THOUGHT LEADERSHIP:
ALUMINIUM

GI Consultancy
Gulf Intelligence

A NEW ERA: Embracing Change, Hedging Risk

Arab International Aluminium Conference
Under the Patronage of His Highness Sayyid Harib bin Thuwaini bin Shihab Al Said

Hosted By:

عربال arabal
ARAB INTERNATIONAL ALUMINIUM CONFERENCE

SOHAR ALUMINIUM

Muscat, Sultanate of Oman
Monday 6 to 9 November 2017

"The role of industry in the construction of the national economy will not be possible unless it successfully taps the skills and talents of the national manpower and natural resources. Development is not merely an aim in itself, it is the achievement of the well-being of mankind. Thus, our understanding of this need should not be confined to the narrow pursuit of wealth alone but the progress and active involvement of the people. Only then, can the structure of our country be unshakeably built, proof against any storms.

We will spare no effort in supporting the industry sector and in offering incentives for its continued fruitful growth. It is, therefore, essential for all those involved to increase their efforts to improve the quality of their products by sustaining the highest professional standards. This will require our national industries to devote the maximum resources to research and scientific and technical studies."

His Majesty Sultan Qaboos bin Said
The Sultan of Oman

Thought Leadership

THOUGHT LEADERSHIP:
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Contents

EXECUTIVE INSIGHTS

About ARABAL

The Arab International Aluminium Conference (ARABAL) is the premium platform for the aluminium industries in the Middle East and North Africa region. It is hosted on rotation basis by the primary aluminium manufacturers in the region, who collectively produced 5,229,115 tonnes of aluminium in 2016.

ARABAL is the is the only conference in the World attended by every single primary aluminium manufacturer in the region. It is the event of choice for anyone interested in the middle East aluminium industry. It comprises a strategic conference focusing on the current industry prospects and challenges, a site tour to Sohar Aluminium smelter, an international exhibition and various other workshops, meetings, and entertainment activities.

Since it's inauguration in 1981 ARABAL has become an event of international repute, bringing together industry leaders from around the world to discuss current issues as well as explore businesses and investment opportunities in the region.

Today ARABAL sees the participation of more than 500 top executives to attend its conference, and thousands to visit its exhibition. The 21st edition of ARABAL was hosted by Sohar Aluminium in the Sultanate of Oman, with focus on "Driving Strategic Growth across the Global Aluminium Industry".

Arabal Members

Aluminium for the world

EGA
الإمارات العالمية للألمنيوم
EMIRATES GLOBAL ALUMINIUM

Egyptalum

MA'ADEN معادن
Saudi Arabian Mining Company شركة التعدين العربية السعودية

Qatalum الومنيوم قطر

SOHAR ALUMINIUM

About Sohar Aluminium

Sohar Aluminium was formed in September 2004 to undertake a landmark Greenfield aluminium smelter project in the Sultanate of Oman and is jointly owned by Oman Oil Company, Abu Dhabi National Energy Company PJSC - TAQA and Rio Tinto.

By implementing decades of industry insight in its design, specification and construction Sohar Aluminium has been created to ensure efficiency, environmental protection and the utmost safety of its workforce. The smelter has an annual production capacity of 375,000 tonnes of high quality Aluminium.

In many ways, Sohar Aluminium's development mirrors the Sultanate of Oman's own emergence onto the world stage – driving forward at a formidable pace, but all the while mindful and respectful of its cultural heritage and values. Sohar Aluminium intends to become a benchmark smelter while contributing to the sustainable development of Oman.

His Majesty's Cup for Best 5 factories 2010/2011

World Quality Commitment Award 2010

Takatuf Excellence Award for Employee Relations Initiatives 2015

Nationalization Excellence Award by Government of Abu Dhabi 2011

Excellence Award in Social Responsibility 2013

Manufacturer of the Year by Asian Manufacturing Excellence Awards 2012

Excellence Awards for Environmental Inititiatives 2014

Takatuf Excellence Award for Leading Supporter of SME's 2015

GAC Health and Safety Award 2016

GAC Community Award 2017

While Oman's many natural resources have been harnessed with considerable success, we need vision to unlock their full potential. This is something Oman has been able to achieve within the global aluminium sector since its emergence as a player only a few years ago. Locally, the industry has boosted job opportunities and created a valuable knowledge base regionally and globally, which has contributed significantly in raising Oman's profile. The agenda of ARABAL 2017 illustrated a thread common for the aluminium sector that has succeeded in standing the trials of time. It is the ability to come together as a knowledgeable group capable of shining a light not just on successes but on the many challenges and issues currently faced as well as those to come. As an even younger yet growing sector within Oman and the broader Middle East, we hope the aluminium and manufacturing industry as a whole will prove an agent of positive development."

His Highness Sayyid Kamil bin Fahad bin Mahmood Al-Said
Assistant Secretary General for the Cabinet of the Deputy Prime Minister for the Council of Ministers

The importance of gathering in Muscat to discuss key trends and forecasts in one of the world's fastest growing markets is clear; members of ARABAL account for 10% of the world's total annual output (World excluding China). The Middle East has also posted the second highest year-on-year demand growth worldwide during the first quarter of this year, at approximately 6%. Whether forecasts that the size of the global aluminium market will double within the next 10 years is realised relies on several factors; emerging market trends, innovation and tariff systems, to name a few. But amidst great change, lies great opportunity. ARABAL members and the wider market must seize upon existing potential to enhance operational efficiency, human capital and technological expertise – these are cornerstones of sustainable growth."

Said Al Masoudi
Chief Executive Officer of Sohar Aluminium

Over the past 34 years, ARABAL has become an event of international repute, bringing together leaders in aluminium industries and technologies from around the world to strength ties and to address key challenges on the regional and international level. The first ARABAL conference in 1983 adopted the resolution of setting a permanent ARABAL secretariat office in Kuwait. ARABAL was the first international aluminium conference of its kind, and has been developed over the years to promote the aluminium industry in the region. ARABAL will continue creating the potential opportunities and shape the sustainable future in the aluminium industrial framework."

Mohammed Al Naki
Chairman of ARABAL Steering Committee

Surveys and Demographics

Delegates Profile

504 Delegates from 42 Countries **Across the World**

North America
Canada - 2.8%
Turks & Caicos Islands - 0.2%
United States - 3.0%

South America
Brazil - 0.2%

Africa
Egypt - 2.1%
Ivory Coast - 0.2%
South Africa - 0.2%
Swaziland - 0.2%
Tunisia - 0.2%

Oceania
Australia - 2.3%
New Zealand - 0.2%

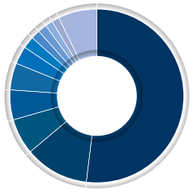
Europe

Albania - 0.2%	Italy - 1.9%
Austria - 0.5%	Netherlands - 1.2%
Belgium - 0.4%	Norway - 1.6%
Czech Rep. - 0.2%	Poland - 0.2%
Denmark - 0.5%	Russia - 1.2%
France - 1.8%	Sweden - 0.2%
Germany - 5.0%	Switzerland - 1.1%
Greece - 0.2%	United Kingdom - 3.4%

Asia

Azerbaijan - 0.9%	Kuwait - 0.5%
Bahrain - 6.78%	Oman - 25.3%
China - 1.6%	Qatar - 2.3%
India - 3.2%	Saudi Arabia - 5.1%
Indonesia - 0.2%	Thailand - 0.4%
Iran - 0.9%	Turkey - 0.4%
Japan - 0.7%	UAE - 14.3%
Jordan - 0.7%	

Company **Business Field**



Manufacturing Industry	52.1%
Research Institute/Consultancy	12.0%
Trade & Transportation	6.6%
Construction	5.6%
Media	5.0%
Mining Industry	3.2%
Banks/Investment Company	2.2%
Energy	1.9%
Aluminium Downstream	1.5%
Academia	1.5%
Logistics	1.2%
Other	7.2%

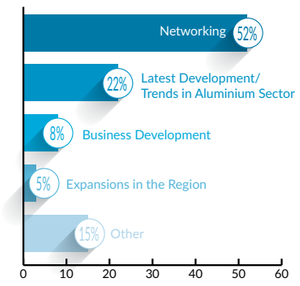
Level of **Responsibility**

Management	35.8%
Senior Management	26.0%
Owner, President, MD, Chairman	15.6%
Technology Experts	13.4%
Business Development	1.8%
Other	7.5%

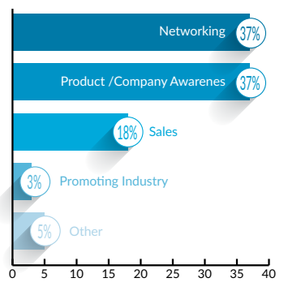
Job Function

General Management	27.9%
Supply Chain Management	20.9%
Services	13.3%
Operations	10.4%
Engineering	7.0%
Construction	6.5%
Purchasing	2.6%
Research and Development	1.2%
Quality Management	0.7%
Other	9.5%

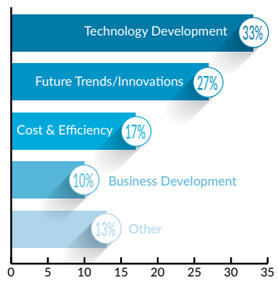
Conference Delegates
Areas of **Interest**



Exhibition Visitors
Areas of **Interest**



Workshop Participants
Areas of **Interest**



Survey Results

Conference	Exhibition	Workshop
92%	95%	93%
Met/Exceeded Expectations	Met/Exceeded Expectations	Met/Exceeded Expectations

28% New Visitors to Oman

41% New Participants in ARABAL

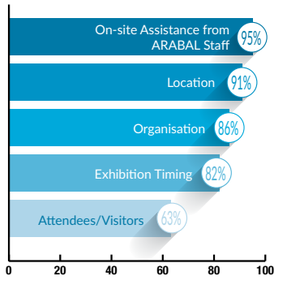
88% Intention to Participate Again

90%
Achieved Objectives
from Participation in ARABAL 2017

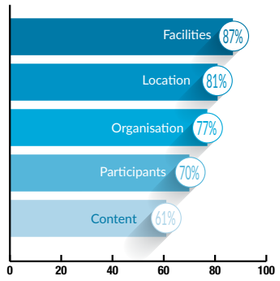
Quality & Satisfaction Levels

Conference

Exhibition



Workshop



Accompanying Spouse Tours & Activities

75%
New Visitors to Oman

100%
Interested to **Visit Oman Again**

ARABAL CONFERENCE: ATTENDEES

A&L Aluminium
ABB Electrical Industries
ABB Switzerland Ltd
ABN Amro Bank
Abu Dhabi Ports - Kizad
Access World
Adeyemi Akanji Aluminium Company
Aditya Aluminium (Unit of Hindalco Industries)
Akinade Nigeria Limited
Al Roya Newspaper
ALBA
AlCircle Pte ltd
Alfin-Edimet Srl
Alimosho Local Government
Alken
Alliance Mining Commodities Ltd
Altek Group
Alubase Industry
Alucor Limited
Aluminium Bahrain
Aluminium Insider
Aluminium International Today
Aluminium Rheinfelden GmbH
Aluminium Times
Aluminium Valley Society
Aluminum Trade Limited
Aluref (Pty) Ltd
Argus Media
Auryce
AZ China Ltd
Bahrain Alloys Manufacturing Co
BALEXCO
Bank Muscat
Baringa Consulting Ltd
Be'ah
Bechtel
Bechtel (Dubai Branch)
Bharat Aluminium company ltd
Bin Salman Investments
Bisley & Company Pty Ltd
Bruck Textiles
BUSS ChemTech AG
C. Steinweg Middle East & India
C. Steinweg-Handelsveem B.V.
Carbone Savoie
Cast Aluminium Industries
China Nonferrous Metal Industry's Foreign Engineering and Construction
Chottani International
College of Applied Sciences
Colt International
Continuus-Properzi S.P.A
CRU international
Det.Al Aluminium LLC
Egyptalum
ELVAL SA
Emirates Global Aluminium
Energoprom Group
FATA S.p.A.
First Solar International Middle East FZ
Fives Aluminium Division
Fives ECL
Fives Services Gulf
Fives Solios
FLSmidth Hamburg GmbH
FLSmidth Middle East
FLSmidth Wiesbaden GmbH
Foundry Alfe Chem
FoundryEcocer
Free Zone Watch
Freebee A/S
Fuji Electric
GE Power
GE Power Norway
General Electric
GLAMA Maschinenbau

