



## Financial evaluation tool for CCS projects: Manual

Prepared by: Clinton Foundation  
TNO  
Ecofys

Reviewed by: Chris Hendriks (Ecofys)

Approved by: J.Brouwer  
(CATO-2 Director)

A handwritten signature in blue ink, likely belonging to J. Brouwer.

## 1 Executive Summary (restricted)

This document gives the manual for the Financial evaluation tool for CCS projects.

The lay-out is a Power Point presentation.

The model is an excel-based tool and is submitted as:

- D04a: Financial evaluation tool for CCS projects: Tool

This model can be found at website:

<http://www.globalccsinstitute.com/publications/transport-and-storage-economics-ccs-networks-netherlands>

# TRANSPORT & STORAGE ECONOMICS

Simple Guide to the Financial Model, part of the Knowledge Sharing Deliverables Relating to the Targeted Report titled “Transport & Storage Economics of CCS Networks in the Netherlands”

Delivered by the Rotterdam Climate Initiative (RCI) Supported by the Clinton Climate Initiative (CCI)



ROTTERDAM.**CLIMATE**.INITIATIVE



April 2013

# DISCLAIMER

---

This model was developed by the Clinton Climate Initiative (CCI) as part of the knowledge sharing deliverables relating to the “Transport & Storage Economics of CCS Networks in the Netherlands” targeted report, based on publicly available information.

As the model's output is dependent upon inputs and related assumptions provided by the user, careful judgment is required when interpreting the results. While this model may be used as a quantitative tool for developing a CCS project, it is not intended to act as a business case or validate any decisions regarding a specific project.

Finally while every effort has been made to ensure complete accuracy, CCI does not accept responsibility for any errors in the model or for any errors that may result from using the model. In no event shall CCI or any of its employees be liable for any damages whatsoever, arising out of or in any way connected with the use of this model.

# TABLE OF CONTENTS

---

- BACKGROUND and MODEL OVERVIEW
- FINANCIAL MODEL OVERVIEW
- WORKING WITH THE FINANCIAL MODEL HANDS ON
  - INPUT WORKSHEETS
    - CONTROL & ASSUMPTIONS WORKSHEET
      - QUICK CONTROL
      - GENERAL SETTINGS
      - TIMING ASSUMPTIONS
      - FINANCING ASSUMPTIONS
      - CCS CASES and COST DATA
  - CALCULATION WORKSHEETS
    - COST SCHEDULES
    - TARIFF SOLVER
  - OUTPUT WORKSHEETS
    - KEY METRICS & Year 1 FINANCIALS
    - DETAILED FINANCIAL STATEMENTS
- REFERENCES

## BACKGROUND and MODEL OVERVIEW

---

- This model was developed as part of the key deliverables relating to the “Transport & Storage Economics of CCS Networks in the Netherlands” target report undertaken by a project team led by the Rotterdam Climate Initiative for the benefit of the Emitter Steering Group during the course of 2012
  - The CCS project landscape in this region is starting to take shape and there is a strong vision for commercial deployment based on common-user networks
  - However, given the incremental costs of such a concept and the urgent decisions on infrastructure design facing projects currently under development, there is potential for misalignment of potential “anchor” projects relative to the needs of a future network
  - The analysis underlying the target report (which remains largely confidential) aims to provide a framework to support the necessary strategic dialogue between key stakeholders in the Netherlands and Belgium on the costs and risks of pursuing alternative CO<sub>2</sub> offtake options and determine ways to collectively address key issues
- The purpose of this model is to introduce a simple planning tool relating to the transport and storage components of an integrated CCS project using readily available, non-confidential data.
  - The model is pre-set with a few simple example cases, based on an interpretation of the reference case outlined in the Global CCS Institute Economic Assessment reports of 2009, 2011 (see Appendix for details).
  - It can be used to assess the total transport and storage costs to emitters as well as the impact of different commercial and financing structures on tariffs payable
  - The generic cost inputs can be adapted by users to reflect specific project data
- The following slides provide a “Hands On” manual explaining how to run and adapt the model

# FINANCIAL MODEL OVERVIEW

## KEY COMPONENTS & OUTPUTS

### QUICK CONTROL

- Sets the “active” capture / CO2 volume, transport and storage case in the model and settings for key general, financing and timing assumptions
- Model pre-set with a limited number of scenarios and possible for users to establish new ones

