

Alumina Technology Roadmap Workshop Game Plan

1-2 May 2001

Esplanade Hotel
Fremantle, Western Australia



Organized by
AMIRA International

Sponsored by
U.S. Department of Energy
Australian Commonwealth
Department of Industry, Science and Resources
Australian Aluminium Council
The Aluminum Association, Inc.

Prepared by
Energetics, Incorporated
Columbia, Maryland, USA

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ALUMINA TECHNOLOGY ROADMAP WORKSHOP

PRELIMINARY AGENDA

1 -2 May 2001
Esplanade Hotel
Fremantle, Western Australia

Tuesday, 1 May

7:30 – 8:30	Continental Breakfast and Registration
8:30 – 9:45	Plenary Session <ul style="list-style-type: none">• Welcome - <i>Dick Davies, CEO, AMIRA International</i>• Opening Remarks - <i>Ivan Anich, Alcoa World Alumina</i>• Keynote Address - <i>TBA</i>• Instructions and Process - <i>Jack Eisenhower, Energetics</i>
9:45 – 10:00	Break
10:00 – 12:00	Breakout Sessions: <i>Review Strategic Goals and Identify Key Challenges</i>
12:00 -13:00	Lunch
13:00 - 15:00	Breakout Sessions (cont): <i>Identify R&D Needs</i>
15:00 - 15:15	Break
15:15 - 16:30	Breakout Sessions (cont): <i>Identify R&D Time Frames</i>
16:30	Adjourn

Wednesday, 2 May

7:30 - 8:30	Continental Breakfast
8:30 - 10:00	Breakout Sessions (cont): <i>Analyze and Integrate R&D Needs</i>
10:00 - 10:15	Break
10:15 - 11:30	Breakout Sessions (cont): <i>Discuss Common Themes and Next Steps</i>
11:30 - 12:30	Lunch
12:30 - 15:00	Summary Session <ul style="list-style-type: none">• Group Reports• Common Themes• Collaborative Opportunities• Closing Comments
15:00	Adjourn



ALUMINA INDUSTRY TECHNOLOGY WORKSHOP

Purpose

The alumina industry has experienced tremendous growth in the past decade while at the same time adapting to new global dynamics and the rapid pace of technological change. As the industry looks forward, it faces tremendous growth opportunities but also significant technical challenges. Future alumina industry growth will need to occur within the context of new competitive pressures as well as public expectations for a clean and sustainable industry. The alumina industry has determined that it is time for a concerted look at the near- and long-term technical challenges facing alumina production. The global nature of the industry suggests that this strategic exercise be conducted on an international basis to achieve maximum impact.

To position the alumina industry for future success, leading alumina producers throughout the world are coming together on May 1 and 2 in Fremantle, Western Australia to address the industry's technical challenges. The **Alumina Industry Technology Roadmap Workshop** will bring together experts from alumina producers, the research community, and government to outline a comprehensive 20-year research and development agenda that can be pursued through collaborative partnerships as well as by individual companies. **The research priorities identified at the workshop will be incorporated into an Alumina Technology Roadmap that will provide a long-term strategy for attaining international alumina industry goals in energy and resource efficiency, productivity, product quality, environmental performance, and safety and health.**

Background

Over the past five years, the U.S. aluminum industry has led a collaborative effort to define its technology needs over the next 20 years. Working with the U.S. Department of Energy (DOE), through its Office of Industrial Technologies (OIT), and the Aluminum Association, Inc., the industry has endeavored to identify and pursue its technology needs through public-private partnerships. The first step in this strategic planning process is to establish broad strategic goals that can be embraced by the entire industry. These goals provide the framework for developing a technology roadmap, which outlines the industry's technology strategy for attaining industry-wide goals over the near- and long-term. In addition, a roadmap often identifies appropriate roles for government and private-sector partners in the process.

What is a Technology Roadmap?

A technology roadmap is a strategic plan that contains a focused, goal-based R&D agenda that can be pursued by both individual companies and collaborative partnerships within an industry, as well as help guide government participation.

