

AP60
AP50
AP40
AP30
AP18
AP Technology™
Exceptional value delivery worldwide

Kitimat

AP Technology™
transforms Kitimat
into one of the world's
most efficient and
lowest production
cost smelters.





Editorial

The AP Technology™ success story continues with another industry shaping step change at our doorstep.

The AP Technology™ success story continues at an unprecedented pace with a total of more than two million tonnes of smelter capacity under construction by our customers in Saudi Arabia, India, Canada and around the world. On the carbon front an impressive seven AP Technology™ anode bake furnaces representing about 1.6 million tonnes per annum of capacity are also being built.

On the innovation front our AP60 cell technology is our latest flagship in a long line of industry shaping changes. Designed to overcome the challenges of very high amperage, the AP60 pot is the result of years of continuous and focussed efforts in R&D and pilot-scale operations. First demonstrated at our R&D facilities in France, AP60 lies at the heart of a 38 pot expandable smelter in Jonquière, Canada where construction is well under way. The smelter will be commissioned in early 2013.

Over the last decade the energy input cost for aluminium smelting climbed from an average of 29 per cent of the total production cost to a hefty 36 per cent. That is why our second major AP Technology™ innovation stream is focussed on achieving a step change reduction in specific energy consumption with a target of 11.5 MWh/tAl. We are making excellent progress on this journey with a demonstrated specific consumption of 12.2 MWh/tAl already reached.

As part of our AP Technology™ innovation DNA, we are investing to significantly shrink the smelting industry's environmental footprint as exemplified by our new pot gas emissions reduction system which decreases fluoride pot emissions by 50 per cent. We are also determined to further enhance operator safety through our newly developed remote controlled solutions for cell short-circuiting and open electrical circuit protection.

There is even more good news — I am very excited to announce that we recently created a dedicated team to challenge our industry paradigms in terms of aluminium smelter design and operation with the sole goal of spearheading the next generation aluminium smelter.

It is going to be another exciting year in AP Technology™ as we continue to focus on delivering value-creating innovation and flawless technology transfer to our customers. This newsletter highlights some of the milestones in our AP Technology™ success story for you. I hope that you enjoy reading it.

Vincent Christ
Vice-President, Technology, Equipment Sales & Services and Value Improvement

APXe cell

Driving down energy consumption

In operation for over 125 years, the Hall-Heroult process experienced dramatic improvements in cell productivity with the development of high amperage cells. However energy efficiency gains levelled off after the 1970s. In the coming decades, the challenge of meeting massive demand for aluminium in a restricted energy future will drive the development of low energy cell designs.

Following extensive economic and technical studies, we launched two new cell technologies to address this challenge, using the same generic cell equipment:

- AP60 cell, the benchmark of cell productivity
- APXe, operating at low energy consumption

Over the next few years, these technologies will drive the delivery of optimal solutions for greenfield projects worldwide.

Launched in December 2010, the first APXe cell produced very promising results, achieving the 12.2 kWh/kg target at 500 kA with very low fluoride emission at particularly low gas suction rates. Building on this success, two improved APXe cells will start up in the coming months targeting 11.5 kWh/kg.

Innovations stemming from our APXe cell development can also be deployed in existing smelters to reduce both energy consumption and the environmental footprint. Our AP40 platform leverages the same low energy cell approach with its target of 12.5 kWh/kg at 400 kA.

Managing intellectual property

Key to our competitiveness

At Rio Tinto Alcan, we are constantly improving our AP Technology™ engineering package for aluminium smelters. Our continuous research, development and engineering efforts are essential to both our technology and organisation's competitiveness.

To protect our intellectual property assets and ensure seamless technology transfers, we have developed a comprehensive system to manage sensitive information related to key AP Technology™ components (equipment, materials and activities). Suppliers are accredited and periodically reviewed by us in terms of their policies and procedures. Today 45 companies have been accredited and 15 others are in the process of receiving accreditation.

AP60 Jonquière

Our latest benchmark technology

This enhanced performance technology delivers lower capital expenditure per tonne of capacity, improved labour productivity, reduced operating costs and a shorter construction, commissioning and start-up schedule for a given capacity.

