CONTENTS

COMPASS INTERNATIONAL INC.

vendor assistance and off-sites, percentages / multipliers include contingency funds because the above stated values are based on numerous "historical" return cost data, where the contingency was expended / incorporated into the capital cost of the completed facility. Engineering, Procurement Activities and Construction Management costs are included in the indirect costs. EPC Office includes engineering and design, procurement, project management / control and required administration. Owner C.M. is not included in the EPC office percentage.

Note: the factors for piping, electrical and instrumentation work indicated in (2) and (3) above could be reduced by 20 – 40% (use 30%) if work is fabricated as modules / pre-assemblies / skid, structural steel values should be increased by 10 – 20 % if work is completed as modules / pre-assemblies / skid (use 15%).

Table 3
AVERAGE HISTORICAL (MULTIPLIER) FACTORS – SOLIDS PLANTS

REF	DIRECT CONSTRUCTION COSTS	TYPICAL % OF M.E.	% BULK MATERIALS	% LABOR - S/C	TOTAL	REMARKS
1	Major Equipment (M.E.)	0	1.00*	0.00	1.00	Assume $1.00 million
2	Freight (used 4%)	2.5 - 5	0.02	0.02	0.04	50/50 split
3	Overseas Freight	5 - 8	N/A	N/A		N/A for this example
4	M.E. Setting (Millwright work)	1 - 7	0.01	0.05	0.06	Heavy lift cranes in line 15
5	Site work / civil (excavation / roads)	3 - 10	0.03	0.04	0.07	Site clearance / minor demolition
6	Concrete work	10 - 50	0.04	0.12	0.16	SOG & elevated
7	Structural steel	20 - 50	0.13	0.15	0.28	Including platforms
8	Facilities / Buildings (including services)	3 - 20	0.03	0.02	0.05	
9	Piping** (includes hangars & testing)	25 - 100	0.25	0.40	0.65	ISBL only
10	Electrical	15 - 45	0.09	0.13	0.22	Including tracing
11	Instrumentation / Controls	15 - 60	0.13	0.12	0.25	
12	Insulation	3 - 25	0.02	0.03	0.05	
13	Painting	2 - 10	0.01	0.01	0.02	
14	Safety / F P / Misc. (A)	4 - 12	0.02	0.03	0.05	
	TOTAL DIRECT COST		**1.78**	**1.12**	**2.90**	
	INDIRECT PROJECT COSTS					
15	Field Establishment Costs ***				0.25	22% of labor / S.C. costs
16	EPC Office H.O. range 20% - 30%				0.67	23% of total direct costs
17	Construction Management range 20% -.45% of line 16				0.17	25% of EPC H.O
18	Owner Engineering & CM 5% – 15% of line 16 & 17				0.08	10% of line 16 & 17
19	**TOTAL INDIRECT COSTS**				**1.17**	
20	**TOTAL COST MULTIPLIER**				**4.07**	

(A) = Start up costs, initial chemicals, expense items and other minor items.
** 1.00 = Total value of Major Equipment / Assume 25 items (M.E.)*
*** 25% - 100% is based on using a 60 - 40 split of Carbon Steel and 304-316 SS. This value could in some situations exceed 100% in circumstances where exotic / expensive piping materials are utilized, i.e. Glass / Kynar / Teflon lined / Alloy 20 / Nickel, etc., or high percentage of 304 - 316 SS etc. is used due to hazardous / highly corrosive chemical applications.*
**** Field establishment includes, construction equipment, field offices, field in directs, G.C.'s & S/C trailers, temporary warehouses, Division 1 (Preliminaries) etc. If the proposed project is a hybrid of a liquids and solids plant, use an average of both plants / facilities.*

