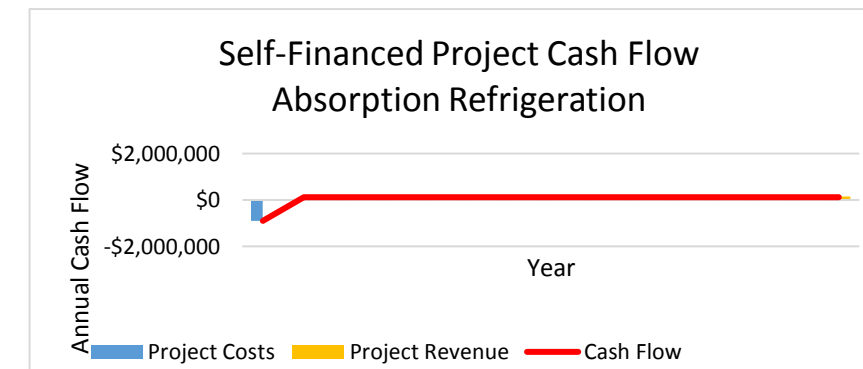
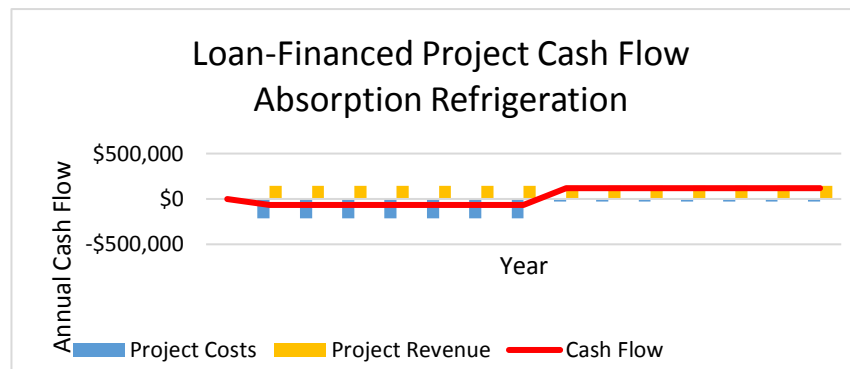
2) **Scrap Pretreatment (EAF)**

Investment Cost	\$3,800,000
Annual Savings	\$970,000
Payback Period	3.92
NPV of Self-Financed Project	\$13,642,674
NPV of Loan-Financed Project	\$3,768,320
Term	7
Interest Rate	10%
Energy Saved (MWh)	140000
CO2 Emissions Reduced (tons)	70560



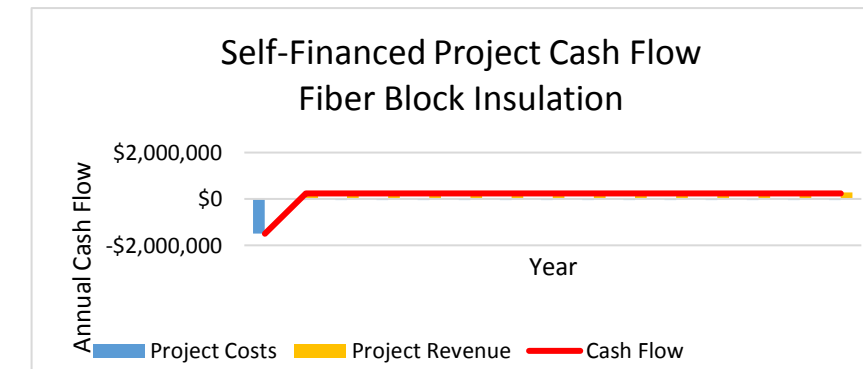
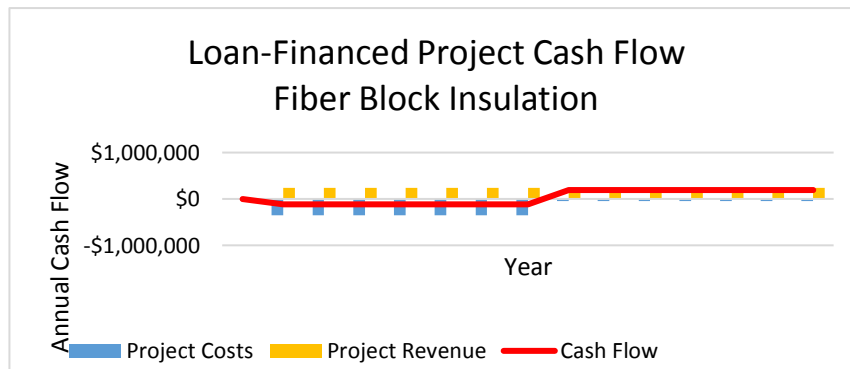
3) **AC with Absorption Type Refrigeration (RHF)**

Investment Cost	\$900,000
Annual Savings	\$145,500
Payback Period	6.19
NPV of Self-Financed Project	\$259,989
NPV of Loan-Financed Project	\$98,373
Term	7
Interest Rate	10%
Energy Saved (MWh)	21000
CO2 Emissions Reduced (tons)	10584



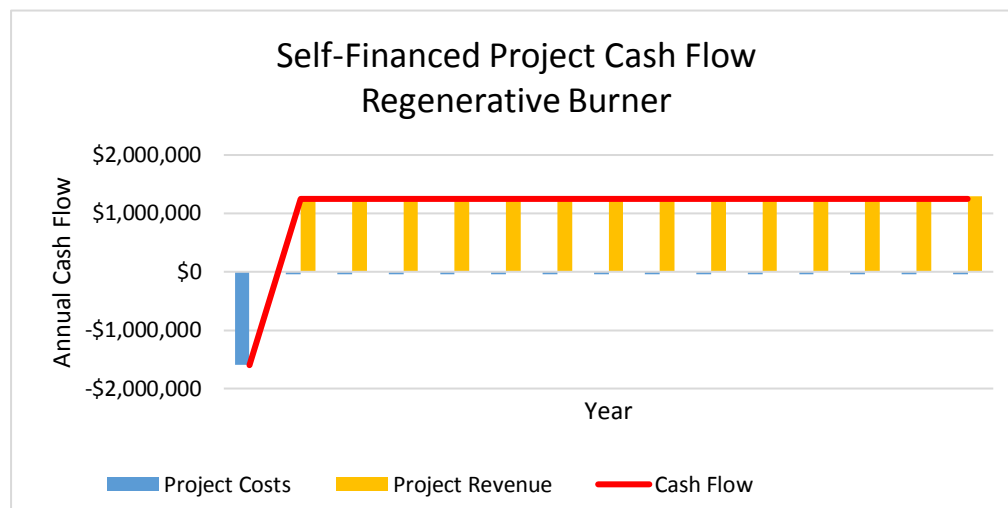
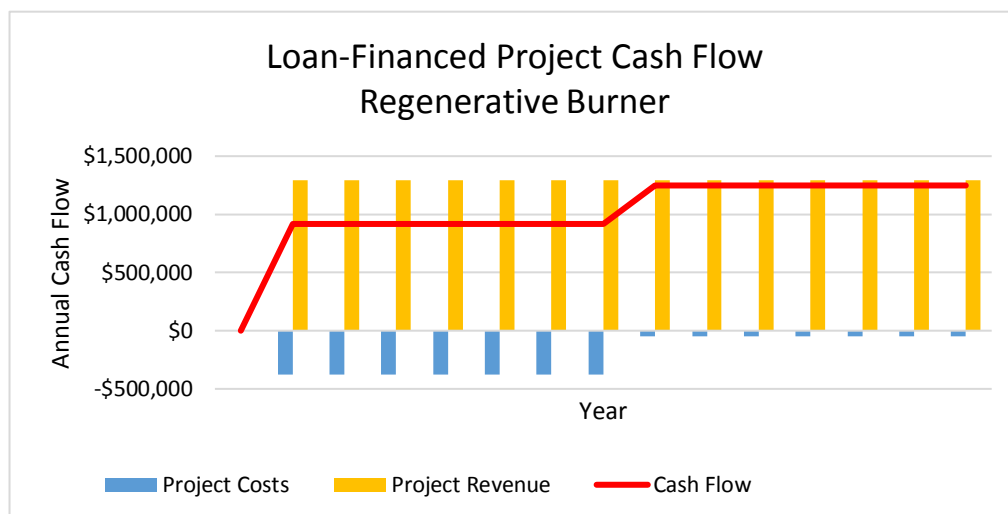
4) **Fiber Block Insulation (RHF)**