First demonstrated at our research and development facilities in France, the AP60 pot technology will lie at the heart of a 38 pot commercial operation in Jonquière, complete with all the logistical and operational challenges. The multi-phase AP60 technology project will eventually reach a production of 460 kt/y, taking into account real estate limitations (a full single production line generates up to 760 kt/y).

At the end of 2011, the overall AP60 project was progressing on plan at 69.5 per cent. Engineering was 82 per cent completed and all major purchase orders had been awarded.

Technology	1st generation	2nd generation
Scheduled for	First Hot Metal Q1 2013	2014 onward
Current (kA)	570	600
Pot production (tonnes/day)	4.3	> 4.5
Specific energy consumption (MWh/t)	13.3	<13

Both the carbon and reduction areas are starting to receive mechanical equipment. The focus for 2012 is to continue driving the mechanical, electrical and architectural contracts forward.

Following the demonstration phase in early 2013, this unique technology will continue to be developed at Jonquière, further increasing pot productivity, decreasing capital and operating costs as well as reducing energy consumption and the environmental footprint. We are investing to strengthen our global leadership in reduction technologies for the benefit of our pipeline of internal growth projects as well as those of our partners and customers.



Jonquière

Kitimat modernisation project (KMP)

KMP gets the green light!

On 1 December 2011, Rio Tinto signed off on an additional US\$2.7 billion capital investment to modernise our aluminium smelter in Kitimat, British Columbia. This new investment will enable completion of the US\$3.3 billion project in 2014.

KMP will feature:

- a 384 pot potline
- the latest AP Technology™ at 405 kA and 13,150 kWh/t
- a plant layout fully optimised for the site configuration and soil conditions

“The modernisation of Kitimat will transform its performance, moving it from the third quartile to the first decile of the industry cost curve, and cut greenhouse gas emissions by about half,” says Jacynthe Côté, chief executive of Rio Tinto Alcan. “This project draws on two of our greatest competitive advantages – clean, self-generated hydropower and leading-edge AP smelting technology. Once completed, Kitimat will be one of the most efficient and lowest cost smelters in the world, and will better position us to serve the rapidly growing demand for aluminium in the Asia-Pacific market.”

First Hot Metal is scheduled for the beginning of 2014.





Ma'aden AP37 project

Ma'aden – Ras Al Khair smelter

Progressing on track

More than 50 per cent completed, the Ma'aden aluminium smelter project at Ras Al Khair in the Eastern Province of Saudi Arabia is on track to start-up on schedule.

Since the first concrete was poured on 24 October 2010, the Ma'aden project has progressed at a rapid pace. Here's a snapshot of the major milestones achieved.

- all major equipment supply contracts awarded between 2010 and 2011
- key equipment such as the first rectifier transformers in the substation, first pots being installed
- PTA cranes being installed in reduction
- cathode sealing started with the first cathodes sealed and ready to be installed in the pots

The 77 square kilometre site has changed dramatically as dozens of cranes help erect building after building. With nearly 13,000 people on site, our dedicated AP Technology™ experts are working alongside the Ma'aden project team to ensure start-up of the first pot and production ramp-up as scheduled.

Initially the smelter will have two potlines of 360 pots, featuring AP37 technology with a combined capacity of 740,000 tonnes of aluminium per year.

Hindalco projects

On track too!

Progress on the smelter and captive power plants at Mahan and Aditya in India is also proceeding well. With engineering nearly completed and all major equipment contracts awarded, site work is well under way. Here's a quick summary of where we stand.

Mahan

- site grading nearly completed
- focussed on advanced start-up of 32 out of 360 pots with purchased anodes
- concreting, structural works, busbar and pot fabrication and positioning of the first turnkey equipment progressing in all areas
- training of Hindalco technical staff under way at Rio Tinto Alcan smelters

Aditya

- green light given by India's environmental authorities
- site work accelerating
- civil and structural works in full swing in all areas

At both sites AP Technology™ experts are working closely with the project teams.



Mahan
smelter

Tomago

Tomago Aluminium AP24: a success story from start to finish

When Tomago Aluminium (TAC) began looking for a new AP Technology™ pot design to creep its production in mid-2008, it turned to AP24, initially called AP2X.

Under the close supervision of our AP Technology™ R&D teams, the first test pots were started at TAC in a boosted section in early 2009. Excellent collaboration between the TAC reduction team and our own technology teams enabled full validation of the AP24 pots at the end of 2010.

Today more than 20 per cent of the 840 pots at TAC are now equipped with this new AP24 lining. The TAC and Rio Tinto Alcan teams also worked together to adjust and align the older pots with the planned creep roadmap. By December 2011 the average amperage at TAC had increased by 4.6 per cent to 237.8 kA from 227.2 kA in December 2008.

Despite the constraint of having the older AP22 pots running at the upper limit of their operating capacity, TAC is now close to achieving its target of operating its three potlines above 240 kA.

Alouette

Teaming up with Alouette for new AP40LE (Low Energy) development technology

On 14 December 2009 a cooperation agreement was signed with Alouette (AAI) to develop a high amperage and low energy pot for the smelter's low ACD operation. The target was to develop a pot that will operate at around 400 kA with an energy consumption of 12.5 to 12.7 MWh/t using the existing anode dimensions.

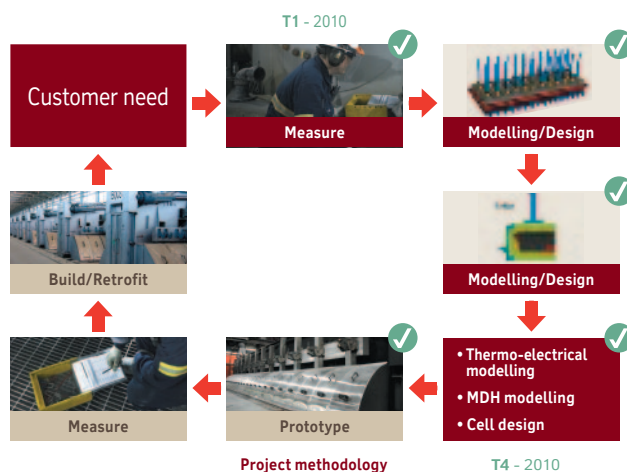
Both partners are bringing their expertise to the table to fast track this new technology. At Rio Tinto Alcan, our expertise is in pot development including pot lining and modelling/design while Alouette is the leader in low ACD operations and low specific energy consumption on AP3X pots.

We started the project using Rio Tinto Alcan R&D cycle development process outlined below.

Pot development cycle used by Rio Tinto Alcan development team

The AP40LE technology is being developed in one of the booster sections of nine pots. Alouette is responsible for starting up and operating these pots.

This win-win project will strengthen Alouette's competitiveness and reinforce our global leadership in smelting technology. AP30 pots can be readily converted to AP40LE with a relatively low capital investment.



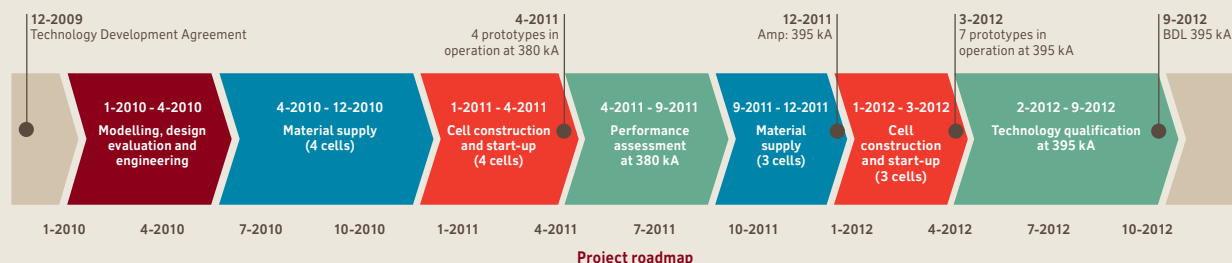
AP40LE project roadmap to meet customer needs and business objectives

The AP40LE project is progressing according to plan and on budget.

The roadmap outlines the main activities from the project start-up in December 2009 to the planned completion in September 2012. In summary, four pots were started at 380 kA, demonstrating the feasibility of making the transition from the old technology to the new AP40LE

solution before creeping the amperage. These pots operated at 380 kA for ten months, performing well and producing very good results.

In January 2012 three others pots were started at 395 kA. Today seven pots are running on target based on our prediction model.





Boyne



Sebree

AP Technology™ baking furnaces

In addition to the five baking furnaces under engineering and construction at Ma'aden, Kitimat and with Hindalco, four other major projects are under way.

Emal

High capacity baking furnace for phase 2 project

Emal is getting a brand new high capacity baking furnace to supply the anodes required for its new phase 2 project. Engineering work is well advanced on the 68 section furnace, which will deliver a capacity of about 330 kt/year using AP Technology™. Excavation work is under way and civil work and concrete casing erection will begin in the coming months. With nine pits per section and a high anode load per pit, the furnace will achieve record efficiency including reduced energy consumption.

Sebree

Rapid rebuild of open furnace

Sebree has set a new record. It replaced the heat insulation and refractory of its 54 section baking furnace in only two months. The project was completed on time and budget with close to 250,000 man-hours free from injury.

To minimise production loss, the first fire started up one month after construction began on the refractory and as soon as enough sections had been built. The third fire started up in July 2011, one week before completion of the refractory. This is also when the first baked anodes were produced.

With three fires and nine pits per section, Sebree's baking furnace has a capacity of about 100 kt of baked anodes per year.

Boyne

Baking furnace just started-up

Following its completion at the end of 2011, Boyne's AP Technology™ baking furnace has started up early February 2012. Last year the heat insulation and refractory of this large 66 section furnace were erected in eight months. With four fires and eight pits per section, it will have a capacity of about 250 kt of baked anodes per year. The furnace will reduce site greenhouse gas emissions by some 20,000 tonnes of CO₂ annually, along with a number of safety, operational and maintenance improvements.

Aluar

Changing from a closed to an open furnace

Work is under way to convert Aluar's closed furnace 2 to an open one. After the furnace had been shut down, the used refractory material removed and the existing tub repaired, a new ventilation system was installed at the end of 2011. In the coming months workers will start erecting the tubular steel crossover, heat insulation and refractory. The AP Technology™ open furnace will have a capacity of 75 kt/year with 50 sections and three fires.

AP Technology™ solutions

Exciting innovations across the board

2012 is going to be an important year for our AP Technology™ solutions.

- ALPSYS® is the world reference for pot control systems. Retrofitting and replacing Laterrière's pot control system with the latest ALPSYS® system is demonstrating the new Ethernet based configuration's robustness and efficiency, even when used on non AP pots like Laterrière's P155. Another important milestone: RTA Alesa is delivering its first ALPSYS® system to the Jonquière AP60 project. Our AP Technology™ team has also been providing Level 2 maintenance support to Tomago Aluminium since the beginning of 2012. But the year's highlight will be making the latest ALPSYS® software developments available to all users. Examples include the new alumina feeding algorithm that is delivering value to smelters such as Alma, Alouette and Mozal.
- MESAL® is the Manufacturing Execution System for Aluminium developed by our AP Technology™ team. MESAL® manages smelter operations and production, using a structured and reliable information system to measure, manage and optimise performance. It also feeds the business information system of a greenfield smelter or diverse sectors of an existing smelter.

This integrated management solution interfaces with workshops Level 2, ALPSYS® Level 2 and ERP. It capitalises on our unrivalled know-how and incorporates best

industry practices for managing modern smelters around the world. First localised at the Sohar Aluminium greenfield smelter, then at the Aluchemie anode plant, this pre-packaged business solution has been deployed or is being deployed or planned in 2012/2013 at the:

- Kitimat Modernisation Project
- Aluminium Dunkerque (casthouse, carbon sector and operational excellence in reduction)
- Alma and Laterrière's casthouses
- In a world where risk management is increasingly crucial, our AP Technology™ SURMEC solution ensures a smelter's integrity over the years. SURMEC monitors the interface between reduction and substation to detect potential open circuit issues.
- To help smelters reduce their energy consumption, we are currently industrialising a solution that will dramatically improve aluminium welding in potlines. Based on the Diverse Zero B patent, this AP Technology™ solution will soon enable much better positive riser connections, thanks to the quality of the welding, even in a strong magnetic field.

Three newcomers at the 10th AP30 Club meeting

From the 27 to 30 June 2011, Alcoa Deschambault hosted the 10th AP30 Club meeting in Quebec City, Canada, with 27 delegates attending from 13 AP30 smelters worldwide. Sohar, Hindalco and Ma'aden participated for the first time.

The three-day meeting included numerous high level presentations, giving participants a unique opportunity to exchange views, experience and improve their knowledge of the technology. It also provided delegates with a great opportunity to network. Delegates toured Deschambault's potroom, anode plant and casthouse as well as Old Quebec City.





Rio Tinto Alcan Technology Group at TMS 2012

Our experts will present several technical papers at TMS 2012 in Orlando, Florida from 11 to 15 March.

At the upcoming TMS Light Metals Conference in March 2012, our experts will present seven papers covering aspects of the main smelting processes: reduction, carbon, environmental and casting.

In reduction, one paper presents the recent development, led by Rio Tinto Alcan, of low energy cells based on the AP platform. With the energy market changing rapidly, we launched a new strategy two years ago focussed on developing cells with either very high productivity or with low energy consumption. This approach delivered the AP60 and APXe technologies, based on the same platform and operating in the 500 to 600 kA range with energy efficiency between 12.0 and 13.2 DCkWh/kg and reduced air emissions. The paper discusses how prototype results confirm the feasibility of such ambitious targets and how innovation is key to developing the cell of the 2020s, operating at low energy consumption with a reduced environmental footprint.

A second reduction paper entitled "AP40: the latest of the AP Technology™ solutions" continues the theme of high productivity technology development. After AP39 technology validation, an enhanced operating point allowed cells to operate above 400 kA without decreasing energy efficiency. Since July 2010, these cells, now referred to as AP40, operate at St-Jean-de-Maurienne in the 400 to 405 kA range with specific energy consumption below 13.15 DCkWh/kg. The result is a high level of process performance and excellent pot robustness.

A third paper in reduction presents a dedicated system developed to protect a potline from an open circuit and its potentially disastrous consequences. This dedicated system provides effective protection, such as a quick tripping of the rectifying groups, when the open circuit trend is detected. The paper also describes how the protection system settings must always be optimised based on operating conditions and potline parameters to protect the potline and avoid unnecessary stoppages.

At the junction of the reduction and carbon fields, a fourth paper presents a new method for making representative measurements of anode electrical resistance. Anode carbon contributes close to fifty per cent of the anode assembly voltage drop. Raw materials as well as forming and baking conditions are sources of significant variation in anode properties including anode resistance. The current

method for anode resistivity measurement is based on core sampling of a small number of anodes in limited locations and may not represent the global anode resistance. The paper proposes a non-destructive measurement method that reproduces the current distribution in service and provides immediate results.

In the environment section, a paper presents new developments and the outlook for a jet induced boosted suction (JIBS) system for reduction line roof vent emission control. Patented since 2007, trialled and now rolled out on Tomago's AP22 potlines, our JIBS solution has been scaled up to fit AP3X technology. A 36 pot section, including automatic pot hood opening detection, was installed for industrial demonstration in the Alma smelter. The paper presents the system's operational and environmental trial performance as well as the design and proof of concept completed in preparation for the AP60 Jonquière project.

A second environmental paper, co-authored with Alstom, presents the integration of desalination and primary aluminium production. It describes how a desalination plant can be installed in combination with a gas-fired power plant and how, with a compact, robust double-effect desalination plant, a typical AP40 smelter project can provide the water required during predicted variations in water consumption. The paper shows how part of the natural gas consumed for water production in the desalination process can be replaced with waste heat from the aluminium smelter pot gas. It also demonstrates how installing heat exchangers enables a significant downsizing of the gas treatment centres as well as improved control of stack fluoride emissions.

In casting, a paper discusses a new approach to identify aluminium dross reduction opportunities using an integrated weighing system. As batch-to-batch measurements of dross weight are generally not made in the casthouse, the task of dross reduction is complicated because key process parameters and batch preparation practices affecting dross are not well known. This paper describes the industrial dross weighing strategy as well as the equipment installed in one of our casthouses. It includes a new integrated weighing device for continuously measuring dross generation and discusses how the data generated are used not only to track long term furnace performance, but also to complete a statistical analysis aimed at identifying key dross contributors.

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