Earned Value Management Case Study

Detail	Description
Project Name	Greenfield Power Plant (GPP)
Type	EPC (Engineering, Procurement, Construction)
Scope	Design, procure, and construct a 500MW natural gas power plant.
Duration (Baseline)	30 Months
Budget at Completion (BAC)	$500 Million USD
EVM Challenge	Managing integrated cost and schedule performance across three distinct phases (E, P, and C) and providing transparent performance reports to stakeholders.

EVM Implementation Strategy

The project management team established a robust EVMS (Earned Value Management System) from the outset, focusing on the following key steps:

1. **Work Breakdown Structure (WBS):** A detailed WBS was created, and the project budget ($500M) was allocated down to the **Work Package** level, establishing the **Planned Value (PV)** baseline for each period.

2. **Earned Value Rules:** Specific progress measurement techniques were defined for each phase:
    - **Engineering:** Milestone completion (e.g., 50% design complete, 90% drawing approval).
    - **Procurement:** Deliverable-based milestones (e.g., Purchase Order placed, Vendor Data Received, Equipment Delivered to Site).
    - **Construction:** Physical measurement (e.g., cubic meters of concrete poured, feet of pipe installed).
3. **Data Collection:** A centralized Project Management Information System (PMIS) was used to collect **Actual Costs (AC)** and track the achievement of progress milestones (to calculate **Earned Value (EV)**) in real-time.

📉 Project Scenario and EVM Analysis (Month 12)

After 12 months of execution, the project team conducted a formal EVM analysis.

Key EVM Metrics

The project's status at the end of **Month 12** was:

- **Planned Value (PV):** $200,000,000 (The planned budget for the work scheduled to be completed by Month 12).
- **Earned Value (EV):** $180,000,000 (The budgeted value of the work actually completed by Month 12).
- **Actual Cost (AC):** $210,000,000 (The actual money spent by Month 12).

Performance Calculation

Using the core EVM formulas:

Metric	Formula	Calculation	Result	Interpretation
Schedule Variance (SV)	$EV - PV$	$180M - $200M$	- $20M	Behind Schedule

Cost Variance (CV)	$EV - AC$	$180M - 210M$	-$30M	Over Budget
Schedule Performance Index (SPI)	EV / PV	$180M / $200M$	0.90	For every dollar of planned work, only $0.90 was completed.
Cost Performance Index (CPI)	EV / AC	$180M / $210M$	0.86	For every dollar spent, only $0.86 worth of work was earned.

Monitoring and Control Actions

The clear, objective data provided by EVM triggered immediate corrective action, which would have been missed by simply comparing the planned budget ($200M) to the actual cost ($210M), a mere $10M overrun that doesn't account for the lack of progress.

1. Root Cause Analysis (Drill Down)

- The EVM report allowed the team to **drill down** into the negative variances (SV and CV).
- **Finding:** The major $ variance}}$ was identified in the **Procurement** phase, specifically for long-lead equipment (e.g., the main turbine) where vendor submittals were delayed, halting subsequent Engineering and Construction activities.
- **Finding:** The major $\mathbf{CV \text{ variance}}$ was traced to the **Engineering** phase due to unexpected rework caused by late design changes from the client and using more senior, higher-cost engineers for basic tasks.

2. Corrective Actions

- **To address the Schedule Variance (SPI = 0.90):**
  - The project manager immediately held a risk mitigation meeting with the main vendor to expedite the long-lead item submittals.
  - A 'fast-tracking' strategy was implemented, accelerating certain non-critical **Construction** activities (e.g., site preparation) that could proceed without the delayed equipment drawings.
- **To address the Cost Variance (CPI = 0.86):**
  - The Engineering Manager was instructed to implement a **mix of resources**,

shifting basic drawing review tasks to junior engineers to reduce the average hourly rate.
  - A formal **Change Request** process was enforced with the client to secure funding for the documented rework due to late design changes.

3. Forecasting

Estimate At Completion (EAC) = AC+(BAC-EV)/CPI

- Estimate At Completion - EAC
- Actual Cost - AC
- Budget At Completion (BAC)
- Earned Value - EV
- Cost Performance Index (CPI)

EAC = 210 + (500-180) / 0.86 = 582.093

Another way

EVM allowed the team to forecast the likely final outcome using the performance indices:

- **Estimate at Completion (EAC):** The forecast final cost, assuming current cost performance (CPI) continues.
  - $EAC = BAC/CPI$
  - $EAC = \$500M/0.86 \approx \mathbf{\$581.4}\text{ Million}$
- **Estimate Time to Complete (ETC):** (Using the basic formula for simplicity, assuming the original duration is adjusted by SPI).
  - $EAC_{Time} = OriginalDuration/SPI$
  - $EAC_{Time} = 30\text{ Months}/0.90 \approx \mathbf{33.33}\text{ Months}$

Conclusion and Result

By proactively applying EVM, the project team:

- Identified the $30 Million cost overrun and $ 20Million behind-schedule as a single, integrated performance issue.
- The forecast (EAC of $581.4M and 33.33 months) provided a **data-driven warning** to management and the client, allowing for a timely budget increase request and a revised schedule baseline.
- The corrective actions taken between Month 12 and Month 18 led to an improvement in the CPI and SPI, ultimately delivering the project with an actual cost of **$545 Million** and a duration of **32 Months**, significantly better than the initial forecast of $581.4M

and 33.33 months.

EVM transformed the project from a likely failure point (high risk of significant overruns) into a controlled recovery, demonstrating its power in **integrating scope, schedule, and cost** for effective control

TCPI to Achieve the Original Budget at Completion (BAC)

This calculation answers the question: "What CPI must we achieve on the remaining work to finish the project within the original $\mathbf{\$500 \text{ Million}}$ budget?"

The formula is:

$$\text{TCPI}_{(\text{to BAC})} = \frac{\text{BAC} - \text{EV}}{\text{BAC} - \text{AC}}$$

Metric	**Value**
BAC (Original Budget)	$500,000,000
EV (Earned Value)	$180,000,000
AC (Actual Cost)	$210,000,000

$$\text{TCPI}_{(\text{to BAC})} = \frac{\$500\text{M} - \$180\text{M}}{\$500\text{M} - \$210\text{M}} = \frac{\$320\text{M}}{\$290\text{M}} \approx \mathbf{1.10}$$

Interpretation

A TCPI of **1.10** means that for every $1.00 spent on the remaining work, the project team must earn $1.10 worth of value.

Given the project's current CPI 0.86, achieving a CPI of **1.10** on the remaining 60% of the project is extremely difficult, if not impossible. This confirms the original BAC is no longer a viable financial target.