Table 30

CEMENT MANUFACTURING FACILITY
BASIS OF COST - 2015 COST DATA FROM 7 # COMPLETED & OPERATING FACILITIES IN USA AND MEXICO

CAPEX / OPEX CATEGORY	250,000 TON OF PRODUCTION PER YEAR CAPEX COST	500,000 TON OF PRODUCTION PER YEAR CAPEX COST	750,000 TON OF PRODUCTION PER YEAR CAPEX COST
Cement Production Equipment	40% to 50%	40% to 50%	40% to 50%
Construction Bulk Materials	15% to 25%	15% to 25%	15% to 25%
Construction Labor & Indirects	15%-20%	15% to 20%	15% to 20%
Detailed Design & Procurement of Capial Equipment & Bulks	7% to 11%	7% to 11%	7% to 11%
Construction Management	3.5% to 5%	3.5% to 5%	3.5% to 5%
Total CAPEX Value Average	$83,776,000	$161,660,000	$233,550,000
Total CAPEX Value Range Low	$67,020,800	$129,328,000	$186,840,000
Total CAPEX Value Range High	$100,531,200	$193,992,000	$280,260,000
Cost per Ton (Average)	$335,104	$323,320	$311,400
OPEX costs per year, facility operating personel, fuel, property taxes, electricity, water, maintenance and spares	$10 Million - $25 million (average $15 million per year)	$15 Million - $30 million (average $20 million per year)	$20 Million - $35 million (average $25 million per year)
For facilities with extensive pollution / air quality requirements such as ESP, Baghouses, SDA & NOX systems	Increase Total CAPEX values by 20% to 45%	Increase Total CAPEX values by 20% to 45%	Increase Total CAPEX values by 20% to 45%

Table 49

USA ETHYLENE PRODUCTION FACILITY: AVERAGE OF UNION / NON-UNION CONSTRUCTION: COST BASIS 2019

PRODUCTION CAPACITY (TONS PER ANNUM TPA)	NUMBER OF MAJOR EQUIPMENT ITEMS (M.E.)	NUMBER OF TAGGED INSTRUMENTATION EQUIPMENT ITEMS (M.E.)	TOTAL EPC AVERAGE COST PER TON ISBL	TOTAL EPC AVERAGE COST PER TON OSBL	TOTAL EPC AVERAGE COST PER TON ISBL & OSBL	ACCURACY OF DATA
500,000	145	1,760	$3,425	$381	$3,806	+/- 15%
750,000	215	2,645	$3,360	$415	$3,775	+/- 15%
1,000,000	323	3,510	$3,297	$450	$3,747	+/- 15%
1,250,000	345	4,388	$3,172	$516	$3,688	+/- 15%
1,500,000	427	5,260	$3,090	$545	$3,635	+/- 15%

NOTES:

- Typical Cost of Major Equipment Item = $1,575,000 to $1,675,000
- Typical Cost of Tagged Instrument Item = $8,700 to $9,250
- Costs exclude Feed Studies, Land Purchase, Owner Engineering & Construction Management.
- Furnaces Represent 53% of M.E. Engineering & Fees = 14.2% of EPC cost
- Typical Owner Costs (10 to 20 professionals) Project Manager, Deputy Project Manager, Mechanical, Chemical, Electrical and Civil Engineers, Purchasing, QA QC, Estimators, Planners, Construction Manager, Inspectors, Document Control, Secretary- 10 to 20 people x 24 months:

Typical Open Shop (Non Union) Skilled Worker

(PIPEFITTER, ELECTRICIAN ETC. ALL-IN HOURLY RATE BILL OUT RATE):

DESCRIPTION	% OF BASE RATE	$ COST
BASE SKILLED JOURNEYMAN RATE (2Q – 2019)		$29.25
PAYROLL TAXES & INSURANCES		
WORKERS COMPENSATION INSURANCE	17.3	$5.06
GENERAL LIABILITY INSURANCE	4.2	$1.23
FICA	14.3	$4.18
FUI / SUI	4.3	$1.26
BUILDERS ALL RISK INSURANCE	7.6	$2.22
FRINGE BENEFITS	21.2	$6.20
PREMIUM TIME	7.7	$2.25
FIELD OFFICE / TEMP FACILITIES	8.3	$2.43
FIELD OFFICE SUPPLIES / COMPUTERS / COPY MACHINES / COMMUNICATIONS	4.3	$1.26
SAFETY ITEMS / FIREWATCH	8.6	$2.52
SMALL TOOLS / CONSUMABLES	10.9	$3.19
FIELD STAFF / PROCUREMENT / MATERIAL LOGISTICS	22.8	$6.67
SCAFFOLDING	6.7	$1.96
EQUIPMENT RENTAL (excludes Heavy Lift Cranes)	18.5	$5.41
HOME OFFICE SUPPORT / COORDINATION	8.6	$2.52
PER DIEM	5.3	$1.55
PROFIT / CONTRACTOR FEE	15.5	$4.53
OTHER / MISCL ITEMS	9.5	$2.78
TOTAL ALL-IN FIELD WAGE RATE	195.6	$86.46

