Financial and Cost Assessment Model (FICAM)

User Guide

Background

The FICAM model has been developed as a part of the GEF funded TNA project. The tool helps to evaluate contribution of any technology or practice towards mitigation of GHG gases and carry a comprehensive financial analysis.

The model helps in providing objective information which can help in decision making by the stakeholders who are supposed to prioritise various technologies / practices within a given sector.

The model runs on an Excel platform with which many users are quite well versed. The model has been developed with an open source format so that users can make changes based on their needs. For protected sheets the password to un-protect is URCD

Objectives of the model

The model can within a given sector achieve the following objectives

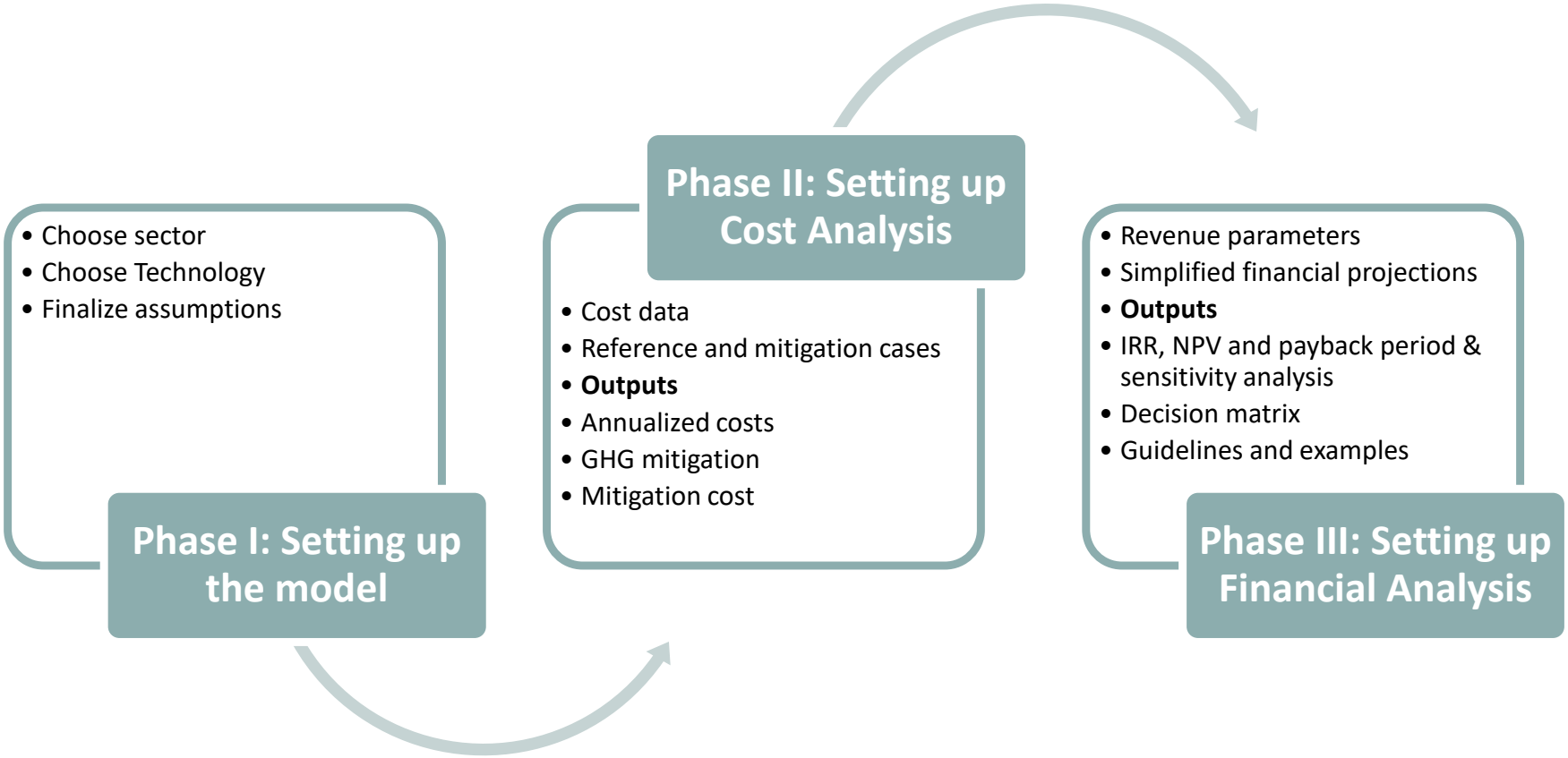
- Evaluate contribution of the alternative technology /practice /program towards mitigation of GHG gases in terms emissions reduced and unit cost of mitigation
- Do a comprehensive financial analysis which can come up with capital requirements, financial ratios (e.g., NPV, IRR, etc)

- Falls in a class of models like RETSCREEN, HOMER etc.
- Expected to assist users in arriving at an indicative mitigation cost and financial parameters.
- Model can run alternative scenarios for policy analysis
- Not an alternative to multi criterion decision making
- The data in model is only indicative and users to input their own data

Chapters: Please click to navigate in presentation mode

MODEL OVERVIEW

Overview


Phase I: Setting up the model
• Choose sector
• Choose Technology
• Finalize assumptions
Phase II: Setting up Cost Analysis
• Cost data
• Reference and mitigation cases
• Outputs
• Annualized costs
• GHG mitigation
• Mitigation cost
Phase III: Setting up Financial Analysis
• Revenue parameters
• Simplified financial projections
• Outputs
• IRR, NPV and payback period & sensitivity analysis
• Decision matrix
• Guidelines and examples

Sectors and Technologies Supported

Back to Chapters

Energy	•Coal IGCC and USCSC •Solar PV and CSP •Wind onshore and offshore •Biomass •Carbon capture and storage	User Defined Technology
Transport	•Fuel economy •Vehicle technology •Modal switch •Urban planning	User Defined Technology
Building	•Efficient envelope and appliances •Heat pumps •Solar heating	User Defined Technology
Agriculture	•Biomass burning •Rice cultivation •Livestock	User Defined Technology
Industrial Processes	•Industrial Processes	User Defined Technology
User Configured	•User Configured sector	User Defined Technology

SETTING UP THE MODEL

Navigation

1

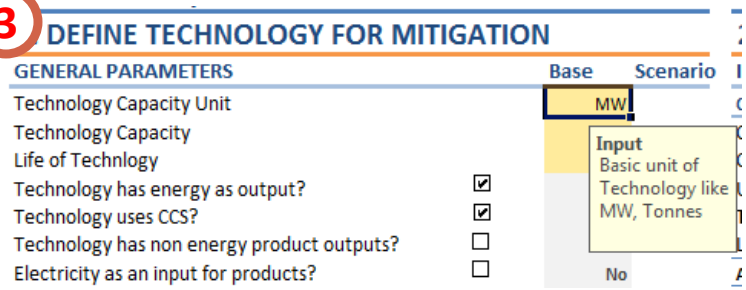
Cells in yellow can be used to change inputs.

2

BACK

Look out for this button to return to the control page.

3



Click on cells in yellow to access help features.

