OMS eLearning Academy
For Refinery Offsite Operations Professionals
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TOPIC ID	**OMSSW1**
CATEGORY ID	**MCOR**
TOPIC	**Butane Calculator**
REVISION	**Revised on 2021-09-18**

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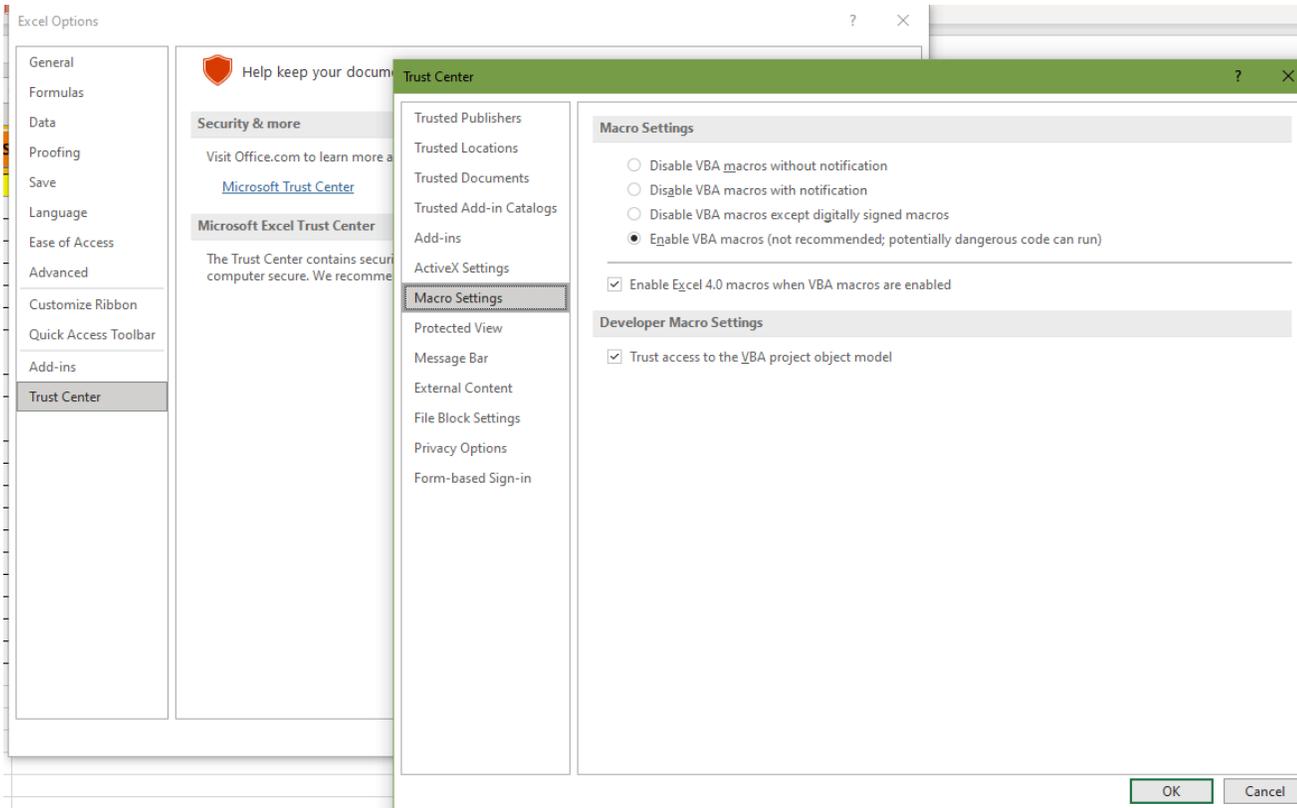**For Refinery Offsite Operations Professionals**

