

Aditya Aluminium

Aditya has achieved several awards and accolades on energy as per attached list.



Case Study Snapshot

Industry	Metal
Product/Service	Pig Ingot, Sow Ingot, Primary Foundry Alloy
Location	Aditya Aluminium (A Unit of Hindalco Industries) At/Po- Lapanga, Dist Sambalpur-(Odisha)
Energy performance improvement percentage (over the improvement period)	3 % improvement over 2 years (2021-22)
Total energy cost savings (over the improvement period)	USD 17,804.73
Cost to implement Energy Management System (EnMS)	USD 109376.43
Total energy savings (over the improvement period)	422723 MWh
Total CO₂-e emission reduction (over the improvement period)	380451 Metric Tons

Organization Profile / Business Case



Aditya Aluminium (AA), a unit of Hindalco Industries Limited is a part of Aditya Birla Group (ABG). Hindalco Industries Limited, the metals flagship company of the Aditya Birla Group, is having a consolidated turnover of **USD 52 billion**.

Aditya Aluminium (AA) operates at its rated capacity of 3.80 lakh tons of aluminium per year. Power, which is considered as base raw material for production of aluminium, is generated in its 150MW*6Nos (total 900MW) coal based thermal Captive Power Plant (CPP). The unit is installed with a capital investment of 2 billion USD (Rs.14700 Cr).

In addition to the smelter and CPP, the complex which spreads across 3300 acres in 3 locations, boasts of a modern township, water reservoirs to cater to the plant for 3 months and ash pond for 25 years of the plant life, with an ambition to double the capacity in next few years.

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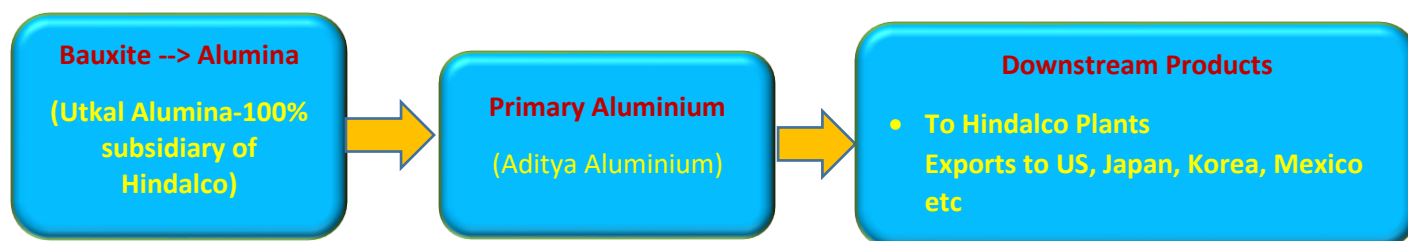
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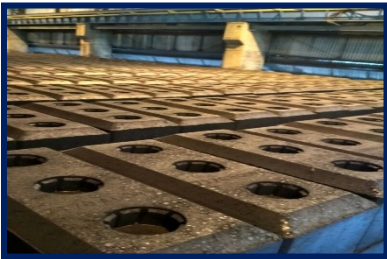
Both smelter and CPP commenced operation in January 2014 and reached full capacity in March 2016. The Plant was **commissioned in a record time of 26 months, a benchmark time for Greenfield project execution in India.** This modern, state-of-the art 360 kilo-amp smelter, is based on Rio-Tinto Alcan's (RTA) AP 36S technology, consisting of a pot line with 360 nos. electrolytic cells, called Pots along with Cast house and Anode manufacturing facilities. Aditya Aluminium has one of the leanest organisation structures among the aluminium producers worldwide with an excellent level of productivity. The unit employs approx 1293 nos. direct and 2076 contract employees.

Aditya Aluminium has the lowest conversion cost currently in the country and has emerged as a leader among premium primary aluminium producers in the international market. The unit is certified for QMS (ISO 9001:2015) , EMS (ISO 14001:2015) , OHSAS(ISO 45001:2018) ,EnMS(ISO 50001:2018)) and both its primary products i.e. Pig Ingots and SOW ingots are registered under London Metal Exchange (LME), thus getting brand recognition in global Aluminium market.

PRODUCTS



Aditya Aluminium produces following products:

SOW 		INGOT 
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- Primary aluminium registered with London Metal Exchange (LME)
- High purity aluminium pig ingots each weighing 23 kg.
- High Purity SOW ingots each weighing 450 kg.
- Carbon baked anodes 1550 X 650 X 660 mm weighing 974 kg for own use and 1175 X 800 X750 mm weighing 785 kg each that are supplied to the sister plant at Hirakud.