So far, the U.S. DOE and the U.S. Aluminum Association, Inc. have collaborated to produce four distinct technology roadmaps:

- *Aluminum Industry Technology Roadmap* (May 1997)
- *Inert Anode Roadmap* (February 1998)
- *Aluminum Industry Roadmap for the Automotive Market* (May 1999)
- *Technology Roadmap for Bauxite Residue Treatment and Utilization* (February 2000)



These roadmaps have successfully established a consensus on key technological challenges and potential R&D pathways within the North American aluminum industry. The technical priorities identified in the roadmaps have helped the industry focus research investments on the most pressing problems, facilitate technical collaboration among companies and across the industry, and ensure common technical problems are addressed in a precompetitive manner. These priorities have been used by the U.S. Department of Energy as a basis for proposal solicitations on technologies to improve the productivity, energy efficiency, and environmental performance of primary and secondary aluminum production, fabrication, and related processes. For example, the *Inert Anode Roadmap* is serving as a framework for the research efforts in nonconsumable anode technology by private industry and government alike.

Until now, there has not been a concentrated focus on alumina production, partly because it is not a major activity within the U.S. aluminum industry. This leaves an important gap in the technology needs of the aluminum materials supply chain, which has a direct impact on the ability of the aluminum industry to achieve its business and market goals. This has generated significant interest for the preparation of a technology roadmap specifically addressing the needs of the world alumina industry.

World alumina producers, under the leadership of AMIRA International, have come together to create an Alumina Technology Roadmap to provide a comprehensive strategy for focusing future technology investments on critical industry needs. To help guide the roadmap process, an Alumina Technology Roadmap Steering Group has been formed (see Appendix B for membership). The Steering Group has a key role in organizing, guiding, and reviewing key aspects of the roadmap effort. As part of this role, the Steering Group has developed a set of draft strategic goals that the industry hopes to achieve by 2020. These goals, shown in Appendix C, have been circulated and refined by a core group of alumina producers and will serve as the basis for discussions at the upcoming roadmap workshop.

Workshop Structure

The workshop will be a two-day facilitated meeting taking place May 1 and 2 in Fremantle, Western Australia. The WA Government will sponsor a dinner and reception the evening of May 1. All events will take place at the Esplanade Hotel in Fremantle, Western Australia (see Appendix D for logistics information). The workshop will consist of three main sessions described below.

Plenary Session: This session will provide participants with a common understanding of the scope of the roadmap and the overall process. It will include an overview of the alumina roadmap effort, review the draft strategy goals, and identify expected workshop products. The session will also include instructions for the facilitated breakout sessions and a description of the workshop process.

Breakout Sessions: The larger group will divide into three smaller groups that will meet concurrently and discuss research needs associated with the three important topics below.

- ***Energy and Liquor Productivity*** - Emphasis on technologies and procedures to enhance energy efficiency, waste heat utilization, and alternative energy sources; and strategies to improve liquor productivity including approaches to enhance or retard production of aluminium hydroxide, liquor purity, seeding protocols, and impurity removal.



- **Process Optimization** - Emphasis on the optimal use of raw materials including bauxite beneficiation, reduced caustic and lime usage; optimal use of capital assets through increased throughput, debottlenecking, descaling, and increased uptime with less maintenance; and improving alumina product quality including desirable physical and chemical characteristics, scrubbing efficiency, and segregation.
- **Environment, Safety, and Health** - Emphasis on issues that affect safe processes including labour productivity, automation, use of sensors, remote operation, and increased process control; strategies for clean production and sustainability including reduced emissions, utilization of red mud, caustic recovery, rehabilitation, and better residue disposal; and synergies with other industries to exchange and/or transfer waste and byproducts.

The breakout sessions will take place concurrently and will follow the same format. The discussions will begin with a review of the draft strategic goals and the key challenges that must be overcome to accomplish them. Participants will then explore potential R&D solutions to address the objectives and needs of the particular topic. These technology options will be prioritized and placed into near- and long-term time frames. The highest priority options will be analyzed in greater detail to determine their potential impact on the goals. Clarifying the respective roles of industry, government, academia, and other stakeholders will help to accelerate implementation strategies.

Summary Session: The summary session will occur after lunch on the second day to allow the entire group to hear the results of each breakout session. Participants will discuss the findings of each group, identify common themes, note cross-cutting needs, suggest next steps, and propose opportunities for collaboration. All participants will provide short concluding remarks.

Preparation

Prior to the Workshop — Participants should bring their personal experience to bear when considering the major issues, barriers, and potential solutions for their topic. What are the key technology issues? How can they be resolved? Which stakeholders should be involved in the solution? What are practical approaches for moving forward?

During the Workshop — Participants will actively share ideas through facilitated sessions. Structured brainstorming and critical analysis will be used to identify critical issues and build consensus on technological options and approaches. Participants need only bring their ideas. **Please dress comfortably and casually.**

After the Workshop — A draft workshop report will be prepared and circulated to participants for review and comment. Additional information may be sought to clarify points and provide technical insight, although any consensus results of the workshop will not be changed. After all comments are received and integrated, a revised draft will be circulated to the larger alumina community for additional comment. Relevant comments and insights will be integrated into the document and a final Alumina Technology Roadmap will be issued.



APPENDIX A. PRELIMINARY LIST OF PARTICIPANTS

Company	Contact
Alcan/Nabalco	David Sutherland
	Jude Barnes
	Steve Healy
Alcoa	John Sibly*
	Ivan Anich
	Gerald Roach
Billiton/Worsley	Paul Potter
	Colin Agnew
	Ab Rijkeboer
Comalco	Mike Hollitt
	S. Chandrashakar
Hindalco (India)	R. P. Shah
Hydro Aluminium	Jon Arild Larsen
	Norunn Hegna
	Dag Olsen
Kaiser	Peter McIntosh
QAL	Robert Bitsch
	Ross Greenhalgh
Pechiney	Jacques Mordini
Glencore/Eurallumina	Vincenzo Rosino
Aluvale, Brazil	Roberto Machado*
Consultant (Northwest Aluminum)	Ray Roberts
Consultant	Tony Kjar
Consultant	George Fulford*
Consultant/Construction Expert	Harry Christensen (Bechtel)
Aluminum Association, Inc.	Mike Skillingberg
	John Green
Australian Aluminium Council	David Coutts
DISR (Australian Government)	Deborah Howard*
DRD (WA Government)	Representative to be determined
Parker Centre	John Farrow
	Gordon Parkinson
CSIRO Minerals	Rod Hill*
CSIRO BCE	Murray Rudman
Melbourne University	Peter Scales*
AMIRA International	Dick Davies
	Tony Bagshaw
Energetics, Inc.	Jack Eisenhauer (facilitator)
	Nancy Margolis (facilitator)
	Ross Brindle (facilitator)

* Not yet confirmed



APPENDIX B. STEERING COMMITTEE

The following people comprise the Steering Committee formed to help organize and guide the roadmapping process:

Ivan Anich, <i>Chair</i>	Alcoa & AMIRA Council (also representing John Sibly)
Dick Davies, <i>Convenor</i>	AMIRA International
Cynthia Carroll	Alcan (via John Hillary)
David Sutherland	Alcan/Nabalco
Robert Bitsch	Queensland Alumina
Mike Hollitt	Comalco
Paul Potter	Billiton/Worsley Alumina
Tony Kjar	Gibson Crest Pty Ltd
Ray Roberts	North West Aluminum Company
David Kirkpatrick	Kaiser Aluminum
Mike Skillingberg	The Aluminum Association, Inc. (USA)
John Green	The Aluminum Association, Inc. (USA)
Sara Dillich	U.S. Department of Energy
David Coutts	Australian Aluminium Council
Deborah Howard	Australian Dept Industry, Science & Resources
Tony Bagshaw	AMIRA International
Jack Eisenhauer	Energetics, Inc.
Nancy Margolis	Energetics, Inc.



APPENDIX C. FINAL DRAFT STRATEGIC GOALS

The Commodity Challenge

Through the application of technology

- Reduce operating costs of existing plants by 3% p a
- Achieve substantial energy efficiency gains against a benchmark of reducing total energy consumption to 25% below current bauxite specific best practice
- Target capital costs of new plants at <US\$500/a t and falling, with major expansion at half this cost, achieved within a framework of return on investment before tax of greater than 18%
- Contribute to improvement of overall performance on environment, health and safety to world's best practice and consistent with global sustainable development principles
- Produce a product that meets all of our customers' current and future needs

This indicates a need to improve over a 5 to 15 year period, with 3 year intermediate goals, through

- Increasing yield by 20% above current bauxite specific best practice
- Reducing DSP caustic consumption to 30 kg/t Al₂O₃ and other losses (excluding to product) to best practice
- Achieving a simple capable process by significantly reducing process variability (3 sigma of <5%) through elimination of the effects of scaling & blockages, by more reliable equipment, better materials, process automation and advanced control.
- Reducing total energy consumption through improved methods of calcination, co-generation and process improvements
- Developing and applying combustion and power generation technology from which waste heat sources can be used for production of alumina, capable of operating at a power generation to alumina ratio that is not significantly less than that for the benchmark of best present technology operated on natural gas, unaffected by bauxite digestion temperature or energy source, other than its net calorific value
- Developing capable processes to achieve a significant reduction and recycling of all other inputs and outputs including water, odours, VOC's, mercury, oxalates, etc.
- Focusing on opportunities with synergistic industries such as caustic soda & power generation
- Developing methods to achieve a 1,000-year ecologically sustainable storage of red mud and other solid wastes in existing storages, and make substantial progress in storage for later reuse as well as achieve substantial progress in the reuse of the red mud.

The Product Challenge

- Improving consistency of alumina with 3 sigma limits of less than half of the present levels, with emphasis on dust, particle toughness after dry scrubbing and impurities including sodium and silica.
- Developing, in conjunction with the aluminium industry, sufficiently good delivery systems such that adequate dispersion is obtained at the cell thus allowing the alumina to readily dissolve in conventional and modified reduction cells in the temperature range 840-900°C and potentially as low as 750°C.



APPENDIX D. LOGISTICS INFORMATION

The Esplanade Hotel

All workshop activities will take place May 1 and 2 at **The Esplanade Hotel** in **Fremantle, Western Australia**.

Hotel Contact: Todd Dooley
Fax: 61 8 9432 4836
Phone: 61 8 9432 4817

Please indicate that you will be attending the Alumina Technology Roadmap Workshop. You should receive the agreed rate of AUS \$157.50 per day, including Goods & Service Tax. For additional information about The Esplanade Hotel, visit their web site at www.esplanadehotelfremantle.com.au

Fremantle Airport Shuttle

The Fremantle Airport Shuttle provides transportation from the airport to Fremantle for a fare of \$15 single. Shuttles depart the airport at 10:00 a.m., 11:00 a.m., 12:00 p.m., 1:00 p.m., 2:30 p.m., 3:15 p.m., 4:15 p.m., 5:15 p.m., 8:30 p.m., 9:30 p.m., 10:30 p.m., and 11:30 p.m. A shuttle reservation can be made when booking your hotel accommodations. Additionally, the shuttle service can be reached by Fax at 61 8 9383 4763.

Contact

If you have any questions about the conference, please contact:

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Australian Mineral Industries Research Association Limited
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Fax: 61 8 9324 1190
tbagshaw@amira.com.au

A.J. Parker Cooperative Research Centre for Hydrometallurgy

The A.J. Parker Cooperative Research Centre for Hydrometallurgy is a premier world Centre for alumina processing research located in Perth. Informal tours of the Centre are available if arranged prior to arrival. If you are interested in touring the Centre and its facilities, please contact Dr. John Farrow, Alumina Program Leader, directly to make arrangements.

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