Issue 17
AP Technology™ newsletter

March 2013
ap-technology.com

AP Technology™

Exceptional value delivery worldwide

AP60 — Our latest benchmark technology

Rio Tinto Alcan

Editorial

AP Technology™: well on our way to the smelter of the future

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

As I write this editorial, construction of the Arvida AP60 Technology centre is in its final stretch. The start-up of the first 38 AP60 cells in Jonquière, Canada, is imminent. It will underpin the ongoing AP Technology™ success story, yielding the most competitive smelter technology in terms of capital expenditure and operating costs. AP60's unprecedented amperage level required many innovative solutions combined with rigorous validation to ensure safe operations and meet customer expectations.

Improving productivity while lowering energy consumption is critical to enhance or even maintain an existing smelter's position on the cost curve. Our AP Technology™ and R&D teams are continuously improving our widely deployed AP18 and AP30 platforms as well as our new AP60 platform. Recent enhancements include adding another 20kA to our AP18 platform to reach 260kA, validating the AP40LE low energy consumption solution at 12.8MWh/t and demonstrating APXe with 12.0MWh/t at 500kA.

We achieved a number of new advances in emission reduction and automation, namely the new low cost pot suction JIBS system to lower emissions, the new ALPSYS cell control algorithm successfully implemented in 12 potlines, the brand-new Tiger bake furnace control system and the new MESAL (Manufacturing Execution System for Aluminium) 2.0 release. I'm also excited about our progress in developing a fully automated smelter, particularly the automated anode change and the driverless logistic system with prototyping planned for 2013.

In 2012 several AP Technology™ customers advanced with their smelter projects. On 12 December 2012, Ma'aden marked the commissioning of the first of 720 pots, just 25 months after pouring the first concrete. With 720 pots, it's the largest smelter ever built in a single phase. In India, Hindalco is building its two greenfield smelters, Mahan and Aditya, with start-up planned in 2013. In British Columbia, Rio Tinto Alcan continues to modernise its Kitimat smelter to significantly increase production and reduce our environmental footprint.

On the innovation front, AP Technology™ will continue to move toward delivering a fully automated smelter while supporting customers in the successful delivery of their projects. Stay tuned for another exciting year of AP Technology™!

Our website is getting a facelift

We're using the latest technologies to upgrade our website and:

- Improve its online visibility
- Make it more user friendly
- Better communicate with AP Technology™ clients and users

The new site is already online and we'll progressively roll out new applications on it over the coming months.

We look forward to receiving your comments and suggestions. Your satisfaction with AP Technology™ is always our first aim.

www.ap-technology.com

Innovations

AP2Y0 - AP40 LE - APXe

To meet the needs of existing and potential AP Technology™ users worldwide, Rio Tinto Alcan has developed several R&D programmes to improve the performance of its AP platforms. Greater productivity and higher energy efficiency are the trademarks of these new technologies:

- AP18 platform: Currently being tested at Tomago Aluminium in Australia, AP2Y0 is providing an additional 20kA at constant energy consumption despite increased losses in the existing conductors. Validation of AP2Y0 technology is expected at the end of 2013.
- AP30 platform: Tested and validated at Alouette in 2012, AP40LE demonstrated outstanding performance with an operation at 395kA and energy consumption below 12.8MWh/t in a brownfield configuration.
- AP50 platform: In its first version, APXe demonstrated the efficiency of its design at the LRF, making the target of 12.0MWh/t at 500kA achievable. Demonstration is on its way!

With the use of robust technology, the AP Technology™ team has designed and tested a wide range of innovative solutions to meet specific needs and address specific constraints of plants and projects.

Creeping along…

In today's economic context, the ability for a given smelter to improve its efficiency is more important than ever.

For many smelters, this means drastic cost reductions through manpower, maintenance and operational budget cuts. However such actions have a limited impact when not combined with a significant improvement in the performance of the technology used. Solutions are available today.

What will enable smelters to continue running in the future will be their ability to invest the minimum amount of CAPEX to get the maximum performance increase.