About 90% of metal ingots are supplied to international customers in USA, Korea, Japan, European Union and 10% in the domestic market spanning over all geographical zones in the country. The ingots strapped in bundles of 1 T are shipped to the various ports and distribution centres through railway wagons and trucks.

TECHNOLOGY AND EQUIPMENT : Smelter - The unit uses best in class, latest technology which is far more efficient, environment friendly and cost effective. AP technology provided by RTA, is considered as one of the best technologies available worldwide for smelting of aluminium. AA has opted for AP36S technology which is well proven and first of its kind in India.

CPP -The CPP consists of 6X150 MW, units of BHEL. The customised 150 MW, reheat and regenerating cycle with air cooled, environment friendly generators are first of its kind in India. The dry bottom ash handling system designed and

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supplied by Magaldi, Italy is eco-friendly and helps in enhancing boiler efficiency. To handle emergency situation, black start DG (7X 2.5 MW) has been installed. The unit is equipped with environment friendly high concentration slurry disposal system (HCSD). The plant is having water reservoirs with storage capacity to cater 90 days need of the plant, to meet any eventuality in water supply.

Organisational Relationship

The Unit Head, is overall in charge of Aditya Aluminium. He reports to the Cluster Head; who reports to the Managing Director. All Technical, Finance, HR, WCM, Safety and Environment functions report to the Unit Head.

Key Customers and market segment : Aditya Aluminium caters to the primary aluminium market at international and domestic level. Aluminium ingots produced in the plant are supplied to the international customers as mentioned below including Boeing, Mitsubishi, Gerald, Trafigura, etc. in Japan, US, Europe, Brazil, Mexico in addition to the Domestic market. Due to our unmatched product quality and on time delivery, we have a delighted set of international customers who have been buying metal from us since last 3 years.

Timeline of the unit : - Aditya Aluminium started its commissioning of Pots for producing Aluminium and other activities in **January 2014**. The plant came into full capacity utilization on **March 2016**. Since then the plant operations are stable and exceling in all operating parameters with reference to global benchmark figures. The plant had to overcome the challenges in terms of getting acquainted with modern sophisticated technology, recruiting desired manpower with proper knowledge and skills (despite being in a very remote area), adhering to standard operating procedures (SOPs), extensive training of the operatives and staff to acclimatise to a working environment under a state-of-the-Art technology and enhancing the knowledge and skill levels of the operatives and staff.

De Carbonization: Overview: The commitment of Hindalco business involves, “we manufacture the materials that makes the world Greener, Stronger and Smarter” aligns with the established decarbonization strategies involving efficiency improvements, including renewables and other initiatives like fuel switching and Carbon Capture and Storage and Utilization (CCUS) etc. Associated Energy and Carbon policy enables strong risk management practices providing better opportunities for creating value added products and product stewardship.

- Aditya Aluminium has implemented projects involving a 30 MWp solar plant since November 2018 which is directly integrated with plant switchyard and supplies solar power to the aluminium smelter. An agreement has been signed for supplying another 100 MW of renewable energy starting from FY 2025 to increase the share of renewable energy usage.

Business Benefits

- In Captive Power Plant the auxiliary power consumption got reduced from 8.41% (FY16) to 6.69% (FY23) by implementing Operational control, equipment running optimization , Focus on drive efficiency, fan & Pump efficiency optimization, De-Staging in BFP & CEP VFD installation in CEP & CT fans, CW trimming & Efficiency Optimization , VFD implementation in CEPs, CT fans, Operational control, equipment running Hours optimization
- Reduced AHP Specific power consumption from 12.10(FY21) to 8.89(FY 23) by using some control measures like
 - Stop time increased from 11hrs to 12 hrs by improving the line vacuum from 140 to 170 mmHg
 - Stopping hammer mill & Bottom Ash conveying
 - Running 3+2 unit conveying to run 2/3 IA running
 - Knife gate valve replaced with dome valve
 - Fluidizing blower running optimization

Plan

Gaining the commitment of top decision makers .