Table 53

500 MW HYDRO POWER PLANT USA N.E. USA (2020 COST BASIS)

	DESCRIPTION	$ MILLIONS	% OF TOTAL COST
1	General Conditions / Preliminaries / Site Establishment	91,814,580	3.76%
2	Site Work	307,966,230	12.63%
3	Civil worlk	364,343,760	14.94%
4	Rip Wrap	55,845,900	2.29%
5	Concrete Walls / Dam	373,162,680	15.30%
6	O & M Building & Controls - Monitoring	24,750,535	1.01%
7	Intake Structure	23,760,535	0.97%
8	Shafts / Tunnels / Penstock	110,887,603	4.55%
9	Mechanical Equipment / Turbines / Generators	416,790,000	17.09%
10	Electrical Systems / Switch Yard / Sub Stations	76,230,000	3.13%
11	Site In-Directs (Supervision, Construction Equipment, Scaffolding, Testing)	199,980,000	8.20%
12	**S/T CONSTRUCTION COST**	**2,045,531,822**	
13	Engineering / Detailed Design / Procurement	193,965,000	7.95%
14	Project & Construction Management	11,055,000	0.45%
15	Fees / O-H & P	181,905,000	7.46%
16	Owner Engineering & Construction Oversight	6,633,000	0.27%
17	**S/T ENGINEERING / PM & CM + FEES + OWNER COSTS**	**393,558,000**	
18	**TOTAL COST**	**2,439,089,822**	**100.00%**
19	**COST PER MW**	**4,878,180**	
20	**LOWER COST RANGE PER MW -15%**	**4,146,453**	
21	**HIGH COST RANGE PER MW +15%**	**5,609,907**	
	Exclude land purchase		

Table 54

POWER PLANT COST METRICS USA (2020 COST BASIS)

#	POWER PLANT TYPE	TYPICAL SIZE IN MW	$ COST PER MW MINIMUM	$ COST PER MW MAXIMUM	$ OPEX PER MW ANNUAL FIXED & VARIABLE COSTS MINIMUM	$ OPEX PER MW ANNUAL FIXED & VARIABLE COSTS MAXIMUM
1	Coal	150 - 250	2,330,000	2,950,000	25,000	50,000
2	Coal	250 - 500	2,230,000	2,770,000	25,000	50,000
3	Gas - Combined Cycle	150 - 250	970,000	1,385,000	10,000	15,000
4	Gas - Combined Cycle	250 - 500	900,000	1,245,000	10,000	15,000
5	Gas - Simple Cycle	150 - 250	885,000	1,175,000	10,000	15,000
6	Gas - Simple Cycle	250 - 500	850,000	1,130,000	10,000	15,000
7	Fuel Cell	150 - 250	2,570,000	6,220,000	20,000	40,000
8	Fuel Cell	250 - 500	2,530,000	6,140,000	20,000	40,000
9	Wind Power Onshore	50 - 75	2,600,000	2,850,000	1,000	2,500
10	Wind Power Onshore	75 - 150	2,450,000	3,330,000	1,000	2,500
11	Wind Power Offshore	50 - 75	3,150,000	3,450,000	2,500	5,000
12	Wind Power Offshore	75 - 150	3,000,000	3,250,000	2,500	5,000
13	Solar PV	25 - 50	2,750,000	4,800,000	1,000	2,500
14	Solar PV	50 - 100	2,,600,000	4,550,000	1,000	2,500