Investment Cost	\$1,500,000
Annual Savings	\$281,880
Payback Period	5.32
NPV of Self-Financed Project	\$804,562
NPV of Loan-Financed Project	\$110,973
Term	7
Interest Rate	10%
Energy Saved (GJ)	274050
CO2 Emissions Reduced (tons)	15374



Regenerative Burner for Ladle Heating (EAF)

Efficiency Project Details	
Investment Cost per unit	400000 USD
Units	4 # of units
Subsidy or Grant	0 USD
Total Investment Cost	1600000 USD
Operations & Maintenance Cost (annual)	48000 USD
Estimated Useful Life (EUL)	14 years
Fuel savings	40% %
Annual Steel Output	500000 tons of steel
Baseline Energy Consumption (per ton)	0.45 GJ/ton
Baseline Energy Consumption (annual)	225000 GJ
Energy Savings (per ton)	0.18 GJ/ton
Energy Savings (annual)	90000 GJ
Degradation Factor	0.00% %
Fuel costs	14.4 \$/GJ
Fuel Cost Escalator	0.00% %
Project Owner Discount Rate	5.00% %
CO2 Emissions per GJ (natural gas)	0.056100279 tons-CO2/GJ
CO2 Emissions Reductions (first year)	5049 tons of CO2
Value per ton of CO2 reduced	0 \$/ton of CO2
CO2 Value Escalator	0.00% %
Financing Details	
Percentage of project cost financed	100% %
Total Loan Principle	1600000 USD
Term of Loan	7 years
Interest Rate	10% %
Target Max Payback Period	7 years
Target Min Debt Service Coverage Ratio	1.25 ratio



Scenario 1: Self-Financed Project

Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Energy Savings (GJ)		90000	90000	90000	90000	90000	90000	90000	90000	90000	90000	90000	90000	90000	90000
Energy Cost (\$/GJ)		\$14.4	\$14.4	\$14.4	\$14.4	\$14.4	\$14.4	\$14.4	\$14.4	\$14.4	\$14.4	\$14.4	\$14.4	\$14.4	\$14.4
Savings (\$)		\$1,296,000	\$1,296,000	\$1,296,000	\$1,296,000	\$1,296,000	\$1,296,000	\$1,296,000	\$1,296,000	\$1,296,000	\$1,296,000	\$1,296,000	\$1,296,000	\$1,296,000	\$1,296,000
Reduction in CO2 Emissions (ton-CO2)		5049	5049	5049	5049	5049	5049	5049	5049	5049	5049	5049	5049	5049	5049
Value of CO2 Reduction (\$/ton-CO2)		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Revenue from CO2 Reduction (\$)		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Annual Project Revenue (\$)		\$1,296,000	\$1,296,000	\$1,296,000	\$1,296,000	\$1,296,000	\$1,296,000	\$1,296,000	\$1,296,000	\$1,296,000	\$1,296,000	\$1,296,000	\$1,296,000	\$1,296,000	\$1,296,000
O&M Costs (\$)		(\$48,000)	(\$48,000)	(\$48,000)	(\$48,000)	(\$48,000)	(\$48,000)	(\$48,000)	(\$48,000)	(\$48,000)	(\$48,000)	(\$48,000)	(\$48,000)	(\$48,000)	(\$48,000)
Project Cash Flow (\$)	(\$1,600,000)	\$1,248,000	\$1,248,000	\$1,248,000	\$1,248,000	\$1,248,000	\$1,248,000	\$1,248,000	\$1,248,000	\$1,248,000	\$1,248,000	\$1,248,000	\$1,248,000	\$1,248,000	\$1,248,000
Cumulative Savings (\$)	(\$1,600,000)	(\$352,000)	\$896,000	\$2,144,000	\$3,392,000	\$4,640,000	\$5,888,000	\$7,136,000	\$8,384,000	\$9,632,000	\$10,880,000	\$12,128,000	\$13,376,000	\$14,624,000	\$15,872,000
Payback Period (years)		1.23													
Total CO2 Reduction (tons)		70686													
Net Project Cash Flows (\$)		\$15,872,000													
NPV of Cash Flows (\$)		\$10,241,432													