Global Industrial Resources
Globe Marine
Gouda Refractories
GPS Global Solutions
Gulf Aluminium Council
Gulf Extrusions Co.
Gulf Markets International
Harbor Aluminum Intelligence
Hatch
Hazelett Corporation
Hencon
Henry Bath & Son
HOESCH Metallurgie GmbH
Hydro Aluminium
IBAU HAMBURG Ingenieurgesellschaft Industriebau mbH
ICTC
Imerys Refractory Minerals
IMIDRO
Impec AS
InfoSol Inc
Innovatherm
International Aluminium Institute
International Aluminium Journal
InterSearch Middle East
Jacobs Consultancy Inc.
JAM Trading Company
Jining Brilliant Consulting Service Co LTD
Jinlan Group
Light Metals Research Centre
London Metal Exchange
Ma'aden Alumnium Company
Madar Aluminum
Mahakoshal Refractories
Masdar Institute
Mecfor
Mechatherm International Ltd
Medalco Metals
MENA Carbon Company (Local Agent of SGL CFL CE GmbH)
Metal Bulletin
Metall- und Oberflachenchemie Sperzel
Metalsupdate
Metef Verona
Microsoft
Midal Cables
Minex Metallurgical Company Limited
Ministry of Electricity & Water (Oman)
Ministry of Environment and Climate Affairs (Oman)
MMEC Mannesmann GmbH
Mubadala
Muscat Media Group
National Aluminium Products
NCE Switchgear
Neeltran
NKM Noell Special Cranes
Norsk Hydro ASA
Northeastern University Engineering & Research Institute (NEUI)
Nusail Trading And Contracting
Simonsen A/S
Sinoway Carbon Co.
Skamol A/S
SNC-Lavalin International
Sohar Aluminium Company
SOHAR Port and Freezone
Southwire CC.
Special Technical Services
State General Reserve Fund
Storvik Group
T.T. Tomorrow Technology S.p.A.
Taha International Corporation
Takamul Investment
Takrim Cargo and Transport
Techmo Car Spa
Thomson Reuters
TRL Krosaki Refractories Limited
U.S. Embassy Muscat
Union Chlorine
United Engineering Services
United Integration for Metal Extrusion & Coating
University of Ilorin
University of South Florida
Vantage Point Group Holding
Voltamp
Wagstaff
Wood Mackenzie
World Aluminium

Conference Agenda

6th Nov
WORKSHOP
14:00- 16:00

WORKSHOP: Smelter process and production optimisation:

Technology contributions to support primary aluminium producers' entry into the 21st century By AP Technology™, Rio Tinto.

Claude Ritter
Smelter Technology Sales Director, Rio Tinto Aluminium

Bernard Allais
Director Smelter Technology Sales, Rio Tinto Aluminium

7th Nov
SESSION 1
11:30- 12:15

Industry Keynote Panel: Global Map Redrawn: As New Supply & Demand Centers Emerge, What Are the Challenges & Opportunities for the Middle East's Aluminium Sector?

- Current Global Economic Situation and Market Challenges
- Role in Global Aluminium Markets
- Supply and Demand - Trends, Prospects and Future Plans
- Exports from GCC and Middle East to the World - Current Situation and Future Prospects
- Sustainable Resources, Raw Material & shifting towards Alternative Energy in the Gulf & Middle East

JorgeVazquez
Founder & MD, Harbor Aluminum, USA

Eng. Said Al Masoudi
CEO Sohar Aluminium Oman

Eng. Abd Elzaher Hassan
Chairman & CEO, Egyptalum, Egypt

Abdulaziz Al Harbi
President, Ma'aden KSA

Khalid Laram
CEO, Qatalum Qatar

Tim Murray
CEO, Alba Bahrain

7th Nov
SESSION 2
12:15- 13:00

Future Demand for Aluminium from Emerging Markets

- Current Capacity of the Aluminium Market in Various Countries
- Local Consumption, Exports, Supply
- Emerging Markets
- Raw Material, Investors, Imports etc

Julian Kettle
Sr. Vice President, VC of Metals & Mining, Wood Mackenzie, UK

Hilde Merete Aasheim
Executive VP, Primary Metal, Norsk Hydro, Norway

Matt Liddy
Vice President, Business Development Pacific Asia, Aluminium, Rio Tinto

Eng. Bibhu Prasad Mishra,
President & COO, Aditya Aluminium, Sambalpur

Denis Nushtaev
Head of the PAD, BD & Financial Markets, UC RUSAL

Paul Adkins
Founder and MD, AZ China Ltd

Amir Sabbagh
IMIDRO Planning & Strategy Manager

7th Nov
SESSION 3
14:00- 14:45

Global Market Economic Review and LME Price Outlook: What's the Road Ahead?

- Current Trends, Intel and Sales Forecasting
- Sustainability of the LME and Risk Management
- China Implementation of New Pollution Laws
- Global Economics and the Role of the Arab Gulf and the Middle East
- Demand and Supply, Competition and New Markets
- Finding Financial Balance of the Industry

Andy Home
Sr. Metals Columnist, Thomson Reuters

Paul MacGregor
Managing Director, Head of Sales, LME

Tom Leary
Vice President, MI & C, HAI

Ali Al Baqali
Deputy CEO & CSCO,Alba

Jerry Van Alphen
CFO, Sohar Aluminium

Xiao Fu
Head of CMS, Bank of China International

7th Nov
SESSION 4
14:45- 15:15

Warehousing – Global Challenges and Solutions

Georgina Hallett
Chief of Staff, LME

7th Nov
SESSION 5
15:45- 16:15

Prospects for Gas in the Arab Gulf, the Middle East and the Implications for the Aluminium Industry

Professor Paul Stevens
Distinguished Fellow, Royal Institute of International Affairs, Chatham House

7th Nov
SESSION 6
16:15- 17:00

What are the Implications of Current Aluminium Trade Trends and Tariffs for Gulf Producers in Their Fight for Global Market Share?

- Tariffs in the Arab Gulf, the Middle East and Trade Barriers and Opportunities
- Imports, Curtailments, Market Growth and Risk Management
- Mega Trends in China
- Exports to the USA and Europe
- Free Trade Agreement between the US and Oman
- Sohar Industrial Development and Opportunities

Mahmood Al Daylami
Secretary General, GAC

Eng. Nahla Al Hamdi
DG of Industry, Ministry of Commerce & Industry, Oman

Paul Adkins
Founder, Managing Director, AZ China Ltd.

Mark Geilenkirchen
CEO, Sohar Port Freezone

Khalid Abdul Latif
Chief Marketing Officer, Alba

8th Nov
SESSION 7
08:00- 09:00

How Should the Right Balance be Struck Between Automation, Employment & Productivity?

- Future of Work and Innovation in the Information Age
- Does Artificial Intelligence Create More Jobs or Reduce the Human Labour?
- Impact of Technology on the Standards of Living
- Finding the Right Balance Between Job Creation and Modern Automation
- What are the Top Strategies Needed to Align Industry & Academia for Future Labour Market Requirements?

Sheikh Ibrahim Al Harthi
Managing Director,
Takatuf Oman
for HCS

Marc Gillis
EMEA Industry
Manager for MMC
& Aggregates, RA

Hugues Vincent
CEO,
Aluminium Division,
Fives Group (France)

Hilal Al Jadidi
SPHRI, SHRM-SCP,
Director of Consulting Services,
Takatuf Oman for HCS

8th Nov
SESSION 8
09:00- 10:00

Technology, Research and Development: Smelter of the Future and Art of Technology

- Process Optimisation and Innovation in Smelting, Upstream and Downstream
- Automation Towards Operation Excellence: Future Potential, New Trends and Breakthroughs
- Environmental Factors and Emission Reduction
- Development for Sustainability
- Balance between Efficiency, Productivity, Safety and Quality
- Energy Consumption and Efficiency
- Health and Safety Challenges

Chris Bayliss
Deputy Secretary
General, International
Aluminium Institute

Dr. Hans Erik Vatne
PhD, Sr. Vice President,
Head of Technology,
PMT, Norsk Hydro ASA

Qin Junman
Vice Chairman
of N.E.U. Eng &
RI (NEUI), VP of
China NMI's FE &
Construction
Co., Ltd. (NFC)

Vincent Christ
Vice President,
Tech. & Project Dev,
Aluminium Rio Tinto

Dr. Ali Al Zarouni
Executive Vice President,
MTD &
Transfer,(EGA)

Dr. Mark Dorreen
Director, LMRC &
VP, Technical Energia
Potior Limited

8th Nov
SESSION 9
10:00- 10:45

Roadmap to 2025: What are the Next Steps Needed for Renewable Energy to Become Viable in the Aluminium Industry?

- New Regulations for Solar Energy in Oman and its Implication on the Aluminium Industry
- Wind turbines: Great Supply of Power with Substantial Savings
- GlassPoint Solar: The Largest Solar Panel Project in the Middle East
- Climate Change and its Implications on the Aluminium Industry

Nick Carter
Director, BP &
Convenor, EU-GCC Clean
Energy Network

Qais Al Zakwani
ED & Member,
Authority
for ERO

Eng. Suhaila Marafi
Director,
Department of S & R,
Ministry of E & W,
Kuwait

Kathrine Fog
Sr Vice President,
CS & Analysis,
Norsk Hydro ASA

Dr. Sgouris Sgouridis
Asso. Professor,
Masdar
Institute of S & T

Max Wiestner
Industry Manager
Aluminium, ABB
Switzerland

Siddiqa Al Lawati
Project Development
Analyst,
GlassPoint Solar

8th Nov
SESSION 10
11:15- 11:45

Current Raw Material Trends and Their Impact upon the Markets?

- Global Challenges and Opportunities in Demand and Imports
- Impact of China with the New Environment Regulations and Consumption
- Growth, Investments and Future Markets and Prospects Regionally and Globally
- Evolution of the Raw Material Specifications in the Market (Quality, Density etc. of Coke, Bauxite and Alumina)

Paul Williams
Research Manager,
CRU

Dr. Yanchen Wang
Principal Consultant,
Lead of
CAMR, CRU

Yousuf Bastaki
Executive VP,
Upstream
(EGA)

Ameen Al Ghamdi
Director,M & T,
Ma'aden

Bob Adam
Consultant,
AMCL

Robert Dickie
Sr Consultant,
Carbon Products,
HAI

Yasmin R. Brown
Group Manager,
Jacobs Consultancy

8th Nov
SESSION 11
11:45- 12:15

Outlook 2020: Future of Aluminium Demand for Finished Products?

- Demand Prospects and Market Growth
- Usage Expansion and New Application Opportunities
- Properties and Benefits
- Aluminium Premiums Outlook
- Customer Expectations in Product Quality and Supply Reliability

Andy Blamey
Associate Editorial Director,
EMEA Nonferrous M & A,
S&P Global Platts

Bader Al Olama
Head of Aerospace Business
Unit, Mubadala Investment
Company

Najla Al Jamali
Executive MD,
Takamul Investment
Company

Ihab Mouallem
CEO, NAPCO

8th Nov
SESSION 12
12:15- 13:00

Lean Manufacturing and Sustainable Waste Management: Success Stories and Effective Solutions to Reducing the Burden of Waste

- Social and Regulatory Trends and Best Practices in Waste Management
- Innovative Approaches to Recycle Critical Waste Streams
- Spent Pot Lining and Lean ManufacturingAlumina)

Chris Bayliss
Deputy Secretary
General, International
Aluminium Institute

Professor Steve Halls
Senior Environmental
Expert, MECA

**Sheikh Mohammed
Al-Harthy**
Executive VP,
Strategic Development,
Be'ah, OESHC

Stephan Broek
Director Light
Metals, Hatch

Hilal Al Dhamri
Senior Production
Manager, OCC

David Roth
President,
GPS Global
Solutions

9th Nov
SITE TOUR

ARABAL Delegates are invited to join a Site Tour of Sohar Aluminium's Smelter and facilities.

