Introduction

HydCalc is a hydrogen production price estimator. This program helps the user to estimate hydrogen production prices using values from peer reviewed articles. The user can choose from different predefined criterions such as production technologies, feedstock prices, total amount of hydrogen to be produced as well as a tax for CO_2 emissions. The program is coded in Visual Basic and reads the text file recipie.txt and from which it creates a database, Data.db which is then used for the calculations. Recipie.txt is made so that it can be modified in the future with either new prices and/or new technologies. See "Modification of database" for how the Recipie.txt file is structured.

One starts by selecting a production technology, and then follows the instructions that are displayed. Once an initial price is calculated, the estimator also gives the possibility to add a CO_2 tax to the price so that the price can be evaluated in a CO_2 constraint future. One could also regard this CO_2 tax in some way as an average price for CO_2 sequestration and storage if such a number is available.

Modification of database

The structure of the Recipie.txt file is such as that "CREATE TABLE [Table]" gives the command to create a new table with the name [Table], than all the different column names are specified together with their specifics. So for instance "[Production_Technology] TEXT NULL" means that the column [Production_Technology] has to be of TEXT value and that NULL is a valid value as well. A text value is entered between apostrophes. So for instance 'Steam Methane Reformation' is a valid value for the [Production_Technology] column.

To specify a new entry in the Recipie.txt the format has to be exactly as follows without the quotation marks: "INSERT INTO [Table]([Id], [Production_Technology], [H_Price], [CO2_Prod], [CO2_Tax], [H2_out], [Feedstock_Price], [Feedstock_Price_per_kgH2], [esti_year], [URL]) VALUES (1, 'Steam Methane Reformation', 1.78, 11.600, '0', '341000', '$5.95/MMBu', '0.76$/kg', 2010, 'http://www.hydrogen.energy.gov/h2a_prod_studies.html')". This specific line tells the database to create a new line, that should be inserted into the existing table called [Table], furthermore it specifies that this line has an Id, a [Production_Technology], etc (which are given according to the

convention specified in the first row). After this, the values follows specified in VALUES(). The value 1 here represents the Id value is 1 (which must be unique) then a [Production_Technology] is specified etc. So if a new value for the [H_Price] is wanted, one simply changes the value in the 1.78 to a new value which will then be used in future estimations.

Methodology

All the numbers used in the Recipie.txt file is based on peer-reviewed articles (sometimes the source of the articles is cited instead of the article that actually uses them). Further, for the cases where a custom price for feedstock is available, the estimations are based on linear extrapolations with all other variables held constant. In order to give estimations that are comparable with each other even due to different origin year, all prices have been scaled up to 2012 using the Chemical Engineering Plant Cost Index. The CEPCI is based on 10 different categories or four major components which are Equipment, Construction Labour, Supervisory Labour and Buildings. In cases where a feed stock price is given, this price is the result of scaling up the cited original price to a new price based on inflation using the Consumer Price Index Data from July 16, 2013. All prices are based on estimates for a centralized system with no regards taken to distribution system.

Price estimations when a fossil feedstock is taken into account, uses price projections for the corresponding feedstock. So for instance even if the price selected for the feedstock for Steam Methane Reformation is $5.95/mmbtu this means that the initial price is 5.95, while the following years price is based on estimates. For further reading see the US department of energy homepage.

References

The calculator is based on estimations taken from the following sources:

- http://www.hydrogen.energy.gov/h2a_prod_studies.html
- http://www.osti.gov/bridge/servlets/purl/821808-9WJmaq/821808.pdf
- http://www.inderscience.com/storage/f712112410953186.pdf
- http://gcep.stanford.edu/pdfs/hydrogen_workshop/Schultz.pdf
- http://www.sciencedirect.com/science/article/pii/S0360319909013779?np=y
- http://www.nrel.gov/docs/fy09osti/46267.pdf
- http://www.cder.dz/A2H2/Medias/Download/Proc%20PDF/posters/%5BGII%5D%20Production%20from%20electrolysis%20&%20thermochemical%20cycles/215.pdf