### ASSUMPTIONS

- Region specific assumptions (e.g.: tax rate, inflation, currency, exchange rate). Model pre-set to include three regions (US, Europe, Australia) but possible for users to incorporate up to two other countries/regions
- Key timing assumptions and other model switches and sensitivities (e.g.: tariff structure, cost sensitivities, government operating/revenue subsidies)
- Financing structure assumptions (% debt, equity, government grant, cost of debt, target return on equity, debt tenor) outlined separately for transport and storage

### COST SCHEDULES

- Model pre-populated with cost data (mainly CAPEX, OPEX) for a 250km pipeline and two storage options (good and poor offshore saline aquifer), based on inputs provided for the reference case in the Institute report
- Possible for users to add alternative transport and storage cases and associated cost data

### EMITTER TARIFFS

- Model solves for tariffs payable (by emitters) to the transport and storage operators based on the operator’s targeted return over life of the project (set in Financing Assumptions)
- Availability and Throughput tariff structure

### OPERATOR FINANCIAL STATEMENTS

- Separate detailed, annual statements for the transport and storage operator for the active model scenario showing the achieved rate of return and total tariff revenues per tCO2 (payable by CO2 emitters)

# WORKING WITH THE FINANCIAL MODEL – HANDS ON

## ‘CONTROL & ASSUMPTIONS’ WORKSHEET – QUICK CONTROL

- This worksheet sets the active case to be run in the model (Quick Control section) and outlines the general, timing, financing structure assumptions and cost inputs required to run the case
- To set and run a case in the model, follow the instructions below

- Select the capture plant / CO2 volumes, transport and storage case (by making a selection in the dropdown boxes in cells D6, D8, D10)
- Review the active settings by clicking on the “Go to [General / Financing / Timing] Assumptions ” hyperlinks (cells D15, D17, D19). This will take you to the relevant section in the worksheet.
- Check if the case is solved (see message in row 20)

Screenshot of Control & Assumptions worksheet (case already solved)

The screenshot shows the 'Quick Control' section of the 'Control & Assumptions' worksheet. The section is divided into three main areas:

- 1. Select Capture, Transport & Storage Case:** This area contains three dropdown menus for selecting the capture plant, transport method, and storage case. The selected options are:
  - Capture Plant / CO2 Volumes: GCCSI New Coal IGCC w/CCS (3.1 MtCO2/yr)
  - Transport: 250km Pipe
  - Storage: Poor Offshore Saline Aquifer
- 2. Review Assumptions:** This area contains three hyperlinks for navigating to different assumption sections:
  - Go to General Settings
  - Go to Timing Assumptions
  - Go to Financing Assumptions
- 3. Re-Run Scenario if Not Already Solved:** This area contains a 'Re-Calculate Case!' button. A message 'CASE IS SOLVED!' is displayed in a green box above this section.

Red arrows from the instructions on the left point to the dropdown menus in row 5, the hyperlinks in row 14, and the 'CASE IS SOLVED!' message in row 20.

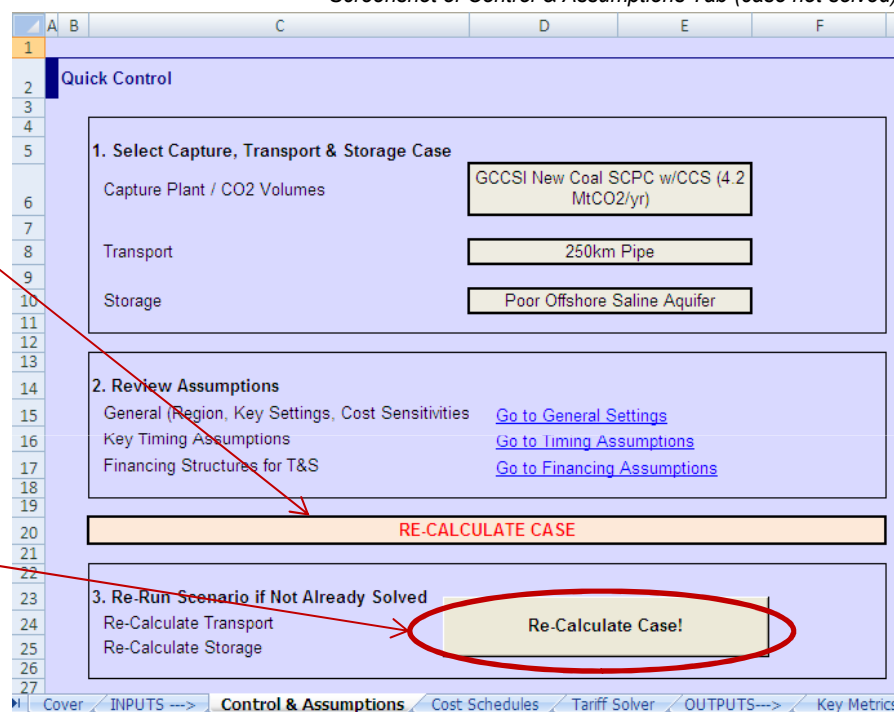


# WORKING WITH THE FINANCIAL MODEL – HANDS ON

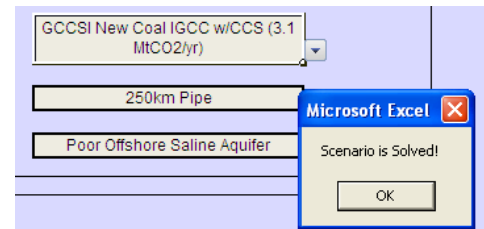
## ‘CONTROL & ASSUMPTIONS’ WORKSHEET – QUICK CONTROL (Cont’d)

- If the selected active case is not solved, the message in row 20 will be replaced by “Re-Calculate Case!”, highlighted in red
- To re-run the case, click on the “Re-Calculate Case” button (rows 24-25) and allow the model to work through the calculations (in the “Tariff Solver” tab)
  - Please be patient while the model goes through the iterations and refrain from interrupting the macro
- When the calculations are done, the model will return to the “Control & Assumptions” worksheet and a message will pop up stating that “Scenario is Solved!”

Screenshot of Control & Assumptions Tab (case not solved)



Screenshot of “Scenario Solved!” Pop Up Message at the end of the macro calculations



# WORKING WITH THE FINANCIAL MODEL – HANDS ON

## ‘CONTROL & ASSUMPTIONS’ WORKSHEET – GENERAL SETTINGS

- The ‘General Settings’ section (rows 28-52) outlines the general assumptions, including
  - Project location and associated macro assumptions and localisation index applied (reference cost data refers to the US)
    - Additional countries can be incorporated in columns M & N (rows 30-38)
  - The tariff structure – is there an “availability” component in addition to the throughput tariff?
  - Potential for (government) operating subsidies to the transport and storage operators and the \$/tCO<sub>2</sub> level
  - Sensitivities to the inputted cost data (% increase/decrease to total CAPEX and OPEX)

The screenshot shows the 'Control & Assumptions' worksheet. The '2. Review Assumptions' section is highlighted with a red box, containing links to 'General Settings', 'Timing Assumptions', and 'Financing Assumptions'. A red arrow points from the 'Go to General Settings' link to the 'General Settings' section below.

**General Settings**

Country and Other Key Settings		
Country or Region	United States	
Currency	USD	
Exchange Rate (USD:USD)	1.00	
Avg Equipment, Materials, Labour, Land/RoW Inc	1.00	
Tax Rate	33.0%	
CPI	1.6%	
Model Currency	USD	
Key Switches		
Inflation Switch (1=ON, 0=OFF)	1	
Interest Switch (1=ON, 0=OFF)	1	
Availability Tariff (1 = ON, 0 = OFF)	1	
Avail. Tariff % CAPEX	100%	
Government Operating Subsidy		<b>Value</b>
Transport (1 = ON, 0 = OFF)	0	1.00 /tCO <sub>2</sub>
Storage (1 = ON, 0 = OFF)	0	1.00 /tCO <sub>2</sub>
Sensitivities to Base Case Costs (1=ON, 0=OFF)		<b>+/- Sensitivity</b>
CAPEX Sensitivity	0	-
OPEX Sensitivity	0	-
Model Electricity Price Assumptions	EIA US Industrial	
NPV Discount Factor	WACC	

The bottom of the screenshot shows the worksheet tabs: Cover, INPUTS, **Control & Assumptions**, Cost Schedules, Tariff Solver, and OUTPUTS.

# WORKING WITH THE FINANCIAL MODEL – HANDS ON

## ‘ASSUMPTIONS’ WORKSHEET – TIMING ASSUMPTIONS

- The ‘Timing Assumptions’ (rows 53-66) defines the model start date, cost basis, depreciation period and the key phases of the project life
  - Note the model assumes straight line depreciation only (for more information, see Cost Schedules worksheet)
- Changes and adjustments are possible in all blue highlighted cells
  - Note that the Cost Basis should be set no later than the Model Start Date

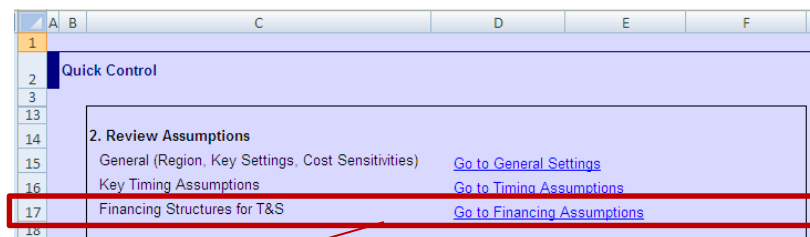
	A	B	C	D	E	F
1						
2			Quick Control			
3						
13						
14			2. Review Assumptions			
15			General (Region, Key Settings, Cost Sensitivities)			<a href="#">Go to General Settings</a>
16			Key Timing Assumptions			<a href="#">Go to Timing Assumptions</a>
17			Financing Structures for I&S			<a href="#">Go to Financing Assumptions</a>
18						

	A	B	C	D	E	F	G
52							
53			Timing Assumptions				
54							
55			Timing				
56							
57			Model Start Date	01-Jan-13			
58			Cost Basis	2010			
59			Economic / Depreciation Life	20			
60				Pre-Construction	Construction	Operation	Abandonment
61			CO2 Volumes (Capture) Start Date			01-Jan-17	
62			Duration (Yrs)			30	
63			Transport Start Dates	01-Jan-13	01-Jan-14	01-Jan-17	
64			Duration (Yrs)	1	3	30	
65			Storage Start Dates	01-Jan-13	01-Jan-14	01-Jan-17	01-Jan-47
66			Duration (Yrs)	1	3	30	1
67							
68			Financing Assumptions				
102							
103			Capture, Transport & Storage Cases and Cost Data				
169							

# WORKING WITH THE FINANCIAL MODEL – HANDS ON

## ‘ASSUMPTIONS’ WORKSHEET – FINANCING ASSUMPTIONS

- The Financing Assumptions outlines the construction (and in the case of storage, also the abandonment) financing structures, including
  - % debt, equity and government capital grant in the mix,
  - the cost of debt, the debt tenor (the repayment period)
  - target return on equity
- It is assumed that during its operating life the project will be financed through operating cash flows / equity rather than any “external” sources of finance
- Column D shows the parameters of the active case (in this example, “Base Case” for both transport and storage)
- Additional financing cases can be built in columns J-L

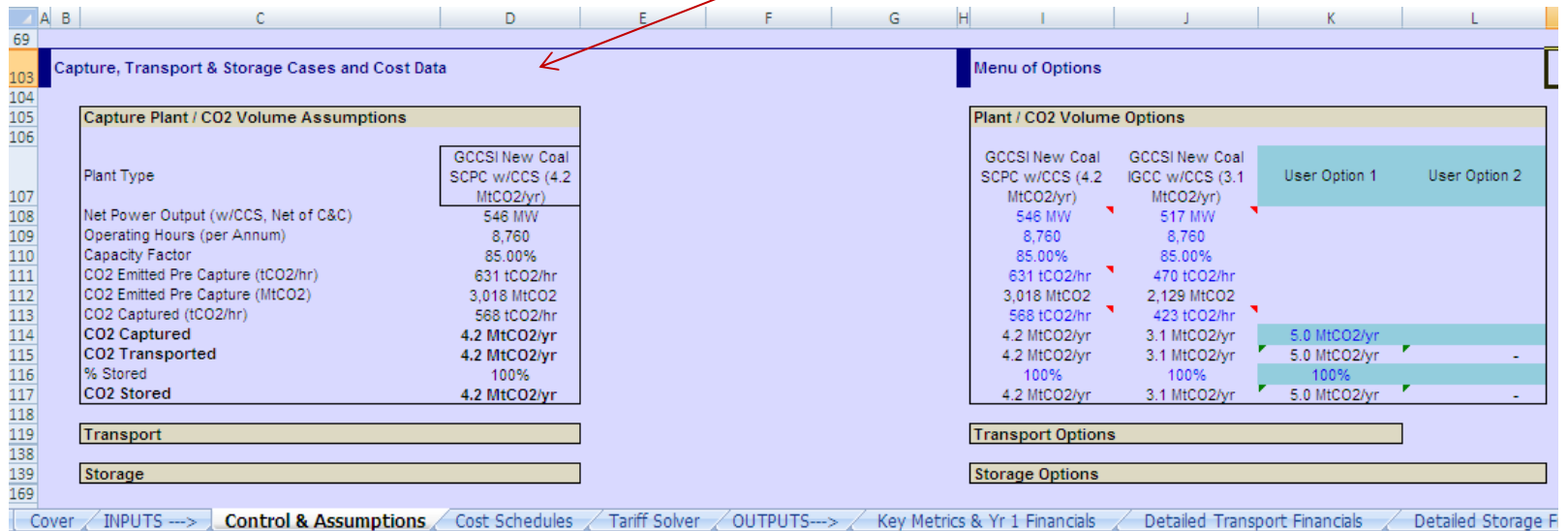
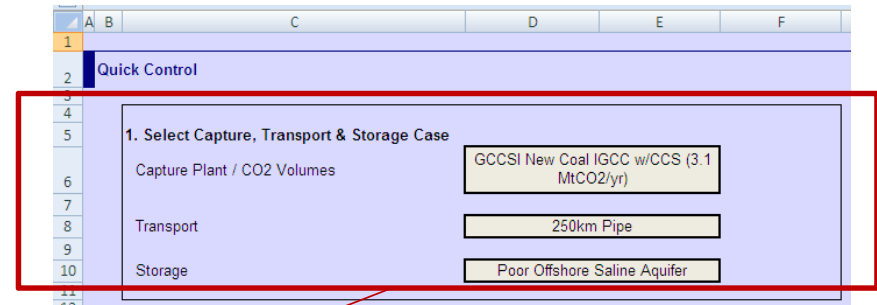


Financing Assumptions		Menu of Options			
<b>Financing Structure Case</b>					
Transport	Base Case				
Storage	Base Case				
<b>Transport Financing Structure</b>		<b>Transport Financing Structure Options</b>			
Financing Case	Base Case	Base Case	User Option 1	User Option 2	User Option 3
<b>Debt</b>		70%	6.0%	15	
% Funding Requirement	70%	30%	100%	100%	100%
Rate	6.0%	10.00%			
Tenor (Years)	15				
<b>Equity</b>		5.81%			
% Funding Requirement	30%	5.81%			
RoE	10.0%				
<b>Government Capital Grant</b>	-				
WACC	5.81%				
WACC (adjusted for Gov Grant)	5.81%				
<b>Storage Financing Structure</b>		<b>Storage Financing Structure Options</b>			
Financing Case	Base Case	Base Case	User Option 1	User Option 2	User Option 3
<b>Debt</b>		60%	6.0%	15	
% Funding Requirement	60%	40%	100%	100%	100%
Rate	6.0%	13.00%			
Tenor (Years)	15				
<b>Equity</b>		7.61%			
% Funding Requirement	40%	7.61%			
RoE	13.0%				
<b>Government Capital Grant</b>	-				
WACC	7.61%				
WACC (adjusted for Gov Grant)	7.61%				

# WORKING WITH THE FINANCIAL MODEL – HANDS ON

## ‘ASSUMPTIONS’ WORKSHEET – CCS CASES and COST DATA

- The model is pre-populated with two capture plant / CO2 volume scenarios, based on an extrapolation of data provided in the Global CCS Institute report for typical plants by capture technology
  - New build Coal IGCC w/CCS
  - New build Coal SCPC w/CCS
- Column D shows the parameters of the active case (in this example, “GCCSI New Coal w/CCS (3.1MtCO2/yr)”)
- Additional CO2 Volume cases can be built in columns K-L

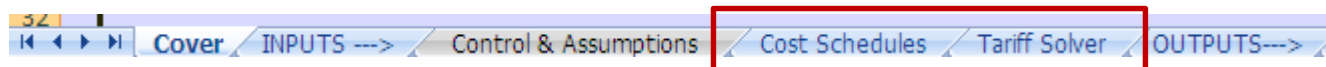


# WORKING WITH THE FINANCIAL MODEL – HANDS ON ‘ASSUMPTIONS’ WORKSHEET – CCS CASES and COST DATA (Cont’d)

- The model is pre-populated with one pipeline transport and two storage options based on an extrapolation of data in the Global CCS Institute reports
- Column D shows the parameters of the active case (in this example “250km Pipe” and “Poor Offshore Saline Aquifer”)
- Users can define their own T&S options (point to point) in columns J & K for transport and K & L for storage) by amending the blue cells
  - At a minimum, inputs must be provided for CAPEX , Fixed and Variable OPEX (bolded rows)

Capture, Transport & Storage Cases and Cost Data		Menu of Options			
<b>Capture Plant / CO2 Volume Assumptions</b>		<b>Plant / CO2 Volume Options</b>			
<b>Transport</b>		<b>Transport Options</b>			
Transport Mode	250km Pipe	250km Pipe	User Option 1	User Option 2	
<b>CAPEX Assumptions</b>		10.0			
Pre-Construction Engineering	10.0	129.4			
Pipeline	129.4				
Booster / Pump	-				
<b>Total Transport CAPEX (USDm)</b>	139.4	139.4			
<b>OPEX Assumptions</b>					
<b>Fixed OPEX (USDm)</b>		6.5			
Pipeline O&M	6.5				
Booster / Pump O&M	-				
<b>Total Transport Fixed OPEX (USDm)</b>	6.5	6.5			
<b>Variable OPEX (USDm)</b>	-	-			
<b>Storage</b>		<b>Storage Options</b>			
Storage Option	Poor Offshore Saline Aquifer	Poor Offshore Saline Aquifer	Good Offshore Saline Aquifer	User Option 1	User Option 2
<b>CAPEX Assumptions</b>		66.0	66.0		
<b>Site Screening &amp; Evaluation</b>	66.0	5.0	5.0		
Deep Monitoring Wells Setup	5.0	1.0	1.0		
Shallow Monitoring Wells Setup	1.0	220.0	50.0		
Injection Wells Setup	220.0	5.8	1.5		
In Field Flow Lines Setup	5.8	231.8	57.5		
<b>Site Construction</b>	231.8	22.0	5.0		
Injection Wells Aband. & Rehab.	22.0	1.0	1.0		
Monitoring Wells Aband. & Rehab.	1.0	23.0	6.0		
<b>Site Closure</b>	23.0				
<b>OPEX</b>					
<b>Fixed OPEX (USDm)</b>		11.8	2.9		
Well Related OPEX	11.8	0.1	0.1		
Monitoring OPEX	0.1	0.1	0.1		
Fees & Rents OPEX	0.1	11.8	3.1		
<b>Total Storage Fixed OPEX (USDm)</b>	11.8				
<b>Variable OPEX (USDm)</b>	-	-	-		

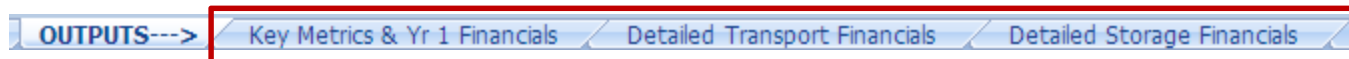
## WORKING WITH THE FINANCIAL MODEL – HANDS ON CALCULATION WORKSHEETS – ‘COST SCHEDULES’ & ‘TARIFF SOLVER’



- The **“Cost Schedules” worksheet** is linked to the Control & Assumptions worksheet and for each operator in the active case calculates the:
  - Annual CAPEX schedule on a nominal basis
  - Annual OPEX and Energy Use schedule on a nominal basis
  - Depreciation schedule (straight line method), based on the depreciation life selection made in the ‘Timing Assumptions (Control & Assumptions worksheet) and the residual value assumptions made in column D of the Depreciation Schedule in this tab
- This worksheet also projects the nominal electricity price, based on the given inputs (see rows 8-16). The model is pre-set with a set of EIA and IEA Industrial electricity prices, however users can add additional inputs in rows 15-16
- It is recommended to use this worksheet mainly as a reference point and refrain from making any significant changes
- The **“Tariff Solver” worksheet** calculates the total tariffs (expressed on a per tCO<sub>2</sub> basis) payable to each operator, given the CO<sub>2</sub> volume and tariff structure assumptions made in the Assumptions worksheet
  - Calculates the availability tariffs payable to the operator, based on the selections made in General Settings of the Control & Assumptions tab
  - Solves for the throughput tariffs payable to the individual operator to cover all costs (e.g.: CAPEX or total fixed costs) and return on equity assumptions specified by the “Assumptions” tab
- Instead of solving for a specific return, it is possible to set a specific throughput tariff in cells F20 and F37 of the Tariff Solver tab to see the impact on operator returns in the relevant financial statement /output sheets (see next slide)



# WORKING WITH THE FINANCIAL MODEL – HANDS ON OUTPUT WORKSHEETS – KEY METRICS & DETAILED FINANCIAL STATEMENTS



- The model three dynamic output worksheets which include key indicators and operator financial statements
  - The “Key Metrics & Yr 1 Financials” gives a quick summary of the key results for the active case as well as a snapshot of the financials for the transport and storage operator (in year 1, on a real basis)
  - The financial statement sheets for each operator provide the detailed breakdown of the income statement (or profit & loss or PL) and cash flows on an annual basis as well as the calculation of the return on equity
    - Also include detailed financing and debt schedule (i.e.: debt amortisation and interest expense) calculations by tranche of debt

Example Key Metrics & Y1 Financials tab

OPERATOR Key Metrics & Year 1 Summary Income Statement (All Data in USDm, Unless Otherwise Stated)			
<b>Key Metrics</b>			
<b>TRANSPORT</b>			
CO2 Transported	4.2 MtCO2/yr	126.9 MtCO2 Total	
Total Transport CAPEX (2010 Basis)			\$139.4m
Transport Target IRR			10.0%
Transport Weighted Average Cost of Capital (WACC)			5.81%
Total Transport Tariff \$/tCO2 (2010 Basis)			\$5.84 tCO2
<b>STORAGE</b>			
CO2 Stored	4.2 MtCO2/yr	126.9 MtCO2 Total	
Total Storage CAPEX (2010 Basis)			\$320.8m
Storage Target IRR			13.0%
Storage Weighted Average Cost of Capital (WACC)			7.61%
Total Storage Tariff \$/tCO2 (2010 Basis)			\$12.60 tCO2
<b>TRANSPORT Summary Income Statement (Year 1 Ops, 2010 Basis)</b>			
			<b>FY 2017</b>
Transport Availability Tariff Revenue	\$1.10 tCO2		4.6
Transport Throughput Tariff Revenue	\$4.74 tCO2		20.0
Government Operating Subsidy Revenue			-
<b>Total Revenues</b>	<b>\$5.84 tCO2</b>		<b>\$24.7m</b>
<b>Total OPEX</b>			<b>(6.5)</b>
<b>EBITDA</b>			<b>\$18.2m</b>
Total Depreciation			(6.3)
<b>EBIT</b>			<b>\$11.9m</b>
Interest Expense			(6.0)
Tax Expense			(2.0)
<b>Net Income</b>			<b>\$4.0m</b>
<b>STORAGE Summary Income Statement (Year 1 Ops, 2010 Basis)</b>			
			<b>FY 2017</b>
Storage Availability Tariff Revenue	\$2.53 tCO2		10.7
Storage Throughput Tariff Revenue	\$10.07 tCO2		42.6
Government Operating Subsidy Revenue			-
<b>Total Revenues</b>	<b>\$12.60 tCO2</b>		<b>\$53.3m</b>
<b>Total OPEX</b>			<b>(11.8)</b>
<b>EBITDA</b>			<b>\$41.5m</b>
Total Depreciation			(11.2)
<b>EBIT</b>			<b>\$30.3m</b>
Interest Expense			(11.2)
Tax Expense			(6.3)
<b>Net Income</b>			<b>\$12.8m</b>



# APPENDIX

## KEY REFERENCES

---

- 'Report 2: Economic Assessment of Carbon Capture and Storage Technologies (2009), WorleyParsons, Schlumberger, Baker & McKenzie, EPRI supported by the Global CCS Institute (part of the Strategic Analysis of Carbon Capture and Storage report)
- 'Economic Assessment of Carbon Capture and Storage Technologies, 2011 Update', WorleyParsons and Schlumberger supported by the Global CCS Institute
  - Together, often referred to in this manual as “the Global CCS Institute report”