The AP Technology™ team provides the market with the unique combination of:

- A strong proven methodology to build creeping roadmaps that integrate local constraints and maximise return on investment with minimal CAPEX
- Complete mastery of all processes used in a smelter
- Debottlenecking solutions that minimise CAPEX
- Validated technologies which allow the quick and safe design of pot technologies to maximise creeping performance

Looking for increased productivity?
Looking for energy consumption reduction?
Looking for both?

AP Technology™ solutions are available to help you reach your target. We can also provide you with your own customised solution that takes into account your specific constraints and needs.

We can help you build a better future.

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 operation at Arvida Technological Centre AP60 in Jonquière, complete with all logistical and operational challenges. The multi-phase AP60 technology project will eventually reach a production of 460kt/y, taking into account real estate limitations (a full single production line with AP60 pots generates up to 760kt/y).

At the end of 2012, the overall AP60 project was handed over to Operations and the tests under electric load started. The focus for 2013 is to complete the pre-operational tests, to start the 38 pots, to ramp up and stabilise the pot operation, and to fully demonstrate the AP60 pot technology capability at the industrial scale.

Demonstration of the technology will also encompass other domains such as health, safety, environment (HSE) and equipment closely related to technology.

Following the demonstration phase, this unique technology will continue to be developed at Jonquière (2nd pot generation), further increasing pot productivity, decreasing capital and operating costs as well as reducing energy consumption and the environmental footprint. We're investing to strengthen our global leadership in reduction technologies to benefit our pipeline of internal growth projects as well as those of our partners and customers.

Technology	1st generation	2nd generation
Scheduled for	First hot metal 2013	2014 onward
Currrent (kA)	570	600
Pot production (tonnes/day)	4.3	> 4.5
Specific energy consumption (MWh/t)	13.3	< 13.0

12 December 2012: first hot metal for Ma'aden smelter project

This milestone marks the successful commissioning of the first of 720 pots, and is a key step toward commercial production at the smelter.

First hot metal celebration

At the ceremony marking the event in Ras al Khair, Ma'aden President and CEO Engineer Khalid Al Mudaifer said that the achievement of first hot metal in just 25 months after the pouring of first concrete is testimony to the vision of the Government of the Kingdom of Saudi Arabia, and to the dedication of Ma'aden, Alcoa and their respective contractor teams.

Chairman of the Ma'aden Aluminium joint venture Engineer Abdullah Busfar highlighted some additional noteworthy statistics that have led to the first hot metal milestone:

"From the outset this has been a project that has been managed to achieve both cost and schedule targets. It is just 29 months since the joint venture issued Bechtel with a Notice to Proceed with construction. That is as we anticipated at the time and it is in keeping with the most advanced and disciplined project construction practices anywhere in the world."

"More than 700 Saudi Arabian citizens have completed their initial intensive training and are ready to take their place as skilled operators within this smelter."

Mr. Busfar continued: "That we can celebrate all this here today, in what was desert less than three years ago, is a great credit to everyone who has contributed to this project. This is exactly the safe and productive outcome that our JV committed to delivering, and we are very pleased that we are seeing it become a reality."

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

Mahan

At Mahan, civil works is nearly completed and progress is focused on an advanced start-up of 32 pots out of 360, using purchased anodes.

Testing and pre-commissioning activities are under way in all workshops. Training modules for HIL managers at Mahan have been completed at Rio Tinto Alcan smelters.

At Aditya, site activities are speeding up after the green light given by the Indian Environmental Authorities.

Civil, structural, pot lining and busbar erection works along with the positioning of turnkey equipment are progressing in all areas.

Start-up of both smelters is being synchronised with the commissioning of six 150MW coal fired captive power plants that are also under construction adjacent to the smelters.

- Mahan: start-up of the first pot is expected mid-March 2013
- Aditya: start-up of the first pot out of 180 is expected in 2013

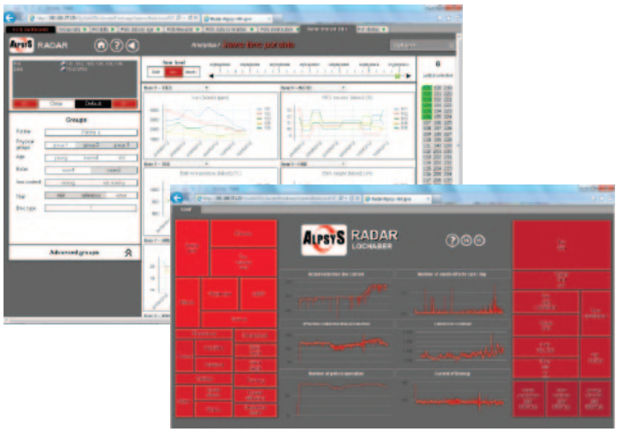
KMP is on its way

The US$2.7-billion modernisation and expansion of our aluminium smelter in Kitimat, British Columbia, is progressing well, with first hot metal expected by year-end 2014.

This is a truly transformational project that will increase the smelter's current production capacity by more than 48 per cent, to approximately 420,000 tonnes per year. The modernised smelter will be powered exclusively by hydroelectricity and use the latest AP40 technology, operating at 405kA and 13.1MWh/t, to cut emissions intensity by more than 50 per cent per year.

By December 2012, the anode baking furnace casing was fully built and covered, and construction of the potline buildings got under way. To fit within the available land, the 384-pot potline will be installed in four separate rooms.

AP Technology™ solutions



Left: MESAL dashboard
Right: ALPSYS screen-shot

2013 is going to be another exciting year for our AP Technology™ solutions.

Continuous innovations across the board

MESAL, a new version 3.0 and plenty of projects
MESAL is the Manufacturing Execution System for Aluminium developed by our AP Technology™ team. MESAL manages smelter operations and productions, 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 know-how and incorporates best industry practices for managing modern smelters around the world. Version 1.0 was first localised at the Sohar Aluminium greenfield smelter, then at the Aluchemie anode plant.

In 2012 casthouse specific functionalities were implemented at the Aluminium Dunkerque smelter and version 2.0 of the full MESAL solution was successfully installed at the Sohar Aluminium smelter. At the same time, the MESAL solution for the Kitimat Modernisation Project was launched and the MESAL solution for the carbon sector was evaluated for the Grande-Baie smelter.

In 2013 the MESAL casthouse solution for value-added product will be implemented at the Alma and Laterrière aluminium smelters. Development of MESAL 3.0 will be achieved in Q3 2013 with on-site installation planned in 2013 at the Grande-Baie smelter (carbon sector) and in 2014 at the Kitimat smelter (full scope).

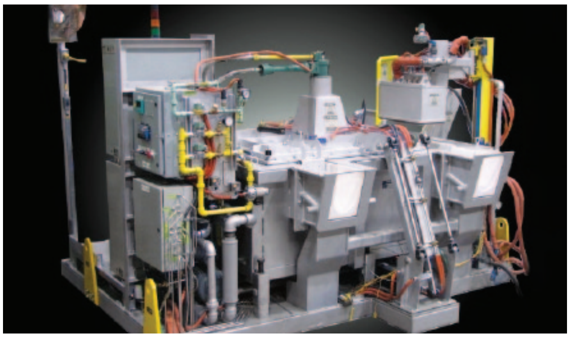
The new MESAL solution for operational excellence in the reduction sector using business intelligence capabilities will be validated and ready for implementation at the Aluminium Dunkerque smelter.

ALPSYS on the RADAR!
Maintaining ALPSYS as the world reference for pot control systems is our main focus. In 2012 we extended the worldwide presence of ALPSYS through deliveries to Laterrière, Hindalco and Ma'aden. In parallel, our new delivery model involving RTA Alesa has delivered ALPSYS V14 to the Jonquière AP60 project. The AP Technology™ team also introduced ALPSYS Maintenance Services to five sites along with the successful rollout of the industrial version of the latest 4A alumina feeding algorithm. The algorithm is now operating on more than 12 potlines worldwide, enabling impressive process performance increases.

While remaining focused on delivering ALPSYS to the Kitimat Modernisation Project and on upgrading existing systems, 2013 will be the year of expansion of our services including the enhancement of our process control procedures, the launch of the ALPSYS Club and the full availability of the new process intelligence module: ALPSYS RADAR.

ALPSYS RADAR (Reduction ALPSYS Data Analysis and Reporting) provides unprecedented ease to access, analyse, display and report process and operational data. Through easy to customise graphical web-based dashboards, the ability to publish and share ALPSYS key performance indicators empowers all users, from operators to managers. Process engineers and technicians will also value the greater efficiency that comes with the ability to spend more time analysing and interpreting the available information rather than finding it!

New casting technology: ACF filters implemented at Laterrière plant



ACF filter unit: improving flexibility while reducing filtration costs

CASTPRO

Developed by Rio Tinto Alcan

Market demand for the on-time delivery of a wide range of products and alloys, without compromising the stringent metal cleanliness requirements, is constantly growing. Our new Advanced Compact Filter (ACF) technology provides inclusion removal efficiencies comparable to deep bed filtration while offering low operating costs and high flexibility.

From 1 January 2010 to 31 August 2012, over 144,000 tonnes of aluminium including 36,000 tonnes of can end stock AA5182 were produced using our new ACF technology. This technology is now fully operational at the Laterrière smelter in Canada and is being deployed at other Rio Tinto Alcan sites.

Compared to standard Ceramic Foam Filters (CFF), the patented ACF allows the use of improved ceramic filter morphology to provide filtration efficiency similar to Deep Bed Filter (DBF) while reducing the filtration cost by close to 70 per cent and improving lead time. Moreover it requires neither metal hold-up between casts nor bed conditioning for high magnesium alloys, enabling greater flexibility for alloy changes.

JIBS: AP Technology™ low cost pot over suction system now on the market

Jet Induced Boosted Suction or JIBS is our patented pot over suction system. Like any other over suction system, its goal is to increase the pot flow during specific operations, using the Venturi effect and lowering pot emissions. Flow in over suction operation is 2x nominal base flow. JIBS delivers this performance at a very reduced CAPEX/OPEX compared to other over suction technologies.

JIBS is composed of a blower that blows air into a feeding duct connected to each pot. These pots are individually equipped with a rotating balancing orifice and an injection probe at the gas exhaust duct.

How does it work? When tapping doors are opened, the orifice at the gas outlet duct pivots to lower restriction and increase the flow (partial JIBS mode). When the hoods are opened, in addition to the orifice rotation, low pressure air is injected into the duct through a specially designed nozzle. The static pressure upstream of the jet decreases as the pot flow increases (normal JIBS mode).

AP2X and AP3X tests (normal JIBS mode) show that fluoride emissions are reduced by 0.07-0.13kg Ft/t Al, depending on the initial emissions. Further developments concerning the automatic detection mode are in progress and will likely lead to additional savings, which could generate a total reduction of 0.10-0.15kg Ft/t Al.

On the cost side, CAPEX estimates indicate a 50 per cent savings compared to conventional DDBS (Dual Duct Boosted Suction) solutions, while the OPEX appears to be similar or slightly lower.

Tiger Firing System

The powerful anode baking solution
Tiger is the latest development from Rio Tinto Alcan's industry leading AP Technology™ Carbon Package. It offers the latest in engineering and design for high productivity anode manufacturing.

The Tiger Firing system can easily be fitted to any type of furnace and furnace technology with minimal anode production loss. It was recently fitted to the Aluminium Dunkerque furnace, at the same time as the renovation of the anode baking furnace. This new firing system improves gas consumption, reduces tar emissions and provides total flexibility for easily configuring the fire.

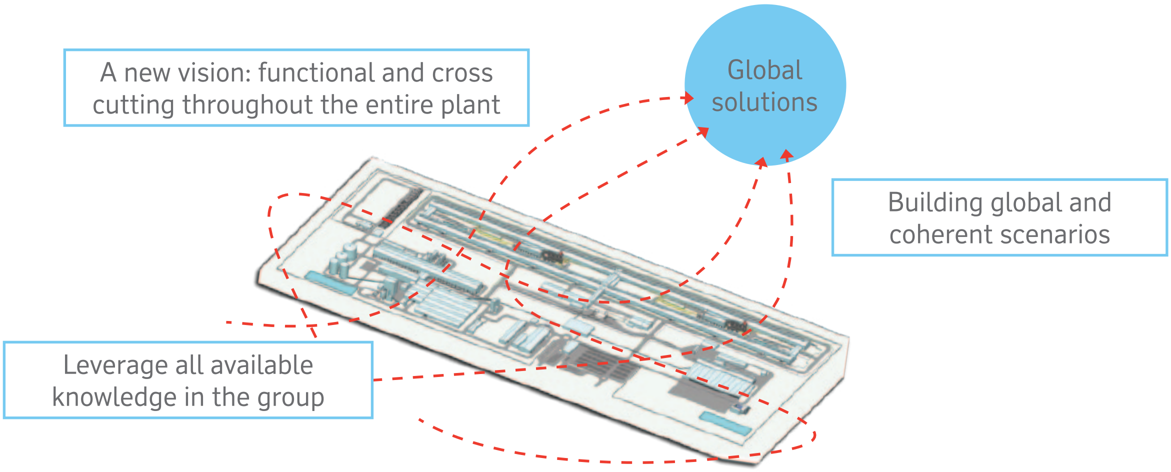
Aluminium Dunkerque can now make the most of a user friendly, well-engineered solution that integrates more than 25 years of experience in operating baking furnaces.

Global Smelter Design (GSD)

The AP Technology™ smelter of the future

The economical, energy efficient and environmentally safe solution for primary aluminium production.

Global Smelter Design mindset



An efficient smelter solution is made up of many technological blocks. Over the years, Rio Tinto Alcan has continuously developed these blocks along with a global approach to its smelter solution.

The global approach, named Global Smelter Design (GSD) is used to design the smelter of the future, building global and coherent solutions based on a functional and cross-cutting view of the plant.

This approach has become even more relevant with the advent of new technologies and products such as automation, robotics, data processing, environmental expertise, innovative civil works and new materials.

From a sequential to an integrated design
The construction of a global vision of the smelter with clearly defined goals allowed us to challenge the conventional 'silo' approach and existing paradigms. Open Innovation is also a key pillar in our approach as well as including technologies and solutions that can be transferred from other industries or applications.

Global vision is a medium and long term vision captured in a high level roadmap based on an e3 approach: energy efficiency, environment and economy with a high standard of health and safety.

Our conventional view of the smelter and how we work has been challenged in a variety of ways. For example if we compare the cost of a smelter not shop by shop but per discipline (concrete, electrical, structural, equipment, etc.), we see that the global building and roads elements are more expensive than all the pots combined.

Open Innovation provides not only technical ideas and solutions but also new methodologies and ways of working, leading to Lean manufacturing and flows in the smelter.

To optimise the various flows (materials, pedestrians, vehicles, fluids) and general layout, safety and environmental footprint, we apply Lean manufacturing concepts and consider flows in the smelter as a key activity, creating a virtuous circle. We use the required technologies such as process automation, simulation or data processing to bring, in a repeatable and safe way, anodes and liquid metal to the pots and to the casthouse when needed. We challenge the size of the different transport systems and generate savings in smelter infrastructures. We also increase process reliability and show that 'just in time' is a key enabler for process quality and improved environmental performance.

The aluminium industry needs to make tremendous improvements and seek new optimisation methods. Rio Tinto Alcan is proposing the reference solution to successfully take up this challenge based on the AP Technology™ cell platforms for both new and existing smelters.

AP Technology™ baking furnaces

Left: Aluar
Right: EMAL

Ready to start converted open furnace at Aluar

Refractory construction of Aluar's baking furnace n°2, converted from closed to open, was completed in 2012.

The furnace's commissioning was completed January 2013.

With three fires, 50 sections and five pits per section, the furnace n°2 will deliver a capacity of about 75kt/y using AP Technology™.

The furnace was designed so that the same bricks can be used in any of Aluar's three furnaces.

Once furnace n°2 is in full production, furnace n°1 will be converted in exactly the same way.

Concrete tub completed for new high capacity baking furnace at EMAL

As part of the EMAL 2 expansion project, construction of the concrete tub of the new high capacity baking furnace was completed in 2012.

With four fires, 68 sections and nine pits per section, this furnace will have a capacity of about 330kt/y using AP Technology™.

To ensure the furnace's refractory quality, an extensive quality control programme was implemented, including meetings, audits and inspections at the refractory suppliers' manufacturing plants.

The refractory construction will be completed and the furnace commissioned in 2013.

Aluminium Dunkerque

After more than 20 years in operation, Aluminium Dunkerque is renovating its anode baking furnace and implementing the latest AP Technology™ improvements for refractory materials and furnace design. Aluminium Dunkerque will soon be able to bake larger anodes and keep pace with its evolving reduction process.

Our newly developed Tiger Firing System will optimise baking of the anodes while improving gas consumption and reducing tar emissions. The Aluminium Dunkerque baking furnace is a 72 section furnace and has a capacity of 170kt/y.

TMS 2013 San Antonio, Texas

Rio Tinto Alcan will be presenting ten papers at the upcoming TMS Light Metals Conference in March 2013. These papers cover the main aspects of the smelting process: reduction, carbon, environment and casting.

1 In the reduction area, one paper explains how the Aluminium Dunkerque smelter (France) successfully ran the potline for eight months at a much reduced amperage following substation problems. The potline was operated at 285kA down from 360kA, demonstrating the technology's robustness and the ability to operate at a lower energy output and pave the way for flexible operation with AP Technology™.

2 A second paper describes the recent development led by Rio Tinto Alcan on low energy AP Technology™ cells at more than 400kA with a target energy consumption of 12.4kWh/kg. This technology aims to maximise the production and profitability of smelters with a limited energy block size. It could be used either to retrofit existing smelters or for greenfields. Saint-Jean-de-Maurienne (France) and Alouette (Canada) smelters are both involved in the development process and running tests on designated booster sections.

3 A third paper in the reduction area is about unsteady magnetohydrodynamic (MHD) modelling applied to cell stability. It compares the results of our latest unsteady stability model developed with the EPFL (École Polytechnique Fédérale de Lausanne) with those of the lab-scale Coventry University experiment and the industrial AP3X operation. This new model clearly demonstrates a good prediction of instability when reducing metal height and anode cathode distance (ACD) at both lab and industrial scales. It also overcomes the limitations of shallow water or linear stability models based on heavy assumptions. It opens numerous opportunities for exploring new solutions to reduce cell MHD instabilities.

4 The fourth paper is about solutions developed in conjunction with Divers Technologies & Systems to address arc welding problems in an operating potline, especially when repairing aluminium busbar systems. To address this issue, an electromagnetic shield was developed and tested by welding cover plates on positive riser bolted joints at full line current. The shield is described along with modelling and magnetic measurements demonstrating its effectiveness. The results are encouraging and show that voltage drop gains can be achieved by making on line repairs.

5 In carbon, the first paper describes a method developed for the rapid characterisation of petroleum coke microstructure using polarised light microscopy. One characteristic historically acknowledged as having a significant detrimental effect on anode thermo-mechanical properties is the so-called isotropic structure. A new method was developed and successfully applied to green and calcined coke for reducing the interpretation time of a sample down to about twenty minutes. The sample preparation and interpretation methodology is described and examples presented, including a case study of how the method was used to guide raw material blend decisions across our North American sites.

6 The second paper is about investigating the removal of impurity from high impurity petroleum coke to enable its use in anodes. A mineralogical analysis of different cokes demonstrated that more than 99 per cent of the particles contained the expected concentrations of sulfur, nickel and vanadium while a small number of particles contained inclusions of other impurities. A number of potential treatment options were identified and investigated, with thermal desulfurisation being studied further. The initial sulfur concentration, residence time and calcination temperature had the highest impact: 45 per cent sulfur removal was achieved but with significant bulk density loss. Acceptable pilot anode quality was not achievable even when the fines fraction was substituted with desulfurised material. While sulfur removal during calcining is possible, the resulting coke, even in the most promising scenario, is not suitable for anode manufacturing. At this time, an industrial process to remove sulfur and other impurities from petroleum coke is unlikely to be viable.

