

H2A Hydrogen Production Analysis Tool

For BILIWG and PURIWG Preliminary
Cost Analyses

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H2A Overview

- Discounted cash flow analysis tool for production of hydrogen from various feedstocks
 - Inputs are;
 - Capital costs
 - Operating costs
 - Financial parameters
 - Outputs are cost of hydrogen (\$/kg) and yearly breakdown of costs and revenue

H2A Hydrogen Analysis Tool - Structure

- Excel spreadsheet based
- Spreadsheet tabs for:
 - Information about the process
 - Feedstock prices and physical properties
 - Calculations
 - Cost and financial parameter input
 - Results
- Color coding

4	
5	COLOR CODING
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H2A Hydrogen Analysis Tool – Information Spreadsheets

Information about the process

- Title
- Description
- Performance assumptions
- Process flowsheet
- Stream summary
- Forecourt parameters
- Daily H2 demand profile

Feedstock prices and physical properties

- Feedstock & Utility Prices
- Physical Property Data

H2A Hydrogen Analysis Tool – Calculation Spreadsheets

- Cash Flow Analysis
- Debt Financing Calculations
- Depreciation

H2A Hydrogen Analysis Tool – Input Spreadsheets

Financial Inputs

Cost Inputs

- Capital costs
- Fixed operating costs
- Variable operating costs

Replacement Costs

H2A Hydrogen Analysis Tool – Financial Inputs

9	ECONOMIC ASSUMPTIONS:				
10		Base Case:	H2A Guidelines:	Values in Reference Study:	Comment
	Reference Year \$ (in half-decade increments)	2005	Half-decade increments,		
11			1	Forecourt Hydrogen Production	
			2	Title	
12	Assumed start-up year	2005	3		
13	After-tax Real IRR (%)	10.0%	4		
14	Depreciation Type	MACRS	5	COLOR CODING	
15	Depreciation Schedule Length (years)	7	6		
16	Analysis period (years)	20	7		
17	Plant life (years)	20	8		
18			9		
19	Inflation rate (%)	1.9%	10		
20	State Taxes (%)	6.0%	11		
21	Federal Taxes (%)	35.0%	12		
22	Total Tax Rate (%)	38.9%	13		
23	Plant Design Capacity (kg of H2/day)	1,500.00	14		
			15		
			16		
			17		
			18		
			19		
			20	Plant Design Capacity (kg/day):	
			21	Start-up Year:	
			22	Primary Product Feedstock Source:	
			23	Secondary Feedstock Source:	

Not on the Financial Inputs sheet!

Enter Plant Design Capacity on Title Sheet!

H2A Hydrogen Analysis Tool – Financial Inputs

Financial Default values	
Reference Year \$ (in half-decade increments)	2005
After-tax Real IRR (%)	10.0%
Depreciation Type	MACRS
Depreciation Schedule Length (years)	7
Analysis period (years)	20
% Equity Financing	100%
% Debt Financing	0%
Length of Construction Period (years)	1
Capital spent during construction. Enter 100% in this cell	100%
Salvage value (% of total capital investment)	0%
Decommissioning costs (% of depreciable capital investment)	0%

Change
to 1
year

H2A Hydrogen Analysis Tool – Case Specific Financial Inputs

Case Specific Financial Input Values	
Assumed startup year	2005 – current; 2012 and 2017 – MYPP targets
Plant life	Match plant life and replacement schedule to analysis period (20 y)
Operating capacity factor (%)	Explain if different from 70% forecourt value
Start time (years)	Explain differences from ½ year assumed value
Percent of revenue, fixed and variable operating costs during start-up	Explain differences from values in baseline case (50%, 50%, and 75% resp.)

H2A Hydrogen Analysis Tool – Default Cost Inputs*

Default Input Values – Depreciable Capital Costs	
Site preparation	\$74,344 - Site Prep w/ GC: fire walls, foundations, etc. plus 20% for construction expenses and GC fee
Engineering & design	\$30,000 – explain if different
Process contingency	\$0
Project contingency	10% of direct depreciable capital investment
Other depreciable capital	\$0
One time licensing fees	\$0

*Default cost input is for a 1500 kg/day station unless otherwise noted

H2A Hydrogen Analysis Tool – Default Cost Inputs cont.

Default Input Values – Non Depreciable Capital Costs	
Non-depreciable capital costs	\$0 - Land is assumed to be leased.
Default Input Values – Fixed Operating Costs	
Production unit labor	0
Storage/dispensing labor (h/y)	1231.9
Storage/dispensing labor cost (\$/h)	15
Overhead and G&A rate	20% of total labor cost
Property tax and insurance	2% of total capital
Rent	\$43,194 (large station) \$13,236 (small station)

H2A Hydrogen Analysis Tool – Default Cost Inputs cont.

Default Input Values – Fixed Operating Costs cont.	
Licensing, permits & fees	\$1000
Production maintenance & repairs (\$/yr)	5% of Production deprec. cap Inv. 3% of Compression deprec. cap 1% of Storage deprec. cap \$800/dispenser (3 dispensers for 1500 kg/day station)
Forecourt maintenance & repairs (\$/yr)	\$0 – see above
Other fees and Other fixed O&M	\$0 – explain if different

H2A Hydrogen Analysis Tool – Default Cost Inputs cont.

Default Input Values – Variable Production Costs	
Electricity (\$/kWh)	Used as a utility. Select “Commercial Electricity” from the dropdown list and enter 0.08
Natural gas (\$/Nm3)	\$0.18

A	B	
Utility Costs		
Type of electricity utility used	Commercial Electricity	Dropdown lists
Use H2A electricity utility cost? (Enter yes or no)	No	
Enter electricity utility cost if NO is selected above (\$/kWh)	0.08	
Electricity utility consumption (kWh/kg H2)	2.17000405	
Electricity utility cost in startup year (\$/year)	\$63,316	

Always select “No”

H2A Hydrogen Analysis Tool – Default Cost Inputs cont.

Default Input Values – Variable Production Costs cont	
Ethanol	\$0.283/L (\$1.07/gal)
Sugar	\$0.064/lb
Process water	\$0.00044/L
Cooling water	\$0.000021/L
Demineralized water	\$0.00132/L
Steam	\$0.01/kg (LHV = 0.00283 GJ/kg)

H2A Hydrogen Analysis Tool – Default Cost Inputs cont.

Default Input Values – Variable Production Costs cont	
Other variable operating costs (\$/yr)	1,800
Royalties; Operator profit; Subsidies; Carbon sequestration	\$0
Byproduct credits	\$0
Working capital (% change in yearly operating costs)	15

H2A Hydrogen Analysis Tool – Case Specific Cost Inputs

Direct Capital Costs

	A	B	C	D	E
8	CAPITAL INVESTMENT (Inputs REQUIRED In Year 2005 \$)				
9	Production: Major Items	Installed		Installation Cost Factor	Calculated Installed Cost
10					
11	Production Unit including housing			1.10	\$1,422,384
12					\$0
13					\$0
14	A			D	E
15	Compression/Storage/Dispensing: Major items	Installed Costs	Uninstalled Costs	Installation Cost Factor	Calculated Installed Cost
16	25				
17	26	(Add in lines as appropriate)			
18	27	H2 Compressor Subsystem	\$286,250	1.2	\$343,500
19	28	H2 Storage Subsystem		1.1	\$1,073,625
20	29	Dispenser System		1.2	\$80,640
21					
22					
23					

Production
Unit
Equipment
Costs

Compression,
storage, and
dispensing
equipment

H2A Hydrogen Analysis Tool – Case Specific Cost Inputs

Direct Capital Costs

- Enter production and compression/storage/dispensing costs in appropriate sections unless you have an integrated system (use production section)
- Include as much detail as possible
- Make sure that the total cost is reflected in the “Total Direct Capital Investment (depreciable) \$” cell

H2A Hydrogen Analysis Tool – Case Specific Cost Inputs

Replacement Costs

[illegible]

Unplanned replacement cost factor generates constant yearly costs – Be careful not to double count with maintenance and repair costs on the “Cost Inputs” sheet

Enter major planned
replacements in the
appropriate year here – Match
with Plant Life

H2A Hydrogen Analysis Tool – Results

- On “Results” sheet, click “Solve cash flow for desired IRR”
- The “Cost Contribution Chart” will be generated automatically
- None of the other charts are generated automatically – The user must enter desired values in the chart table
 - IRR Graph
 - Sensitivity – Tornado
 - Sensitivity – Monte Carlo

H2A Hydrogen Analysis Tool – Resources

- Download current timeframe cases from:
 - http://www.hydrogen.energy.gov/h2a_production.html
 - Click on “Assumptions and Ground Rules” for H2A default values and assumptions.
 - Click on “Central and forecourt production technology case studies” to download Excel workbooks. (follow online directions)
- Download the ethanol case study from:
 - <http://www.hydrogenproductionworkinggroupregistration.govtools.us/GateKeeper.aspx?ReturnUrl=%2fDefault.aspx> (during the meeting only).