

All costs are \$x1,000

2019 Final VEA Generator Interconnection Unit Cost Guide	"Voltages"		138 kV

Revised as of: 01/29/2019

Equipment Categories

Equipment Categories	Units		
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New Substation Equipment

Complete 3-CB ring bus Substation, equipped with one line position to terminate a single gen-tie with as many as (2) outgoing lines.		6,330
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New Substation Equipment

Transformer Banks:

230/138 kV	per unit	2,950
(Add additional options)		

Line Positions to terminate gen-ties and Transformer Bank positions

Single Breaker (add third breaker to breaker and a half)	per unit	680
Breaker and a half (2CB)	per unit	1,330
Breaker and a half (3CB)	per unit	2,140
Double Breaker (2CB, double bus)	per unit	1,300

Double Operating Bus Sections - 2 new buses, spanning 2 positions	per unit	1,240
Double Operating Bus Sections - 2 new buses, spanning 4 positions	per unit	2,375

Sectionalizing Breaker	per unit	
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Shunt Capacitors	per unit	
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Miscellaneous Equipment (see comments)

Bus Tie (1CB)	lump sum	
Shunt Reactors	lump sum	
Phase Shifter	lump sum	
Ground Bank	lump sum	
Series Capacitors	lump sum	
Static VAR Compensator (SVC)	lump sum	
Tertiary Reactors (1 reactor, 1 bay)	lump sum	

Gas Insulated Substation (in lieu of open air construction) lump sum

Replacement Substation Equipment

Line drops (Tie Downs)- 3 phases	lump sum	
Circuit Breakers (including replacement of foundation)	per unit	360
Circuit Breakers (without TRV caps)	lump sum	
Transient recovery voltage capacitors (set of 3, separate from CBs)	lump sum	
Disconnect switches (incl. steel structures and foundations)	per unit	142
Line protection relays (other end of line)	per set	340
Wave Trap - 1 phase only	lump sum	
Wave Trap removal	lump sum	

New Protection Equipment

New RAS	lump sum	
RAS Relays	lump sum	
Additional set of bushing current transformers (3) at existing CBs	lump sum	

Information Technology (IT) Equipment

IT interface equipment - Control Rooms		
Communication rack placed in existing B station MEER bldg	per set	
Comm. Rack with own environmental enclosure	per set	
Full Comm. package for AA or A stations	per set	
Prefab communications building	per unit	
48V DC power supply for comm. equipment	per set	
100' self-supporting comm. tower (3 legs)	per unit	
120' self-supporting comm. tower (4 legs)	per unit	
IT interface equipment - miscellaneous equipment		
Light wave terminal	per unit	
Microwave terminal and dish antennas	per set	
Dehydrator for microwave antennas	per unit	
Channel bank	per unit	
Digital Access Cross Connect (DACCS)	per unit	
Network synchronization equipment (BITS clock)	per unit	
Large router for network access to work bases	per unit	
Small router for equipment monitoring, "data beyond SCADA"	per unit	
T1 cross connect	per unit	
Fiber to Telco connection (high voltage protected)	per unit	
Satellite Terminal for "RTU only" locations	per unit	
IT interface equipment - T/L		
Fiber optic cable on existing poles	per mile	
Fiber optic cable on new poles	per mile	

New HV Transmission Line

Double Circuit, Strung on both sides, Tubular Steel Pole	per mile	3,250
Single Circuit, Tubular Steel Pole	per mile	2,000

SubTransmission Line (Overhead Facilities)

SubTransmission Line (Underground Facilities)

Removal of HV Transmission Line (complete tear down)

Double Circuit	per mile	615
Single Circuit	per mile	424

Reconductor/Upgrade Transmission Line

Double Circuit, Strung on both sides, Tubular Steel Pole	per mile	2,495
Single Circuit, Tubular Steel Pole	per mile	1,480

Metering

Upgrade of existing RTUs	lump sum	
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Lump Sum costs below are in addition to per-unit or lump-sum costs listed above:

Notes/Comments:

VEA does not currently have 500 kV facilities on their system. 500 kV connections will be estimated on an as-needed basis.

We are estimating the cost of a three breaker ring bus interconnection substation at 138 kV. The station typically is designed with the capability to be expanded to a multi-bay Breaker and a Half station. Transformer cost is not included.

Unit cost of transformer banks reflects cost of a 100 MVA rated transformer for the given voltage. Includes disconnects and additional relaying.

Position cost estimate includes cost of any related disconnect switches and protection equipment located within the position

Typical configuration includes "pair" of N/S or E/W buses
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If required these items will be estimated as a lump sum

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Not typical, would be estimated as a Lump sum, if GIS required.

Not typical to the VEA system.

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Will be estimated as needed.

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Assumes no environmental, permitting or ROW acquisition.

SubTransmission not typical to the VEA system.

Assumes removal of old poles.

Assumes removal of existing conductor and installation of new.

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Equipment Categories	Units		
Engineering costs	lump sum		
Capitalized Licensing and Permitting Costs, including mitigation measures, FAA permits, etc.	lump sum		
Civil work: Site Preparation including site grading, ground grid, and walls/fencing/containment	lump sum		
General Facilities: station light & power, backup generator, station utilities (water, gas, etc. if manned substation)	lump sum		
Substation Control (MEER) Buildings	lump sum		
Incremental cost for transmission line crossings (roads, streams, rail, highway, other TL)	lump sum		
Land cost for substations and T/L ROW	lump sum		
Incremental cost of soil/geotechnical mitigation measures	lump sum		
Incremental environmental monitoring and mitigations	lump sum		
Corporate Overheads (A&G, P&B, and AFUDC)	lump sum		
Income Tax Component of Contribution (ITCC)	lump sum		

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Will be estimated as needed.

ESCALATION OVERVIEW :

Current VEA Unit Cost Guide as posted on the CAISO website is in 2019 Constant Dollars.

VEA's cost estimating is done in 2019 constant dollars and then escalated over the years during which the project will be constructed, arriving at project costs in 2019 Constant Dollars Escalated to OD Year.

DEFINITIONS :

Project Cost in 2019 Constant Dollars represents the cost of the Project if all costs were paid for in 2019.

Project Cost Escalated to OD Year represents the cost of the Project if all costs were paid for in the OD Year.

Mathematical formula: Constant Dollars Escalated to OD Year = Cost in Constant Dollars + Escalation to OD Year
= Cost in Constant Dollars x Escalation Factor

Proposed Escalation Rate - Effective 1/1/2019												
	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Escalation Rate	5.53%	2.72%	2.44%	2.35%	2.08%	2.21%	2.19%	2.22%	2.18%	2.25%	2.00%	2.14%
Escalation Factors	0.9736	1.0000	1.0244	1.0485	1.0703	1.0940	1.1179	1.1428	1.1677	1.1939	1.2178	1.2439

2018 - 2028 Q3 2017 IHS GI Forecast
2029 3-year average escalation rate (2026-2028)
Note: These escalation rates apply to Transmission Capital Projects.