

**Clean Air Task Force
Zero-Carbon Fuels Project
Units Conversion Worksheet
Version 30 March 2021**

Hydrogen

To Convert From...	To...	Multiply By...
lb	kg	0.454
kg	lb	2.205
kg	GJ-HHV	0.141
kg	GJ-LHV	0.120
kg	MMBtu-HHV	0.134
kg	MMBtu-LHV	0.114
GJ-HHV	GJ-LHV	0.848
GJ-LHV	GJ-HHV	1.179
kWh - Thermal	kJ	3600
kWh - Thermal	Btu	3412.141
kJ	kWh (Thermal)	2.778E-04
Btu	kWh (Thermal)	2.931E-04
kg	Nm3	11.126
kg	SCF	415.269
lb	SCF	188.363
ston	SCF	376725.875
SCF	ston	2.654E-06
SCF	Nm3	0.0268
Nm3	SCF	37.326
kg/s	kg/hr	3600
kg/hr	tonne/day	0.024
kg/hr	Nm3/hr	11.126
Nm3/hr	kg/hr	0.0899
Nm3/hr	SCF/day	895.814
tonne/day	MMSCF/day	0.415
tonne/day	MW-HHV (Thermal)	1.638
MMSCF/day	MW-HHV (Thermal)	3.944
* BTU/SCF	KJ/kg	438.132
* BTU/SCF	KJ/mol	0.883
* KJ/kg	BTU/SCF	0.00228
* KJ/mol	BTU/SCF	1.132
MMSCF/day	tonne/day	2.408
\$/kg	\$/GJ-HHV	7.068
\$/kg	\$/GJ-LHV	8.336
\$/kg	\$/MMBtu-HHV	7.457
\$/kg	\$/MMBtu-LHV	8.795
\$/GJ-HHV	\$/GJ-LHV	1.179
\$/GJ-LHV	\$/GJ-HHV	0.848
\$/MMBtu-HHV	\$/MMBtu-LHV	1.179
\$/MMBtu-LHV	\$/MMBtu-HHV	0.848
\$/MMBtu-HHV	\$/GJ-HHV	0.948
\$/MMBtu-LHV	\$/GJ-LHV	0.948
\$/MMBtu-HHV	\$/kg	0.1341
\$/GJ-LHV	\$/kg	0.1200

Notes

Properties data adapted from NIST Standard Reference Database 23 (DLL 10.0)

Cubic meters at NTP (0C, 1 atm) = "Nm3"

Cubic feet at STP (60F, 1 atm) = "SCF"

All heating values at standard conditions (25C, 1 atm)

"MM" = 1,000,000

"ston"=2000lbs

*For converting heating value units. If input is HHV then output is HHV. Same for LHV.

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Methane

To Convert From...	To...	Multiply By...
lb	kg	0.454
kg	lb	2.205
kg	GJ-HHV	0.056
kg	GJ-LHV	0.050
kg	MMBtu-HHV	0.053
kg	MMBtu-LHV	0.047
GJ-HHV	GJ-LHV	0.901
GJ-LHV	GJ-HHV	1.110
kWh - Thermal	kJ	3600
kWh - Thermal	Btu	3412.141
kJ	kWh (Thermal)	2.778E-04
Btu	kWh (Thermal)	2.931E-04
kg	Nm ³	1.394
kg	SCF	52.047
lb	SCF	23.608
ston	SCF	47216.582
SCF	ston	2.118E-05
SCF	Nm ³	0.0268
Nm ³	SCF	37.342
kg/s	kg/hr	3600
kg/hr	tonne/day	0.024
kg/hr	Nm ³ /hr	1.394
Nm ³ /hr	kg/hr	0.7175
Nm ³ /hr	SCF/day	896.205
tonne/day	MMSCF/day	0.052
tonne/day	MW-HHV (Thermal)	0.643
MMSCF/day	MW-HHV (Thermal)	12.345
* BTU/SCF	KJ/kg	54.913
* BTU/SCF	KJ/mol	0.881
* KJ/kg	BTU/SCF	0.01821
* KJ/mol	BTU/SCF	1.135
MMSCF/day	tonne/day	19.213
\$/kg	\$/GJ-HHV	18.014
\$/kg	\$/GJ-LHV	19.990
\$/kg	\$/MMBtu-HHV	19.006
\$/kg	\$/MMBtu-LHV	21.090
\$/GJ-HHV	\$/GJ-LHV	1.110
\$/GJ-LHV	\$/GJ-HHV	0.901
\$/MMBtu-HHV	\$/MMBtu-LHV	1.110
\$/MMBtu-LHV	\$/MMBtu-HHV	0.901
\$/MMBtu-HHV	\$/GJ-HHV	0.948
\$/MMBtu-LHV	\$/GJ-LHV	0.948
\$/MMBtu-HHV	\$/kg	0.0526
\$/GJ-LHV	\$/kg	0.0500

Notes

Properties data adapted from NIST Standard Reference Database 23 (DLL 10.0)

Cubic meters at NTP (0C, 1 atm) = "Nm³"

Cubic feet at STP (60F, 1 atm) = "SCF"

All heating values at standard conditions (25C, 1 atm)

"MM" = 1,000,000

"ston"=2000lbs

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Propane

To Convert From...	To...	Multiply By...
lb	kg	0.454
kg	lb	2.205
kg	GJ-HHV	0.050
kg	GJ-LHV	0.046
kg	MMBtu-HHV	0.048
kg	MMBtu-LHV	0.044
GJ-HHV	GJ-LHV	0.921
GJ-LHV	GJ-HHV	1.086
kWh - Thermal	kJ	3600
kWh - Thermal	Btu	3412.141
kJ	kWh (Thermal)	2.778E-04
Btu	kWh (Thermal)	2.931E-04
kg	Nm3	0.497
kg	SCF	18.633
lb	SCF	8.452
ston	SCF	16903.313
SCF	ston	5.916E-05
SCF	Nm3	0.0267
Nm3	SCF	37.461
kg/s	kg/hr	3600
kg/hr	tonne/day	0.024
kg/hr	Nm3/hr	0.497
Nm3/hr	kg/hr	2.0105
Nm3/hr	SCF/day	899.065
tonne/day	MMSCF/day	0.019
tonne/day	MW-HHV (Thermal)	0.582
MMSCF/day	MW-HHV (Thermal)	31.261
* BTU/SCF	KJ/kg	19.659
* BTU/SCF	KJ/mol	0.867
* KJ/kg	BTU/SCF	0.05087
* KJ/mol	BTU/SCF	1.154
MMSCF/day	tonne/day	53.669
\$/kg	\$/GJ-HHV	19.870
\$/kg	\$/GJ-LHV	21.582
\$/kg	\$/MMBtu-HHV	20.964
\$/kg	\$/MMBtu-LHV	22.771
\$/GJ-HHV	\$/GJ-LHV	1.086
\$/GJ-LHV	\$/GJ-HHV	0.921
\$/MMBtu-HHV	\$/MMBtu-LHV	1.086
\$/MMBtu-LHV	\$/MMBtu-HHV	0.921
\$/MMBtu-HHV	\$/GJ-HHV	0.948
\$/MMBtu-LHV	\$/GJ-LHV	0.948
\$/MMBtu-HHV	\$/kg	0.0477
\$/GJ-LHV	\$/kg	0.0463

Notes

Properties data adapted from NIST Standard Reference Database 23 (DLL 10.0)

Cubic meters at NTP (0C, 1 atm) = "Nm3"

Cubic feet at STP (60F, 1 atm) = "SCF"

All heating values at standard conditions (25C, 1 atm)

"MM" = 1,000,000

"ston"=2000lbs

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Ammonia

To Convert From...	To...	Multiply By...
lb	kg	0.454
kg	lb	2.205
kg	GJ-HHV	0.022
kg	GJ-LHV	0.019
kg	MMBtu-HHV	0.021
kg	MMBtu-LHV	0.018
GJ-HHV	GJ-LHV	0.828
GJ-LHV	GJ-HHV	1.208
kWh - Thermal	kJ	3600
kWh - Thermal	Btu	3412.141
kJ	kWh (Thermal)	2.778E-04
Btu	kWh (Thermal)	2.931E-04
kg	Nm3	1.296
kg	SCF	48.535
lb	SCF	22.015
ston	SCF	44030.557
SCF	ston	2.271E-05
SCF	Nm3	0.0267
Nm3	SCF	37.447
kg/s	kg/hr	3600
kg/hr	tonne/day	0.024
kg/hr	Nm3/hr	1.296
Nm3/hr	kg/hr	0.7716
Nm3/hr	SCF/day	898.738
tonne/day	MMSCF/day	0.049
tonne/day	MW-HHV (Thermal)	0.260
MMSCF/day	MW-HHV (Thermal)	5.360
* BTU/SCF	KJ/kg	51.207
* BTU/SCF	KJ/mol	0.872
* KJ/kg	BTU/SCF	0.01953
* KJ/mol	BTU/SCF	1.147
MMSCF/day	tonne/day	20.604
\$/kg	\$/GJ-HHV	44.488
\$/kg	\$/GJ-LHV	53.761
\$/kg	\$/MMBtu-HHV	46.937
\$/kg	\$/MMBtu-LHV	56.720
\$/GJ-HHV	\$/GJ-LHV	1.208
\$/GJ-LHV	\$/GJ-HHV	0.828
\$/MMBtu-HHV	\$/MMBtu-LHV	1.208
\$/MMBtu-LHV	\$/MMBtu-HHV	0.828
\$/MMBtu-HHV	\$/GJ-HHV	0.948
\$/MMBtu-LHV	\$/GJ-LHV	0.948
\$/MMBtu-HHV	\$/kg	0.0213
\$/GJ-LHV	\$/kg	0.0186

Notes

Properties data adapted from NIST Standard Reference Database 23 (DLL 10.0)

Cubic meters at NTP (0C, 1 atm) = "Nm3"

Cubic feet at STP (60F, 1 atm) = "SCF"

All heating values at standard conditions (25C, 1 atm)

"MM" = 1,000,000

"ston"=2000lbs

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Carbon Dioxide

To Convert From...	To...	Multiply By...
lb	kg	0.454
kg	lb	2.205
kg	GJ-HHV	
kg	GJ-LHV	
kg	MMBtu-HHV	
kg	MMBtu-LHV	
GJ-HHV	GJ-LHV	
GJ-LHV	GJ-HHV	
kWh - Thermal	kJ	3600
kWh - Thermal	Btu	3412.141
kJ	kWh (Thermal)	2.778E-04
Btu	kWh (Thermal)	2.931E-04
kg	Nm3	0.506
kg	SCF	18.903
lb	SCF	8.574
ston	SCF	17148.247
SCF	ston	5.832E-05
SCF	Nm3	0.0268
Nm3	SCF	37.367
kg/s	kg/hr	3600
kg/hr	tonne/day	0.024
kg/hr	Nm3/hr	0.506
Nm3/hr	kg/hr	1.9768
Nm3/hr	SCF/day	896.804
tonne/day	MMSCF/day	0.019
tonne/day	MW-HHV (Thermal)	
MMSCF/day	MW-HHV (Thermal)	
* BTU/SCF	KJ/kg	19.943
* BTU/SCF	KJ/mol	0.878
* KJ/kg	BTU/SCF	0.05014
* KJ/mol	BTU/SCF	1.139
MMSCF/day	tonne/day	52.903
\$/kg	\$/GJ-HHV	
\$/kg	\$/GJ-LHV	
\$/kg	\$/MMBtu-HHV	
\$/kg	\$/MMBtu-LHV	
\$/GJ-HHV	\$/GJ-LHV	
\$/GJ-LHV	\$/GJ-HHV	
\$/MMBtu-HHV	\$/MMBtu-LHV	
\$/MMBtu-LHV	\$/MMBtu-HHV	
\$/MMBtu-HHV	\$/GJ-HHV	
\$/MMBtu-LHV	\$/GJ-LHV	
\$/MMBtu-HHV	\$/kg	
\$/GJ-LHV	\$/kg	

Notes

Properties data adapted from NIST Standard Reference Database 23 (DLL 10.0)

Cubic meters at NTP (0C, 1 atm) = "Nm3"

Cubic feet at STP (60F, 1 atm) = "SCF"

All heating values at standard conditions (25C, 1 atm)

"MM" = 1,000,000

"ston"=2000lbs

*For converting heating value units. If input is HHV then output is HHV. Same for LHV.