7 In terms of the environment, a paper presents the latest developments in potroom building ventilation CFD (computational fluid dynamics) modelling. With production increases and proactive management of future health regulations, optimised workshop ventilation is necessary. Accurate predictions are required to achieve cost effective ventilation design. Models also need to be able to accurately simulate the impact of ventilation on cell cooling and determine the positions for roof vent monitoring equipment. Having developed several CFD tools of varying sophistication, a combination of tools with the most appropriate level of complexity can now be selected depending on project requirements to optimise the trade-off between accuracy and computation time. This approach, validated through comparison with measurement campaigns, can now be used for cell development and new projects, regardless of building design and local conditions.

8 A second paper in the environmental field, co-authored with Solios Environment, looks at how fumes from the anode baking furnace are collected and mixed with gases from the reduction pots at the Aluminium Dunkerque smelter. The mixed gases and fumes are scrubbed together using a unique gas treatment centre (GTC), designed and sized accordingly. This paper outlines the solutions implemented at Aluminium Dunkerque. Technical performances, investment costs and operation costs are detailed and compared with traditional solutions using a GTC and fume treatment centre (FTC). Technical and organisational recommendations for ensuring the success of this solution are also given.

9 In casting, we're presenting a paper on a new cost effective filtration process that we've developed and industrialised, the Advanced Compact Filter (ACF). The ACF provides flexible, efficient and robust filtration suited for large product mix environments. This technology was successfully demonstrated on critical products, and is now fully operational in one of our casthouses.

10 The tenth paper is about the application of a rigorous methodology to maximise the value created through amperage creeping at an existing smelter. To minimise issues during the execution phase, a rigorous and thorough preparation is required, including the identification of creeping impacts on all smelter units and the possible solutions to mitigate them. We present the integrated approach and tools we used to identify the impacts of creeping, starting at the smelter level and beyond to the different units. This methodology is now available as an AP Technology™ solution.

AP18 Club members in the Hunter Valley

25th anniversary of the AP18 Club meeting!

From 19 to 22 November 2012, Tomago Aluminium Company hosted the 12th AP18 Club meeting in Newcastle, Australia. Fourteen delegates representing seven AP18 smelters crossed the oceans to attend the meeting and celebrate the club's 25th anniversary.

The three-day meeting included numerous quality presentations on technical and HSE topics, giving the delegates the unique opportunity to exchange views, knowledge and experience in all areas of an AP18 smelter.

A tour of the Tomago smelter, a trip to the Hunter Valley and sightseeing at Lake Macquarie also provided an excellent backdrop for connecting and networking.

The whole team, which includes the few members who couldn't attend the 2012 event, are now looking forward to the 13th meeting to be held in Kidricevo, Slovenia, in 2015.

Technology sales department
725, rue Aristide Bergès
Centr'Alp - BP 7 -
38341 Voreppe Cedex
France

T +33 (0)4 76 57 85 00
F +33 (0)4 76 56 61 10

ap-technology.com

Rio Tinto Alcan head office
1188 Sherbrooke Street West
Montreal, Quebec H3A 3G2
Canada

T +1 514 848 8000
F +1 514 848 8115

riotintoalcan.com

Mailing address
PO Box 6090
Montreal, Quebec H3C 3A7
Canada

At Rio Tinto Alcan, we're committed to ramping up smelter productivity and driving down energy consumption. From AP40 to AP60 for unprecedented productivity and from AP50 to APXe for dramatically lower energy use, our AP Technology™ platforms continue to break new ground.

Contacts

You can reach our AP Technology™ sales force at:

Bernard Allais — bernard.allais@riotinto.com
Ivan Bauret — ivan.bauret@riotinto.com
François Charmier — francois.charmier@riotinto.com
Christian Dreyer — christian.dreyer@riotinto.com
Benoit Feve — benoit.feve@riotinto.com
Alain Herrmann — alain.herrmann@riotinto.com
Claude Ritter — claude.ritter@riotinto.com
Christian Staub — christian.staub@riotinto.com

ALPSYS
Patrick Richard — patrick.richard@riotinto.com

MESAL
Pierre Trouiller — pierre.trouiller@riotinto.com

CastPro
Jean Crepeau — jean.crepeau@riotinto.com

FSC
www.fsc.org
MIX
Paper from responsible sources
FSC® C000000

Design and production: tmdesign.ca
Printed in Canada