

Basis of Estimate

1. WBS ID 1.2.5 **Total cost for this WBS: \$64,401**

2. WBS Name Power Generation

3. Estimated by Ian McEwen & Barb Birrittella (University of Wisconsin)

4. WBS Dictionary Description

Includes evaluation and repairs, logistics and sub-contract arrangements for the overhaul and repairs of the IceCube Gen1 Generators, Power Distribution Module, and Electrical Grid. Design, specification, procurement, integration, and testing of power generation systems, generator exhaust heat recovery systems; Procurement and fabrication of replacement skis; Design review/procurement of breakers, connectors, etc replaced/removed by previous custodians.

5. Assumptions and Related Documents

The estimates described in this document rely on the following assumptions, which are consistent with the Project’s “Key Assumptions” document” (1) and the “Cost Estimating Plan” (2).

- The cost estimate technique classifications (A-L) follow the US Government Accountability Office (GAO) best practices. These are summarized in the Project’s Key Assumptions document (1). The techniques are: A=Analogy; C=Engineering build-up; D=Expert opinion; E=Extrapolation from actuals; F=Parametric; L=Learning Curves.
- Contingency codes are assigned to each item: C1—C8. These reflect the estimated uncertainty in the estimate. The meanings of the contingency codes and the percentage of contingency in each case are described in the Key Assumptions document (1).

6. Scope

1.2.5 is comprised of the following L4 elements. The scope of this BOE covers 1.2.5.2 and 1.2.5.4 in PY5-8. There are no more costs in 1.2.5.1 nor 1.2.5.3.

1.2.5.1	Generator 1	Develop IceCube Generator -1 overhaul, integration, and tune-up statement of work. Arrange and facilitate sub-contract with Caterpillar engineers to perform overhaul work. Develop specifications, procurement plans, integration and testing, commissioning.
1.2.5.2	Generators 2, 3, and PDM	Develop IceCube Generator 2, 3, and PDM evaluation and testing plans. Procure Caterpillar sub-contractor to deploy and implement generator tests, tune-up, and identify/perform repairs, as well as troubleshoot PDM synchronization. Develop specifications, procurement

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		plans, integration and testing, commissioning. Fabricate replacement skis for 3 generator modules, 1-PDM, 1-Reel Container
1.2.5.3	ISO 3 Sled	N/A - Task Removed
1.2.5.4	System Electrical Distribution	Evaluate EHWD electrical distribution system, define requirements, design/build, testing.

7. Equipment, Materials, Supplies, Travel

1.2.5 only contains equipment procurements, which are capitalized as part of the larger power generation subsystems. There is no M&S and no travel in 1.2.5.

7.1. Equipment

The Power Generation equipment is listed in the table below.

1.2.5 CapEx ☆

Grid View | 2 Sheets | 10 Columns | 4 Filters | Group | Summarize | 1 Sort

WBS	Activity	12mo Subtotal PY5	12mo Subtotal PY6	12mo Subtotal PY7	12mo Subtotal PY8	Insti...	Estimating Technique	Contingency
1.2.5.2.6	GEN-2, 3, PDM - Procure Batteries	\$2,000	\$0	\$0	\$0	PSL	C - Engineering Bt	C2
1.2.5.2.7	GEN-2, 3, PDM - Generator 2 Subcontract Repairs in New Zealand	\$14,804	\$0	\$0	\$0	PSL	C - Engineering Bt	C2
1.2.5.2.8	PDM - Procure Batteries	\$600	\$0	\$0	\$0	PSL	C - Engineering Bt	C2
1.2.5.4.10	Elec Dist. System: System Electrical Resupply (PY7)	\$0	\$0	\$5,000	\$0	PSL	D - Expert Opinior	C4
1.2.5.4.3	Elec Dist. System: Design & Procure	\$5,460	\$0	\$0	\$0	PSL	D - Expert Opinior	C4
1.2.5.4.8	Elec Dist. System: System Electrical Resupply (PY6)	\$0	\$5,000	\$0	\$0	PSL	D - Expert Opinior	C4

Total equipment cost is \$32,864. 53% of the total equipment cost is based on engineering buildup from quotes or catalog pricing. The remaining 47% is based on expert estimates on future season-to-season resupply needs.

7.2. Materials & Supplies

No M&S included in this WBS area.

7.3. Travel

There is no travel in this WBS area.

8. Labor

Labor includes specification, procurement, vendor communications, and shipping preparation. The breakdown is given in the table below.

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All labor estimates are based on expert opinion.

8.1. Labor Estimate

Labor to support the procurement of the equipment is given in the table below.

8.2. Summary of Labor Resources

1.2.5 Labor Hours ☆

Grid View | C | 2 Sheets | 11 Columns | 4 Filters | Group | Summarize | 1 Sort

WBS	Activity	Resource ID	LPY5	LPY6	LPY7	LPY8	Institution	Estimating Technique	Contingency
1.2.5.2.10	GEN-2, 3, PDM - Predeployment Coordination with Power Generation Technical Support Subcontract Vendor (PY6)	EN-ME	40	40	0	0	PSL	D - Expert Opinion	C4
1.2.5.2.6	GEN-2, 3, PDM - Procure Batteries	EN-ME	8	0	0	0	PSL	D - Expert Opinion	C2
1.2.5.2.9	GEN-2, 3, PDM - Develop SOW for South Pole Power Generation Technical Support Subcontract & Communicate with Vendor	EN-ME	0	40	0	0	PSL	D - Expert Opinion	C3
1.2.5.4.10	Elec Dist. System: System Electrical Resupply (PY7)	EN	0	0	24	0	PSL	D - Expert Opinion	C4
1.2.5.4.10	Elec Dist. System: System Electrical Resupply (PY7)	TE	0	0	24	0	PSL	D - Expert Opinion	C4
1.2.5.4.3	Elec Dist. System: Design & Procure	EN-EE	20	0	0	0	PSL	D - Expert Opinion	C4
1.2.5.4.5	Elec Dist. System: Build and Test Subcomponents	EN-EE	36	0	0	0	PSL	D - Expert Opinion	C4
1.2.5.4.8	Elec Dist. System: System Electrical Resupply (PY6)	EN-EE	0	24	0	0	PSL	D - Expert Opinion	C4
1.2.5.4.8	Elec Dist. System: System Electrical Resupply (PY6)	TE	0	24	0	0	PSL	D - Expert Opinion	C4

9. References

[Ref-1] 1. **IceCube Upgrade Project. Key Assumptions for the IceCube Upgrade Project.**

[Ref-2] 2. —. *Cost Estimating Plan.*

Revision History

Date	Revised by	Summary of changes
2022-03-04	Barb Birrittella	Initialized document
2022-04-01	V. O'Dell	Updated tables
2022-04-08	Terry Benson	Updated tables