4 EXAMPLES

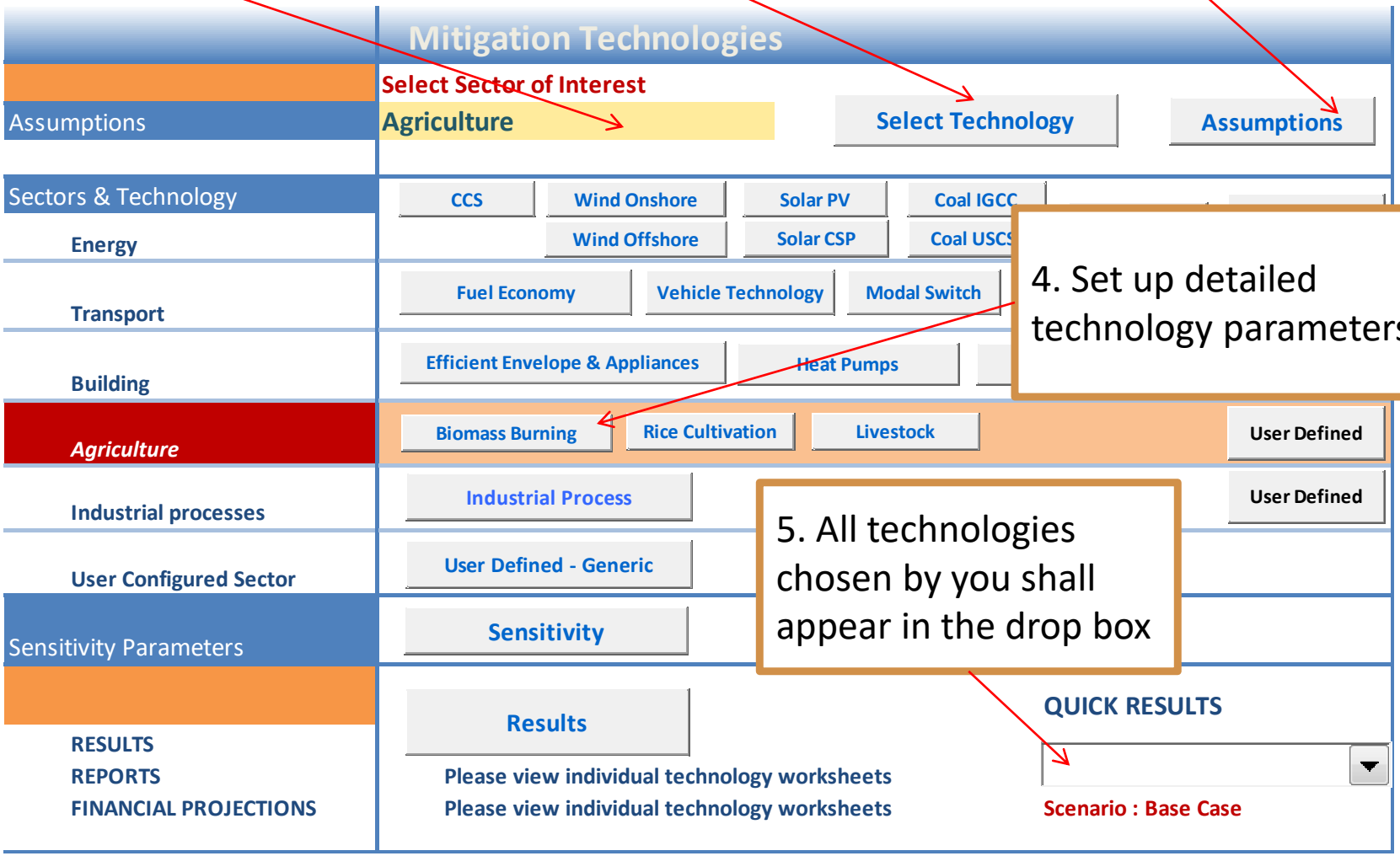
Explore numerous examples and input data sets.

Control Page

1. Choose sector by clicking here

2. Choose multiple technologies

3. Finalize assumptions



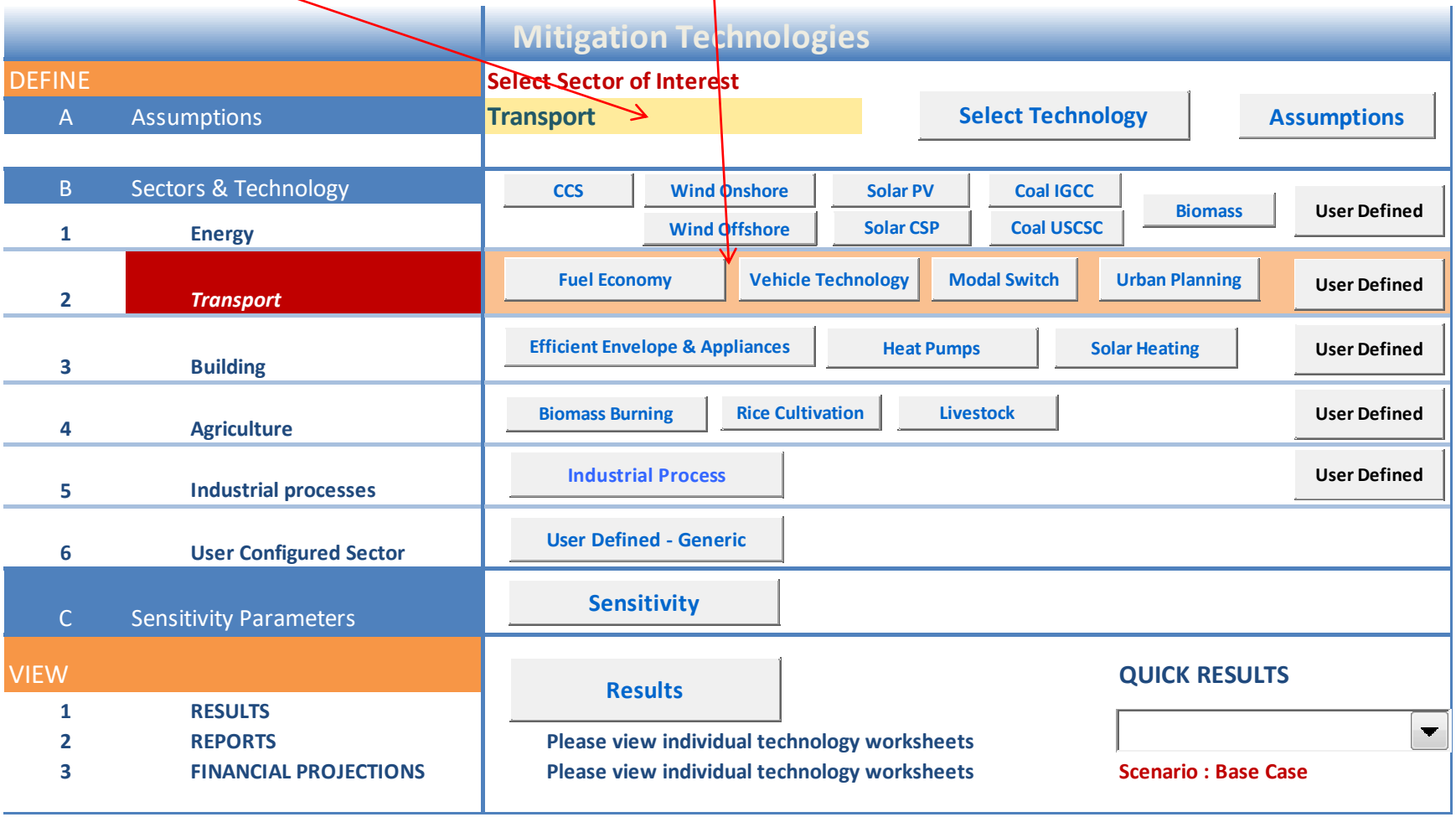
4. Set up detailed technology parameters