Butane Calculator

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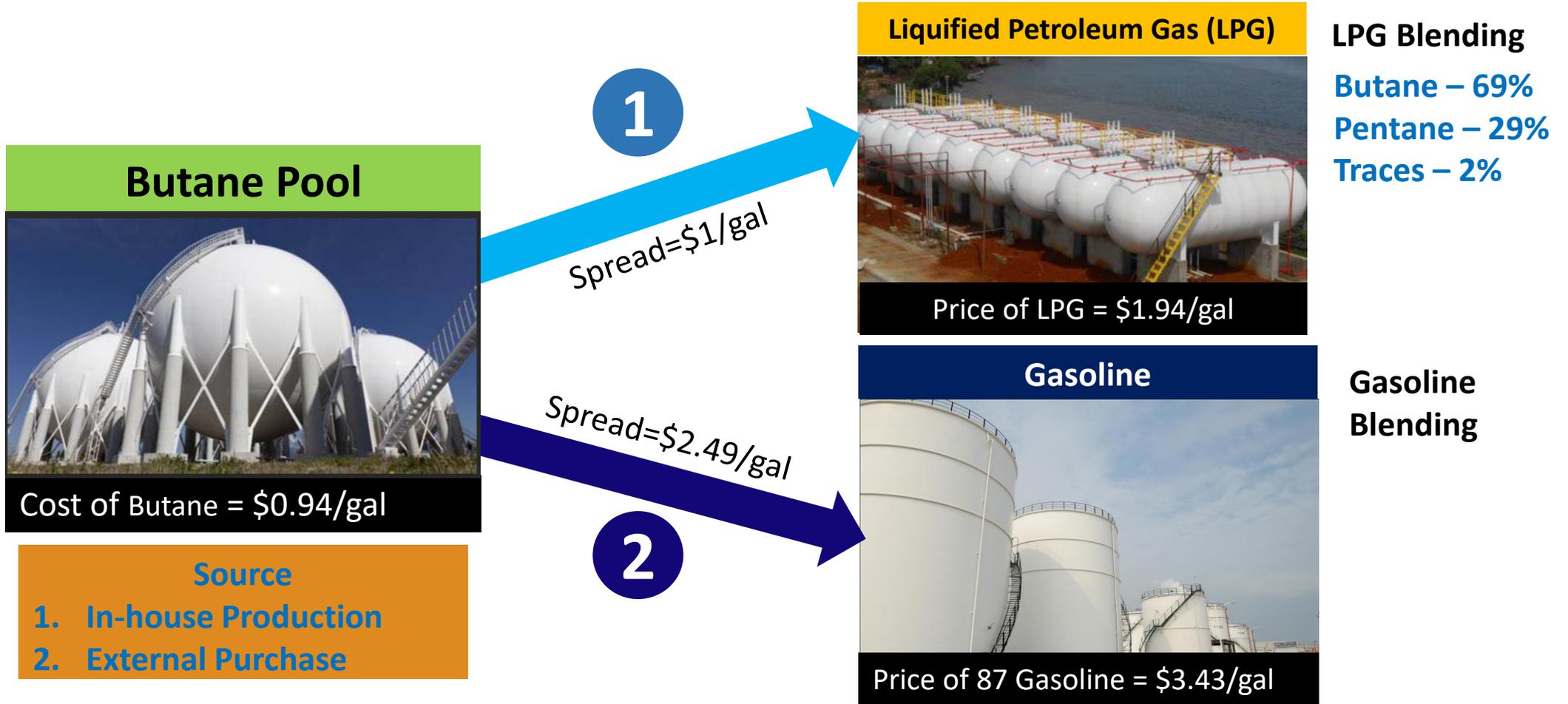# Prerequisites to use this Excel Macro based calculator

1. Excel VBA Macro must be turned on in the excel workbook as follows:
   a. Go to Excel Options
   b. Click on Trust Center
   c. Click on Macro Setting
   d. Check all as shown

2. You should be conversant to modify the VBA code if you need to. We hold no responsibility if the calculator breaks in the process.

3. You agree not to forward this calculator to any other recipient as it is copyrighted.

OMSSW1-Butane Calculator

Butane Destinations and Economics

Butane Pool

Cost of Butane = $0.94/gal

Source
1. **In-house Production**
2. **External Purchase**

1

Spread=$1/gal

Liquified Petroleum Gas (LPG)

Price of LPG = $1.94/gal

LPG Blending

Butane – 69%
Pentane – 29%
Traces – 2%

2

Spread=$2.49/gal

Gasoline

Price of 87 Gasoline = $3.43/gal

Gasoline Blending

**The prices shown are world averages and spreads may differ for countries.

OMSSW1-Butane Calculator

Butane Blending Models

Linear Model ①

$$RVP_B = \sum_{i=1}^{n} v_i RVP_i$$

Texaco Model (Non-linear) ②

No customizable parameter, can include a bias term for feedback

$$RVP_{BF} = \sum_{i=1}^{n} v_i RVP_i$$

$$RVP_{NC4} = 520.124\left(e^{-0.01516*RVP_{BF}}\right) - 0.036635\left(RVP_{BF}\right)^2 + 7.11985\left(RVP_{BF}\right)$$
$$- 512.18 + RVPI_{NC4}\left[0.00061058\left(RVP_{BF}\right)^2 - 0.015169\left(RVP_{BF}\right) + 1.08103\right]$$

$$RVP_B = RVP_{BF} + v_{NC4} RVP_{NC4}$$

Indexed Model (Non-linear) ③

X ranges 1.25-1.75 and must be regressed specifically and can include a bias term for feedback

$$RVPI_i = RVP_i^x \qquad RVP_B = \left[\sum_{i=1}^{n} v_i RVPI_i\right]^{\frac{1}{x}}$$

All three models can be solved deterministically for Butane and Gasoline composition ratios.

OMSSW1-Butane Calculator

How to use the Calculator

1. In the sheet "Monthly Benefits" only, enter or change data for Octane, RVP and Prices, Click "RunAllModels"

2. The calculator will calculate benefits per all three models as shown in the sheet "Models"

3. The monthly benefits will be shown in the "Monthly Benefits" Sheet and also charted out in the "Blending Benefits" Sheets

OMSSW1-Butane Calculator

Calculator Dashboard

All Models executed at 8/13/2021 8:03:11 AM				
Input qualities and Cost Data				**Run the calculator**
Quality	Spec	**Gasoline**	**Butane**	
Cost, $/gal		3.85	0.94	**RunAllModels**
Octane	87	87	94	
RVP,psi	14.3	7	54	

Non-linear Texaco Butane Blending Model

Tangible Benefits of Butane Blending

Month	Blend RVP, Psi	% Butane	% Gasoline	$/gal Benefits	M$ per 100K Bls Batch	M$/30 Days
January	13.50	12.91	86.05	0.3758	1.5784	47.35
February	12.50	10.93	88.19	0.3180	1.3356	40.07
March	11.50	8.94	90.34	0.2602	1.0928	32.78
April	10.50	6.95	92.49	0.2024	0.8499	25.50
September	10.00	5.96	93.56	0.1735	0.7285	21.86
October	11.00	7.95	91.41	0.2313	0.9714	29.14
November	12.00	9.93	89.27	0.2891	1.2142	36.43
December	13.00	11.92	87.12	0.3469	1.4570	43.71
Summary				**Total Benefits, M$**		**276.84**
				Benefit, M$/Batch		**1.54**

OMSSW1-Butane Calculator

Butane Blending Models

Summary of Results Output. Do not Change anything here

Inout qualities and Cost Data

Quality	Spec	Gasoline	Butane
Cost, $/gal		3.85	0.94
Octane	87	87	94
RVP,psi	14.3	7	54

Do not Change any values for these parameters here.

X=1.25

X=1.75

Linear Butane Blending Model — **Tangible Benefits of Butane Blending**

RVP Giveaway, Psi	Blend RVP, Psi	% Butane	% Gasoline	$/gal Benefits	M$ per 100K Bls Batch	M$/30 Days
0.00	7.00	0.00	100.00	0.0000	-	-
0.50	7.50	1.08	98.84	0.0313	0.1316	3.95
0.80	7.80	1.72	98.14	0.0501	0.2106	6.32
1.00	8.00	2.15	97.67	0.0627	0.2632	7.90
1.50	8.50	3.23	96.51	0.0940	0.3948	11.84
2.00	9.00	4.31	95.35	0.1253	0.5264	15.79
2.50	9.50	5.38	94.18	0.1567	0.6580	19.74
3.00	10.00	6.46	93.02	0.1880	0.7896	23.69
3.50	10.50	7.54	91.86	0.2193	0.9212	27.64
4.00	11.00	8.61	90.69	0.2507	1.0528	31.58
4.50	11.50	9.69	89.53	0.2820	1.1844	35.53
5.00	12.00	10.77	88.37	0.3133	1.3160	39.48
5.50	12.50	11.84	87.20	0.3447	1.4476	43.43
6.00	13.00	12.92	86.04	0.3760	1.5792	47.38
6.50	13.50	14.00	84.88	0.4073	1.7108	51.32
7.00	14.00	15.07	83.71	0.4387	1.8424	55.27
						420.85

Non-linear Indexed Butane Blending Model — **Tangible Benefits of Butane Blending**

RVP Giveaway, Psi	Blend RVP, Psi	% Butane	% Gasoline	$/gal Benefits	M$ per 100K Bls Batch	M$/30 Days
0.00	7.00	0.00	100.00	0.0000	-	-
0.50	7.50	0.76	99.17	0.0223	0.0935	2.80
0.80	7.80	1.23	98.67	0.0358	0.1503	4.51
1.00	8.00	1.54	98.33	0.0449	0.1885	5.66
1.50	8.50	2.33	97.48	0.0679	0.2851	8.55
2.00	9.00	3.13	96.61	0.0912	0.3831	11.49
2.50	9.50	3.95	95.74	0.1149	0.4824	14.47
3.00	10.00	4.77	94.85	0.1388	0.5831	17.49
3.50	10.50	5.60	93.94	0.1631	0.6850	20.55
4.00	11.00	6.45	93.03	0.1877	0.7882	23.65
4.50	11.50	7.30	92.11	0.2125	0.8925	26.78
5.00	12.00	8.17	91.18	0.2376	0.9980	29.94
5.50	12.50	9.04	90.24	0.2630	1.1046	33.14
6.00	13.00	9.92	89.28	0.2886	1.2122	36.37
6.50	13.50	10.81	88.32	0.3145	1.3209	39.63
7.00	14.00	11.71	87.35	0.3406	1.4306	42.92
						317.94

Non-linear Indexed Butane Blending Model — **Tangible Benefits of Butane Blending**

RVP Giveaway, Psi	Blend RVP, Psi	% Butane	% Gasoline	$/gal Benefits	M$ per 100K Bls Batch	M$/30 Days
0.00	7.00	0.00	100.00	0.0000	-	-
0.50	7.50	0.37	99.60	0.0108	0.0453	1.36
0.80	7.80	0.60	99.35	0.0175	0.0736	2.21
1.00	8.00	0.76	99.18	0.0221	0.0929	2.79
1.50	8.50	1.17	98.74	0.0340	0.1428	4.28
2.00	9.00	1.60	98.28	0.0464	0.1950	5.85
2.50	9.50	2.04	97.80	0.0594	0.2493	7.48
3.00	10.00	2.50	97.30	0.0728	0.3059	9.18
3.50	10.50	2.98	96.78	0.0868	0.3646	10.94
4.00	11.00	3.48	96.24	0.1013	0.4255	12.77
4.50	11.50	4.00	95.68	0.1163	0.4885	14.65
5.00	12.00	4.53	95.11	0.1318	0.5535	16.61
5.50	12.50	5.08	94.51	0.1478	0.6207	18.62
6.00	13.00	5.64	93.90	0.1642	0.6898	20.70
6.50	13.50	6.23	93.27	0.1812	0.7610	22.83
7.00	14.00	6.83	92.63	0.1986	0.8342	25.03
						175.28

Non-linear Texaco Butane Blending Model — **Tangible Benefits of Butane Blending**

RVP Giveaway, Psi	Blend RVP, Psi	% Butane	% Gasoline	$/gal Benefits	M$ per 100K Bls Batch	M$/30 Days
0.00	7.00	0.00	100.00	0.0000	-	-
0.50	7.50	0.99	98.93	0.0289	0.1214	3.64
0.80	7.80	1.59	98.28	0.0463	0.1943	5.83
1.00	8.00	1.99	97.85	0.0578	0.2428	7.29
1.50	8.50	2.98	96.78	0.0867	0.3643	10.93
2.00	9.00	3.97	95.71	0.1156	0.4857	14.57
2.50	9.50	4.97	94.63	0.1445	0.6071	18.21
3.00	10.00	5.96	93.56	0.1735	0.7285	21.86
3.50	10.50	6.95	92.49	0.2024	0.8499	25.50
4.00	11.00	7.95	91.41	0.2313	0.9714	29.14
4.50	11.50	8.94	90.34	0.2602	1.0928	32.78
5.00	12.00	9.93	89.27	0.2891	1.2142	36.43
5.50	12.50	10.93	88.19	0.3180	1.3356	40.07
6.00	13.00	11.92	87.12	0.3469	1.4570	43.71
6.50	13.50	12.91	86.05	0.3758	1.5784	47.35
7.00	14.00	13.91	84.97	0.4047	1.6999	51.00
						388.30

OMSSW1-Butane Calculator

Tangible Benefits of Butane Blending

Monthly RVP Spec, % Butane and Tangible Benefits for 30 Batches/Month
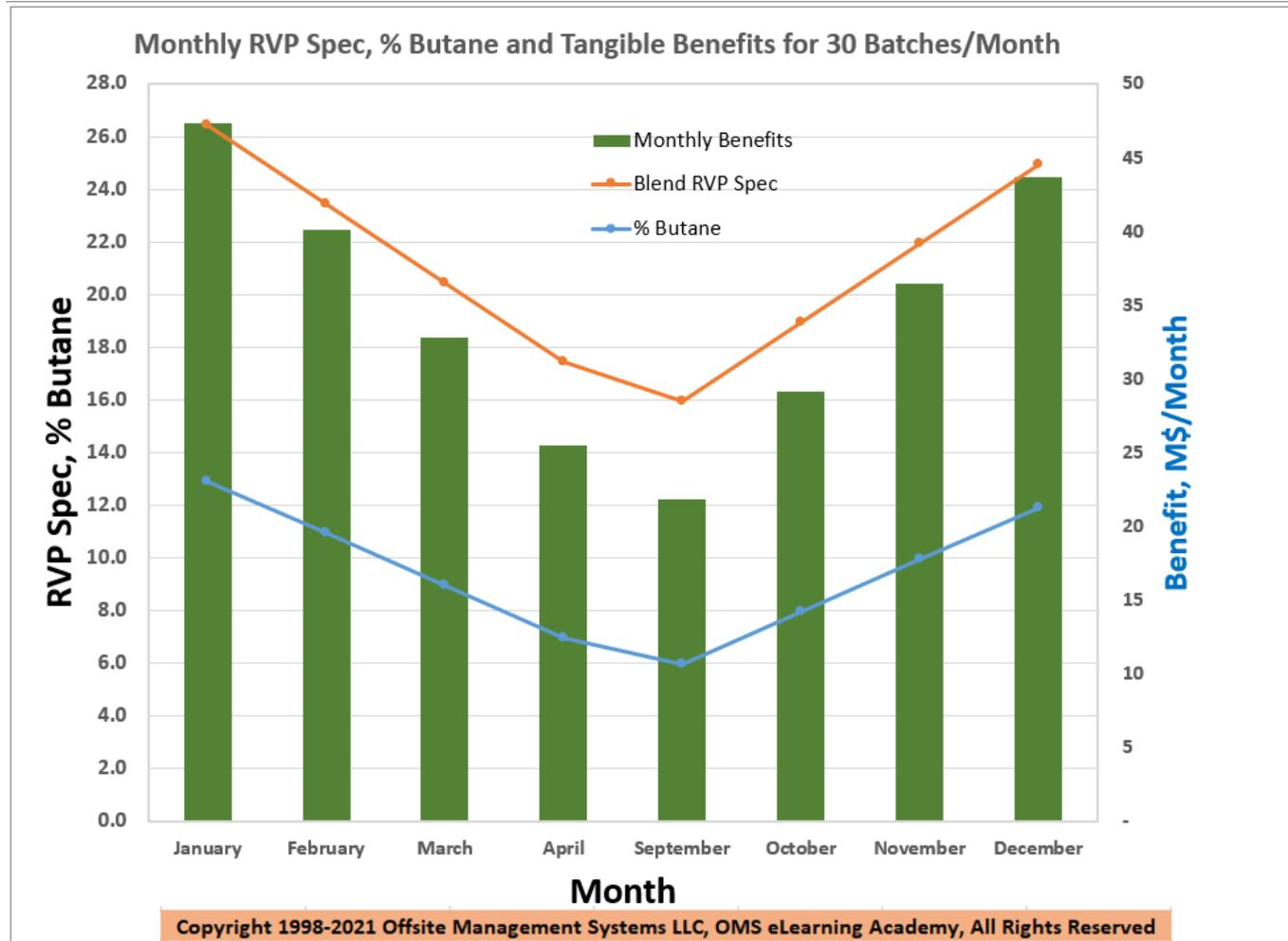
OMSSW1-Butane Calculator

Summary

- The butane calculator includes
  a. A white paper
  b. Macro based Excel Calculator
  c. A video to explain how to use the calculator
  d. Email support only

OMSSW1-Butane Calculator