DIAMETER	$ MATERIAL COST PER LF	$ M-H COST PER LF	$ COST PER LF	$ MATERIAL COST PER M	$ M-H COST PER M	$ COST PER M
FRP - Furan Complicated / Intricate (ISBL - Inside Facility) Piping - Numerous changes in direction (CONTINUED)						
4" / 100 mm	169.32	95.04	264.37	555.38	311.74	867.12
6" / 150 mm	173.89	172.81	346.70	570.36	566.81	1,137.17
8" / 200 mm	205.93	214.45	420.38	675.46	703.39	1,378.85
10" / 250 mm	276.10	253.72	529.82	905.61	832.20	1,737.81
12" / 300 mm	341.69	301.63	643.32	1,120.74	989.34	2,110.08
Add 4.5% - 7.5% to labor & material costs for hangars, bolts, gaskets & testing						
FRP - Furan Straight run / OSBL Piping						
2" / 50 mm	53.40	19.64	73.03	175.14	64.40	239.54
3" / 75 mm	67.20	27.27	94.47	220.40	89.45	309.85
4" / 100 mm	80.62	35.06	115.68	264.44	114.98	379.42
6" / 150 mm	103.02	58.42	161.44	337.90	191.62	529.52
8" / 200 mm	155.27	85.69	240.96	509.28	281.07	790.34
10" / 250 mm	200.06	105.17	305.22	656.18	344.94	1,001.13
12" / 300 mm	250.82	128.54	379.37	822.70	421.62	1,244.32
Add 4.5% - 7.5% to labor & material costs for hangars, bolts, gaskets & testing						
FRP - Epoxy - Double Walled Pipe Complicated / Intricate (ISBL - Inside Facility) Piping - Numerous changes in direction						
1" dia. inside a 3" dia.	175.77	101.68	277.46	576.54	333.52	910.06
2" dia.inside a 4" dia.	254.42	175.98	430.40	834.49	577.22	1,411.72
3" dia.inside a 6" dia.	279.09	293.31	572.40	915.41	962.05	1,877.46
4" dia. inside a 8" dia.	337.68	379.36	717.04	1,107.59	1,244.29	2,351.89
6" dia. inside a 10" dia.	420.94	524.05	945.00	1,380.69	1,718.89	3,099.59
Add 4.5% - 7.5% to labor & material costs for hangars, bolts, gaskets & testing						
FRP - Epoxy - Double Walled Pipe Straight run / OSBL Piping						
1" dia. inside a 3" dia.	66.29	43.02	109.31	217.42	141.12	358.54
2" dia. inside a 4" dia.	90.95	50.84	141.79	298.30	166.76	465.06
3" dia. inside a 6" dia.	115.61	89.95	205.55	379.19	295.02	674.21
4" dia. inside a 8" dia.	143.35	129.53	272.87	470.17	424.86	895.03
6" dia. inside a 10" dia.	234.27	183.81	418.08	768.40	602.90	1,371.30
Add 4.5% - 7.5% to labor & material costs for hangars, bolts, gaskets & testing						

CONCRETE GENERAL ESTIMATING DATA

TYPE	PER SF	PER M2
Bush hammer concrete	$0.65 - $1.30	$7.00 - $14.00
Acid wash concrete	$0.23 - $0.40	$2.47 - $4.30
Pattern concrete slabs	$0.50 - $0.84	$5.38 - $9.04
Colorize concrete slab	$0.63 - $1.05	$6.80- $11.30
Bag / Dress concrete walls	$0.30 - $0.75	$3.23 - $8.07

Estimating Thoughts for Structural Steel and Miscellaneous Steel

Obtain and review any available engineering deliverables / drawings or sketches. Take off lengths of steel section and multiply by appropriate weight in pounds per LF, determine pounds / tons of steel that is depicted on the drawings. Structural steel is usually fabricated in a vendors shop, and delivered to the site for eventual erection. Structural steel has a number of differing specifications / materials of construction, that have differing cost consequences the most widely used is A36.

Issues that may perhaps impact the erection activity of new structural steel are:

- Lifting equipment / cranes / hoists
- Mobilization / de-mobilization of crane (crane are typically rented by the day or week)
- Crane reach
- Lifting capacity
- Number of floors
- Bolted connections
- Welded connections
- Painting / touch up painting

Platforms, ladders, handrails, stair risers and other miscellaneous: perform take off and establish pounds / tons of material and assign appropriate installation man-hours. Checker plate, grating and floor plate and metal decking: perform take off and establish square feet of material and assign appropriate installation man-hours, allow at least 5% for waste in the cutting / fit up activity.

Order of Magnitude Structural Steel Estimating Data

Structural Steel weights per SF:

- Manufacturing Building = 10 - 15 lb / S.F.
- 5 Floor Office Building = 15 – 25 lb / S.F.
- Heavy industrial Facility = 25 – 75 lb / S.F.
- Process Structures: Preliminary weights of structures can vary from 1.5 lb to 3.5 lb (Cubic Foot of enclosed area).

Structural Steel as percentage of major equipment cost: usually falls in the 5% to 8% of major equipment cost. The following pie chart delineates the various cost / fabrication and installation activities associated with structural steel.

PERCENTAGE BREAKDOWN OF STRUCTURAL STEEL BASED ON 500-TON, 3-STORY BUILDING: