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Dry Cell Battery Factory

Feasibility Study

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DIGITAL REPORT

Electrical Manufacturing · Ethiopia

A 40-million-unit-per-year zinc-carbon (AA and C size) battery plant in Addis Ababa, Ethiopia



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1 Executive Summary

This study assesses the establishment of a plant producing 40 million zinc-carbon dry cell batteries a year, in the AA and C sizes, in Addis Ababa. Dry cell batteries power portable devices such as radios, flashlights, wall and table clocks and remote controls, and are used by both rural and urban households.

Ethiopia's requirement for dry cell batteries is met entirely through imports. The present (2012) demand is estimated at 215.3 million units and is projected to reach 228.5 million units by 2015 and 267.7 million units by 2023.

The principal raw materials (steel casing, zinc casing, steel plates, polyethylene, cardboard paper, sealing rings, electrolyte paste and carbon electrodes) are imported; labels and packing materials are sourced locally.

The total investment cost, including working capital, is Birr 41.83 million, of which Birr 5.73 million (13.7%) is required in foreign currency. At a factory-gate price of Birr 3.00 per unit, the IRR is 42.0% and the NPV at a 10% discount rate is Birr 78.32 million. The result is sensitive to the selling price (Section 8.5). The plant will employ 108 people.

Table 1.1: Project at a glance

Item	Description
Product	Zinc-carbon dry cell batteries, AA and C sizes
Location	Industrial zone, Addis Ababa
Plant capacity	40 million units per year (300 working days)
Production programme	75% of capacity in the first operating year, 85% in the second, 100% thereafter
Main raw materials	Zinc and steel casings, electrolyte paste, carbon electrodes, steel plates, sealing rings
Land / built-up area	2,000 m² / 1,000 m²
Employment	108 persons
Total investment	Birr 41.83 million (fixed investment Birr 14.64 million)
Financing	30% equity, 70% bank loan at 10%
Price base	Constant 2012 prices, Ethiopian Birr

Table 1.2: Key financial indicators

Indicator	Value
Annual sales at full capacity	Birr 120.00 million
Annual production cost at full capacity	Birr 102.02 million
Internal rate of return (IRR)	42.0%
NPV at 10% discount rate	Birr 78.32 million
NPV at 18% discount rate	Birr 43.23 million
Payback period	About 2.5 years from start of operation
Break-even sales (full-capacity year)	22.5% of sales (12.6% on a cash basis)
Corporate income tax over project life	Birr 43.95 million

The project substitutes imports and saves foreign exchange, supplies a product used throughout the country, and generates income tax and payroll tax revenue.

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3.2 Demand Projection

Demand for dry cell batteries is related to population growth and to ownership of devices that use them. Since most rural areas still lack access to electricity, batteries will remain in use even as electrification expands. Balancing the dampening effect of electrification against population growth and rising device ownership, demand is projected to grow by 2% a year (Table 3.2).

Table 3.2: Projected demand for dry cell batteries, 2013–2023 (million pieces)

Year	Projected demand
2013	219.6
2014	224.0
2015	228.5
2016	233.0
2017	237.7
2018	242.5
2019	247.3
2020	252.3
2021	257.3
2022	262.4
2023	267.7

Source: Study projections.

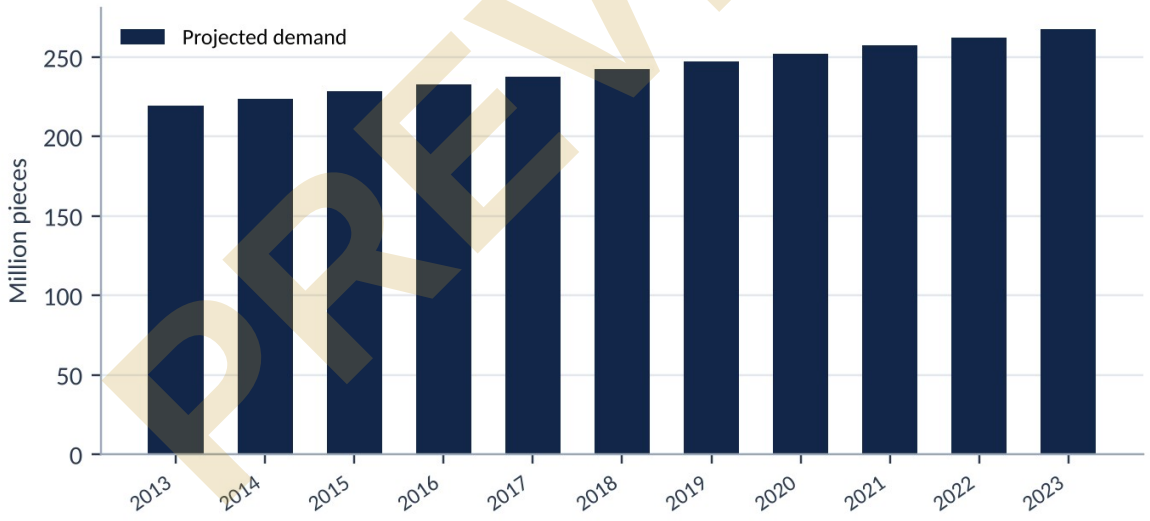


Figure 3.2: Projected demand for dry cell batteries, 2013–2023

Source: Table 3.2.

Demand rises from 219.6 million units in 2013 to 228.5 million in 2015, 252.3 million in 2020 and 267.7 million in 2023.

3.3 Pricing and Distribution

Battery prices vary with size, capacity, brand and application. The average CIF import price in 2011 was Birr 2.57 per unit; imported batteries reach the market at a higher price once import duties, taxes, clearing and distribution costs are added. The financial analysis adopts a factory-gate price of Birr 3.00 per unit. Section 8.5 shows the effect of a lower price.

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6 Technology and Engineering

6.1 Production Process

The plant assembles zinc-carbon cells from purchased components and paste (Figure 6.1):

- Zinc can preparation: zinc casings, which form the negative electrode and the container, are inspected and cleaned.
- Paper lining: a paper separator is inserted into the can to keep the electrodes apart while allowing ions to pass.
- Paste filling: the can is filled with electrolyte paste, a mixture of manganese dioxide, carbon and electrolyte that forms the positive electrode.
- Carbon electrode: a carbon rod is pressed into the centre of the paste to act as the current collector.
- Sealing: a sealing ring and sealing compound close the top of the cell, leaving space for gases formed in use.
- Capping and casing: the upper and lower steel plates are fitted as terminals, and the cell is enclosed in a steel jacket.
- Ageing, testing and finishing: cells are aged, tested for open-circuit voltage and short-circuit current, labelled and packed.

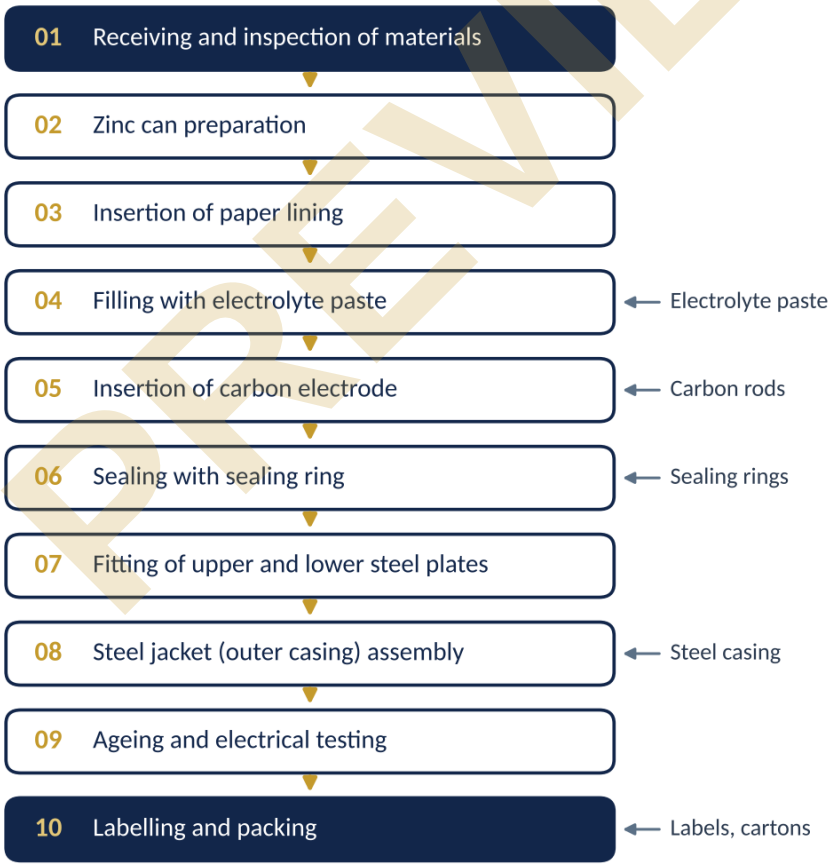


Figure 6.1: Dry cell battery assembly process

6.2 Environmental Impact

Zinc and manganese, the main materials in zinc-carbon cells, do not pose serious environmental difficulties. The principal potential pollutant historically associated with batteries is mercury, formerly added to the zinc to

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8.4.5 Net Present Value

Net present value (NPV) is the sum of the project's net cash flows discounted to Year 1. At the base-case discount rate of 10%, the NPV is Birr 78.32 million. Table 8.4 shows the NPV at higher discount rates, which reflect the higher cost of capital prevailing in the Ethiopian market.

Table 8.4: Net present value at alternative discount rates

Discount rate	NPV (Birr '000)	Result
10% (base case)	78,323	Positive
15%	54,191	Positive
18%	43,227	Positive

Source: Calculated from the net cash flows in Table A.5.

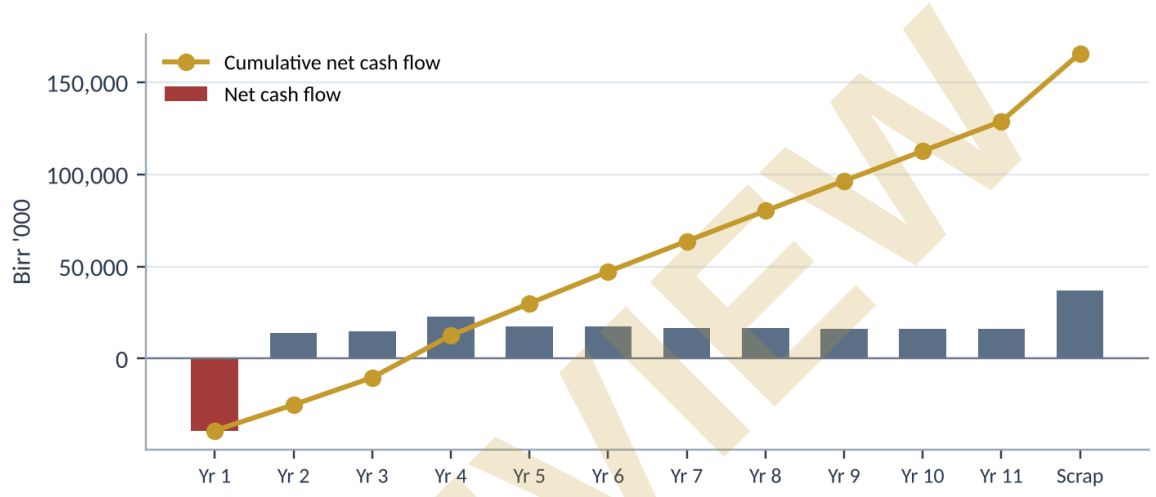


Figure 8.2: Net cash flow and cumulative net cash flow over the project life

Source: Table A.5.

8.5 Price Sensitivity

Raw materials make up more than 90% of production cost, so profitability depends heavily on the selling price. Table 8.5 shows the approximate effect of selling at Birr 2.60 per unit, close to the 2011 CIF import price, with all costs and working capital held constant and income tax adjusted at 30% in taxable years.

Table 8.5: Approximate effect of a lower selling price

Indicator	Birr 3.00 per unit (base case)	Birr 2.60 per unit
Annual sales at full capacity (Birr million)	120.00	104.00
IRR	42.0%	11.3%
NPV at 10% (Birr million)	78.32	3.19
NPV at 18% (Birr million)	43.23	−12.43

Source: Calculated from Table A.5.

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