5. All technologies chosen by you shall appear in the drop box

Choosing a sector

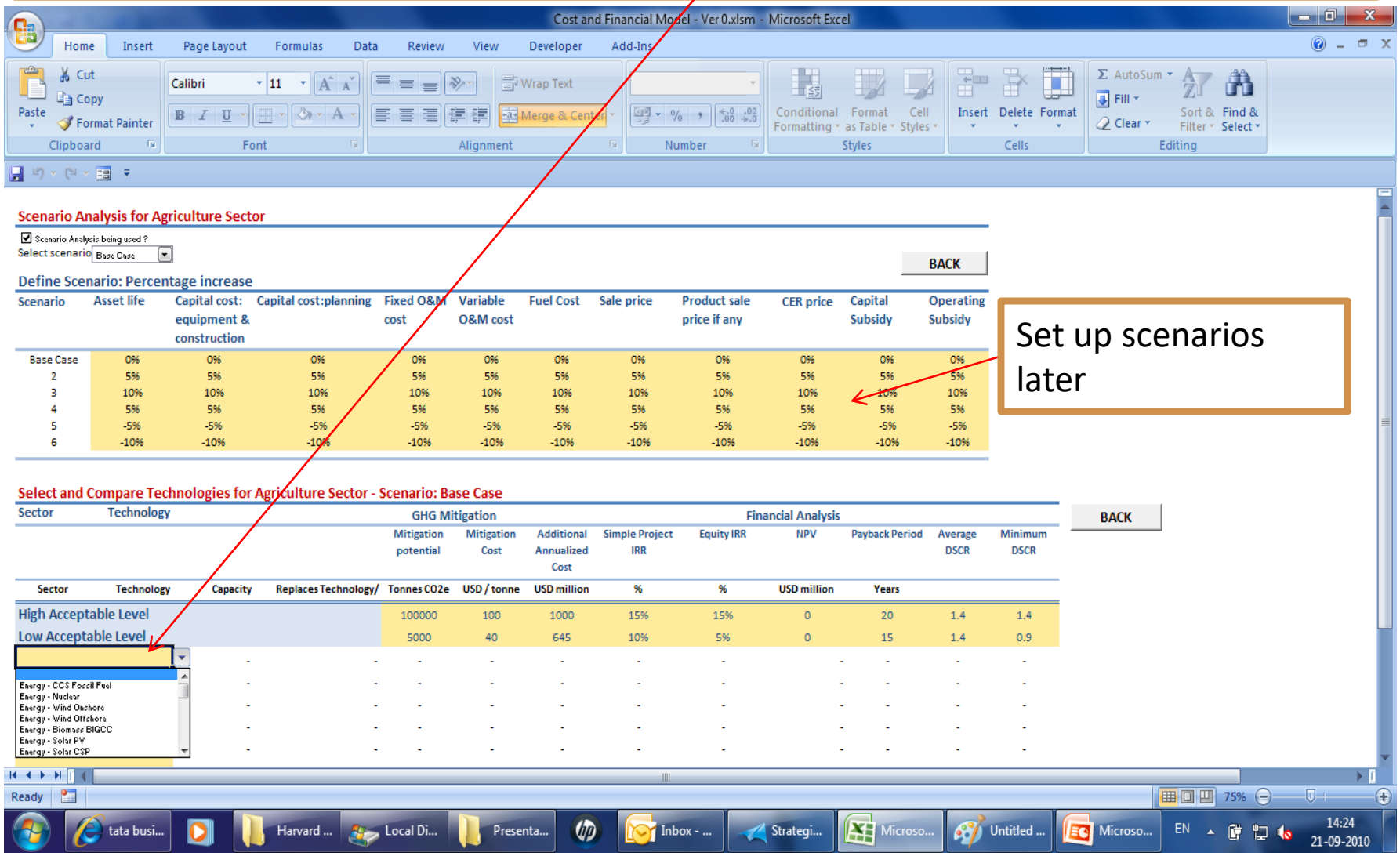
Choose sector by clicking here

1. Chosen sector changes color



Choosing multiple technologies for your study

Please click on this cell and choose the technology option. The cell below in the same column all have technology list boxes for next 10 rows.



Finalize Assumptions – General parameters

A GLOBAL PARAMETERS

Country Currency	USD
Discount Rate	5%
Annual % increase to cost of inputs?	6%
Annual % increase to price of output?	6%
Annual % increase to CER price?	6%
Technology start year	2012
Technology construction start date	01 April 2012

Note: Please insert country specific assumptions

B OTHER PARAMETERS

Base year price of CER (USD)	15
Percentage Debt	70%
Interest rate on Debt	10%
Tenure of debt for energy (years)	10
Income tax rate	30%

Note: Please insert country specific assumptions

BACK

C Global Warming Potential (GWP)

Carbon Dioxide	1
Methane	25
Nitrous Oxide	298
Chlorofluorocarbons	8500
HCF-22c	1700
Perfluorocarbon	6500
Sulphur hexafluoride	22800
CO	
NOX	

Source: IPCC, 2007

Source: Garg Amit;Shukla P.R., Emissions Inventory of India, 2002

Set up sector specific parameters

Click on this symbol to expand sector specific parameters

- D ENERGY Emissions (kg/GJ)
- E TRANSPORT Emissions (kg/GJ)
- F AGRICULTURE Emissions - Biomass Burning (g/kg dm burnt)
- G AGRICULTURE Emissions - Rice Cultivation (kg/ha/day)
- H AGRICULTURE Emissions (CH4 and N2O) - Livestock (kg/head/year)
- I BUILDINGS Emissions

Finalize sector specific parameters

E TRANSPORT Emissions (kg/GJ)

Sl. No.	Mode	Fuel	Technology	Combined	CO2	CH4	N2O	NoX
1	Road	Motor Gasoline	Uncontrolled	Road, Motor C	69.3	0.0330	0.0032	0
2	Road	Motor Gasoline	Oxidation Catalyst	Road, Motor C	69.3	0.0250	0.0080	0
3	Road	Motor Gasoline	Low Mileage Light Duty Vehicle	Road, Motor C	69.3	0.0038		
4	Road	Gas / Diesel Oil	Vehicles	Road, Gas / Di	74.1	0.0039		
5	Road	Natural Gas	Vehicles	Road, Natural	56.1	0.0920		
6	Road	Liquified petroleum gas	Vehicles	Road, Liquifie	63.1	0.0620		
7	Road	Ethanol	Trucks	Road, Ethanol	0	0.2600		
8	Road	Cycle	Conventional	Road, Cycle, C	0	0.0000	0.0000	0
9	Off Road	Diesel	Agriculture	Off Road, Dies	74.1	0.0042	0.0286	0
10	Off Road	Diesel	Forestry	Off Road, Dies	74.1	0.0042	0.0286	0
11	Off Road	Diesel	Industry	Off Road, Dies	74.1	0.0042	0.0286	0
12	Off Road	Diesel	Household	Off Road, Dies	74.1	0.0042	0.0286	0
13	Off Road	Gasoline Motor 4 Stoke	Agriculture	Off Road, Gas	69.3	0.0800	0.0020	0
14	Off Road	Gasoline Motor 4 Stoke	Forestry	Off Road, Gas	69.3	0.0000	0.0000	0
15	Off Road	Gasoline Motor 4 Stoke	Industry	Off Road, Gas	69.3	0.0500	0.0020	0
16	Off Road	Gasoline Motor 4 Stoke	Household	Off Road, Gas	69.3	0.1200	0.0020	0
17	Off Road	Gasoline Motor 2 Stoke	Agriculture	Off Road, Gas	69.3	0.1400	0.0004	0
18	Off Road	Gasoline Motor 2 Stoke	Forestry	Off Road, Gas	69.3	0.1700	0.0004	0
19	Off Road	Gasoline Motor 2 Stoke	Industry	Off Road, Gas	69.3	0.1300	0.0004	0
20	Off Road	Gasoline Motor 2 Stoke	Household	Off Road, Gas	69.3	0.1800	0.0004	0
21	Railways	Diesel	Conventional	Railways, Dies	74.1	0.0042	0.0286	0
22	Railways	Sub bituminous coal	Conventional	Railways, Sub	96.1	0.0020	0.0015	0
23	Water	Gasoline	Conventional	Water, Gasoli	69.3	0.0070	0.0020	0
24	Water	Other Kerosene	Conventional	Water, Other	71.9	0.0070	0.0020	0
25	Water	Gas/Diesel Oil	Conventional	Water, Gas/D	74.1	0.0070	0.0020	0
26	Water	Residual Fuel Oil	Conventional	Water, Resid	77.4	0.0070	0.0020	0
27	Water	Liquefied Petroleum Gases	Conventional	Water, Liquef	63.1	0.0070	0.0020	0
28	Water	Refinery Gas	Conventional	Water, Refine	57.6	0.0070	0.0020	0
29	Water	Paraffin Waxes	Conventional	Water, Paraff	73.3	0.0070	0.0020	0
30	Water	White Spirit & SBP	Conventional	Water, White	73.3	0.0070	0.0020	0
31	Water	Other Petroleum Products	Conventional	Water, Other	73.3	0.0070	0.0020	0
32	Water	Natural Gas	Conventional	Water, Natur	56.1	0.0070	0.0020	0
33	Civil Aviation	Aviation Gasoline	Conventional	Civil Aviation,	70	0.0005		
34	**Transport**	**User Defined**	**Conventional**	**Transport, U**	**71.5**	**0.0005**		
35	Transport	Electricity	Vehicle input	Transport, Ele	64.7	0		

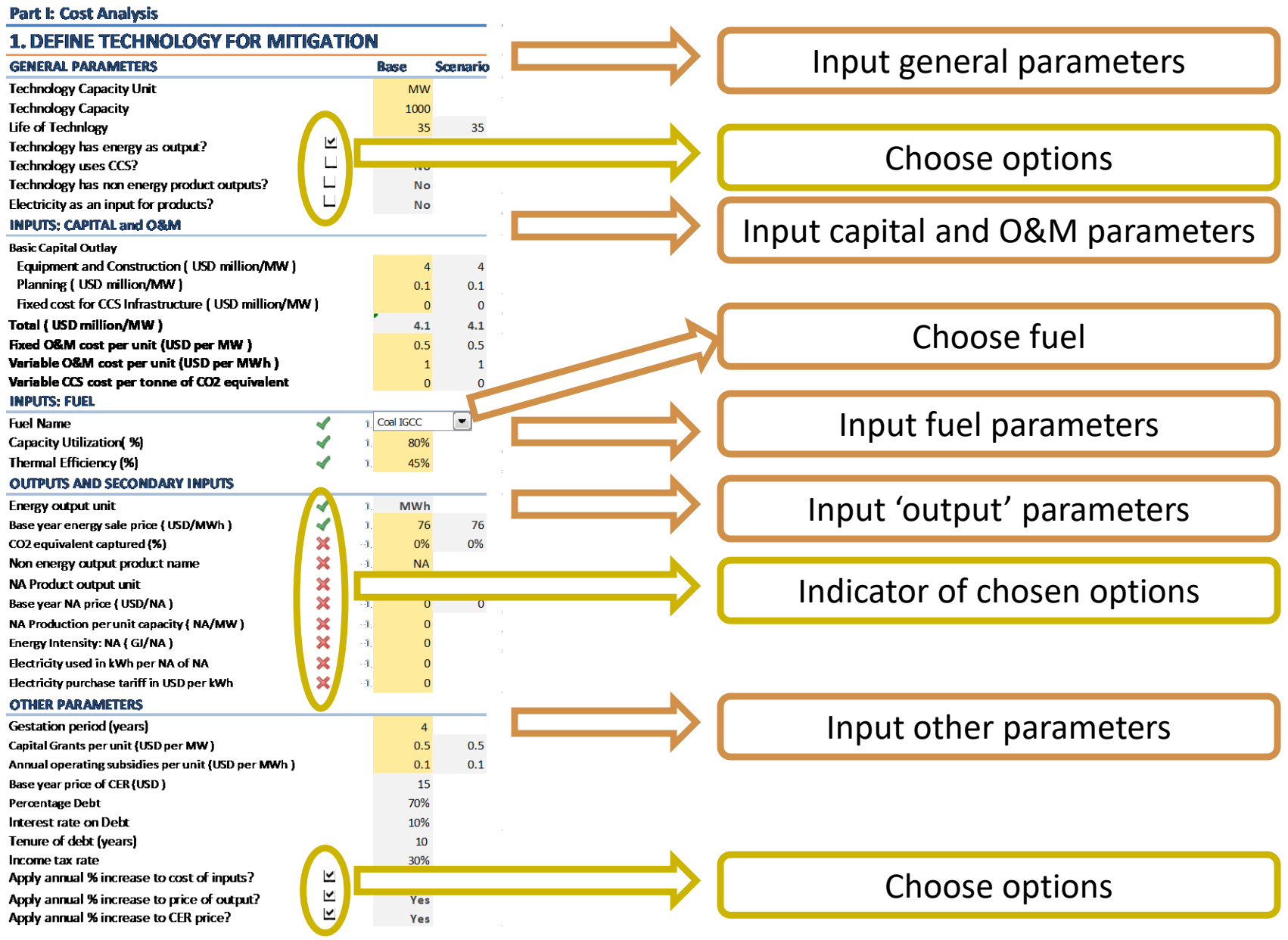
Notes: Data from IPCC. Primary source USEPA (2004) and EEA (2005). Data pertains to USA and Europe.

Source: 2006 IPCC Guidelines for National Greenhouse Gas Inventories

Modify data for your specific case

Check sources of existing data

Setting up the Mitigation Technology



Setting up the Baseline Technology

2. CALCULATE MITIGATION COST	Mitigation	Baseline
INPUTS	Coal IGCC	Coal Conventional
CAPITAL		
Capacity Unit Label	MW	MW
Capacity (MW)	1000	1143
Unit Capital cost (USD million per MW)	4.1	1
Total capital cost (USD million)	4100	1143
Life of Capacity (Years)	35	35
Annual Capital Cost (USD)	250394000	69796237
OPERATION AND MAINTENANCE		
Fixed O&M cost per unit (USD per MW)	0.5	0
Variable O&M cost per unit (USD per MWh)	1	3
Variable CCS Cost (USD)	0	0
Annual O&M Cost (USD)	7008500	21024000
FUEL		
Capacity Utilization(%)	80%	70%
Thermal Efficiency (%)	45%	35%
Fuel Name	Coal IGCC	Coal Conventional
Total Fuel Cost (USD)	56064000	72082285.71
Electricity used in kWh per annum	0	
Input Electricity Cost (USD)	0	0
Total Annual Cost (USD)	313466500	162902523
ENERGY OUTPUT		
Energy Produced (MWh)	7008000	7008000
Notional input energy (MWh)	15573333.33	20022857.14
PRODUCT OUTPUT		
NA Produced (NA)	0	
Notional Input Energy : NA (GJ)	0	
Total Energy Consumed (GJ)	56064000	72082285.71

EMISSIONS (Tonnes)	Mitigation Option	Baseline Option
Carbon Dioxide	5326080	6847817
Methane	0	0
Nitrous Oxide	78	101
Chlorofluorocarbons	0	0
HCF-22c	0	0
Perfluorocarbon	0	0
Sulphur hexafluoride	0	0
Carbon Dioxide Equivalent	5349470	6877890
Carbon Dioxide Equivalent Captured	0	
MITIGATION COST (USD/ Tonnes)		
Reduction in CO2 Equivalent (Tonnes)	1528420	
Increase in cost (USD)	150563977	
Mitigation Cost (USD/ Tonnes)	99	

Define baseline technology

Annualized technology cost

Annual GHG Emissions

Mitigation Cost

Generate summary report

3. AUTO SUMMARY REPORT

1000 MW Coal IGCC power capacity has been considered to replace 1143 MW Coal Conventional based power. The replacement capacity is based on equivalent energy output by both plants. The total annual cost of the Coal IGCC capacity is USD 313 million compared to the annual cost of USD 163 million for the Coal Conventional based capacity. Reduction in CO2 Equivalent (Tonnes) is 1528420 with an additional cost of 151 million USD. The total Mitigation Cost (USD/ Tonnes) is 99.
The technology has the following financial indicators : Simple project IRR = 18 % , Post Tax Equity IRR = 19 % , Net Present Value = 11801 million USD , Payback Period = 14 years. The project has a an average debt service coverage ratio (DSCR) of 15.69 and a minimum DSCR of 1 .

Summary Report

Suggested data sources: IEA, Projected Costs of Generating Electricity – 2010

Data Sources

Scroll right for Financial Projections

1. Capital Costs
2. Grants & Subsidies
3. Revenues
4. Operating Costs
5. Financing Needs
6. Income Statement

Key Indicators

- NPV
- IRR
- DSCR
- Payback period

Part II: Financial Analysis

	Year	2012	2013	2014	2015	2016	2017
	Financial Year End Date	31.3.12	31.3.13	31.3.14	31.3.15	31.3.16	31.3.17
	Operational Status	FALSE	FALSE	FALSE	FALSE	FALSE	TRUE
	Years of Operation	0	0	0	0	0	1
1	**Capital Costs**						
	Equipment and Construction / CCS Infrastructure (USD)		1000000000	1000000000	1000000000	1000000000	0
	Planning (USD)		100000000				
	Total Capital Costs (USD)		**1100000000**	**1000000000**	**1000000000**	**1000000000**	**0**
2	**Grants & Subsidies**						
	Capital Grants (USD)		125	125	125	125	
	Operating Subsidies (USD)		0	0	0	0	700800
	Total Grants and Subsidies (USD)		**125**	**125**	**125**	**125**	**700800**
3	**Revenues**						
	Revenue from sale of energy (USD)		0	0	0	0	712749648
	Revenue from sale of product (USD)		0	0	0	0	0
	Revenue from sale of CERs (USD)		0	0	0	0	30680560
	Total Revenues (USD)		**0**	**0**	**0**	**0**	**743430209**
4	**Operating Costs**						
	Fixed O&M cost (USD)		0	0	0	0	669
	Variable O&M cost - Non Fuel (USD)		0	0	0	0	9378285
	Variable CCS cost (USD)		0	0	0	0	0
	Fuel cost (USD)		0	0	0	0	75026279
	Input Electricity cost (USD)		0	0	0	0	0
	Total Operating Cost (USD)		**0**	**0**	**0**	**0**	**84405233**
5	**Financing Needs**						
	Total Capital Costs (USD)		1100000000	1000000000	1000000000	1000000000	
	Capital Grants (USD)		125	125	125	125	
	Balance (USD)		1099999875	999999875	999999875	999999875	
	Debt (USD)		769999913	699999913	699999913	699999913	
	Equity (USD)		329999963	299999963	299999963	299999963	
	Debt Service (USD)		76999991	146999983	216999974	286999965	658973101
	Interest payment (USD)		0	0	0	0	286999965
	Debt balance (USD)		**769999913**	**1469999825**	**2169999738**	**2869999650**	**2498026514**
6	**Income Statement**						
	Total Capital Costs (USD)		1100000000	1000000000	1000000000	1000000000	0
	Total Grants and Subsidies (USD)		125	125	125	125	700800
	Total Revenues (USD)		0	0	0	0	743430209
	Total Operating Cost (USD)		0	0	0	0	84405233
	Net Revenue from operations (USD)		0	0	0	0	659024976
	Operating Subsidies (USD)		0	0	0	0	700800
	Earnings before Interest, Taxes, Depreciation, Amortization (EBITDA) (USD)		0	0	0	0	659725776
	Simple pre tax pre financing returns (USD)		-1099999875	-999999875	-999999875	-999999875	660426576
	Interest expenses (USD)		0	0	0	0	286999965
	Depreciation (St. Line) (USD)		0	0	0	0	117142857
	Taxable income (St. Line) (USD)		0	0	0	0	255582954
	Allowance for taxes (USD)		0	0	0	0	76674886
	Net income (USD)		0	0	0	0	178908068
	Add back: Depreciation (USD)		0	0	0	0	117142857
	Less: Amortization/ Principal Payments (USD)		0	0	0	0	371973136
	Net cash flow to investors (USD)		-329999963	-299999963	-299999963	-299999963	-75922211
	Post Tax Equity IRR		**19%**				
	Simple pre tax pre financing project IRR		**18%**				
	Net present value (USD)		**11,80,13,61,128**				
	Debt Service Coverage Ratio (DSCR)		**-**	**-**	**-**	**-**	**1.0**
	Average Debt Service Coverage Ratio (DSCR)		**15.7**				
	Workings for Minimum DSCR		NA	NA	NA	NA	1.001142194
	Minimum Debt Service Coverage Ratio (DSCR)		**1.00**				
	Payback period						
	Cumulative Profit After Tax (USD)		0	0	0	0	178908068
	Year from start (USD)		1	2	3	4	5
	Initial Investment		4100000000				
	Payback period		**14**				

Set up scenario analysis

Define scenario using percentage change in key parameters. Up to 6 scenarios can be defined.

Scenario Analysis for Transport Sector

☑ Scenario Analysis being used ?

Select scenario: Base Case

BACK

Define Scenario: Percentage increase

Scenario	Asset life	Capital cost: equipment & construction	Capital cost:planning	Fixed O&M cost	Variable O&M cost	Fuel Cost	Sale price	Product sale price if any	CER price	Capital Subsidy	Operating Subsidy
Base Case	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
3	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%
4	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
5	-5%	-5%	-5%	-5%	-5%	-5%	-5%	-5%	-5%	-5%	-5%
6	-10%	-10%	-10%	-10%	-10%	-10%	-10%	-10%	-10%	-10%	-10%

The scenarios are useful for analysis alternative policies for removing financial barriers

Choose scenario for analysis. The chosen scenario shall be used for displaying model results.

Define acceptable levels for parameters

Define high acceptable level for a particular parameter

Define low acceptable level for a particular parameter

Select and Compare Technologies for Energy Sector - Scenario: Base Case

Sector	Technology			GHG Mitigation			Financial Analysis					
				Mitigation potential	Mitigation Cost	Additional Annualized Cost	Simple Project IRR	Equity IRR	NPV	Payback Period	Average DSCR	Minimum DSCR
Sector	Technology	Capacity	Replaces Technology/	Tonnes CO2e	USD / tonne	USD million	%	%	USD million	Years		
High Acceptable Level				100000	100	1000	15%	15%	0	20	1.4	1.4
Low Acceptable Level				5000	40	645	10%	5%	0	15	1.4	0.9
Energy - Solar PV		30 MW	Coal Conventional Powe	77376	75	6	18%	19%	219.16	14	11.36	1.02
Energy - Biomass BIGCC		1000 MW	Coal Conventional Powe	930442	34	200	19%	20%	9812.83	13	16.92	1.08
Energy - Coal IGCC		1000 MW	Coal Conventional Powe	1528420	99	151	18%	19%	11801.36	14	15.69	1.00

Understand indicators

Beyond low or high acceptable levels

Between low and high acceptable levels

Check quick results

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QUICK RESULTS

Energy - Coal IGCC

1000 MW Coal IGCC power capacity has been considered to replace 1143 MW Coal Conventional based power. The replacement capacity is based on equivalent energy output by both plants. The total annual cost of the Coal IGCC capacity is USD 313 million compared to the annual cost of USD 163 million for the Coal Conventional based capacity. Reduction in CO2 Equivalent (Tonnes) is 1528420 with an additional cost of 151 million USD. The total Mitigation Cost (USD/ Tonnes) is 99.
The technology has the following financial indicators : Simple project IRR = 18 % , Post Tax Equity IRR = 19 % , Net Present Value = 11801 million USD , Payback Period = 14 years. The project has a an average debt service coverage ratio (DSCR) of 15.69 and a minimum DSCR of 1 .

Quick summary

Mit Cost	Project IRR	NPV	Payback Period	Avg DSCR
USD / tonne of CO2e	%	Million USD	Years	Ratio
1528420	18%	11801	14	15.69

Key model outputs

Color indicators based on scenario settings and acceptable levels

TROUBLESHOOTING

Enabling Macros

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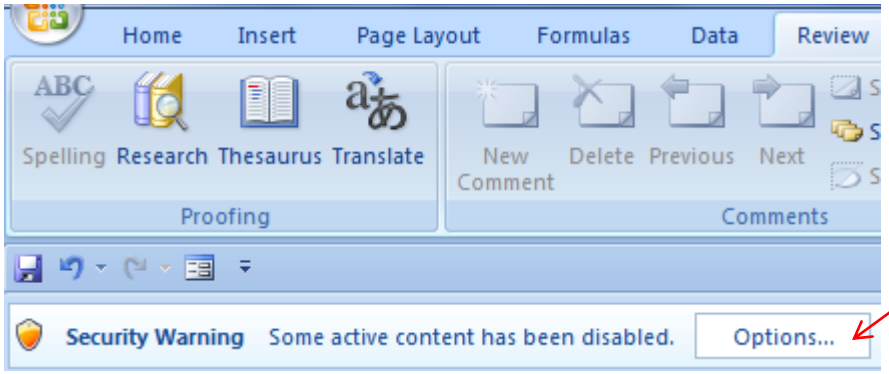

Click on options when the excel file is opened.

Enable this content

Click OK

WORKED OUT EXAMPLES - ENERGY

In this example coal IGCC based plant is compared with conventional coal technology.

SETTING UP THE COST MODEL

COST MODEL: GENERAL PARAMETERS	Explanation	Value
Technology Capacity Unit	Unit of the generating plant	MW
Technology Capacity	Capacity of the generating plant	1000
Life of Technology	Number of years the plant is expected to operate	35
Technology has energy as output?	The output is electricity ? By default Yes.	Yes
Technology uses CCS?	Any carbon capture & storage technology used ?	No
Technology has non energy product outputs?	Any other output apart from electricity? By Default No.	No
Electricity as an input for products?	Any other input apart from auxiliary consumption ?	No
COST MODEL: CAPITAL and O&M		
Basic Capital Outlay		
Equipment and Construction (USD million/MW)	Cost of generating plant per MW including construction	4
Planning (USD million/MW)	Initial cost prior to construction of plant	0.1
Fixed cost for CCS Infrastructure (USD million/MW)	Capital cost for carbon capture & storage per MW of plant	0
Total (USD million/MW)		**4.1**
Fixed O&M cost per unit (USD per MW)	Operation and maintenance cost per MW of generating plant	0.5
Variable O&M cost per unit (USD per MWh)	Operation and maintenance cost per unit of generation	1
Variable CCS cost per tonne of CO2 equivalent	Variable cost of CCS per tonne of CO2 output by plant	0
COST MODEL: FUEL		
Fuel Name	Name of fuel: Please select from dropdown list	
Capacity Utilization(%)	Plant load factor	80%
Thermal Efficiency (%)	Ratio of output energy to input energy for the plant	45%
CO2 equivalent captured (%)	Expected percentage capture of CO2 output from plant	0%

SETTING UP THE FINANCIAL MODEL

COST & FINANCIAL MODEL: ADDITIONAL INPUTS	Explanation	Value
Energy output unit	Output unit for the power plant	**MWh**
Base year energy sale price (USD/MWh)	Unit price for sale of electricity in the base year	76
Non energy output product name	Name of non energy output if any. Default-Not Applicable.	NA
Product output unit	Unit of non energy output if any. Default-Not Applicable.	NA
Base year price (USD/Unit)	Price of non energy output if any. Default = 0.	0
Non Energy Production per MW	Unit Production of non energy output if any. Default = 0.	0
Energy Intensity in GJ per unit	Energy Intensity of non energy output if any. Default = 0.	0
Electricity used in kWh per unit	Electricity Consumption for non energy output if any.	0
Electricity purchase tariff in USD per kWh	Electricity price of non energy output if any. Default = 0.	0
FINANCIAL MODEL: OTHER PARAMETERS		
Gestation period (years)	Number of years required for construction of plant	4
Capital Grants per unit (USD per MW)	Grants to facilitate setting up of plant if any	0.5
Annual operating subsidies per unit (USD per MWh)	Subsidies if any provided to generator per unit output	0.1
Base year price of CER (USD)	Price of CER in the base year	15
Percentage Debt	Percentage of debt in the total cost of putting up the plant	70%
Interest rate on Debt	Interest rate on debt	10%
Tenure of debt (years)	Number of years allowed to repay the debt	10
Income tax rate	Tax rate on profits if any	30%
Apply annual % increase to cost of inputs?	Apply % increase to cost of inputs from assumptions	**Yes**
Apply annual % increase to price of output?	Apply % increase to price of inputs from assumptions	**Yes**
Apply annual % increase to CER price?	Apply % increase to CER price from assumptions	**Yes**

SETTING UP PARAMETERS FOR TECHNOLOGY BEING REPLACED

INPUTS	New: Coal IGCC	Existing: Coal Conventional
CAPITAL		
Capacity Unit Label	MW	MW
Capacity (MW)	1000	1143
Unit Capital cost (USD million per MW)	4.1	1
Total capital cost (USD million)	4100	1143
Life of Capacity (Years)	35	35
Annual Capital Cost (USD)	**250394000**	**69796237**
OPERATION AND MAINTENANCE		
Fixed O&M cost per unit (USD per MW)	0.5	0
Variable O&M cost per unit (USD per MWh)	1	3
Variable CCS Cost (USD)	0	0
Annual O&M Cost (USD)	**7008500**	**21024000**
FUEL		
Capacity Utilization(%)	80%	70%
Thermal Efficiency (%)	45%	35%
Fuel Name	Coal IGCC	Choose fuel from dropdown
Total Fuel Cost (USD)	**56064000**	**72082285.71**
Electricity used in kWh per annum	0	
Input Electricity Cost (USD)	**0**	**0**
Total Annual Cost (USD)	**313466500**	**162902523**

Understanding Results

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1. 1000 MW Coal IGCC power capacity has been considered to replace 1143 MW Coal Conventional based power. The replacement capacity is based on equivalent energy output by both plants.

Taking energy output to be the same, the plant capacity replacement required.

2. The total annual cost of the Coal IGCC capacity is USD 313 million compared to the annual cost of USD 163 million for the Coal Conventional based capacity.

Total Costs Incurred Annually

3. Reduction in CO2 Equivalent (Tonnes) is 1528689 with an additional cost of 151 million USD.

CO2 Reduction

4. The total Mitigation Cost (USD/ Tonnes) is 98.

Mitigation Cost

5. The technology has the following financial indicators : Simple project IRR = 18 % , Post Tax Equity IRR = 19 % , Net Present Value = 11801 million USD , Payback Period = 14 years. The project has a an average debt service coverage ratio (DSCR) of 15.69 and a minimum DSCR of 1 .

Optional: Financial Indicators

WORKED OUT EXAMPLES - TRANSPORT

In this example 1000 natural gas based transport units have been subject to fuel economy improvement involving some investment per unit.

SETTING UP THE COST MODEL

COST MODEL: GENERAL PARAMETERS	Explanation	Value
Technology Capacity Unit	Unit of the transport	No.
Units	Number of transport units	1000
Life of Technlogy	Number of years the vehicle is expected to operate	10
Emission control technology used ?	Any emission control technology used? By default Yes.	Yes
Apply operating conditions filter ?	Provision for emission reduction for operating conditions ?	Yes
Apply standby fuel consumption filter ?	Any fuel consumption during standby? By Default yes.	Yes
Electricity used as an input ?	Electricity used as an input?	Yes
Distance travelled unit	Unit of distance	Km
Fuel Consumption Unit	Unit of fuel consumption	Litre
COST MODEL: CAPITAL and O&M		
Basic Capital Cost per No.		
Transport Technology (USD /No.)	Capital cost of transport per unit	15000
Processing costs (USD /No.)	Initial processing cost for procurement of transport per unit	50
Additional fixed cost for emission control (USD /No.)	Any other fixed cost for emission control	0
Total (USD /No.)		15050
Fixed O&M cost per unit (USD per No.)	Fixed O&M cost per unit incurred annually	1000
Variable O&M cost per unit (USD per Km)	Variable O&M cost based on distance travelled	0.03
Variable cost of emission control per Km	Cost of emission control linked to distance travelled	0.015
COST MODEL: FUEL		
Fuel Name	Select fuel used from dropdown	
Average annual distance covered by each unit (Km)	Annual distance covered by each transport unit	20,000
Fuel Efficiency (Km/Litre)	Distance travelled per unit of fuel consumption	12
Specific heat value of fuel (GJ/Litre)	Heat value of fuel	0.030
Standby Fuel consumption (Litre/hr.)	Any standby fuel consumption	1
Fuel Cost (USD/GJ)	Cost of fuel	8
Average annual standby time per unit (hr.)	Expected standby time	10
COST MODEL: ADDITIONAL INPUTS		
CO2 equivalent reduced by emission control (%)	Reduction in emissions expected through use of emission control	10%
Pollutant wieghting factor for CH4	Weighting factor for CH4	80%
Pollutant wieghting factor for N2O	Weighting factor for N2O	100%
Emission reduction due to operating conditions	Reduction expected by improving operating conditions	10%
Electricity used in kWh per Km	Electricity used as input if any	0
Electricity purchase tariff in USD per kWh	Electricity Price	0

SETTING UP THE FINANCIAL MODEL

FINANCIAL MODEL: OTHER PARAMETERS	Explanation	Value
Base year price of alternative travel (USD/Km)	Price of alternative mode of transport per km	0.4
Setup time (years)	Time required for improving fuel economy	1
Capital Grants per unit (USD per No.)	Capital grants for improving fuel economy if any	50
Annual operating subsidies per unit (USD per Km)	Operating subsidies if any	0
Base year price of CER (USD)	Base year price of CER	15
Percentage Debt	Percentage of debt in the capital cost	70%
Interest rate on Debt	Interest rate on debt	10%
Tenure of debt (years)	Number of years allowed to repay the debt	3
Income tax rate	Tax rate on profits if any	0%
Apply annual % increase to cost of inputs?	Apply % increase to cost of inputs from assumptions	**Yes**
Apply annual % increase to price of output?	Apply % increase to price of inputs from assumptions	**Yes**
Apply annual % increase to CER price?	Apply % increase to CER price from assumptions	**Yes**

SETTING UP PARAMETERS FOR TECHNOLOGY BEING REPLACED

CAPITAL		NEW	EXISTING
Capacity Unit Label		No.	No.
Units (No.)		1000	1000
Unit Capital cost (USD per No.)		15050	10000
Total capital cost (USD)		15050000	10000000
Life of Capacity (Years)		10	10
Annual Capital Cost (USD)		1949044	1295046
OPERATION AND MAINTENANCE			
Fixed O&M cost per unit (USD per No.)		1000	500
Variable O&M cost per unit (USD per Km)		0.03	0
Variable cost of emission control per Km		0.02	0.1
Annual O&M Cost (USD)		1900000	2500000
FUEL			
Average annual distance covered by each unit (Km)		20,000	20,000
Average annual standby time per unit (hr.)		10	10
Fuel Efficiency (Km/Litre)		12	8
Fuel Type	Natural Gas		Select from dropdown
Specific heat value of fuel (GJ/Litre)		0.030	0.030
Standby Fuel consumption (Litre/hr.)		1	1
Fuel Cost (USD/GJ)		8	10
Total Fuel Cost (USD)		402400	750000
Electricity used in (kWh)		-	-
Input Electricity Cost (USD)		0	-
Total Annual Cost (USD)		4251444	4545046

Understanding Results

Back to Chapters

1. 1000 No. Natural Gas powered transport have been considered to replace 1000 No. Natural Gas based transport. The replacement capacity is based on equivalent transport units.
2. The total annual cost of the Natural Gas technology is USD 4 million compared to the annual cost of USD 5 million for the Gasoline based capacity.
3. Reduction in CO2 Equivalent (Tonnes) is 2020 with an additional cost of 0 million USD.
4. The total Mitigation Cost (USD/ Tonnes) is -145.
5. The technology has the following financial indicators : Simple project IRR = 47 % , Equity IRR = 68 % , Net Present Value = 46 million USD , Payback Period = 5 years. The project has a an average debt service coverage ratio (DSCR) of 6.45 and a minimum DSCR of 1.06 .

Improving fuel economy in 1000 transport units based on natural gas.

Total Costs Incurred Annually

CO2 Reduction

Mitigation Cost

Optional: Financial Indicators

WORKED OUT EXAMPLES - BUILDING

In this example solar water heating technology is replacing electrical water heating technology involving some investment per unit.

SETTING UP THE COST MODEL

COST MODEL: GENERAL PARAMETERS	Explanation	Value
Solar heating technology unit label	The unit label of the technology under consideration	No.
Heating units	Number of solar heating units considered	5000
Life of Technlogy	Number of years the technology is expected to operate	10

COST MODEL: CAPITAL and O&M		
Basic Capital Outlay		
Fixed cost of solar heater (USD /No.)	Capital cost of solar water heater per unit	50
Fixed cost of backup systems (USD /No.)	All other capital costs including other systems & planning	200
Total (USD /No.)		**250**
Fixed O&M cost per heater (USD per No.)	Fixed O&M cost annually per solar water heater	20

COST MODEL: HEAT PUMP CHARACTERISTICS

HEATING

Surface area of collector per unit in sq. m.	Surface area of collector of each solar heater	1
Heat energy captured in kWh/sq.m./annum	Heat energy captured per annum per unit of surface area	600
Annual heat capture per unit in kWh	Calculated by model	600
Annual heat captured per unit in GJ	Calculated by model	2

SETTING UP THE FINANCIAL MODEL

FINANCIAL MODEL: OTHER PARAMETERS

Gestation period (years)	Number of years required for setting up the system	1
Capital Grants per unit (USD per No.)	Capital grants to facilitate setting up of system if any	50
Annual operating subsidies per unit (USD per No.)	Annual subsidies if any per unit	10
Base year price of CER (USD)	Price of CER in the base year	15
Percentage Debt	Percentage of debt in the total cost of putting up the plant	70%
Interest rate on Debt	Interest rate on debt	10%
Tenure of debt (years)	Number of years allowed to repay the debt	3
Income tax rate	Tax rate on profits if any	30%
Apply annual % increase to cost of inputs?	Apply % increase to cost of inputs from assumptions	**Yes**
Apply annual % increase to price of output?	Apply % increase to price of inputs from assumptions	**Yes**
Apply annual % increase to CER price?	Apply % increase to CER price from assumptions	**Yes**

SETTING UP PARAMETERS FOR TECHNOLOGY BEING REPLACED

INPUTS	New: Solar	Existing: Electrical
CAPITAL		
Solar heating technology unit label	No.	No.
Heating units	5000	2000
Unit Capital cost (USD per No.)	250	500
Total capital cost (USD)	1250000	1000000
Life of Capacity (Years)	10	10
Annual Capital Cost (USD)	**161881**	**129505**
OPERATION AND MAINTENANCE		
Fixed O&M cost per unit (USD per No.)	20	50
Annual O&M Cost (USD)	**100000**	**100000**
FUEL COSTS		
Thermal Efficiency (%)		60%
Fuel used	Electricity	Select
Annual heat captured per unit in GJ	Calculated	Calculated
Total heating load in GJ	10800	18000
Fuel Cost (USD/GJ)	25	25
Annual Fuel Cost (USD)	**270000**	**450000**

Understanding Results

Back to Chapters

1. 5000 No. solar heating systems have been considered to replace conventional heating devices. The replacement capacity is based on equivalent input heat.
2. The total annual cost of the solar heating systems are USD 531881 compared to the annual cost of USD 679505 for the conventional capacity.
3. Reduction in CO2 Equivalent (Tonnes) is 591 with a decrease in cost of 147624 USD.
4. The total Mitigation Cost (USD/ Tonnes) is -250.
5. The technology has the following financial indicators : Simple project IRR = 0 % , Post Tax Equity IRR = 0 % , Net Present Value = -2903941 USD , Payback Period = 46 years. The project has a an average debt service coverage ratio (DSCR) of -3.04 and a minimum DSCR of -0.51 .

Replacement of electrical water heating systems by solar water heaters.

Total Costs Incurred Annually

CO2 Reduction

Mitigation Cost

Optional: Financial Indicators

WORKED OUT EXAMPLES - AGRICULTURE

In this example, emissions from rice cultivation under various conditions is considered.

SETTING UP THE COST MODEL

COST MODEL: GENERAL PARAMETERS	Explanation	Value
Land Area Unit	Unit of land area under consideration for cultivation	ha
Annual harvested area in ha	Area harvested annually for rice cultivation	100
Life of mitigation option	Time period under consideration	1
Changing water management ?	Any change in water management practices ?	Yes
Midseason drainage/intermittent irrigation ?	Any change in irrigation practices ?	Yes
Shallow flooding ?	Any change in flooding technologies ?	Yes
Additives for CO2 and N2O ?	Any additives like phosphogypsum or nitrification ?	Yes
Rice output unit	Output unit for rice cultivation	Kg

COST MODEL: CAPITAL and O&M		
Basic Fixed Cost per ha		
Basic Fixed Costs (USD /ha)	Fixed costs for cultivation per unit area	100
Establishment Costs (USD /ha)	Cost of establishment per unit area	50
Additional fixed cost for mitigation (USD /ha)	Any additional fixed cost for changing practices etc.	50
Total (USD /ha)		200
Fixed O&M cost per unit (USD per ha)	All fixed O&M costs linked to cultivation	0
Variable O&M cost per unit (USD per ha)	All variable O&M costs linked to cultivation	0

SETTING UP THE COST MODEL

COST MODEL: EMISSIONS	Explanation	Value
Ecosystem	The ecosystem of the cultivation area	Select
Cultivation period of rice (days)	No. of days in a year that rice is cultivated	200
Baseline emission Factor CH4 (kg/ha/day) Efc	Emission factor for continuously flooded fields without organic amendments.	1.3
Scaling factor for water regime during cultivation SFw	Scaling factor to account for differences in water regime	0.5
Pre cultivation conditions	Conditions prevailing prior to cultivation	Select
Scaling factor for water regime pre cultivation SFp	Scaling factor: : From assumptions sheet	1.9
Rate of organic amendment (tonnes/ha) ROA	Any organic additions	1
Conditions for organic amendment	Conditions for organic additions	Select
Conversion factor for organic amedment CFOA	Conversion factor: From assumptions sheet	0.05
Scaling factor for both types of organic amendment SFo	Scaling factor: From assumptions sheet	1.03
Scaling factor for soil type, rice cultivar SFsr	Scaling factor: From assumptions sheet	1
Adjusted daily emission factor CH4 (kg/ha/day) EFi	: From assumptions sheet	1.32
Emission Factor CO2	: From assumptions sheet	0.5
Emission Factor N2O	: From assumptions sheet	0.7
Specific rice production (Kg/ha)	Rice production per unit area of land	2000

COST MODEL: ADDITIONAL EMISSION REDUCTION		
Changing water management ?	Emission reduction due to changing water management	10%
Midseason drainage/intermittent irrigation ?	Emission reduction due to changing drainage/irrigation	40%
Shallow flooding ?	Emission reduction due to shallow flooding	10%
Additives for CO2 and N2O ?	Emission reduction due to additives	10%

SETTING UP THE FINANCIAL MODEL

FINANCIAL MODEL: OTHER PARAMETERS	Explanation	Value
Price of rice in USD per Kg	Price of rice per kg	1
Setup time (years)	Number of years required for setting up cultivation process	-
Capital Grants per unit (USD per ha)	Capital grants to facilitate setting up of process if any	0
Annual operating subsidies per unit (USD per Kg)	Annual subsidies if any per kg of rice	0
Base year price of CER (USD)	Price of CER in the base year	15
Percentage Debt	Percentage of debt in the total cost of putting up the process	70%
Interest rate on Debt	Interest rate on debt	10%
Tenure of debt (years)	Number of years allowed to repay the debt	1
Income tax rate	Tax rate on profits if any	0%
Apply annual % increase to cost of inputs?	Apply % increase to cost of inputs from assumptions	**Yes**
Apply annual % increase to price of output?	Apply % increase to price of inputs from assumptions	**Yes**
Apply annual % increase to CER price?	Apply % increase to CER price from assumptions	**Yes**

Understanding Results

Back to Chapters

1. 100 land with ha have used for harvesting rice.

Area used for harvesting rice.

2. The total annual cost of harvesting the rice is USD 20000 .

Total Costs Incurred Annually

3. Reduction in CO2 Equivalent (Tonnes) is -2146 with an additional cost of 20000 USD.

CO2 Reduction

4. The total Mitigation Cost (USD/ Tonnes) is -9.

Mitigation Cost

5. The technology has the following financial indicators : Net Present Value = 190905 USD

Optional: Financial Indicators