Scenario 2: Loan-Financed Project

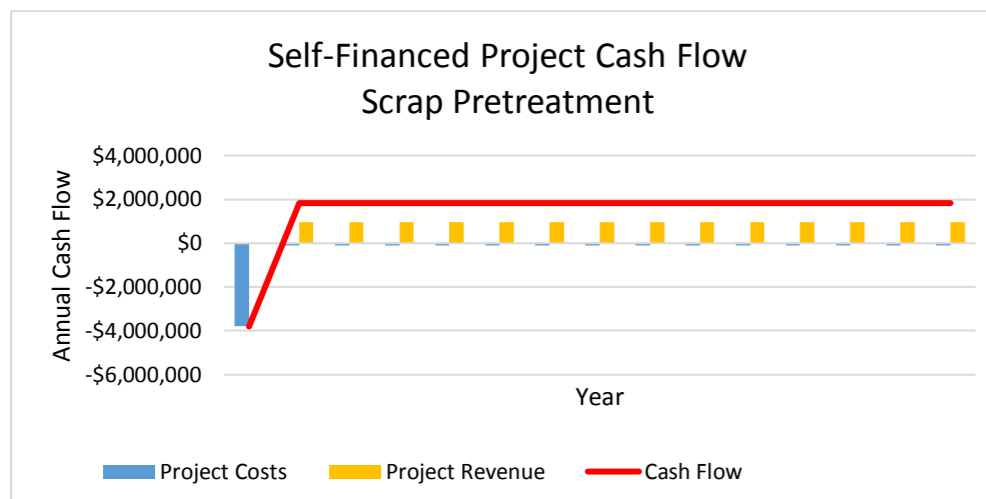
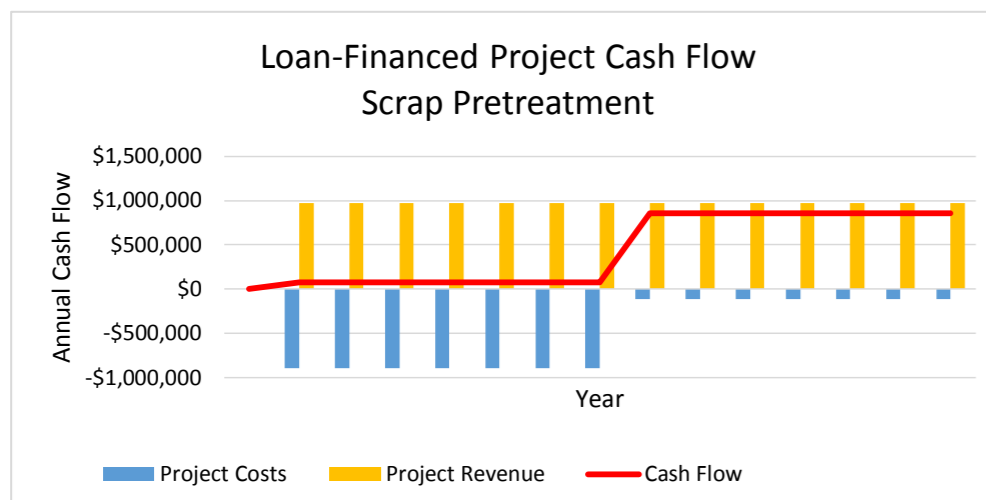
Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Energy Savings (GJ)		90000	90000	90000	90000	90000	90000	90000	90000	90000	90000	90000	90000	90000	90000
Energy Cost (\$/GJ)		\$14.4	\$14.4	\$14.4	\$14.4	\$14.4	\$14.4	\$14.4	\$14.4	\$14.4	\$14.4	\$14.4	\$14.4	\$14.4	\$14.4
Savings (\$)		\$1,296,000	\$1,296,000	\$1,296,000	\$1,296,000	\$1,296,000	\$1,296,000	\$1,296,000	\$1,296,000	\$1,296,000	\$1,296,000	\$1,296,000	\$1,296,000	\$1,296,000	\$1,296,000
Reduction in CO2 Emissions (ton-CO2)		5049	5049	5049	5049	5049	5049	5049	5049	5049	5049	5049	5049	5049	5049
Value of CO2 Reduction (\$/ton-CO2)		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Revenue from CO2 Reduction (\$)		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Annual Project Revenue (\$)		\$1,296,000	\$1,296,000	\$1,296,000	\$1,296,000	\$1,296,000	\$1,296,000	\$1,296,000	\$1,296,000	\$1,296,000	\$1,296,000	\$1,296,000	\$1,296,000	\$1,296,000	\$1,296,000
O&M Costs (\$)		(\$48,000)	(\$48,000)	(\$48,000)	(\$48,000)	(\$48,000)	(\$48,000)	(\$48,000)	(\$48,000)	(\$48,000)	(\$48,000)	(\$48,000)	(\$48,000)	(\$48,000)	(\$48,000)
Loan Payment (\$)		(\$328,649)	(\$328,649)	(\$328,649)	(\$328,649)	(\$328,649)	(\$328,649)	(\$328,649)	(\$328,649)	(\$328,649)	(\$328,649)	(\$328,649)	(\$328,649)	(\$328,649)	(\$328,649)
Annual Expense (\$)		(\$376,649)	(\$376,649)	(\$376,649)	(\$376,649)	(\$376,649)	(\$376,649)	(\$376,649)	(\$376,649)	(\$376,649)	(\$376,649)	(\$376,649)	(\$376,649)	(\$376,649)	(\$376,649)
Project Cash Flow (\$)	\$0	\$919,351	\$919,351	\$919,351	\$919,351	\$919,351	\$919,351	\$919,351	\$919,351	\$1,248,000	\$1,248,000	\$1,248,000	\$1,248,000	\$1,248,000	\$1,248,000
Debt Service Coverage Ratio		3.94x													
Total CO2 Reduction (tons)		70686													
Net Project Cash Flows (\$)		\$15,171,458													
NPV of Cash Flows (\$)		\$9,954,114													

Project NPV Varying Term and Rate

Rate	Term									
	4	5	6	7	8	9	10			
\$9,954,114										
16%	\$9,834,218	\$9,750,365	\$9,666,207	\$9,581,959	\$9,497,831	\$9,414,029	\$9,330,750			
14%	\$9,910,785	\$9,843,558	\$9,776,286	\$9,709,107	\$9,642,156	\$9,575,563	\$9,509,453			
12%	\$9,986,272	\$9,935,087	\$9,884,040	\$9,833,208	\$9,782,669	\$9,732,498	\$9,682,766			
10%	\$10,060,642	\$10,024,891	\$9,989,369	\$9,954,114	\$9,919,161	\$9,884,547	\$9,850,306			
8%	\$10,133,857	\$10,112,906	\$10,092,175	\$10,071,676	\$10,051,422	\$10,031,424	\$10,011,693			
6%	\$10,205,880	\$10,199,067	\$10,192,356	\$10,185,749	\$10,179,246	\$10,172,849	\$10,166,558			
4%	\$10,276,672	\$10,283,310	\$10,289,815	\$10,296,190	\$10,302,435	\$10,308,553	\$10,314,545			
2%	\$10,346,193	\$10,365,570	\$10,384,454	\$10,402,859	\$10,420,797	\$10,438,281	\$10,455,323			

Scrap Pretreatment (EAF)

Efficiency Project Details	
Investment Cost per unit	3800000 USD
Units	1 # of units
Subsidy or Grant	0 USD
Total Investment Cost	3800000 USD
Operations & Maintenance Cost (annual)	114000 USD
Estimated Useful Life (EUL)	14 years
Annual Steel Output	500000 tons of steel
Energy Savings (per ton)	20 kWh/ton
Energy Savings (annual)	10000000 kWh
Degradation Factor	0.00% %
Fuel costs	0.097 \$/kWh
Fuel Cost Escalator	0.00% %
Project Owner Discount Rate	5.00% %
CO2 Emissions per GJ (electricity)	0.000504 tons-CO2/kWh
CO2 Emissions Reductions (first year)	5040 tons of CO2
Value per ton of CO2 reduced	0 \$/ton of CO2
CO2 Value Escalator	0.00% %
Financing Details	
Percentage of project cost financed	100% %
Total Loan Principle	3800000 USD
Term of Loan	7 years
Interest Rate	10% %
Target Max Payback Period	7 years
Target Min Debt Service Coverage Ratio	1.25 ratio



Scenario 1: Self-Financed Project

Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Energy Savings (kWh)		10000000	10000000	10000000	10000000	10000000	10000000	10000000	10000000	10000000	10000000	10000000	10000000	10000000	10000000
Energy Cost (\$/kWh)		\$0.097	\$0.097	\$0.097	\$0.097	\$0.097	\$0.097	\$0.097	\$0.097	\$0.097	\$0.097	\$0.097	\$0.097	\$0.097	\$0.097
Savings (\$)		\$970,000	\$970,000	\$970,000	\$970,000	\$970,000	\$970,000	\$970,000	\$970,000	\$970,000	\$970,000	\$970,000	\$970,000	\$970,000	\$970,000
Reduction in CO2 Emissions (ton-CO2)		5040	5040	5040	5040	5040	5040	5040	5040	5040	5040	5040	5040	5040	5040
Value of CO2 Reduction (\$/ton-CO2)		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Revenue from CO2 Reduction (\$)		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Annual Project Revenue (\$)		\$970,000	\$970,000	\$970,000	\$970,000	\$970,000	\$970,000	\$970,000	\$970,000	\$970,000	\$970,000	\$970,000	\$970,000	\$970,000	\$970,000
O&M Costs (\$)		(\$114,000)	(\$114,000)	(\$114,000)	(\$114,000)	(\$114,000)	(\$114,000)	(\$114,000)	(\$114,000)	(\$114,000)	(\$114,000)	(\$114,000)	(\$114,000)	(\$114,000)	(\$114,000)
Project Cash Flow (\$)	(\$3,800,000)	\$1,831,040	\$1,831,040	\$1,831,040	\$1,831,040	\$1,831,040	\$1,831,040	\$1,831,040	\$1,831,040	\$1,831,040	\$1,831,040	\$1,831,040	\$1,831,040	\$1,831,040	\$1,831,040
Cumulative Savings (\$)	(\$3,800,000)	(\$1,968,960)	(\$137,920)	\$1,693,120	\$3,524,160	\$5,355,200	\$7,186,240	\$9,017,280	\$10,848,320	\$12,679,360	\$14,510,400	\$16,341,440	\$18,172,480	\$20,003,520	\$21,834,560
Payback Period (years)		3.92													
Total CO2 Reduction (tons)		70560													
Net Project Cash Flows (\$)		\$21,834,560													
NPV of Cash Flows (\$)		\$13,642,674													