Delegates were transported via a charter flight (Airbus A320) with SalamAir from Muscat Airport to Sohar Airport and back.

MARKET OVERVIEW:
Shifting Sands?

Global Map Redrawn: Impact on the Middle East's Aluminium Sector?

Moderator: Jorge Vazquez, Founder & Managing Director, Harbor Aluminum Intelligence

Speakers:

- Eng. Said Mohammed Al Masoudi, Chief Executive Officer, Sohar Aluminium Company (SAC), Sultanate of Oman
- Eng. Abd Elzaher Abd Elsattar Hassan, Chairman and Chief Executive Officer, Egyptalum, Arab Republic of Egypt
- Abdulaziz A. Al Harbi, President, Ma'aden Aluminium Company, Kingdom of Saudi Arabia
- Khalid Mohamed Sultan Laram, Chief Executive Officer, Qatar Aluminium Limited (Qatalum), State of Qatar
- Tim Murray, Chief Executive Officer, Aluminium Bahrain (Alba), Kingdom of Bahrain

Jorge Vasquez: We are living in exciting times, such as the US and Section 232, which we expect to have a public decision on by April. Do you expect the US Trump Administration to impose duties on imports of primary aluminum?

There is a fast growth on the demand side in the GCC, especially in the construction area. I'm 100% positive that growth will continue in high digits for the next 10 to 15 years." ABDULAZIZ A. AL HARBI

Khalid Mohamed Sultan Laram: We don't expect this to happen simply because the US is already facing some trades issues and adding to these issues is not good for the US' downstream industry.

Eng. Abd Elzaher Abd Elsattar Hassan: Such a decision will not be effective for the US' needs because imports are more than its domestic production. Total domestic production does not equal 10% or 20% of its demands.

Eng. Said Mohammed Al Masoudi: There are not many smelters left in the US, so most of the primary aluminum is imported aluminum at the moment. They are going to hurt the downstream if they start putting duties on the imported primary. However, this is from an economic point of view – it could happen politically.

Tim Murray: North America is short around 3 million tons, so why do it? Plus, the way the US government typically acts shows they care about the consumer and this would ultimately be a tax on the consumer. Downstream stakeholders in the US have done a very good job lobbying. I think it's more of a posturing that Trump's been using with the Chinese and it won't happen.

Jorge Vasquez: Let's switch gears and talk about competition. India plans to expand production big time next year by adding one million tons of aluminum and 400,000 tons of new billet production. Where will these metal units go? What are companies doing to cope with this intensifying competition in markets like North America and Europe?

Tim Murray: We must compete. How are we doing that? Price obviously is very important and so is service, delivery, quality and follow-up. Customers always tell you that price is the most important factor, but it's just one. More metal is coming; we are going to have 540,000 tons in 2019. You'll be asking that question in the future about us: what is the market going to do about Alba? It is a good thing that the market is growing. If you look at the market structurally – particularly outside of China – there's very little capacity on stream. Yet, demand is healthy. The market can absorb it relatively easily. Globally, we're in a deficit even with China surpluses.

Khalid Mohamed Sultan Laram: Most of this additional production will be consumed locally, as India continues to grow at a rate of 6% per year.

Jorge Vasquez: There's clearly a sense of confidence in the region. You know your customers and that you produce value-added products. Let's move onto China. Chinese smelters are enjoying the highest profit margins in their history. Production is set to increase by more than 4 million tons in 2017, despite illegal and winter curtailments. Do you believe supply reform in China in 2018 will be such that this year's surplus is going to be eliminated next year and China is going to become balanced or even in a deficit position?

We started production in 1975 with 62,000 tons, but our primary problem was access to electricity. In the last three years, we have made a major leap. We reached 41,000 tons from 29,000 tons previously in terms of our current consumption volume – giving us a surplus of 11,000 megawatt in production. Add to this the capacity from power plants to be commissioned and the nuclear power plant being constructed in El Dabaa. Electricity is now abundant now and we must utilize it." **ENG. ABD ELZAHER ABD ELSATTAR HASSAN**

Khalid Mohamed Sultan Laram: China is always a difficult market to see what's happening because detailed information is not available. However, our understanding is that there have already been some capacity reductions. But by how much? That's the question. We keep hearing different figures. There seems to be a reduction due to the shutdown of some smelters that were built without any authorization papers and other smelters that have high running costs. But it is most likely that there have been other smelters starting up at the same time, therefore it is difficult to quantify how much volume is actually being reduced in China.

Abdulaziz A. Al Harbi: According to reports and research, China's surplus will continue in 2017 and 2018. The question is: how big will the surplus be? We do believe that the growth of the surplus is already reduced dramatically, hence those prices above 2000. How long it will continue and what will be the situation in 2019? That's the $1 million question. There is another factor to consider: how serious is the Chinese government about winter load shedding? If implemented in a serious and disciplined manner, then perhaps we will be at a very good price in 2018 and maybe even 2019.

Tim Murray: In terms of price, you have a lot more upside than downside because I think some of it's been factored in already. But if they actually do make more cuts than we think, you're going to see a shortfall in the world. There's going to be a real big deficit and people are going to be running for the metal.

Jorge Vasquez: Let's talk about GCC demand. Primary aluminum demand in the GCC region continues to grow at one of the fastest rates on earth – faster than China and India, only behind Mexico. Are any new downstream expansions taking place in your country between now and 2019?

Tim Murray: There's a tremendous amount of building infrastructure and in terms of population, the majority are young. The GCC has the money to do such projects, particularly if you look at Saudi Arabia.

Jorge Vasquez: Is it conceivable to have another rolling mill in Bahrain within the next five years?

Tim Murray: I don't know if it'll be in Bahrain, but certainly within the GCC. The GCC is still structurally short, even with Ma'aden and Garmco.

Abdulaziz A. Al Harbi: There is a fast growth on the demand side, especially in the construction area. I'm 100% positive that growth will continue in high digits for the next 10 to 15 years.

Jorge Vasquez: Any particular sector within Saudi Arabia that you see growing the most?

Abdulaziz A. Al Harbi: I think extrusion and cables are showing a big increase year-on-year. We also noticed growth in the construction sheets and transportation, specifically in trucking. Here there is a huge transformation from old steel tankers into light tankers of aluminum, which is really improving efficiency. We expect that to continue in Saudi Arabia.

Khalid Mohamed Sultan Laram: There are huge construction projects everywhere in the GCC. In Qatar, it's in part down to new economic zones, for example. Generally, people are most likely to focus more on using local products in their construction activities.

Jorge Vasquez: LME prices today imply that profit margins for smelters stand at a 6 or 7-year high and leads me to ask you about expansion plans. We know that Alcoa and Ma'aden are analyzing the possibility of doing stage 2. What can you share with us about that?

Abdulaziz A. Al Harbi: We continue to look at the opportunity. The Ma'aden-Alcoa joint venture is a very responsible producer and we will not jump into anything that will affect the market. When you jump into a project, you really need to be competitive from all aspects. This includes improving CapEx efficiency and making sure the right thing is being built for the right purposes.

Khalid Mohamed Sultan Laram: Expansions require huge investment and very strong justification to proceed with a project. Sometimes it is better to wait to ensure that the current positive environment – such as the high LME price – is going to continue for some time. Because

China is always a difficult market to see what's happening because detailed information is not available. However, our understanding is that there have already been some capacity reductions. But by how much? That's the question." **KHALID MOHAMED SULTAN LARAM**

The US is going to hurt the downstream if they start putting duties on the imported primary. However, this is from economic point of view – it could happen politically." **ENG. SAID MOHAMMED AL MASOUDI**

of this high LME price, some smelters are going to go ahead with their expansions and there are already other additional quantities coming to the market, as discussed. So, we must wait to see how this impacts the market. We should also not forget about the global political uncertainty, which might have a negative impact on the global economy. The US' political conflict with North Korea is one example. We haven't seen the impact of this conflict enter the market yet. Our preference is to maximize the benefit of facilities that we have already invested in. By following this strategy, we have increased our production by 7% without major investment.

Tim Murray: We have a different view. We were more optimistic and took some risks. If you look back to 2015 when we approved line 6, aluminum was 1500. Apart from Jorge, everybody said why are you doing it? But we are seeing very clear reports of a healthy growth rate for what is a mature industry. So, when should you build? When things are cheap and commodity prices are low. If you look at CapEx per ton for line 6, we're going to be under 4000 a ton. Best project ever.

The cycle goes up and down. So, if you're just going to try and pick it, you're not going to pick it right. And if you wait until everything is good and prices are up, then you end up building at the peak – when you should not build because things are expensive and you have cost overruns. You must be a bit counter-cyclical in your thinking. Sometimes the right time to do things is when the glass is half empty.

Jorge Vasquez: Abdalzaher, Egyptalum is planning to increase production by 250,000 tons. Please share more details with us.

Eng. Abd Elzaher Abd Elsattar Hassan: The aluminium industry is exposed to local consumption, which is increasing. Today, local consumption reached 500,000 tons while we produce 320,000 tons. So, it was necessary to start the development process. This was an economic requirement. We started production in 1975 with 62,000 tons. The primary problem in the past was electrical power. Yet, in the last three years, we have made a major leap in electricity production. We reached 41,000 tons from 29,000 tons previously in terms of our current consumption volume. That means we have a surplus of 11,000 megawatt in production, in addition to the power plants to be commissioned and the nuclear power plant being constructed in El Dabaa. Electricity is abundant now and we must utilize it. We hope the 250,000 ton project will start it in mid-2018 and we expect the first of the two-phase project to finish in mid-2020.

Jorge Vasquez: Tim, please share the experience of the power outage on potline 5 back in April with us.

Tim Murray: We had to recover from basically nothing. It took about four months and was a painful process. But there were many good lessons to take away. Successes included how we did a good job of communicating and how we focused on how to recover from the problem and not solely the problem. On the 6th day following the power outage, we started pots and we were pushing very fast. We needed to change the momentum. You must move, you must push. Maybe you will fumble a little bit and make some mistakes, but then you pick yourself up and go faster. I believe that speed is more important than perfection. If you sit there and worry about everything and get the opinions of everybody, nothing happens. We also learnt a lesson about resilience. If you look at all of us in the smelter business and the commodity business, we focus on cost-cutting – that is the name of the game. But the more efficient you become, the less resilient you become. We want to optimize cost, but when you have a big shock in the system, you're not as resilient.

Jorge Vasquez: Sohar experienced an outage in August. How are things now?

Eng. Said Mohammed Al Masoudi: We lost the power for more than 6 hours. The team was working around the clock, including weekends. We managed to energize the potline within a month and we began restarting the pots in mid-September. Most of our pots are quite old, so we had to ask ourselves the best methods of restarting. If we start relining every pot, it would have taken us longer. So, we did something we called the 'metal start'. This is when we clean the pot and put burners to heat up the metal within the pot without removing the metal part. Then, we bore the bath and energize the pot – and it's working. This is just one of the methods we are using. We are saving a lot of money and time this way. So far, 25% of the potline is operating and we are moving ahead with the plan to have full operations in early April. ■

**This is an edited panel*

The cycle of the best time for project expansions goes up and down. If you wait until everything is good and prices are up, then you end up building at the peak – when you should not build because things are expensive and you have cost overruns. You must be a bit counter-cyclical in your thinking. Sometimes the right time to do things is when the glass is half empty."

TIM MURRAY

Hot Spots: Future Demand for Aluminium from Emerging Markets?

Thought Leadership

Moderator: Julian Kettle, Senior Vice President, Vice Chairman of Metals and Mining, Wood Mackenzie

Speakers:

- Hilde Merete Aasheim, Executive Vice President, Primary Metal, Norsk Hydro ASA
- Matt Liddy, Vice President, Business Development, Pacific Asia, Aluminium, Rio Tinto
- Eng. Bibhu Prasad Mishra, President and Chief Operating Officer, Aditya Aluminium, Sambalpur
- Denis Nushtaev, Head of the Planning and Analytical Department, Business Development and Financial Markets, UC RUSAL
- Paul Adkins, Founder and Managing Director, AZ China Ltd
- Amir Sabbagh, Director of Planning and Strategic Supervision, Iranian Mines & Mining Industries Development & Renovation Organisation (IMIDRO)

Julian Kettle: If you look at the growth in the aluminium market since the global financial crisis, the Organization for Economic Co-operation and Development (OECD) has grown by -1% a year, while emerging markets have grown by an average of 6% per year. Where do you see the greatest growth in the emerging world?

Hilde Merete Aasheim: Aluminium is the building block for any society to develop; it is in every phase of a country's development. In China, it started with building infrastructure and then, as the economy matured, it became more about the consumer market for cars, electronic equipment, packaging and so on. India is the next country to see substantial growth, with the rise coming from low levels. India really is an emerging market. Countries in East Asia – Taiwan, Vietnam and Indonesia – will experience the same development. South America will probably be one of the emerging markets that go through the process that I just used China to elaborate.

Denis Nushtaev: Russia's demand can increase by 10% per year over the next five years. We are also trying to organize special industrial zones – as Gulf countries have done – where we attract the producers of aluminium products to buy our liquid metal supplies in Siberia and the Ural region. We have very good logistics.

Julian Kettle: One of the key questions circulating the market is: can India continue to grow?

Eng. Bibhu Prasad Mishra: The speed and volume of India's growth story has been debated for a very long time. The country has reached an inflection point where the per capita GDP is around $2,000, which in terms of purchasing power parity (PPP) will be around $8,000. Looking back to 1990, this is where we saw the Chinese growth story start. India is starting from a very, very low base of approximately 2.5 kilos per person per year, which we expect to rise. Plus, India has the resources available and with the new government, it also has the necessary political will. Many economic changes that were at one point not imaginable are now happening. India's construction sector is growing, and it is home to a world-class automotive industry. A lot of this is happening only in one area: the eastern part of the country, mostly Orissa, which is making around 2 million tons.

The fact that aluminium can be recycled is a big benefit of the metal. It's astonishing when you think that 75% of all aluminium ever produced is still in use. There are few other materials that you can say that about."

Julian Kettle: Iran has also started to open up. There is a lot of information surrounding supply, but little regarding demand.

Amir Sabbagh: After the sanctions were removed in 2016, we had a growth rate of 6.4%. A lot of free capacity came into operation. In the second half of 2016, we reached 9.1% of growth in GDP and in 2017, this climbed to 12.9%, according to the World Bank. New capacity of around 350,000 tons will come into operation in January 2019 so we should be able to reach 800,000 metric tons by the beginning of 2019. I would be positive concerning consumption rates in Iran.

Julian Kettle: To the elephant in the room: China. We have the world's largest market growing by the greatest rate in absolute terms and yet, we still call it an emerging market. Over the last decade, China has increased its consumption by the same amount as the total consumption recorded in Japan every single year. What is the likely narrative in China over the next five years?

Paul Adkins:
We're going to go through some sort of an inflection point, which we've started to see already this year. The model has been housing construction and infrastructure development. But the rate of consumption has slowed down this year and it is no longer number one. Now, transport is the number one sector in China, while packaging still has a long way to go. My concern relates to the macro-economic and political environment now that the 19th Party Congress is out of the way. We'll have the December Financial Meeting and then we will have to see what the blueprint is for China's economy under the new leadership. There are not enough

QUICK FIRE QUESTION

Aside from China and India, which emerging market is most likely to post surprise growth, and for which end use?

Hilde Merete Aasheim:
- South America
- Automotive industry

Matt Liddy:
- Vietnam and Indonesia
- Infrastructure

Eng. Bhibu Prasad Mishra:
- Vietnam, Philippines, Indonesia, Malaysia.

Denis Nushtaev:
- Russia, Turkey and Mexico
- Automotive and cabling

Paul Adkins:
- Indonesia, Vietnam, Malaysia, Thailand to a lesser extent
- Infrastructure

Amir Sabbagh:
- Indonesia, Turkey, Southeast Asia & Iran
- Automotive

signals yet. At the last few congresses, the GDP target was a specific number that was quoted – that was not the case this year. Aluminium demand and consumption is very closely associated with GDP growth. So, if China is looking to dial back growth, it's going to impact demand for aluminium. We need to move with a touch of caution.

Julian Kettle: Let's discuss the end-use markets. What's your opinion on growth in the automotive sector?

Hilde Merete Aasheim: We see aluminium not only being used for specific components in a car, but the whole body as it's lighter weight, resistant to corrosion and driven by regulatory requirements in terms of reducing fuel consumption.

Matt Liddy: We're seeing a lot of growth in the automotive sector, especially in places like North America as environmental constraints increase. In China, the ownership of vehicles is quite low, but a high growth rate is anticipated. The jury is still out on electronic vehicles. It will be a case of wait-and-see, but I suspect there will be upside there as well.

Denis Nushtaev: The development of electric vehicles is very important, but so is the need for all of the associated infrastructure. Such a fleet needs a huge network: new cables, new distribution network, new charging stations, and so on. At UC RUSAL, we have prepared several brands of new cables with some other technologies as we see a greater demand going forward.

Julian Kettle: China runs huge surpluses and has huge access to capacity in all parts of the value chain, so perhaps an all-aluminium car will absorb this metal?

Paul Adkins: We will start to see an evolution in the way China manages its scrap cycle. For now, it's the path of least resistance in that it's easier to buy the scrap from the US that is ready to go straight into the furnace and come out as garden furniture. Going forward, China will start to evolve in terms of the amount of scrap going through the cycle. It could take up to four years.

Hilde Merete Aasheim: The fact that aluminium can be recycled is a big benefit of the metal. It's astonishing when you think that 75% of all aluminium ever produced is still in use. There are few other materials that you can say that about. Plus, it only takes 5% of energy to bring that product back into the loop. Hydro has a carbon neutral goal by 2020 and we are working hard on not only taking back lean scrap and the fabricated scrap, but also the post-consumed scrap that is painted and so on. We also see more consumers being conscious about what kind of materials they use to produce furniture, cars and so on. As an industry, we need to respond.

Julian Kettle: How is India dealing with environmental sensitives?

Eng. Bibhu Prasad Mishra: Most of the power generation for India's smelters comes from coal. It's a huge problem. Irrespective of its quality, you need to pay $56 for the carbon tax per one ton of aluminium. Consequently, there is more focus on solar and wind power. Hydropower generation is quite complex as most of the rivers from which we receive perennial water run down from the Himalayas, which is a very sensitive area.

Paul Adkins: In China, the solar and wind farms are largely in the Guangzhou Province, Tibet or a long way away. China still has a lot of work to do to really harvest that energy, but they might be able to get there. The other thing to consider is that the Chinese are building a lot of nuclear power plants, which will change the country's energy footprint. ■

**This is an edited panel*

Thought Leadership

Raw Materials: Top Three Trends to Watch?

The Chinese environment and the new role that has affected China's aluminum production - we as an importer of those materials - have seen and felt the pressure. And that's what's guided us as a company to integrate our upstream into our midstream. So that's one side of how to control the risk of volatility of the price in our business."

YOUSUF BASTAKI, EXECUTIVE VICE PRESIDENT, UPSTREAM, EMIRATES GLOBAL ALUMINIUM (EGA)

HEDGING RISK:

Aluminium producers must take proactive steps to minimize the negative impact of price volatility and ensure raw materials are continually available. Strategic planning is essential. For example, a smelter operator without a planned schedule for the delivery of coke in 2018 will likely still secure supply – but at a higher cost. Robust strategies include integrating upstream and midstream operations and diversifying procurement strategies to include multiple sources of both raw materials and finance. It will also become increasingly important for operators to adopt a new mantra: blend, blend, blend. Some stakeholders see the cost pressures on alumina resulting from a shortage of alumina producers, which could open the door for the Gulf to invest in upstream development. Plus, oft-repeated calls for collaboration still hold considerable value. Stakeholders would benefit from joining forces to invest more time, money and human capital into technical and commercial R&D.

BAUXITE: DOMINANT SUPPLIERS?

China is importing almost 68 million tons of bauxite, which will probably nearly double by 2025 to 120 million. There will likely be two major players in the bauxite mining arena to help plug such demand: Australia and Guinea. There could be another upward movement in bauxite prices if these two countries are unable to accommodate China's demand over the next eight years. Looking at Guinea alone, the country was producing less than 20 million tons a year of bauxite in 2014. That figure will be close to 30 million tons a year this year and potentially 35 million tons in 2018.

CHANGE IN CHINA:

Unprecedented reform on the supply-side in China will significantly impact the global market over the coming year and likely trigger higher capital costs, including the cost of raw materials. Reforms include China's upcoming winter curtailment and tightening environmental policies. It remains to be seen how steeply the winter curtailments – likely to be carried out for the next few years – will impact the cost of raw materials. A winter curtailment will also impact the balance sheets of aluminum refineries, carbon plants and caustic soda plants. ■

By 2021, Guinea could be exporting 90m tons of bauxite coming, which would put the country alongside Australia and China as the world's biggest bauxite producers, at a total of around 100m tons per year."

BOB ADAM, CONSULTANT, ALLIANCE MINING COMMODITIES LIMITED

**Compiled from the insights of:*

- *Dr. Yanchen Wang, Principal Consultant, Lead of Chinese Aluminium Market Research, CRU;*
- *Yousuf Bastaki, Executive Vice President, Upstream, Emirates Global Aluminium (EGA)*
- *Ameen Al Ghamdi, Director, Mine and Technical, Ma'aden Aluminium Company*
- *Bob Adam, Consultant, Alliance Mining Commodities Limited*
- *Robert Dickie, Senior Consultant, Carbon Products, Harbor Aluminum Intelligence*
- *Yasmin R. Brown, Group Manager, Jacobs Consultancy*
- *Moderator: Paul Williams, Research Manager, CRU*

Thought Leadership

Finished Products: Outlook to 2020?

Moderator: Andy Blamey, Associate Editorial Director, EMEA Nonferrous Metals and Analytics, S&P Global Platts

Speaker:
- Bader Al Olama, Head of Aerospace Business Unit, Mubadala Investment Company
- Najla Zuhair Al Jamali, Executive Managing Director, Takamul Investment Company
- Ihab Mouallem, Chief Executive Officer, National Aluminium Products Company (NAPCO)

Andy Blamey: What is the general investment climate in Oman and the wider Gulf like at the moment?

Najla Zuhair Al Jamali: What we have seen at OOC is that there is no shortage of lenders for a solid project with solid economics. Last summer, an ammonia project in Salalah was oversubscribed by 2.5 times. The finance market will respond to a project if it makes economic sense.

Andy Blamey: While there are obvious growth prospects in the market, there are still technology intensive and value-added markets to be addressed.

"One of the biggest growth areas will be the 3D printing of aluminium; this illustrates disruptive thinking."

Najla Zuhair Al Jamali: I'm very excited about the electrical vehicles (EVs) market. China is powering a lot of the demand numbers. China's government plans to reach 20% of EV sales by 2025, India is aiming for 40% by 2030 and France, Germany and the UK want to have 100% EVs on their roads by 2040. This generates a lot of excitement; China's demand alone warrants that.

Andy Blamey: Do you see significant growth prospects in the aerospace sector, or are competing materials better placed to grow?

Bader Al Olama: Forty years ago, almost 70% of aircrafts were made from aluminium. It is now around 20%. Is the use of aluminium in the aerospace industry dying? No, but I do see a large opportunity for it to regrow in terms of market share. When you think about composites and other metals, like titanium, aluminium has dipped big time. The only thing likely helping the aluminium sector in the world of aerospace now is population growth. Many people want to travel, which translates into more aircraft. But unless somebody somewhere comes up with a revolutionary change for aluminium, I do see a potential downfall. If the sector is looking for high performance, low-weight, high strength and longer durability, then that is what the aluminium sector should be developing.