1. Top management of the organization has demonstrated leadership and commitment with respect to the energy management system in the following manner :

- a) Accountability of the effectiveness has been accepted; Implementation of requirement against new international standard ISO 50001:2018 have been mobilized by provision of additional resources and trainings to all concerned.
- b) Energy policy, objectives and targets are established, communicated and continual improvement in the system are monitored by conducting repeated cycles of internal audit and Management Review Meeting. Such policy, objectives and targets are compatible with the strategic direction of the organization.
- c) Integration of the EnMS requirements into the organization's core business process affecting energy conservation process is ensured by analyzing the gaps observed during internal audits. CARA done against each such gap and integration of the processes are ensured by constant monitoring of implemented actions.
- d) Process approach is encouraged at all level of working, departmental complexities have been removed as far as possible. A structured and approved process-interaction map is prepared and distributed to all concerned showing hierarchy of operation within the processes.
- e) Top Management has provided all the resources needed to comply standards requirement within its management system for sustainable effectiveness.
- f) Top management has been supporting other relevant management roles to demonstrate their leadership as it applies to their areas of responsibility. It has been ensured that the EnMS implemented is capable to achieve its intended outcome(s). This is being monitored through EnPI on regular basis.
- h) Activities planned and implemented within the organization is promoting continual improvement of energy performance and the EnMS.
- i) An energy management team has been formed and made functional within each process who are responsible to implement EnMS requirement within their respective processes.
- j) Top management has taken necessary steps to direct and support persons to contribute to the effectiveness of the EnMS and to energy performance improvement, by delegating them suitable roles and responsibilities.
- k) Process owners engaged in manufacturing of aluminium or generation of thermal power have been given supporting roles to demonstrate their leadership for effective EnMS implementation in their core responsibility area with energy reduction targets per unit production/generation and meeting the energy targets as laid down through this EnMS or through PAT cycle auditors by BEE.
- l) Energy Performance Indicators (EnPI) have suitable measurement criteria, which appropriately represent energy performance in the processes where it has been implemented.
- m) A change management system is in place to identify and address process specific changes that can affect EnMS output. Any activity or event (i) planned or unplanned (ii) temporary or permanent, which has the potential of high energy impacts arising out of modification to plant/equipment or for meeting local regulation has been identified, quantified and dealt with suitably

The responsibilities and authorities for efficient job performance are clearly defined and is communicated within the organization. Top management and all **process leaders** are authorized to take suitable actions in order to ensure the fulfilment of designated responsibilities to all level of employees. Aim is to ensure that processes are delivering their intended outputs; and are able to promote energy conservation focus throughout the organization;

The responsibility and authority of the personnel are documented in subsequent pages. The responsibility of the key management personnel with respect to the energy management system requirements is tabulated in the Responsibility Matrix.

The responsibility and authority are communicated to the personnel at the time of appointment, during orientation.

The FH-(HR/Admin) communicate temporary change of authority and responsibility directly to the personnel concerned. Management ensures that responsibility and authorities are commensurate with the scope of each job title.

Financial commitments and resources : - Organization has implemented a system to monitor that adequate provision of resources have been made considering existing internal and external resources required. Internal resources include testing and measuring instruments, power factor meters, meggers, earth resistance testers, ampere meters, thermographs etc. External resources include agencies engaged in undertaking NDT works, condition monitoring work, repairing and maintenance of critical & significant energy consuming equipment's, accredited calibration agencies etc.

Understanding energy consumption and use : - The Aditya has determined:

- a) the methods for monitoring, measurement, analysis and evaluation needed to ensure valid results; including objectives and energy targets, EnPI(s) and operation of SEUs.
- b) Actual versus expected energy consumption
- c) the methods for monitoring, measurement, analysis and evaluation to ensure valid results.
- d) frequency of such measurements including sampling and testing procedures;
- e) analysis and evaluation of monitoring and measurement results.

Process specific energy performance results yield to the organization level energy performance. Such energy performance and the sustainable effectiveness of EnMS is regularly monitored and evaluated as per standard procedures of continual improvement.

Significant deviations in energy performance (Targeted vs. actual) is analysed through various methods to identify the root cause for such deviations and is then responded to respective process owners with further implementation plan to mitigate such gaps. Monitoring and measurement of energy performance data are retained as per AA policy.

All the data and information arising from monitoring and measurement are analyzed and evaluated through various methods including statistical techniques to ascertain the following :

- a) Conformity of energy management system;
- b) The degree of energy performance of processes;
- c) To verify that planning has been implemented effectively;
- d) The effectiveness of actions taken to address risks and opportunities;
- e) The performance of external providers;
- f) The need for improvements to the energy management system.

Process for reviewing and analyzing energy use, deciding where to focus resources, and prioritizing action.