Scenario 2: Loan-Financed Project

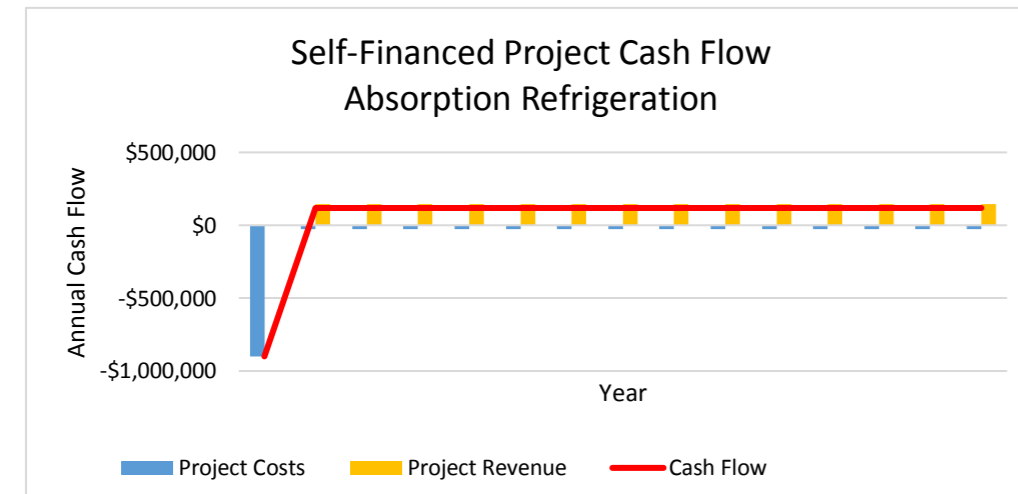
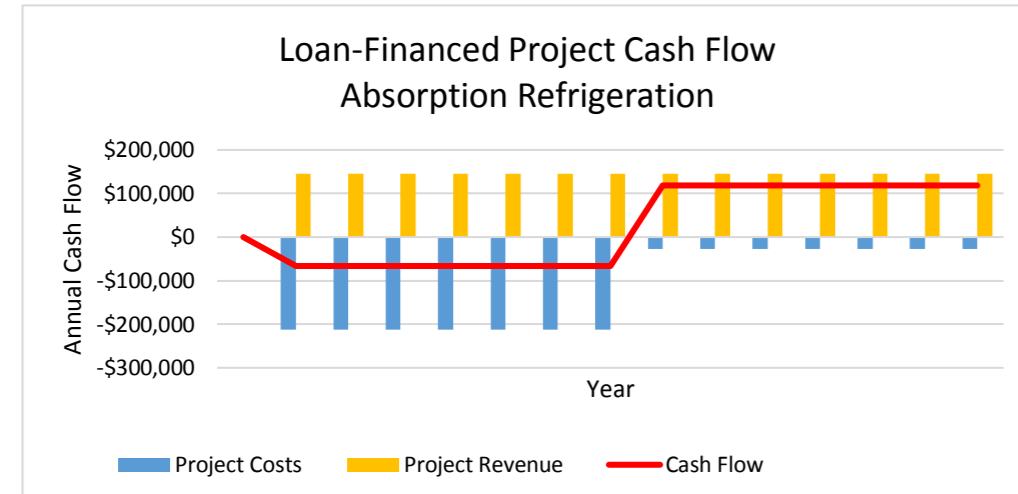
Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Energy Savings (kWh)		10000000	10000000	10000000	10000000	10000000	10000000	10000000	10000000	10000000	10000000	10000000	10000000	10000000	10000000
Energy Cost (\$/kWh)		\$0.097	\$0.097	\$0.097	\$0.097	\$0.097	\$0.097	\$0.097	\$0.097	\$0.097	\$0.097	\$0.097	\$0.097	\$0.097	\$0.097
Savings (\$)		\$970,000	\$970,000	\$970,000	\$970,000	\$970,000	\$970,000	\$970,000	\$970,000	\$970,000	\$970,000	\$970,000	\$970,000	\$970,000	\$970,000
Reduction in CO2 Emissions (ton-CO2)		5040	5040	5040	5040	5040	5040	5040	5040	5040	5040	5040	5040	5040	5040
Value of CO2 Reduction (\$/ton-CO2)		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Revenue from CO2 Reduction (\$)		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Annual Project Revenue (\$)		\$970,000	\$970,000	\$970,000	\$970,000	\$970,000	\$970,000	\$970,000	\$970,000	\$970,000	\$970,000	\$970,000	\$970,000	\$970,000	\$970,000
O&M Costs (\$)		(\$114,000)	(\$114,000)	(\$114,000)	(\$114,000)	(\$114,000)	(\$114,000)	(\$114,000)	(\$114,000)	(\$114,000)	(\$114,000)	(\$114,000)	(\$114,000)	(\$114,000)	(\$114,000)
Loan Payment (\$)		(\$780,541)	(\$780,541)	(\$780,541)	(\$780,541)	(\$780,541)	(\$780,541)	(\$780,541)	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Annual Expense (\$)		(\$894,541)	(\$894,541)	(\$894,541)	(\$894,541)	(\$894,541)	(\$894,541)	(\$894,541)	(\$114,000)	(\$114,000)	(\$114,000)	(\$114,000)	(\$114,000)	(\$114,000)	(\$114,000)
Project Cash Flow (\$)	\$0	\$75,459	\$75,459	\$75,459	\$75,459	\$75,459	\$75,459	\$75,459	\$856,000	\$856,000	\$856,000	\$856,000	\$856,000	\$856,000	\$856,000
Debt Service Coverage Ratio		1.24x													
Total CO2 Reduction (tons)		70560													
Net Project Cash Flows (\$)		\$6,520,214													
NPV of Cash Flows (\$)		\$3,768,320													

Project NPV Varying Term and Rate

Rate	Term						
	4	5	6	7	8	9	10
16%	\$3,483,568	\$3,284,417	\$3,084,542	\$2,884,452	\$2,684,648	\$2,485,618	\$2,287,831
14%	\$3,665,415	\$3,505,749	\$3,345,979	\$3,186,430	\$3,027,421	\$2,869,262	\$2,712,252
12%	\$3,844,696	\$3,723,132	\$3,601,894	\$3,481,169	\$3,361,140	\$3,241,983	\$3,123,869
10%	\$4,021,324	\$3,936,417	\$3,852,052	\$3,768,320	\$3,685,307	\$3,603,099	\$3,521,776
8%	\$4,195,210	\$4,145,452	\$4,096,215	\$4,047,530	\$3,999,427	\$3,951,932	\$3,905,071
6%	\$4,366,265	\$4,350,084	\$4,334,146	\$4,318,454	\$4,303,010	\$4,287,816	\$4,272,875
4%	\$4,534,395	\$4,550,161	\$4,565,611	\$4,580,750	\$4,595,583	\$4,610,113	\$4,624,344
2%	\$4,699,508	\$4,745,528	\$4,790,378	\$4,834,089	\$4,876,693	\$4,918,218	\$4,958,693

Air Conditioning with Absorption Type Refrigeration (RHF)

Efficiency Project Details	
Investment Cost per unit	900000 USD
Units	1 # of units
Subsidy or Grant	0 USD
Total Investment Cost	900000 USD
Operations & Maintenance Cost (annual)	27000 USD
Estimated Useful Life (EUL)	14 years
Annual Steel Output	500000 tons of steel
Energy Savings (per ton)	3 kWh/ton
Energy Savings (annual)	1500000 kWh
Degradation Factor	0.00% %
Fuel costs	0.097 \$/kWh
Fuel Cost Escalator	0.00% %
Project Owner Discount Rate	5.00% %
CO2 Emissions per GJ (electricity)	0.000504 tons-CO2/kWh
CO2 Emissions Reductions (first year)	756 tons of CO2
Value per ton of CO2 reduced	0 \$/ton of CO2
CO2 Value Escalator	0.00% %
Financing Details	
Percentage of project cost financed	100% %
Total Loan Principle	900000 USD
Term of Loan	7 years
Interest Rate	10% %
Target Max Payback Period	7 years
Target Min Debt Service Coverage Ratio	1.25 ratio



Scenario 1: Self-Financed Project

Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Energy Savings (kWh)		1500000	1500000	1500000	1500000	1500000	1500000	1500000	1500000	1500000	1500000	1500000	1500000	1500000	1500000
Energy Cost (\$/kWh)		\$0.097	\$0.097	\$0.097	\$0.097	\$0.097	\$0.097	\$0.097	\$0.097	\$0.097	\$0.097	\$0.097	\$0.097	\$0.097	\$0.097
Savings (\$)		\$145,500	\$145,500	\$145,500	\$145,500	\$145,500	\$145,500	\$145,500	\$145,500	\$145,500	\$145,500	\$145,500	\$145,500	\$145,500	\$145,500
Reduction in CO2 Emissions (ton-CO2)		756	756	756	756	756	756	756	756	756	756	756	756	756	756
Value of CO2 Reduction (\$/ton-CO2)		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Revenue from CO2 Reduction (\$)		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Annual Project Revenue (\$)		\$145,500	\$145,500	\$145,500	\$145,500	\$145,500	\$145,500	\$145,500	\$145,500	\$145,500	\$145,500	\$145,500	\$145,500	\$145,500	\$145,500
O&M Costs (\$)		(\$27,000)	(\$27,000)	(\$27,000)	(\$27,000)	(\$27,000)	(\$27,000)	(\$27,000)	(\$27,000)	(\$27,000)	(\$27,000)	(\$27,000)	(\$27,000)	(\$27,000)	(\$27,000)
Project Cash Flow (\$)	(\$900,000)	\$118,500	\$118,500	\$118,500	\$118,500	\$118,500	\$118,500	\$118,500	\$118,500	\$118,500	\$118,500	\$118,500	\$118,500	\$118,500	\$118,500
Cumulative Savings (\$)	(\$900,000)	(\$781,500)	(\$663,000)	(\$544,500)	(\$426,000)	(\$307,500)	(\$189,000)	(\$70,500)	\$48,000	\$166,500	\$285,000	\$403,500	\$522,000	\$640,500	\$759,000
Payback Period (years)		6.19													
Total CO2 Reduction (tons)		10584													
Net Project Cash Flows (\$)		\$759,000													
NPV of Cash Flows (\$)		\$259,989													

Scenario 2: Loan-Financed Project

Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Energy Savings (kWh)		1500000	1500000	1500000	1500000	1500000	1500000	1500000	1500000	1500000	1500000	1500000	1500000	1500000	1500000
Energy Cost (\$/kWh)		\$0.097	\$0.097	\$0.097	\$0.097	\$0.097	\$0.097	\$0.097	\$0.097	\$0.097	\$0.097	\$0.097	\$0.097	\$0.097	\$0.097
Savings (\$)		\$145,500	\$145,500	\$145,500	\$145,500	\$145,500	\$145,500	\$145,500	\$145,500	\$145,500	\$145,500	\$145,500	\$145,500	\$145,500	\$145,500
Reduction in CO2 Emissions (ton-CO2)		756	756	756	756	756	756	756	756	756	756	756	756	756	756
Value of CO2 Reduction (\$/ton-CO2)		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Revenue from CO2 Reduction (\$)		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Annual Project Revenue (\$)		\$145,500	\$145,500	\$145,500	\$145,500	\$145,500	\$145,500	\$145,500	\$145,500	\$145,500	\$145,500	\$145,500	\$145,500	\$145,500	\$145,500
O&M Costs (\$)		(\$27,000)	(\$27,000)	(\$27,000)	(\$27,000)	(\$27,000)	(\$27,000)	(\$27,000)	(\$27,000)	(\$27,000)	(\$27,000)	(\$27,000)	(\$27,000)	(\$27,000)	(\$27,000)
Loan Payment (\$)		(\$184,865)	(\$184,865)	(\$184,865)	(\$184,865)	(\$184,865)	(\$184,865)	(\$184,865)	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Annual Expense (\$)		(\$211,865)	(\$211,865)	(\$211,865)	(\$211,865)	(\$211,865)	(\$211,865)	(\$211,865)	(\$27,000)	(\$27,000)	(\$27,000)	(\$27,000)	(\$27,000)	(\$27,000)	(\$27,000)
Project Cash Flow (\$)	\$0	(\$66,365)	(\$66,365)	(\$66,365)	(\$66,365)	(\$66,365)	(\$66,365)	(\$66,365)	\$118,500	\$118,500	\$118,500	\$118,500	\$118,500	\$118,500	\$118,500
Debt Service Coverage Ratio		0.79x													
Total CO2 Reduction (tons)		10584													
Net Project Cash Flows (\$)		\$364,945													
NPV of Cash Flows (\$)		\$98,373													

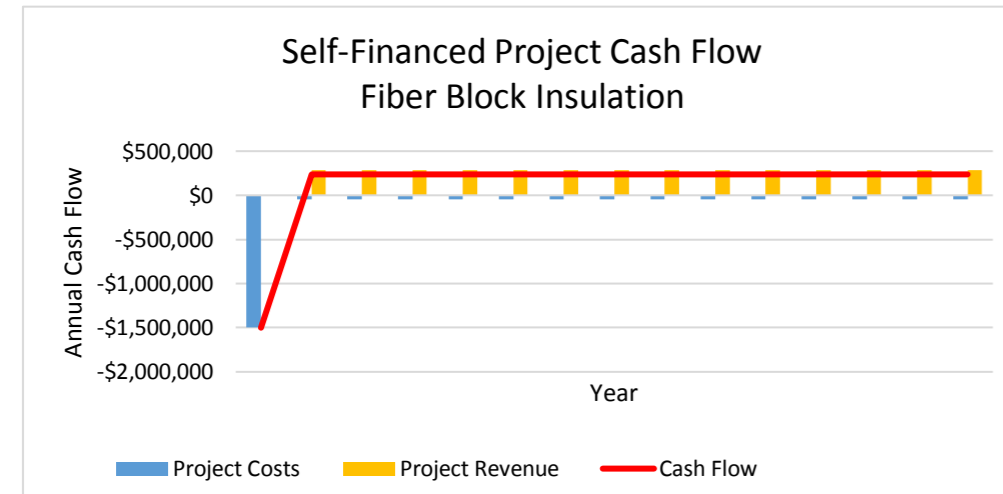
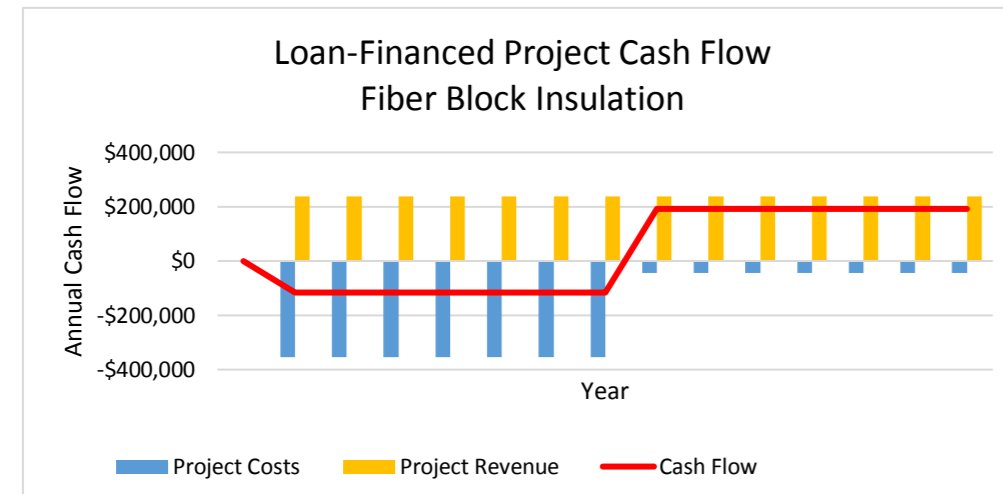
Project NPV Varying Term and Rate

		Term						
		4	5	6	7	8	9	10
Rate	16%	\$30,931	(\$16,236)	(\$63,575)	(\$110,964)	(\$158,286)	(\$205,425)	(\$252,269)
	14%	\$74,000	\$36,185	(\$1,655)	(\$39,443)	(\$77,103)	(\$114,562)	(\$151,749)
	12%	\$116,462	\$87,670	\$58,956	\$30,363	\$1,935	(\$26,286)	(\$54,260)
	10%	\$158,295	\$138,185	\$118,204	\$98,373	\$78,712	\$59,241	\$39,981
	8%	\$199,478	\$187,693	\$176,032	\$164,502	\$153,109	\$141,860	\$130,761
	6%	\$239,991	\$236,159	\$232,384	\$228,668	\$225,010	\$221,411	\$217,873
	4%	\$279,812	\$283,546	\$287,205	\$290,791	\$294,303	\$297,745	\$301,115
	2%	\$318,917	\$329,817	\$340,439	\$350,792	\$360,882	\$370,717	\$380,303

Fiber Block Insulation (RHF)

Efficiency Project Details	
Investment Cost per unit	1500000 USD
Units	1 # of units
Subsidy or Grant	0 USD
Total Investment Cost	1500000 USD
Operations & Maintenance Cost (annual)	45000 USD
Estimated Useful Life (EUL)	14 years
Fuel savings	2.70% %
Annual Steel Output	500000 tons of steel
RHF Baseline Energy Consumption (per ton)	1.45 GJ/ton
RHF Baseline Energy Consumption (annual)	725000 GJ
Energy Savings (per ton)	0.03915 GJ/ton
Energy Savings (annual)	19575 GJ
Degradation Factor	0.00% %
Fuel costs	14.4 \$/GJ
Fuel Cost Escalator	0.00% %
Project Owner Discount Rate	5.00% %
CO2 Emissions per GJ (natural gas)	0.056100279 tons-CO2/GJ
CO2 Emissions Reductions (first year)	1098 tons of CO2
Value per ton of CO2 reduced	0 \$/ton of CO2
CO2 Value Escalator	0.00% %

Financing Details	
Percentage of project cost financed	100% %
Total Loan Principle	1500000 USD
Term of Loan	7 years
Interest Rate	10% %
Target Max Payback Period	7 years
Target Min Debt Service Coverage Ratio	1.25 ratio



Scenario 1: Self-Financed Project

Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Energy Savings (GJ)		19575	19575	19575	19575	19575	19575	19575	19575	19575	19575	19575	19575	19575	19575
Energy Cost (\$/GJ)		\$14.4	\$14.4	\$14.4	\$14.4	\$14.4	\$14.4	\$14.4	\$14.4	\$14.4	\$14.4	\$14.4	\$14.4	\$14.4	\$14.4
Savings (\$)		\$281,880	\$281,880	\$281,880	\$281,880	\$281,880	\$281,880	\$281,880	\$281,880	\$281,880	\$281,880	\$281,880	\$281,880	\$281,880	\$281,880
Reduction in CO2 Emissions (ton-CO2)		1098	1098	1098	1098	1098	1098	1098	1098	1098	1098	1098	1098	1098	1098
Value of CO2 Reduction (\$/ton-CO2)		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Revenue from CO2 Reduction (\$)		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Annual Project Revenue (\$)		\$281,880	\$281,880	\$281,880	\$281,880	\$281,880	\$281,880	\$281,880	\$281,880	\$281,880	\$281,880	\$281,880	\$281,880	\$281,880	\$281,880
O&M Costs (\$)		(\$45,000)	(\$45,000)	(\$45,000)	(\$45,000)	(\$45,000)	(\$45,000)	(\$45,000)	(\$45,000)	(\$45,000)	(\$45,000)	(\$45,000)	(\$45,000)	(\$45,000)	(\$45,000)
Project Cash Flow (\$)	(\$1,500,000)	\$236,880	\$236,880	\$236,880	\$236,880	\$236,880	\$236,880	\$236,880	\$236,880	\$236,880	\$236,880	\$236,880	\$236,880	\$236,880	\$236,880
Cumulative Savings (\$)	(\$1,500,000)	(\$1,263,120)	(\$1,026,240)	(\$789,360)	(\$552,480)	(\$315,600)	(\$78,720)	\$158,160	\$395,040	\$631,920	\$868,800	\$1,105,680	\$1,342,560	\$1,579,440	\$1,816,320

Payback Period (years)	5.32
Total CO2 Reduction (tons)	15374
Net Project Cash Flows (\$)	\$1,816,320
NPV of Cash Flows (\$)	\$804,562

Scenario 2: Loan-Financed Project

Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Energy Savings (GJ)		19575	19575	19575	19575	19575	19575	19575	19575	19575	19575	19575	19575	19575	19575
Energy Cost (\$/GJ)		\$14.4	\$14.4	\$14.4	\$14.4	\$14.4	\$14.4	\$14.4	\$14.4	\$14.4	\$14.4	\$14.4	\$14.4	\$14.4	\$14.4
Savings (\$)		\$236,880	\$236,880	\$236,880	\$236,880	\$236,880	\$236,880	\$236,880	\$236,880	\$236,880	\$236,880	\$236,880	\$236,880	\$236,880	\$236,880
Reduction in CO2 Emissions (ton-CO2)		1098	1098	1098	1098	1098	1098	1098	1098	1098	1098	1098	1098	1098	1098
Value of CO2 Reduction (\$/ton-CO2)		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Revenue from CO2 Reduction (\$)		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Annual Project Revenue (\$)		\$236,880	\$236,880	\$236,880	\$236,880	\$236,880	\$236,880	\$236,880	\$236,880	\$236,880	\$236,880	\$236,880	\$236,880	\$236,880	\$236,880
O&M Costs (\$)		(\$45,000)	(\$45,000)	(\$45,000)	(\$45,000)	(\$45,000)	(\$45,000)	(\$45,000)	(\$45,000)	(\$45,000)	(\$45,000)	(\$45,000)	(\$45,000)	(\$45,000)	(\$45,000)
Loan Payment (\$)		(\$308,108)	(\$308,108)	(\$308,108)	(\$308,108)	(\$308,108)	(\$308,108)	(\$308,108)	(\$308,108)	\$0	\$0	\$0	\$0	\$0	\$0
Annual Expense (\$)		(\$353,108)	(\$353,108)	(\$353,108)	(\$353,108)	(\$353,108)	(\$353,108)	(\$353,108)	(\$45,000)	(\$45,000)	(\$45,000)	(\$45,000)	(\$45,000)	(\$45,000)	(\$45,000)
Project Cash Flow (\$)	\$0	(\$116,228)	(\$116,228)	(\$116,228)	(\$116,228)	(\$116,228)	(\$116,228)	(\$116,228)	\$191,880	\$191,880	\$191,880	\$191,880	\$191,880	\$191,880	\$191,880