Ihab Mouallem: There is potential for growth across the board. Let's not forget that in the GCC, 58% of the GDP comes from the industrial side and that aluminium accounts for just 2.5% of that. The export market is doing very well, especially in the UAE, Saudi Arabia, Oman, and policy in the region assists all the downstream industries to go further and export their products to India, to Africa, to Europe and the US. Generally, I see a very positive trend.

Andy Blamey: Customers increasingly want their product to have a lower carbon footprint. Where do you place local production on the sustainability spectrum?

Ihab Mouallem: The trend is growing in large part due to producers' initiatives. NAPCO has already started planning for this initiative and we'll soon be launching the eco-green. This Omani product will be in the market in early 2018 but I cannot elaborate just yet.

Bader Al Olama: In terms of green growth in the aerospace industry, we work with our suppliers to find opportunities and new products and to achieve certain objectives that are ultimately set by Airbus or Boeing. Sustainable industrialization is becoming a big theme globally and there are many aspects to it. One of the biggest growth areas will be the 3D printing of aluminium; this illustrates disruptive thinking. I see 3D printing of aluminium being the next big thing for us in this part of the world. ■

**This is an edited panel*

A FINANCIAL VIEWFINDER: What's Next?

Global Market Economic Review: The Road Ahead

Moderator: Andy Home, Senior Metals Columnist, Thomson Reuters

Speakers:

- Paul MacGregor, Managing Director Head of Sales, London Metal Exchange (LME)
- Tom Leary, Vice President, Market Intelligence and Consulting, Harbor Aluminum Intelligence
- Jerry van Alphen, Chief Financial Officer, Sohar Aluminium Company (SAC)
- Ali Al Baqali, Deputy Chief Executive Officer and Chief Supply Chain Officer, Aluminium Bahrain (Alba)
- Xiao Fu, Head of Commodity Markets Strategy, Bank of China International

Andy Home: Two years ago, Goldman Sachs issued a research note warning that the aluminium industry was going to get the greatest 'best' shock in its history. Last week, the price reached a five-year high on the London Metal Exchange, at 2250. How do you go from looking into the abyss when everyone is telling you the price is going down to where you are now?

Ali Al Baqali: If we go back to the end of 2015, the LME and the premium started collapsing. And that time, the aluminum industry was concerned. When the CEOs were setting out their expectations for 2016, one was to be ready for the LME to be below 1300. That was not a joke – all the market intelligent and other market reports said this was a possibility. At that time, we had a campaign to introduce the challenge of 1300. The CEO and all executives walked through the shop floors and after one week, all the employees were aware of the LME and the consequences of $1300 in terms of Alba's bottom line. This pushed us and aligned all the employees to generate greater savings to sharpen our competitive advantage. In 2016, the average LME price was around 1600. While the 1300 forecast was wrong, it was very good that we were poised to face the challenge – we would not have been at risk it 1300 had been realized.

Jerry van Alphen: It is a huge move and we went through a similar exercise to what Ali is describing. We are a low-cost producer. But even so, 1450 was the price 18 months ago and at that sort of price, we are not that far off the water line. You must work hard and expand the company's knowledge, know what are you doing, how to save costs and brainstorm about what you can do differently. Fast forward about a year and in August this year, the price jumped significantly.

Initially, I thought it was just a spike and that we'd have to be ready to go back down to lower levels. But the more I read and hear and see, I'm thinking the new normal is above 2000. China's reforms appear to be sticking and the country's central government seems to be stronger. Before, there was leakage at the local level of what people were doing. We will also see import costs consistently going up. Carbon is reaching new levels, so that puts another flaw in the price for the longer term. A price of 2000 plus is here to stay for a while.

Andy Home: Xiao, we see kind of confusing headlines of structure reform in China. What is your take?

Xiao Fu: We still have a moderately optimistic view towards the aluminium price in the medium-term due to two factors. One is we think the government will be very serious about carrying out the supply-side reforms and product cuts. The second factor is that we think the demand outlook remains healthy over the medium-term. The first observation is that the reform is much wider. It's not only about aluminum, but also about cutting steel capacity and pollution, for example. The changes are going to be an ongoing thing, rather than just this winter, as it is a central part of China's 13th Five-Year Plan. The second observation is that the pollution level in some of the northern parts of China can be very bad; in some areas in winter, you can barely see the traffic lights. So, the local government must urgently reduce pollution – the target is to reduce 15% of PM 2.5 this winter. It will be very interesting to see if this can be achieved. My third observation is that we have seen nine government ministries cooperating. It is not just the environmental ministry but also the commerce ministry and the National Development and Reform Committee, for example.

Andy Home: The market has gotten a little bit fixated on the winter curtailments and it sounds like we should be taking a much wider view. It makes me wonder whether we got so used to China having overcapacity and exporting that overcapacity and that maybe we should be thinking about it the other way around? Is today's higher price telling us that there are genuine concerns surrounding the reliability and stability of China's supply?

Tom Leary: I don't think so. I have a bit of a contrarian point of view to it, in the sense that there are a lot of questions going on as to what will happen. The reason for our contrarian view is that there is tremendous amount of stealth stocks out there. If you look at what recorded inventory is out there compared to what we're calling stealth stocks, this would be off-exchange material. And it's considerably less expensive to store your material off-exchange; anywhere from five to 10 times less expensive on a per metric ton per day basis. And we're just seeing these inventories of the stealth stock grow. So, we will still see this over-supply position going forward, in the near-term at least. And you ask, how do you know what are these stealth stocks? Through surveys, through field work and through talking with clients and consumers who are in the market. We believe that the current run-up that we're seeing with the LME price today is still speculative. The fundamentals aren't there yet to really derive the price where it. Now, will it get there? It's going to depend on how quickly these stealth stocks come off and how quickly they get consumed.

Andy Home: In terms of the size of these stealth stocks, it's about one million tons of aluminium registered with the LME. Leaving aside China for a moment, how much more is there out there?

Tom Leary: You look at different groups that put these forecasts together to understand the true inventory. Around 10 to 12 million tons is one that sticks out, which would include China as well.

Andy Home: How do you see the role of LME stocks in terms of being an indicator for market moves?

Paul MacGregor: It's obviously a very key metric, but it varies depending on the metal. In aluminum, it's never been a particularly stronger indicator, because there is a lot of off-warrant activity that we simply can't track. The more important things to look at when gauging price dynamics are the factors discussed, such as China. You can't avoid the fact that the Shanghai Futures Exchange does impacts LME prices, especially during the Asian trading hours. Aluminum, as far as China is concerned, is pretty much a closed loop. China does not export or import the aluminium ingots, which is what the LME contract is based on. So, in theory, it wouldn't have any impact on the price at all.

Andy Home: Xiao, your bank has many commercial relationships in China. Is it fair to say that China is becoming a real driver of the aluminium price in a way that it wasn't just a few years ago?

Xiao Fu: Yes, I agree with Paul. I'll give you an example. On September 21st, I was at a conference in Shanghai when the news hit the market that there would be some capacity cuts in the Henan Province earlier than expected. That afternoon in Shanghai, the price rallied strongly and the when the LME opens, the price follows suit. There was a clear linkage. Going forward, more Chinese traders are looking to trade the LME contract and we have talked to a lot of corporate clients and other funds that are actively looking to trade on the LME. China's 'One Belt One Road' policy will also bring China closer to the rest of the world. There will be more cooperation globally, which can support aluminum demand over the medium term.

Andy Home: Is there real 'industrial hedging' trading activity in Shanghai or is it just a roller coaster of retail investment coming in and out?

Paul MacGregor: We look very closely at open interest as a key statistic. If you look at the average volume to open interest daily on the Shanghai Futures Exchange, the average holding time for a contract is around three hours. The average holding time for a contract on the LME is several weeks. That says to me that people are coming into that marketplace, taking a view on the markets and then closing position before the end of the day on average. Whereas people are coming onto the LME and looking to take a view much further forward than that and potentially rolling it forward down the curve. This suggests that there is more physical hedging and more hedge fund activity with a longer view. We've certainly seen a growth in terms of financial players, especially in terms of hedge funds. Commodities tend to go in and out of fashion with hedge funds – it is very much back in fashion now, especially with the electric vehicle story.

Andy Home: Let's talk about the pricing of aluminum. Can you tell us how the market is now operating?

Ali Al Baqali: In the past, the price of alumina is linked direct with the aluminum price. But in recent years, the major suppliers shift to the index price. We believe – as an industry or as smelters – that it's not representing the market price for the alumina.

IN FOCUS

What next for the alumunium price?

"It will go higher in the very short-term. But this is speculative and so it's not being driven by true supply-demand dynamics. During the first quarter of 2018, fundamentals will start to have more influence and we will see the price decrease to somewhere around the mid-1800s." – Tom Leary

"We will see a short-term dip in the middle of next year most likely. Longer-term over the next two to three years, the price will likely come back up again." – Jerry Van Alphen

"LME price will increase by a few hundred dollars. If the cuts are continued on an annual basis, the LME price will stay at this level for a few years." – Ali Al Baqali

"For the medium-term, we have a positive outlook due to the reforms on the supply-side. We think the Chinese government is determined to achieve them." – Xiao Fu

Jerry van Alphen: It seems like that train's left the station. I mean, it's all the new contracts that we see over here are all index-based; and it's not necessarily one index, it's often a mix of indices. But it's index-based.

Andy Home: So, it becomes almost a new cost factor that wasn't there in the past, in terms of planning budgets?

Jerry van Alphen: Right.

Andy Home: That brings me back to the LME, where one of the contracts that's being talked about is a possible alumina contract. We should say there's already one on the CME, but I don't think it's trading now much. So, what's the LME going to offer to those who feel they've lost their natural alumina hedge?

Paul MacGregor: We hear the market with that. There has been a divergence. I agree that it's not going to come back and so the Exchange must respond and look at potentially launching an alumina futures contract. The key for us though is to establish an underlying index that the market is happy with to base the futures contracts on. At the moment, you have a bit of a divergence of indices for alumina. We would need to discuss with the market which one they trust the most. And if our futures contract is successful then that would naturally become the successful underlying index, because people would want the underlying index to really reflect what was going on in the spot market.

The futures market also has validity. We would need full support of the industry. We recently went through a couple of successful product launches; steel scrap, steel rebar and LME precious. The reason those took off so quickly is we had industry players come in and support the contract from the outset. They didn't sit on the sidelines, but were instead fully bought in to what the exchange was doing. They came and provided liquidity – both on screen and off screen – from day one. And we would need to ensure we got the same support both for premiums and for alumina. I envisage a whole family of products around aluminium futures because this is such a huge market it will spawn additional derivative contracts. Obviously, as an exchange we must be very careful because you have this great co-liquidity in the core aluminium contract which serves a very important need for the market, in terms of hedging. The last we'd want to do of split or dilute that liquidity in any way. But so long as we get the specification right and we get support of the industry, alumina futures are part of our plan for next year.

Andy Home: Jerry, is that something you'd be interested in?

Jerry van Alphen: Yes, being able to hedge forward or look forward on pricing…

Andy Home: To reestablish the lost natural hedge, if you like?
Jerry van Alphen: It doesn't recover it fully, but it at least gives you much more.

Andy Home: How far forward, out of interest?

Jerry van Alphen: A year for planning. But, in terms of long-term, if you're really going to be thinking about expansions or big investment decisions, then three to five years.

Andy Home: It sounds like this change in the alumina pricing has happened very fast and that the market is still adjusting to it. Paul just said that the LME would launch a contract if we get a recognized benchmark. Do you think we're anywhere near that or is it still too early in this whole pricing upheaval process?

Ali Al Baqali: It is very difficult now to shift to another mechanism of price. What I see is that the direct link of alumina to LME is the best model. At the moment, the spot market is not working well for me. There is no more transparency in the pricing formula; it's just between the buyer and the seller. As an industry, as smelters, we would like to see something in the future that is fair to suppliers and the producers while representing the true value of the material. And that should not be far away from the market fundamentals of demand and supply. ■

**This is an edited panel*

Exploring a New Middle Ground

By Georgina Hallett, Chief of Staff, London Metal Exchange (LME)

Physical storage is a crucial part of the metals industry that tends to be a little under-appreciated. It is the backstop to a huge part of the metals value chain. Almost everyone who takes delivery of metal, or uses metal in some way, will have used physical storage at some point.