- Internal audits are conducted to verify any non-conformity existing in EnMS of the organization at least once in a year by competent and certified internal auditor either from within the organization or by auditors outsourced for the purpose.
- If any non-conformity is observed by the auditor, the same is recorded in "Internal Audit Findings" format and expected closure date of said NCR is annotated.
- Corrections are done immediately to eliminate the existing non-conformities by reinstating the NC before it occurred.
- Subsequently, Root Cause Analysis is carried out in order to find out the proximate and most prominent cause of such NC's existed in the system. All the possible causes are analysed to arrive at the most prominent cause and is then designated as the root cause of non-conformance that has occurred. Appropriate corrective actions are then initiated to remove the potential recurrence of same or similar non-conformance.
- Preventive actions/ Risk Assessment are initiated afterwards to avoid occurrence of potential new problems. All the corrections, corrective actions and RCA are updated in the "Internal Audit Findings" format for further use and review of the effectiveness of the actions taken for continual improvement. All such actions are reviewed during

Core committee Meeting and daily review meetings conducted from time to time. Effectiveness is also monitored during subsequent internal audits. Records are maintained appropriately.

- A documented procedure has been established for conducting Internal Audits; and records are maintained of such audits and actions taken thereof.

Management Review Meetings are organized minimum **once in a year** to be chaired by Unit Head after circulating prior agenda to all process owners. Energy objectives, targets, achievements, NCR's, Internal and external audit reports, follow-up actions taken on previous MRM's, EnPI including suggestions from PAT-3 cycle auditors are taken as inputs to such review meetings.

Organization has determined and selected opportunities for improvement and implement any necessary actions to meet energy performance expectations and enhance energy efficiency. These include:

- a) improving performance of the equipment's as well as to address future needs and expectations;
- b) correcting, preventing or reducing undesired effects of SEU's;
- c) improving the performance and effectiveness of the energy management system.

Examples of improvement can include correction, corrective action, continual improvement, breakthrough change, innovation and re-organization.

- SEUs, which does not conform to requirements, is identified and controlled to prevent further unintended use or delivery.
- The controls and related responsibilities and authorities for dealing with non-conforming energy performance are defined.
- Non-conforming processes are dealt with by one or more of the following ways:
 - By taking action to eliminate the detected non-conformity.
 - By establishing a procedure to avoid such energy performance gaps in future.

Then non-conforming performance is detected, appropriate action to the effects or potential effects of the non-conformity is taken.

Necessary control procedures are established to carry out this activity throughout the organization. Rigorous controls are initiated if any energy efficient process/equipment is required within the system, once the performance of such equipment/process becomes questionable. RCA is done by analysing the data to arrive at root cause. Corrective and preventive actions are initiated to avoid the occurrence and recurrence of non-performing incidences. It is ensured by concerned process owners that actions are effective.

a) Corrective Action

- Appropriate corrective action is taken to eliminate the cause of non-conformities
- Documented procedure is established to define requirements

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Do, Check, and Act

First of all according to the standard unit decided to go for certification & before that unit prepare the required documents to get certified like EnMs Manual, EnMS Procedure and department wise Energy Review, Energy Baseline and Register of opportunities. Unit displayed policies all over in the plant and shared soft copies to all the employees then the certification body assesses the whole process and the prepared documents. After that unit was ready for stage 1 audit and after surpassing the audit unit calls for stage 2 audit. After complying all necessary requirements of the stage 2 audit unit was certified. The improvement points that were raised in the audits were successfully implemented with the help of top management.

For motivation top management supports shop floor awareness sessions like celebrating theme of the month related to EnMS and their after the session some of the leaders ask some basic questions to all the employees present over there and appreciate them in front of people so that they get motivated and motivate other employees also to get knowledge on various subjects and get rewarded.

The employees get motivated by appreciation from getting a Bhoomika card, praise, as a quiz winner & awarded in townhall, which are various practices.

In various systems of whole plant the energy measuring devices got installed and the points that have been raised in the audits got complied by which unit improved energy performance & did some energy reduction projects and won awards which motivated others to do more energy improvement projects.

Unit has achieved all the targets on Energy, with action plans for them in place to achieve annualized energy improvements.

- In our unit the system of auditing is twice in a year by which the auditing team recognizes the faults or the good points regarding to energy and that is reviewed to top management and the necessary action is also taken by the auditee team. From there unit determine whether performance has improved or not.

By the documents (Energy Review, Baseline & ROO) the departments SPOC analyzes the data and verify the results. Unit also have a Eureka portal where employees have to put their suggestions & kaizen and the systematic Improvement KFA continuously look after the energy performance improvement.

- Timeframes for your baseline and reporting periods
Its once in a year
- Energy baseline and whether the organization has an energy baseload
It is prepared for 10 sections at Aditya and every year we review the energy baseline
- EnMS Indicators used to monitor and assess energy performance improvements

S. No.	Parameter	UOM	Actual	Base year (2017-18)
1	Avg. Current – Potline	kAmp		
2	Potroom Power –DC	kWh/MT		
3	Potline Auxiliary	kWh/MT		
3	Current Efficiency	%		
4	Plant Heat Rate – CPP	Kcal/Kwh		
5	Auxiliary power - CPP	%		

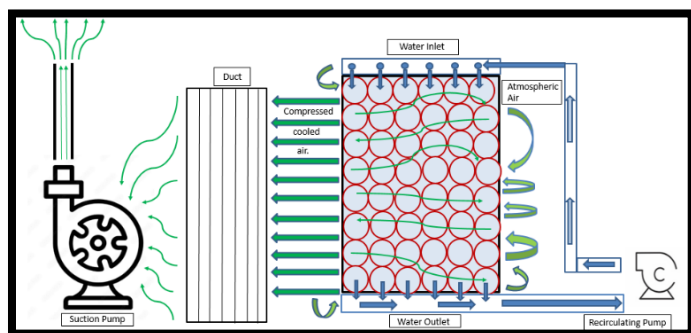
1	Avg. Current – Potline	kAmp		
2	Potroom Power –DC	kWh/MT		
3	Potline Auxiliary	kWh/MT		
3	Current Efficiency	%		
4	Plant Heat Rate – CPP	Kcal/Kwh		
5	Auxiliary power - CPP	%		

- Key high-level equations and explanation to estimate energy savings and energy performance improvement
- Relevant variables affecting energy consumption
 1. Reduce electrical energy consumption of Pot line
 2. Reduce auxiliary power consumption of CPP
 3. Reduce Plant Heat Rate
 4. Reduce Carbon emissions by optimizing energy.
 5. Comply with all legal & other requirements w.r.t Energy & Carbon.
 6. Continuously improve the energy efficiency & reduce GHG emission in every sphere of operation.

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- Method(s) to ensure normalization (If normalization was not used, then rationale must be provided)

Cross check with the energy bills

- What tools and resources were used?
Energy metering system and dashboard for monitoring and review
- As per the International Aluminium 2022 statistics on the Greenhouse Gas Emissions Intensity of primary aluminium production, the full lifecycle cradle to gate greenhouse gas emission intensity for 2021 is 16.6

tonnes of CO₂e per tonne of primary aluminium. This needs to be drastically reduced in order to align with the Net Zero emissions scenario by 2050.

- Acknowledging the energy-intensive nature of our business, we at Aditya Aluminium (AA) believe that our decarbonization strategy will enable us to contribute towards the global commitment of limiting global warming to 1.5 degrees Celsius. AA has started its journey towards Net Carbon Neutrality and aim to achieve it by 2050. In line with this target, long term decarbonization target of the Aditya Aluminium involves emissions reduction by more than 30% by FY 2030 taking FY 2017 as base year.

- How did you prepare for the third-party EnMS audit?

We have engaged M/s LRQA for third party certification for which audit is conducted on annual basis.

Transparency

After making of policy we have displayed it in every place of Aditya where it is visible to all the employees and contractual workers. We also celebrate theme of the month on energy conservation and energy saving where we are aware about the certification and all about ISO 50001

What We Can Do Differently : We shall use multivariate regression analysis with digitization of systems and processes at our plant.

Case Study -1 - : Terakool System, a sustainable cooling system. The structure inspired by Ant Studio and the design inspired by the structure of beehive. We built a cooling envelope using traditional cooling system for a modernized cooling solution in the MCC rooms thus, giving the least impact on the environment during the manufacturing process. It uses eco-friendly element like terracotta pots for creating the cooling effect. Evaporating Cooling is the technique that cools the surroundings by reducing the temperature using water and terracotta pots. The cylindrical pots provided a larger surface area for maximum cooling effect. The recycled water was allowed to flow over the pots. A scalable temperature difference was noticed in the surrounding cooling area.

Case Study -2: Name of Project: **Auxiliary Power Consumption Reduction for Aditya CPP**

- ❖ Implementation year of project: FY 2021-2022

- ❖ Brief Write-up about the project:

Aditya Smelter relies on 900MW captive power plant for continuous and uninterrupted power for smelting operations. Aluminium smelting happens to be one of **the most Energy intensive processes of India**. Around 160 GJ to 170 GJ of energy is consumed to produce one tonne of metal. Power cost comprises to 40% of the entire metal cost. One paisa increase in power cost results to increase in metal cost by 157 Rs/ MT. Due to huge impact of macro-economic factors, controlling cost of production, to be competitive in global markets is a challenge in the present scenario. Here reducing auxiliary power consumption, the CPP process emerges as a great alternative to reduce the OPEX. Aditya's energy team audited and studied the entire production process to identify power losses both in terms of efficiencies and operational losses. **12 nos of initiatives** were identified which had huge saving potential.