

Class		Indicator Name	Description	Unit
Environmental	Env. 1	Greenhouse Gas Emissions	Total greenhouse gas emissions measured in CO <sub>2</sub> equivalents per unit of methanol produced.	CO <sub>2</sub> e/kg methanol
	Env. 2	Energy Self-Efficiency	Ratio of energy produced to energy consumed in the process.	Dimensionless ratio
	Env. 3	Air Pollutants Emission	Emissions of harmful air pollutants (e.g., NO <sub>x</sub> , SO <sub>x</sub> ) per unit of methanol produced.	g/kg methanol
	Env. 4	Resource Efficiency	Efficiency of raw material utilization in the methanol production process.	% or ratio
	Env. 5	Land Use	Land area required for the methanol production process per unit of methanol produced.	m <sup>2</sup> /kg methanol
	Env. 6	Waste Intensity	Measures the amount of waste generated per unit of output produced. It indicates the efficiency of the production process in terms of waste generation.	kg waste/kg methanol produced
	Env. 7	Carbon Footprint	Overall carbon emissions including all stages of methanol production, from cradle to grave.	CO <sub>2</sub> e/kg methanol
	Env. 8	Water Footprint	Total volume of freshwater used directly and indirectly in the methanol production process.	L/kg methanol
	Env. 9	Particulate Matter Formation	Emission of particulate matter (e.g., PM <sub>10</sub> , PM <sub>2.5</sub> ) per unit of methanol produced.	g/kg methanol
	Env. 10	Resource availability	Measures the accessibility and sufficiency of the raw materials required for methanol production.	Qualitative or tons/year available
Economic	Eco. 1	Capital Cost	Initial investment required to set up the methanol production facility.	\$/kg methanol
	Eco. 2	Operational Cost	Ongoing costs associated with the operation and maintenance of the methanol production facility.	\$/kg methanol
	Eco. 3	Feedstock Cost	Cost of raw materials required for the production of methanol.	\$/kg methanol
	Eco. 4	Product Yield	Amount of methanol produced per unit of feedstock.	kg methanol/kg feedstock
	Eco. 5	Value Added at Factor Cost	Contribution of the methanol production to the economy, excluding taxes and including subsidies.	\$/kg methanol

Social	Socl. 1	Job Creation	Number of direct and indirect jobs created per unit of methanol produced.	Jobs/kg methanol
	Socl. 2	Worker Safety and Health	Frequency and severity of workplace injuries and illnesses.	Incidents per year
	Socl. 3	Need for Skilled Labor and Training	Requirement for skilled labor and the provision of training opportunities for employees.	Hours/year or \$/year
Circularity	Circ. 1	Process Material Circularity	Evaluates the circularity of materials used within the production process, focusing on the extent to which materials are recycled, reused, or minimized.	% (Percentage of materials recycled/reused)
	Circ. 2	Material Flow Analysis (MFA)	Analyzes the flow of materials through the production, use, and disposal stages to optimize material efficiency and circularity.	kg/year (Total material flow) or tons/year
	Circ. 3	Direct CO <sub>2</sub> Utilization	Measures the amount of CO <sub>2</sub> directly captured and used in the methanol production process.	kg CO <sub>2</sub> /kg methanol
	Circ. 4	Landfill-to-Recycle Ratio	Ratio of waste sent to landfill compared to waste recycled. Indicates the efficiency of waste management practices and the effectiveness of recycling efforts.	Ratio (Landfill waste / Recycled waste)
Technological	Tech. 1	Scalability	Assesses the ability of the technology to be scaled up from laboratory or pilot-scale to commercial-scale production.	Qualitative scale or production capacity (tons/year)
	Tech. 2	Technology Readiness Level (TRL)	Evaluates the maturity of a technology from initial concept (TRL 1) to fully commercialized (TRL 9).	TRL scale (1 to 9)
	Tech. 3	Process Stability	Measures the consistency and reliability of the production process over time.	% uptime or standard deviation of key process parameters
	Tech. 4	Methanol Purity	Assesses the quality of the methanol produced, measured by the concentration of methanol in the final product.	% purity
	Tech. 5	Process Yield	Measures the efficiency of the conversion process, defined as the amount of methanol produced per unit of feedstock.	kg methanol/kg feedstock or % yield
	Tech. 6	Energy Efficiency	Evaluates the amount of energy required to produce a unit of methanol.	MJ/kg methanol or kWh/kg methanol
	Tech. 7	Process Integration	Assesses how well the methanol production process is integrated with other processes or systems to maximize efficiency.	Qualitative scale (e.g., Poor, Fair, Good, Excellent)

Tc	Tech. 8	Operational Flexibility	Measures the ability of the production process to adapt to changes in feedstock, product specifications, or operating conditions.	Qualitative scale (e.g., Low, Medium, High)
	Tech. 9	Automation Level	Assesses the degree of automation in the production process.	% of processes automated
	Tech. 10	By-product Intensity	Measures the amount of by-products generated per unit of methanol produced.	kg by-products/kg methanol
	Tech. 11	Feedstock Flexibility	Evaluates the ability of the production process to utilize different types of feedstocks.	Number of feedstock types or qualitative scale (e.g., Low, Medium, High)
	Tech. 12	Needs for Catalyst and Its Efficiency	Measures the amount and effectiveness of catalysts required for the production process.	kg catalyst/kg methanol or % conversion per unit of catalyst
	Tech. 13	Reaction Time	Measures the time required for the chemical reactions to reach completion or a desired level of conversion.	Hours or minutes