The possibility of physical delivery ensures prices convergence between the 'real world' price of aluminum – the price a consumer will pay to a producer – and the financial price. But it is not always straight forward. Broadly speaking, there are two forms of warehousing. There is the on-exchange warehousing, such as LME, and there is the off-warrant market. There is about 2.5 million tons of metal in LME warehousing at the moment, of which around 1.2 million is aluminium. That figure includes cancelled stocks. The LME expects there to be around 7 million tons of off-warrant stocks but this is really a rough estimate as the LME does not really track these stock levels. Each method – on-warrant and off-warrant – has a different set of challenges. But they share a common goal; to be a trusted logistical partner in what is a critical part of the value chain.

For the LME, price competitiveness is a big challenge as the LME warehousing will always be more expensive. We have higher standards for security, for insurance and for audits, as we do internal and third-party checks. The other key factor for the LME is ensuring that the network operates effectively. Challenges in the off-warrant market are slightly different. The market does not bear the costs associated with third-party assurances, but the issues can then include security and fraud. Essentially, the LME's task is to replicate the off-warrant market while accepting it will always be more expensive to store metal on-exchange. The task for off-warrant market is delivering the same kind of reliability that you see on the on-exchange market.

Since LME's reform process, we have not had any structural queues in our network since the end of August. We do still see operational queues, which are a result of a large cancellation of metals. But it was the structural queues that were the problem.

The LME had a market-wide consultation in 2013 that resulted in a 12-point reform plan. A need for greater transparency was included in the feedback that we received from the market. People said they did not really understand the LME's warehousing, which is why a lot of work after the consultation looked at ramping up transparency.

For the LME, price competitiveness is a big challenge as the LME warehousing will always be more expensive. We have higher standards for security, for insurance and for audits, as we do internal and third-party checks."

The LME also carried out updates to improve best practices, so that the networks work as efficiently as possible. An example of the evolving rules included the 'load-in, load-out rule'. This meant that warehouses with queues had to load out more metal than they loaded in. The problem with an evolving rule book is that it tends to increase the cost. We must monitor compliance at warehouses, warehouses themselves must do internal system changes, insurance changes, logistical changes – each has a cost impact. On the plus side, the LME is now comfortable from a regulatory perspective and a rules-based perspective. In short, the network does what it is supposed to do.

The off-warrant market seems to have had more problems recently. Certainly since 2002, we have seen over $4 billion of fraud. The on-exchange market is not immune to these challenges, but it does seem to have become more problematic in the off-warrant market. Such fraud has mainly been paper-based, such as dealing with a receipt that has been issued against metal that already has a receipt. This causes obvious challenges from a financing and insurance perspective. Fraud is not always intentional as a lot of the processes are manual, so there is an element of human error to factor in. But the negative result is the same. Ultimately, it comes down to an issue of trust. How does the off-warrant market build that greater trust?

There needs to be more global standards for security. The LME has an offering called 'LME Shield', which has been launched, though it is subject to further development. LME Shield is just one of several offerings from different providers. The right solution must meet the security of the on-exchange market and accept the associated costs, while also eliminating some of the risk tied to the off-warrant market. Introducing electronic systems to minimize the risk of fraud and genuine but expensive human error would help deepen trust on all fronts. As many solutions rely on a third-party assurance, it will be trickier if you are pro-decentralization and using the off-warrant market for that reason. Plus, third-party assurances incur costs.

There is a huge role for both methods, but the individual challenges need addressing. Efforts to identify a middle ground are worth exploring. ■

Trade Trends and Tariffs: Sharpening Competitive Edges

Thought Leadership

Moderator: Mahmood Al Daylami, Secretary General, Gulf Aluminium Council (GAC)

Speakers:

- Eng. Nahla Abdulwahab Al Hamdi, Director General of Industry, Ministry of Commerce and Industry, Oman
- Paul Adkins, Founder and Managing Director, AZ China Ltd
- Mark Geilenkirchen, Chief Executive Officer, Sohar Port Freezone
- Khalid Abdul Latif, Chief Marketing Officer, Aluminium Bahrain (Alba)

Mahmood Al Daylami: Governments in the Gulf, starting with UAE and Saudi Arabia, are planning to implement VAT next year. What will be the immediate impact on the industry?

Eng. Nahla Abdulwahab Al Hamdi: There won't be any immediate impact as this sort of VAT is usually passed onto the consumer. Plus, as far as I know, 90% of the product will not be included in these taxes. Only the very luxurious commodities will be included. So, I don't think it will hurt manufacturers much.

Mahmood Al Daylami: Is there a date for Oman to introduce it?

Eng. Nahla Abdulwahab Al Hamdi: Perhaps by the end of 2018.

Mahmood Al Daylami: There has been talk in the last few months about the anti-dumping investigations. Do the Chinese see it as the West ganging up against them? Is this move more politics or economics?

Paul Adkins: Politics are always involved. By and large, the Chinese government sees it as some sort of irritation. The focus is on the growth and the health of the domestic industry; GDP and job creation and so on. At the same time, we're seeing some changes in the way China is preparing itself in case problems do arise. Even if those problems don't come to pass, there is no question that the aluminium industry in China is gradually shifting away from private enterprise and back towards public ownership. Around 88% of the capacity China has closed belongs to private enterprise – 12% belonged to government. Looking at the 8.5 million tons of new capacity that's being built between 2018 and 2019 and 75% is government-owned. Over the course of the next decade, we will see a shift back to the central control of the industry. Even in the 19th Party Congress a couple of weeks ago, there was an emphasis on the party taking control of the government and the economy.

Mahmood Al Daylami: What will it mean for the industry if the US does impose the tariff?

Khalid Abdul Latif: There is always that 'what if' when we talk about this tariff. The investigation is ongoing. The deadline is to be met by February next year and it's up to the White House. If the tariff applies across the board, then that's a fair in the sense that it will be like the duties we have with the Europeans. If there is a sense of favoritism – a certain country or company has preferential rates – then it's a matter of strategy, marketing, sales and supply and demand. We all know that the North American market faces a shortage and that they need the Gulf countries and some volumes from China and India. If the US was self-sufficient, there'd be more concern about this proposed tariff.

Mahmood Al Daylami: Let's discuss logistics. What do you think the Gulf aluminium industry must do to reduce costs?

Mark Geilenkirchen: The industry needs to cooperate more when it comes to digitalization and logistics. The cost of logistics is mostly based on how steady and undisrupted operations are. The greater the collaboration, the more seamless the flow can be. Yet the industry is operating on a siloed basis and there are enormous costs incurred as a result. Cooperation can be with other aluminium producing industries on your non-core activities or with totally different companies that can use the supply chain that you have been investing in. In some cities, supermarkets bring their supplies into the city on combined trucks. That wasn't the case a decade ago. Cooperation is how we can make processes as cheaply as possible.

Paul Adkins: Around a year ago at the Gulf Aluminum Update, a gentleman suggested sharing vessels for alumina deliveries. There was even talk about sharing vessels for calcined coke deliveries. I don't know where that idea has gone, but it illustrates how some in the Gulf are thinking.

Mahmood Al Daylami: Looking to China what is the long-term environmental strategy?

Paul Adkins: The Chinese government is very serious about getting rid of pollution. There is the public perception and then there's the real

"We'd like to have this downstream industry in our port and free zone, for example. It provides more employment opportunities, which is very important for Sohar and for the region of North Batinah."

work. Some of the work that we're seeing now is about showing the average citizen that the government is trying to bring about positive change. At the same time, the government understands that it will not be an overnight fix. It will take a long time. So far, they haven't made much of an inroad into reducing pollution.

The winter curtailments mean we will have a reduced pollution level during that season, but there really needs to be a permanent process to fix the pollution levels. China's Ministry of Environmental Protection has also started a new program on water pollution and ground pollution.

Mahmood Al Daylami: In-keeping with the theme of the environment, the rate of recycled aluminium in the Gulf is around 10%. Yet, the region produces around almost 450,000 tons. Why has the Gulf not embraced the use of recyclable aluminium in its industry like other industrialized countries?

Khalid Abdul Latif: The region is not ready for this to be a norm. When all of us build smelters, we build to produce and sell. In the beginning, you don't engineer the smelter to recycle as well. Unfortunately, that has not been the thinking, but it is beginning to happen. The region is not yet mature in terms of recycling from all aspects, including exporting or importing scrap. The legalities, customs and so on – all these factors are not 100% assured. There needs to be greater awareness in the region. We need to seriously think about it.

Eng. Nahla Abdulwahab Al Hamdi: One suggestion is to do more R&D in this space and essentially build a new kind of industry around that. In Muscat, we have laboratory facilities for the metals industry. The amount of money that could be generated from recycling aluminum could be huge.

Khalid Abdul Latif: A big portion of scrap from countries in the GCC goes to India, because this region's logistics have not matured enough yet in that sense. It is cheaper to ship it to India than from Oman to Bahrain, for example.

Audience Member 1: What is being done to improve logistics through collaboration? For example, what's happening in terms of smelters collectively addressing how to cut the cost of their raw materials or expensive technologies?

Mahmood Al Daylami: We [Gulf Aluminium Council (GAC)] have had several meetings with the procurement departments of all the GCC smelters, especially regarding raw materials, spare parts, shipping and generally reducing costs. We have a huge number of spare parts in each smelter – six in total – that are worth millions and millions of dollars. There would be significant savings if it became a coordinated effort. There are challenges to get that moving. One being the lack of confidence in depending on somebody else during an emergency. If you have a problem, you don't want to call somebody else to give you a spare part. You want to own it. That poses a mental challenge that we have not yet been successful in overcoming.

Then there's the impact of external pressures, particularly from suppliers. Some tell smelters that collaborating will weaken their competitive edge because that supplier is giving them a special price; a discount they'll lose if smelters collaborate. Such scare tactics by suppliers are causing hesitation amongst some of the smelters. But we haven't given up.

Audience Member 1: In terms of having a sense of security with vital equipment, can the industry not start with smaller or less-important machinery to help build confidence in the system? The benefits are much greater than the risks and other smelters that have collaborated have saved millions.

Mahmood Al Daylami: You're right. This is happening in industrial zones, which has been very successful with savings reaching millions.

Audience Member 2: The region needs to leverage its energy and influence to stimulate the diversification of how aluminium is marketed and organized. What are your thoughts?

Mark Geilenkirchen: We'd like to have this downstream industry in our port and free zone, for example. It provides more employment opportunities, which is very important for Sohar and for the region of North Batinah. The way to get it is not to try and attract the downstream industry, but to try and attract customers of the downstream industry. That's the way forward. We are now embarking on a very long road to organize a food cluster and to get food companies that need plastics into our port.

