Table: Techno-economic assessment of sustainable isoprene production coupled with carbon dioxide sequestration using genetically engineered *Synechococcus elongatus* UTEX 2973

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Supplementary information

The following formulas were used for the techno-economic analysis of Isoprene production

Depreciation Cost (DC) per year:

$$DC = \frac{Acquisition\ Cost\ (CAPEX) - Residual\ (40\%\ of\ CAPEX)}{20}$$

Return on Investment (ROI):

$$ROI = \frac{DR \times [1 + DR]^{ELS}}{[1 + DR]^{ELS} - 1}$$

Income tax (IT):

$$IT = TR \times (IR + ER - OC - DC)$$

At the breakeven point, total cost should be equal to total revenue:

$$IR + ER = OC + ROI + IT$$

Minimum isoprene selling price (MISP):

$$MISP = \frac{IR}{Isoprene\ production}$$

Where CapEx: Capital expenditure; DC: Depreciation cost; DR: Discount rate; ELS: Economic life of project; ER: Revenue without isoprene; IR: Isoprene revenue; OC: Operating cost; TPI: Total project investment; TR: Tax rate; Re: residual.

Table S1: Key parameters used in the calculations and their respective value:

Parameters required		**Million USD**
IR	Isoprene Revenue	4.848
ER	Revenue without isoprene	0.055
OC	Operating Cost	2.234
DR	Discount rate	0.067
TPI	Total Project investment	21.160
DC	Depreciation cost (million USD/year)	0.635
Interest	Interest rate	0.200
TR	Tax Rate	0.350
Re	Residual (salvage value)	8.464
ELS	Economic life of project (Year)	20.000
Capex	Capital cost	21.160

Table S2: Isoprene revenue calculation.

Parameter	**Value**
Depreciation cost (million USD/year)	0.634798818
ROI	1.95716889
Income tax (IT)	0.35*IR-0.9846448
Isoprene revenue (IR) (million USD/year)	4.847686353
Isoprene revenue (IR) (USD/year)	4847686.353

Table S3: Minimum isoprene selling price at different isoprene productivity.

	Isoprene productivity ($g/m^3/day$)	Isoprene production (kg/year)	IR (USD/year)	MISP (USD/kg)	
Experimental productivity	0.744	9992.664	4847686.353	485.125	
10x	7.440	99926.640	4847686.353	48.512	
20x	14.880	199853.280	4847686.353	24.256	**Lower bound**
30x	22.320	299779.920	4847686.353	16.171	**Base case**
40x	29.760	399706.560	4847686.353	12.128	**Upper bound**
50x	37.200	499633.200	4847686.353	9.702	
60x	44.640	599559.840	4847686.353	8.085	
70x	52.080	699486.480	4847686.353	6.930	
80x	59.520	799413.120	4847686.353	6.064	
90x	66.960	899339.760	4847686.353	5.390	
100x	74.400	999266.400	4847686.353	4.851	

Table S4: List of parameters and their respective base case, lower, and upper bound values.

Parameter	Lower bound	Base value	Upper bound
Isoprene productivity (g/m^3/day)	14.88	22.32	29.76
Project length (year)	15.00	20.00	30.00
Nitrogen cost ($/kg)	0.23	0.43	0.63
Total capital investment (%)	80.00	100.00	120.00
Fixed cost of production (%)	80.00	100.00	120.00
Cost of land $/acre	3000.00	4000.00	12000.00
IPTG cost ($/kg)	3.00	7.00	11.00
PBR density (%)	50.00	100.00	200.00

Table S5: Change in Isoprene MISP at lower and upper bounds and base case values of different key factors.

Key factor	MISP lower bound	MISP upper bound	MISP base value	MISP (high diff)	MISP (low diff)
Isoprene productivity ($g/m^3/day$)	24.250	12.128	16.171	8.079	-4.043
Project length (year)	17.470	15.030	16.171	1.299	-1.141
Nitrogen cost ($/kg)	15.970	16.370	16.171	0.199	-0.201
Total capital investment (%)	14.410	17.950	16.171	1.779	-1.761
Fixed operating cost (%)	15.100	17.250	16.171	1.079	-1.071
Cost of land	15.860	18.580	16.171	2.409	-0.311
IPTG cost ($/kg)	15.520	16.820	16.171	0.649	-0.651
PBR density (%)	17.350	15.550	16.171	1.179	-0.621