Debt Service Coverage Ratio	0.77x
Total CO2 Reduction (tons)	15374
Net Project Cash Flows (\$)	\$529,562
NPV of Cash Flows (\$)	\$110,973

Project NPV Varying Term and Rate

Rate	Term						
	4	5	6	7	8	9	10
16%	(\$1,429)	(\$80,041)	(\$158,939)	(\$237,922)	(\$316,792)	(\$395,356)	(\$473,430)
14%	\$70,353	\$7,327	(\$55,740)	(\$118,720)	(\$181,487)	(\$243,918)	(\$305,896)
12%	\$141,122	\$93,136	\$45,279	(\$2,376)	(\$49,756)	(\$96,791)	(\$143,415)
10%	\$210,843	\$177,327	\$144,025	\$110,973	\$78,205	\$45,755	\$13,653
8%	\$279,483	\$259,841	\$240,406	\$221,188	\$202,200	\$183,452	\$164,954
6%	\$347,004	\$340,617	\$334,326	\$328,131	\$322,035	\$316,038	\$310,140
4%	\$413,372	\$419,595	\$425,694	\$431,670	\$437,525	\$443,260	\$448,877
2%	\$478,548	\$496,713	\$514,417	\$531,672	\$548,489	\$564,880	\$580,857

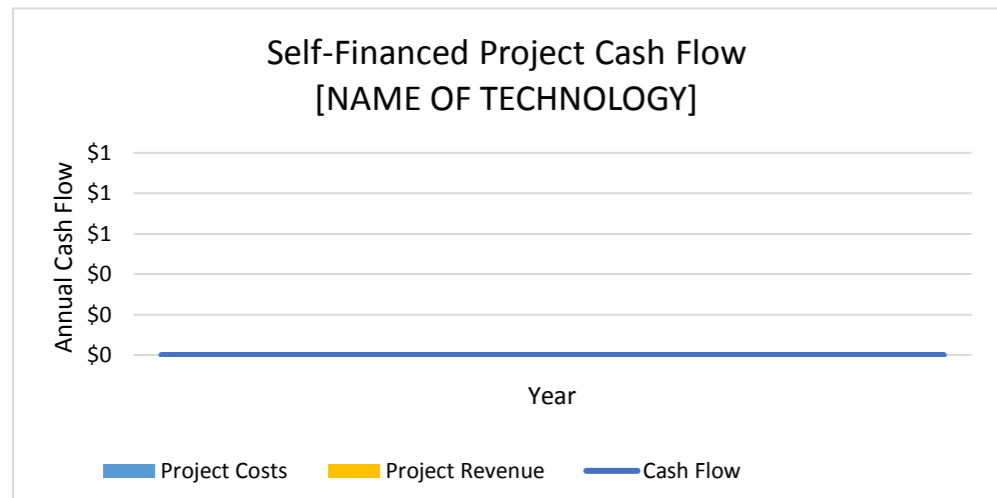
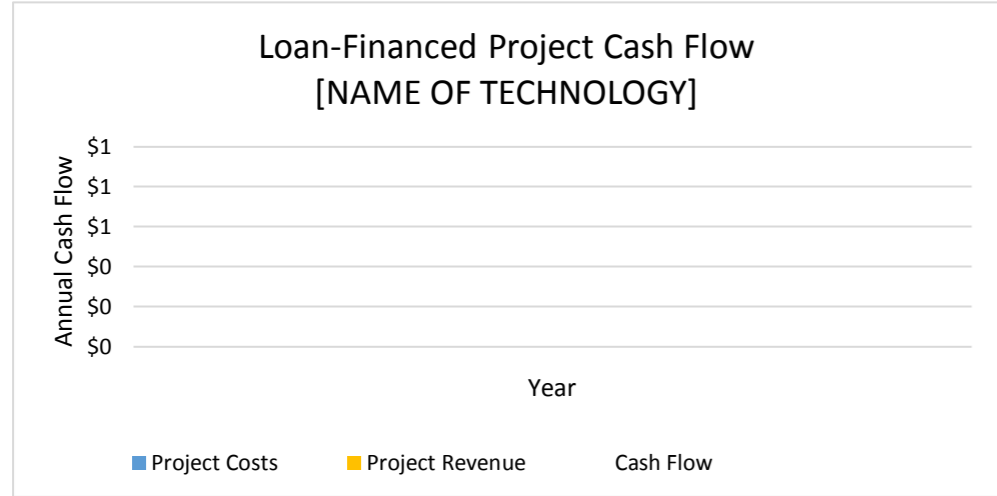
[NAMEOF TECHNOLOGY]

Instructions:
 -Enter values for every cell highlighted in yellow below in Column C
 -Enter the relevant unit of energy (kWh, GJ, etc) in cells D15, D16, D17, D18, B23, and D23
 -Enter the details of the loan you expect to receive in cells C29, C31, and C32

Efficiency Project Details		
Investment Cost per unit	0	USD
Units	1	# of units
Subsidy or Grant	0	USD
Total Investment Cost	0	USD
Operations & Maintenance Cost (annual)	0	USD
Estimated Useful Life (EUL)	14	years
Fuel savings	0%	%
Annual Steel Output of Plant	0	tons of steel
Baseline Energy Consumption (per ton)	0	[unit]/ton
Baseline Energy Consumption (annual)	0	[unit]
Energy Savings (per ton)	0	[unit]/ton
Energy Savings (annual)	0	[unit]
Degradation Factor	0.00%	%
Fuel costs	0	\$/GJ
Fuel Cost Escalator	0.00%	%
Project Owner Discount Rate	5.00%	%
CO2 Emissions per [unit of energy]	0	tons-CO2/[unit]
CO2 Emissions Reductions (first year)	0	tons of CO2
Value per ton of CO2 reduced	0	\$/ton of CO2
CO2 Value Escalator	0.00%	%
Financing Details		
Percentage of project cost financed	100%	%
Total Loan Principle	0	USD
Term of Loan	7	years
Interest Rate	10%	%
Target Max Payback Period	7	years
Target Min Debt Service Coverage Ratio	1.00	ratio

Scenario 1: Self-Financed Project															
Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Energy Savings (GJ)		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Energy Cost (\$/GJ)		\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0
Savings (\$)		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Reduction in CO2 Emissions (ton-CO2)		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Value of CO2 Reduction (\$/ton-CO2)		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Revenue from CO2 Reduction (\$)		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Annual Project Revenue (\$)		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
O&M Costs (\$)		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Project Cash Flow (\$)	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Cumulative Savings (\$)	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Payback Period (years)	#DIV/0!														
Total CO2 Reduction (tons)	0														
Net Project Cash Flows (\$)	\$0														
NPV of Cash Flows (\$)	\$0														