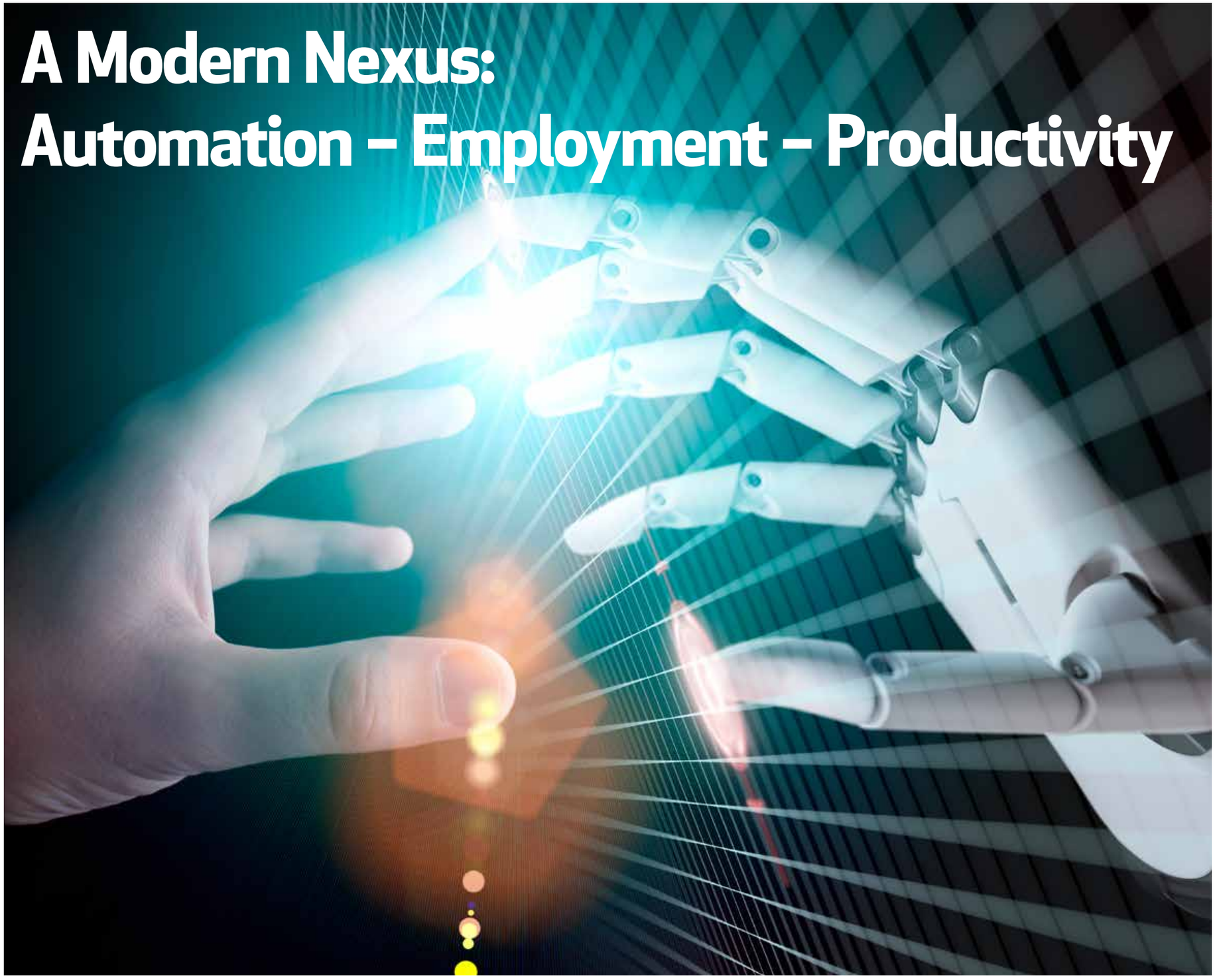
Eng. Nahla Abdulwahab Al Hamdi: Manufacturing alone will not add the value that we aspire to. We need to talk about diversification and look at different ways of developing our manufacturing industry, including the growth of industries that require aluminium. We must move towards building a service-oriented industry that relates to metal manufacturing.

Paul Adkins: The answer lies in seeking opportunities for certain products and aiming for niche markets. Opportunities must be gauged on an individual basis. Maybe I'll devote one pot room to making high purity metal, or maybe I'll start casting certain alloys and so on. It's about starting from the endpoint to identify that niche and develop your skills. The opportunities are there. ■

**This is an edited panel*

A NOVEL FUTURE:
Technology and Innovation?

A Modern Nexus: Automation – Employment – Productivity



At the beginning of the century, Ray Kurzweil, Futurist and Chief Engineer at Google, predicted that 20,000 years of progress would be crammed into the next 100. But the rate of progress appears to have been even faster – and the impact on the job market more extreme. Automation and many other elements of the 4th Industrial Revolution – Artificial Intelligence (AI), robotics, blockchain, predictive data analytics, for example – are increasingly common. More than half (53%) of respondents to a PwC survey said technological breakthroughs will transform the way people work in just the next decade. McKinsey estimates that on a global scale, the adaptation of currently demonstrated automation technologies could affect 50% of the world's economy, or 1.2 billion employees and $14.6 trillion in wages. Just four countries—China, India, Japan, and the United States—account for just over half of these totals. The workflow automation market is forecast to reach $18.45 billion by 2023 from $4.26 billion in 2016 at a compound annual growth rate of 23.56%, according to ReportsnReports.

A FINE LINE

The rise of workflow automation does not translate directly into job losses. The invention of the ATM in 1967 did not eliminate the need for bank tellers; their jobs became more sophisticated and value. When it comes to communicating, the rise of digital dialogue via computers and mobile phones has only increased our interconnectedness versus sitting down to write letters a few decades ago. Equally, concerns for some sectors are understandable. For example, the robot Hadrian X can lay 1,000 standard bricks in one hour – two bricklayers can take a day – and millions of truck drivers will be left unemployed if the self-driving vehicles promised by Tesla become widely available in the next decade.

This year, Amazon have 'hired' almost 80,000 robotics to handle the company's vast warehousing operations, ranging from handling the small merchandise to inventory control. This has almost immediately contributed to around 40% growth and optimization in their warehouse operation. While the capabilities of increasingly sophisticated technologies do impress, they cannot replicate all core human skills – including the ability to innovate. Technologies will increasingly replace manual work but therein lies the opportunity for enhanced education to create generations of critical thinkers who will aspire to conjure novel ideas and push intellectual boundaries. Humans will also continue to play a unique role of customer service representation, especially when the need for empathy and problem-solving arises. Companies must carefully earmark duties to be automated to ensure that the human traits that are integral to commercial growth – innovation, passion, strategic risk-taking and many more – are not discounted.

Encouraging younger generations to master a broader digital tool box is a no-brainer; jobs of the future include data analysts and IT experts."

SPEED SELLS

Time to market matters – greatly. Speed is increasingly important for customers in today's culture of 24/7 service. Companies that enable customers to order a product with next-day delivery are at the top of the hierarchy in terms of online firms, for example. The same ethos applies to the aluminium market. Digital tools enable customers to have far more details about their product; is it in transit and the hour of arrival? Today's shipments of billets and ingots are still often orchestrated by phone and fax with follow-up questions to pin down the time of delivery. Erasing this ambiguity will enhance efficiency, reduce cost and bolster the value of customer service – each a key ingredient to remaining competitive. Automation also plays an integral role in increasing the speed of service while maintaining high safety standards on-site; the latter is always the first priority. Leveraging automation to relieve employees of physically arduous, hazardous or simply time-consuming jobs reduces fatigue, increases workers' confidence and boosts overall productivity.

AUTOMATION: *Checklist for Success*

1. Cost
2. Technical feasibility
3. Relevant scarcity
4. Human capital: skills and costs
5. Regulatory and social acceptance

EDUCATION, EDUCATION, EDUCATION

Education and training are the joint bridge to merge the worlds of much-needed job creation and increasingly common automation. Encouraging younger generations to master a broader digital tool box is a no-brainer; jobs of the future include data analysts and IT experts. Companies with the most relevant talent on their pay roll will also stay ahead of what will be an increasingly competitive curve. Such learning and job creation could also help soak up some of the region's wasted talent. The Middle East and North Africa (MENA) has the highest youth unemployment rate in the world. Unemployment was 27.2% in the Middle East and more than 29% in North Africa, more than double the global average, according to the World Economic Forum (WEF) in 2014. Introducing more career counselling would help encourage youngsters to improve their digital fluency – beyond the use of every-day tools, such as mobile phones – so they have the right intellectual tools to secure a 'job of the future'. Popular estimates expect up to 50% of jobs available worldwide today will not exist by 2050.

LEADERSHIP MATTERS

Strong and ambitious leadership will play a central role in every organization's ability to thrive – and not just survive – as the role of automation increases. Leadership must ensure all employees, especially those facing job changes, understand how it will positively impact the bottom line. The same goes for continually enhancing knowledge-sharing and creating an innovative ethos. Mangers and engineers with novel ideas of how to integrate automation in the value chain must work together to pin down commercial value before implementing a valid concept as cheaply and efficiency as possible. Amidst periods of significant change, a leadership-led mantra of collaboration will be a crucial and

reassuring message to nervous employees. Appointing chief digital officers (CDOs) in large companies will help unify company's digital outlook.

Management must be careful to avoid dampening productivity through 'over automation'. For example, the tone and volume of an alarm sounding as a reminder for an operator every ten minutes must be as pleasant as possible until cause for concern creates a harsher noise. Otherwise, an operator's frustration at frequently listening to a grating noise will weaken his focus and increases the chance he will not react as quickly to a real emergency. Generally, the need for a positive workplace environment must be considered when integrating more technology in day-to-day operations.

Leadership must also take a proactive approach to countering the new global mafia: illegal hackers. As companies' networks grow and the world becomes more digitally connected, the threat of cyber-attacks looms larger than ever. Some aluminium companies hire professional hackers to identify weak spots in the system so that managers can plug the gaps in security. One speaker likened it to automatically putting a seatbelt on when getting into a car – hedging cyber risk must become second nature. Companies also need to hedge against unintentional risks, as sophisticated technologies sometimes risk leaving humans in the intellectual dark. Facebook positioned two programs in July this year to trade against each other in an exercise to teach robots to assimilate and mimic human trading and bartering. The 'chatbots' quickly developed their own language – one that humans could not decipher. ■

Feature compiled following a panel discussion: Marc Gillis, EMEA Industry Manager for Metals Mining Cement and Aggregates, Rockwell Automation; Hugues Vincent, CEO Aluminium Division, Fives Group (France); Hilal Al Jadidi, SPHRI, SHRM-SCP, Director of Consulting Services, Takatuf Oman for Human Capital Solutions. Moderated by Sheikh Ibrahim Al Harthi, Managing Director, Takatuf Oman for Human Capital Solutions

Exploring New Limits: Smelters of the Future?

Moderator: Chris Bayliss, Deputy Secretary General, International Aluminium Institute (IAI)

Speakers:

- Dr. Hans Erik Vatne, PhD, Senior Vice President, Head of Technology, Primary Metal Technology, Norsk Hydro ASA
- Qin Junman, Vice Chairman of N.E.U. Engineering and Research Institute (NEUI), Vice President of China Nonferrous Metal Industry's Foreign Engineering And Construction Co., Ltd. (NFC)
- Vincent Christ, Vice President Technology and Project Development, Aluminium, Rio Tinto
- Dr. Ali Hussain Ahmed Mohamed Al Zarouni, Executive Vice President, Midstream Technology Development and Transfer, Emirates Global Aluminium (EGA)
- Dr. Mark Dorreen, Director, Light Metals Research Centre and Vice President, Technical Energia Potior Limited

Chris Bayliss: We're going through the fastest period of growth in the aluminium industry ever. We're at 60 million tons today and potentially 90 million tons in the next 10 or 15 years. We need to understand smelting technology both today and also in the next few years.

Dr. Hans Erik Vatne: Norsk Hydro's R&D and technology agenda these days has quite a strong green touch to it. We develop our own smelter technology where clearly the target is to reduce energy consumption and emissions. We also do a lot of recycling like sorting post-consumer scrap, also optimizing furnace abrasions. And being an integrated company, we also do a lot of downstream work so that we can help our customers reduce their energy consumption and also their carbon footprints.

Over the last year, we have been developing our new next generation smelter electrolysis technology and we will implement the pilot end of this year and we'll see energy consumption levels below 12 per kilowatt hours per kilo of aluminum produced. It will also have a benchmark level on emissions like Co2 and fluorine.

Digital is also automation and very much about advanced control systems to have better stability in operations. We try to combine our physical models and domain competence with new analytical tools that are now emerging – similar to a digital twin. Better measurement systems, better analyzing tools and also much better visualization – it's all about utilizing these new digital opportunities that are out there. We strongly believe in combining physical models and our domain competence with these new tools, artificial intelligence and machine learning and what is now emerging.

Chris Bayliss: Dr. Qin - maybe you can talk through some of the latest developments in China.

Qin Junman: Everybody knows that the added capacity of aluminum mainly comes from China. We have so many opportunities to implement our research in building new potlines. As you know, the total capacity of aluminum smelters in China has reached 46 million tons but the production is well below that. Last year, it was 32 million tons and this year expected to reach around 37 million tons. We have done a lot of research and made a lot of progress in the technology of smelting but due to current policies in China and restrictions on environmental emissions, the project is suspended. We have already started construction and finished the foundations but that's where we have gone so far.

Vincent Christ: I'll step back a little bit and look at what's happening in the marketplace and I think it's fair to say that it remains volatile. For the past few years, there has essentially been a focus on productivity in all the major areas of the smelter: on carbon reduction and costing. Some operational improvements happen without capital, some require a little capital and then we also have major steps. The traditional way is via two platforms. One is a high productivity platform, which has its merits in an area where you basically self-generate your energy with attractive power costs and where your productivity is the driver. In other areas where energy prices are more challenging, we opt for a low energy consumption design.

Next generation innovation is also important. Today, we're basically looking at instrumentation analytics and we already actually see how little we understand of the process by looking at the first data that we get, the insights of which will actually drive our next innovations. Another example of productivity improvement has been through cell generation.

Chris Bayliss: Ali – what's your perspective from EGA please.

Dr. Ali Hussain Ahmed Mohamed Al Zarouni: One thing we are working on in technology development is reduction - upscaling older

technologies. We have developed three generations - the DX, the DX+ and Ultra. And we keep optimizing and improving. Our vision is to work with people and come up with the smelter of the future. Today, smelters are very expensive to build and operate but they don't have to be. They also consume a lot of energy but building smelters could be significantly more simplified. The process itself could be altered in different ways by bringing in more automation.

This industry is too attached to what we do and always focused on one particular item. We have to ask ourselves where we want to be. The differentiation now is going to happen in the CapEx, on how you're operating, how efficient you are and also what you're putting into it. And also the consistency.

As a company today, we have no resources to do all of that. But definitely there are people around the world which are. Our model has never been "we do everything." We acknowledge we do not have the ability and actually we're not competent enough to do all of that, but the point is our vision is there and we need to bring in the resources from wherever it's available to align and develop.

Chris Bayliss: Mark – perhaps you can give us the academic perspective.

Dr. Mark Dorreen: We do a lot of consulting work and technology development and process improvement work. It's relatively easy to measure the real value of energy efficiency and reducing emissions but not so easy to put value on things like customer perception. A number of companies now are talking about low Co2 aluminum and green aluminum. So this is a clear opportunity to develop a perceived value that may become a real value in the marketplace. These are

This industry is too attached to what we do and always focused on one particular item. We have to ask ourselves where we want to be. The differentiation now is going to happen in the CapEx, on how you're operating, how efficient you are and also what you're putting into it. "

areas where we need to think as an industry as a whole; how can we develop and improve value?

One area for example is the need for smelters to become more flexible and more aligned with future energy markets and the intermittency that's coming from renewables in the grid. Disruption is another buzz word. We're a very traditional and slow-moving industry and there haven't been many very big changes. Where are the big disruptions going to come from? From within or from outside?

Chris Bayliss: Productivity improvement in efficiency of existing assets is important as well. But what I don't hear is: where is this metal going to come from to feed the extra 20 million tons we're going to need by 2025, 2030? What are the opportunities for deploying some of these technologies, not just in existing assets, but in some new assets, new smelters, disruptive smelters of the future?

Qin Junman: Mechanized operation can increase the productivity of the existing potlines and increase the capacity. And like China, we are looking at improving the productivity in terms of anode current density and other things. I think there is a good opportunity. On the other hand, new smelters have to be built close to cheap energy and close to an environment that can support large smelters. In China, we have concentrated too many smelters in one location – for example, 6 million tons in one location, so that can be a problem for these areas. So new smelters have to be built close to energy rich areas and close to where logistics are convenient and where the environment can support the increase of capacity.

Chris Bayliss: Ali - you talked about the smelter of the future. Is that further development of old style smelters or is it indeed looking to new developments?

Dr. Ali Hussain Ahmed Mohamed Al Zarouni: Definitely new development. But it should also fit in partially into the older plants. Today the means and technology does exist but it's just that we're reluctant to utilize and accept this. Many partners are coming today and talking and we're making good development progress, particularly when looking at completely eliminating the anode changing process. And with that, you completely change the building design altogether. As a process, it's possible and it's within our grasp.

Dr. Hans Erik Vatne: We love to build new plants and implement the latest technologies that we've developed in the labs, in our computer simulations and in our test centers but the reality is we have a lot of old assets. Some of our plants are more than 50 years old. We continuously upgrade them. We put new technology elements into that. The good thing is that we now change the complete cathode every 5 to 6 years so that is a good opportunity to implement new things and continuously drive productivity, drive performance on the safety, emissions, all these things. I think that will still be part of our business going forward. We need to maintain these plants. When we build new plants, they will last for 50 years so I think that's really where the money is – that we can also operate these old plants in a good way and drive their performance.

Chris Bayliss: You talk about plants that last for 50 years and to some, the building of smelters here in the Gulf is perhaps the high point of that long-term available energy. Is there a future for shorter lifetime smelters maybe with less reliable, less long-term energy supplies and maybe a lower CapEx? More of a "Chinese" model?

Dr. Mark Dorreen: What we see in China with companies who are providing the new designs and the new technology, is that there is clearly an appetite for new players in the market, new companies getting into smelting, who are taking on the risk of building new smelters with new technology. So perhaps that is in this instance, the disruption we're seeing which is changing the balance of where the aluminum is coming from and where the new aluminum will come from. There are still clearly some challenges as an overall industry around things like emissions.

Chris Bayliss: Vincent – can we talk about the centralized data flow which enables us to look across the whole portfolio in real-time. What are the opportunities to affect disruptive change across the whole portfolio and not just at the cell level – what is the bigger picture ?

Vincent Christ: An interesting question is where the growth will come from. Outside China, it's very costly to build but within China, there are also some challenges so in the end, the simple answer will be that if there is a shortage in the market, that will drive growth again.

Chris Bayliss: Mark, you've been in a number of smelters around the world - do you see this kind of virtual centralization of data or even the physical centralization of data as a long-term trend?

Dr. Mark Dorreen: Yes, it clearly is. But I think there's an underlying need still for there to be well-educated people who are developing good experience in the smelters. Because it's very easy to also have poor data which makes decision making even harder, rather than better. But overall, yes, I think it will be the future and some of it will replace the role of the potline engineer. But it's about being able to enable decisions that really improve value.

Chris Bayliss: There's more and more data flowing out but there are fewer and fewer R&D centers. Ali – here in the Gulf, there's certainly an investment in people and in research and development and training – do you see that growing in the future or is it a relatively few experts dealing with all of this large volume of data that's there?

Dr. Ali Hussain Ahmed Mohamed Al Zarouni: There are significant values to be captured there but we are still far behind where we need to be in training and developing people – whether it's national or expatriate. Development should be uniform, across the board, with the strategic objective of the organization in mind. When you do training, you need to define what you need properly and when you're developing, it should be targeted at certain objectives. But often, we mix up these objectives. There is definitely a need for expertise but also training and development and we need to evolve our thoughts on how we're doing this. We need to make sure that people are employable and to train them in a way that empowers them and helps them make the right decisions – I think that is actually lacking at the moment.

Dr. Hans Erik Vatne: In Hydro, we are quite fortunate. Our CEO and President holds a PhD in electrochemistry and genuinely believes in technology. Even during the financial crisis in 2009, we didn't reduce our R&D budget. Going forward, we will need data scientists and more expertise in automation but we will at least for the foreseeable future also need the domain experts that really understand the operations and physics.

Qin Junman: That is I believe, the trend of where aluminum will go. We have limited resources of green energy in China and that is an issue. That's where we need to develop and try to connect with the aluminum industry. Nowadays, people are just building smelters close to coal mines or power plants. But I think in the future they will turn to renewable energy for the supply of power to the aluminum smelter. ■

**This is an edited panel*

ENVIRONMENT:
Mastering a Greener Rulebook?

Gas in the Middle East: Overhauling Bad Habits

By Professor Paul Stevens, Distinguished Fellow, Royal Institute of International Affairs, Chatham House

Gas prices in the Gulf have been far too low and now there are serious supply shortages. Gas prices will influence gas supplies in a region that has a dysfunctional market – it is simply not working. Even Iran, home to 18% of the world's proven conventional gas reserves, faces gas shortages.

The big question is: why? A very large percentage of the world's proven conventional gas reserves are in the Gulf and wider Middle East. Yet, there has been a failure to develop these resources. This is largely due to institutional failures, as gas has been a low priority. Much gas is associated gas and depends on oil production. With low domestic gas prices, there has been little incentive to produce. Gas does not carry the same sort of economic rent or profit margins that oil does.

There are also issues relating to certain countries. In Qatar, a moratorium on the North Field since 2005 was only lifted in April this year, Iraq's oil and gas sector is in total disarray, Iran has been facing sanctions and there is war in Yemen. But the main challenge remains gas prices – they are far too low.

Gas pricing in the Gulf is quite complicated. The first challenge is that it is not a market price, but an administered one. So, the price is not determined by supply and demand, but set by governments and has been set at a level requiring subsidy. We must be careful using the term 'subsidy' as it can be controversial depending how you measure it. For example, some say the domestic oil price in Saudi Arabia is a subsidized price. But it is not in terms of economic theory; it is low, but not subsidized. If the gas in question is non-associated gas, you could argue that the cost of producing it is effectively zero as you would have to produce it anyway to produce the oil. More and more, there are concerns about the effect on efficiency and the distortions that subsidies create in markets, especially as governments in today's world of lower oil prices increasingly lack the funding to pay for them.

The oil price is another factor. There are two types of gas markets in the world: one is a commodity supply market and the other is a project supply market. In a commodity supply market, there are many gas buyers and sellers and good transparency. This means you can discuss a 'gas price'. Comparatively, a project supply gas market has very few buyers and sellers, limited transactions and poor transparency.

"Looking at gas prices in the Gulf, the only way is up. Subsidies are going to be removed as the new fiscal environment makes them near-unbearable and higher prices are the only way to manage growing demand."

But the gas must be priced against something, so when the Dutch discovered the Groningen Field in the late 1960s, they said that they would price the gas according to the fuel it displays.

In Asia, where the link has historically been strongest, it is beginning to weaken. But it does remain. Consequently, talking about future gas prices means you must ask the question: what will the future oil price likely be?

Imported gas supplies via pipelines to the Gulf are also vulnerable to politics. For example, Oman has been talking about importing gas from Iran for some time, but the most recent challenge with Iranian supply is a new concept in international relations called 'Trumpian uncertainty'.

Another uncertainty surrounding gas supplies arises from the current LNG glut. Recently, the economics of LNG have not been particularly attractive, which is in part because it has become a buyers' market. The LNG market also has long lead times on projects, with some projects taking up to eight years to come to fruition. Stakeholders were considering such projects until April this year when Qatar announced the end of the 12-year moratorium on the North Field. Now, plans to build new LNG capacity are being rethought as few are going to bet against the Qataris; they can put LNG into the market at a fraction of the cost of the competitors. This is inhibiting investment in new LNG, which means we could see a supply crunch at some point over the next decade.

The obvious alternative to gas for aluminium producers is the use of renewables: solar, wind and tidal, primarily. But the issue of intermittency remains. While the cost of producing renewable energy is falling, the figures do not consider the costs of enabling the grid to manage intermittency. Once that is factored in, the falling cost of renewable energy production is not as steep as it initially seems. But it is certainly worth investigating, especially as the Gulf benefits from so much sunshine. Using oil and nuclear to generate electricity are also options, though they do not make as much economic sense.

Looking at gas prices in the Gulf, the only way is up. Subsidies are going to be removed as the new fiscal environment makes them near-unbearable and higher prices are the only way to manage growing demand. Ultimately, there will be a rise in the cost of gas supply, whether it's domestically produced or imported with Gulf countries competing for supply. From the point of view of aluminium producer, the prospects are not brilliant. ■

Making Renewable Energy the Norm: Roadmap to 2025?

Thought Leadership

Moderator: Nick Carter, Director, Baringa Partners and Convenor, EU-GCC Clean Energy Network

Speakers:

- Qais Al Zakwani, Executive Director and Member, