**Life cycle assessment of Power-to-Methane systems with CO2 supplied by Chemical Looping Combustion of biomass**

Alberto Navajas1,2, Teresa Mendiara3\*, Luis M. Gandía1,2, Alberto Abad3, Francisco García-Labiano3, Luis F. de Diego3

1 Department of Science, Public University of Navarre, Arrosadía Campus s/n, E-31006 Pamplona, Spain

2 Institute for Advanced Materials and Mathematics (InaMat2), Public University of Navarre, Arrosadía Campus s/n, E-31006 Pamplona, Spain

3 Department of Energy and Environment, Instituto de Carboquímica-ICB-CSIC

Miguel Luesma Castán 4, 50018, Zaragoza, Spain.

\* Corresponding author: [tmendiara@icb.csic.es](mailto:tmendiara@icb.csic.es)

Phone: + 34 976 733 977;

Fax: +34 976 733 318

**Table S1**. Environmental impact indicators, LCIA method used for their calculation, and units of the indicator

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Environmental Impact Indicator** | **Abbreviation** | **Calculation Method** | **Unit** | **Classification** |
| Global Warming Potential | GWP | IPPC2007 [1] | kg CO2 Eq. | I |
| Ozone Depletion Potential | ODP | WMO1999 [2] | kg CFC-11 Eq. | I |
| Respiratory Inorganics | RI | UNEP [3] | kg PM2,5 Eq. | I |
| Ionising radiation | IR | ReCiPe2008 [4] | kg U235 Eq. | II |
| Photochemical ozone formation | POF | ReCiPe 2008 [5] | kg NMVOC Eq. | II |
| Acidification Potential | AC | [6, 7] | Mole of H+ Eq. | II |
| Terrestial Eutrophication | EUT | [6, 7] | Mole f N Eq. | II |
| Aquatic freshwater Eutrophication | EUF | ReCiPe2008 [8] | kg of N Eq. | II |
| Aquatic marine Eutrophication | EUM | ReCiPe2008 [8] | kg of N Eq. | II |
| Human Toxicity Potential, Cancer effects | HTC | UseTox [9] | Comparative Toxic Unit for Human Health (CTUh) | II/III |
| Human Toxicity Potential, Non Cancer Effects | HTNC | UseTox [9] | CTUh | II/III |
| Ecotoxicity freshwater | ECFW | UseTox [9] | Comparative Toxic Unit for ecosystems (CTUe) | II/III |
| Resource Use Minerals and Metals | RUM | ADP [10] | kg Sb Eq. | III |
| Water Use – Water Scarcity | WU | UNEP [11] | m3 Eq. | III |
| Land Use | LU | LANCA [12] | Soil Quality Index | III |
| Resource Use Energy Carriers | RUE | ADP [10] | MJ | III |

**Table S2**. Values for the environmental impact indicators LCIA obtained for the different PtM-bioCLC schemes

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **iG-CLC\_mOC** |  | **iG-CLC\_sOC** |  | **CLOU** |  | **Base Case** |
|  | **NOx** | **no NOx** | **NOx** | **no NOx** | **NOx** | **no NOx** |  |
| **GWP** | -1,05E+09 | -1,05E+09 | -1,06E+09 | -1,06E+09 | -8,62E+08 | -8,62E+08 | 2,62E+08 |
| **ODP** | 3,33E-04 | 3,33E-04 | 3,33E-04 | 3,33E-04 | 3,33E-04 | 3,33E-04 | 3,33E-04 |
| **RI** | 2,14E+01 | 5,52E-01 | 2,14E+01 | 5,69E-01 | 1,86E+01 | 4,94E-01 | 8,40E+00 |
| **IR** | 8,68E+06 | 8,68E+06 | 8,66E+06 | 8,66E+06 | 8,66E+06 | 8,66E+06 | 8,82E+06 |
| **POF** | 1,29E+07 | -7,36E+04 | 1,30E+07 | -4,92E+04 | 1,12E+07 | -8,36E+04 | 6,77E+05 |
| **AC** | 9,71E+06 | 7,63E+04 | 9,72E+06 | 9,42E+04 | 8,45E+06 | 7,24E+04 | 7,18E+05 |
| **EUT** | 5,50E+07 | -4,85E+05 | 5,51E+07 | -3,80E+05 | 4,77E+07 | -5,02E+05 | 2,19E+06 |
| **EUF** | 2,80E+02 | 2,80E+02 | 2,80E+02 | 2,80E+02 | 2,73E+02 | 2,73E+02 | 2,53E+02 |
| **EUM** | 5,02E+06 | -4,41E+04 | 5,03E+06 | -3,45E+04 | 4,36E+06 | -4,55E+04 | 2,01E+05 |
| **HTC** | 4,13E-01 | 4,13E-01 | 4,13E-01 | 4,13E-01 | 4,12E-01 | 4,12E-01 | 4,15E-01 |
| **HTNC** | 4,71E+00 | 4,71E+00 | 4,70E+00 | 4,70E+00 | 4,65E+00 | 4,65E+00 | 5,58E+00 |
| **ECFW** | 6,13E+08 | 6,13E+08 | 6,09E+08 | 6,09E+08 | 5,86E+08 | 5,86E+08 | 7,48E+08 |
| **LU** | 2,59E+10 | 2,59E+10 | 2,59E+10 | 2,59E+10 | 2,27E+10 | 2,27E+10 | 5,72E+08 |
| **WU** | 2,62E+09 | 2,62E+09 | 2,62E+09 | 2,62E+09 | 2,62E+09 | 2,62E+09 | 2,62E+09 |
| **RUE** | -8,54E+09 | -8,54E+09 | -8,57E+09 | -8,57E+09 | -8,62E+09 | -8,62E+09 | 1,16E+10 |
| **RUM** | 2,96E+03 | 2,96E+03 | 2,98E+03 | 2,98E+03 | 3,03E+03 | 3,03E+03 | 3,01E+03 |

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