Scenario 2: Loan-Financed Project															
Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Energy Savings (GJ)		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Energy Cost (\$/GJ)		\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0
Savings (\$)		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Reduction in CO2 Emissions (ton-CO2)		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Value of CO2 Reduction (\$/ton-CO2)		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Revenue from CO2 Reduction (\$)		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Annual Project Revenue (\$)		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
O&M Costs (\$)		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Loan Payment (\$)		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Annual Expense (\$)		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Project Cash Flow (\$)	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Debt Service Coverage Ratio	#DIV/0!														
Total CO2 Reduction (tons)	0														
Net Project Cash Flows (\$)	\$0														
NPV of Cash Flows (\$)	\$0														



Project NPV Varying Term and Rate

Rate	Term	4	5	6	7	8	9	10
\$0		\$0	\$0	\$0	\$0	\$0	\$0	\$0
16%		\$0	\$0	\$0	\$0	\$0	\$0	\$0
14%		\$0	\$0	\$0	\$0	\$0	\$0	\$0
12%		\$0	\$0	\$0	\$0	\$0	\$0	\$0
10%		\$0	\$0	\$0	\$0	\$0	\$0	\$0
8%		\$0	\$0	\$0	\$0	\$0	\$0	\$0
6%		\$0	\$0	\$0	\$0	\$0	\$0	\$0
4%		\$0	\$0	\$0	\$0	\$0	\$0	\$0
2%		\$0	\$0	\$0	\$0	\$0	\$0	\$0

Factors

Source: ISO 14404 part 2

Source	Definition	Unit	Energy Consumption Factor			CO ₂ Emission Factor						
			Direct energy consumption factor (Kt,d,E)	Upstream energy consumption factor (Kt,u,E)	Credit energy consumption factor (Kt,c,E)	Direct CO ₂ emission factor (Kt,d,CO ₂)	Upstream CO ₂ emission factor (Kt,u,CO ₂)	Credit CO ₂ emission factor (Kt,c,CO ₂)	CO ₂ emission factor per unit of energy (Kt,d,CO ₂)			
			GJ/unit	GJ/unit	GJ/unit	t-CO ₂ /unit	t-CO ₂ /unit	t-CO ₂ /unit	t-CO ₂ /unit of energy			
Gas fuel	1	Natural gas	mixture of gaseous hydrocarbons, primarily methane, occurring naturally in the earth and used principally as	10 ³ m ³ (stp)	35.900	N/A	35.900	2.014	N/A	2.014	0.056100279	t-CO ₂ /GJ
	2	Town gas	fuel gas manufactured for domestic and industrial use	10 ³ m ³ (stp)	35.900	N/A	35.900	2.014	N/A	2.014	0.056100279	t-CO ₂ /GJ
Liquid fuel	3	Heavy oil	No. 4- No.6 fuel oil defined by ASTM	m ³	37.700	N/A	37.700	2.907	N/A	2.907	0.077108753	t-CO ₂ /GJ
	4	Light oil	No. 2- No.3 fuel oil defined by ASTM	m ³	35.100	N/A	35.100	2.601	N/A	2.601	0.074102564	t-CO ₂ /GJ
	5	Kerosene	paraffin (oil)	m ³	34.700	N/A	34.700	2.481	N/A	2.481	0.071498559	t-CO ₂ /GJ
	6	LPG	liquefied petroleum gas	t	47.300	N/A	47.300	2.985	N/A	2.985	0.063107822	t-CO ₂ /GJ
Solid fuel	7	EAF coal	coal for EAF, including anthracite	dry t	30.100	N/A	30.100	3.257	N/A	3.257	0.10820598	t-CO ₂ /GJ
	8	Steam coal	boiler coal for producing electricity and steam, including anthracite	dry t	25.900	N/A	25.900	2.461	N/A	2.461	0.095019305	t-CO ₂ /GJ
	9	Coke	solid carbonaceous material	dry t	30.100	N/A	30.100	3.257	N/A	3.257	0.10820598	t-CO ₂ /GJ
	10	Charcoal	devolatilized or coked carbon neutral materials. Ex. Trees, plants	dry t	18.800	N/A	18.800	0.000	N/A	0.000	0	t-CO ₂ /GJ
	11	SR/DR coal	coal for SR/DRI including anthracite		N/A	N/A	N/A	2.955	N/A	2.955		t-CO ₂ /GJ
Auxiliary material	12	Limestone	calcium carbonate, CaCO ₃	dry t	N/A	N/A	0.000	0.440	N/A	0.440		t-CO ₂ /GJ
	13	Burnt lime	CaO	t	N/A	4.500	4.500	N/A	0.950	0.950		t-CO ₂ /GJ
	14	Crude dolomite	calcium magnesium carbonate, CaMg(CO ₃) ₂	dry t	N/A	N/A	0.000	0.471	N/A	0.471		t-CO ₂ /GJ
	15	Burnt dolomite	CaMgO ₂	t	N/A	4.500	4.500	N/A	1.100	1.100		t-CO ₂ /GJ
	16	EAF graphite electrodes	net use of EAF graphite electrodes or attrition loss	t	N/A	N/A	0.000	3.663	0.650	3.663		t-CO ₂ /GJ
	17	Nitrogen	N ₂ inert gas separated from air at oxygen plant, imported from outside the boundary or exported to outside the boundary	10 ³ m ³ (stp)	N/A	2.000	2.000	N/A	0.103	0.103		t-CO ₂ /GJ
	18	Argon	Ar. inert gas separated from air at oxygen plant, imported from outside the boundary or exported to outside the boundary	10 ³ m ³ (stp)	N/A	2.000	2.000	N/A	0.103	0.103		t-CO ₂ /GJ
	19	Oxygen	O ₂ gas separated from air at oxygen plant, imported from outside the boundary or exported to outside the boundary	10 ³ m ³ (stp)	N/A	6.900	6.900	N/A	0.355	0.355		t-CO ₂ /GJ
Energy carriers	20	Electricity	electricity imported from outside the boundary or exported to outside the boundary	MWh	N/A	9.800	9.800	N/A	0.504	0.504	0.000504	t-CO ₂ /kWh
	21	Steam	pressurized water vapour imported from/exported to outside the boundary	t	N/A	3.800	3.800	N/A	0.195	0.195	0.000195	t-CO ₂ /kWh
Ferrous-containing material	22	Pellets	agglomerated spherical iron ore calcinated by rotary	t	N/A	N/A	N/A	0.000	N/A	N/A		
	23	Hot metal	intermediate liquid Iron products containing 3 % to 5 % by mass carbon produced by smelting iron ore with equipments such as blast furnace	t	N/A	N/A	N/A	0.172	N/A	0.172		
	24	Cold iron	solidified hot metal as an intermediate solid iron	t	N/A	N/A	N/A	0.172	N/A	0.172		
	25	Gas-based DRI	direct reduced iron (DRI) reduced by a reducing gas such as reformed natural gas	t	N/A	N/A	N/A	0.073	N/A	0.073		
Alloys	26	Coal-based DRI	direct reduced iron (DRI) reduced by coal	t	N/A	N/A	N/A	0.073	N/A	0.073		
	27	Ferro-nickel	alloy of iron and nickel	t	N/A	N/A	N/A	0.037	N/A	0.037		
	28	Ferro-chromium	alloy of iron and chromium	t	N/A	N/A	N/A	0.275	N/A	0.275		
Product and by-product	29	Ferro-molybdenum	alloy of iron and molybdenum	t	N/A	N/A	N/A	0.018	N/A	0.018		
	30	CO ₂ for external use	CO ₂ exported to outside the boundary	t	N/A	N/A	N/A	1.000	N/A	1.000		
Others	N	Other emission sources	other related emission sources such as plastics, scraps, desulfurization additives, alloys, fluxes for secondary metallurgy, dust, sludges, etc	—								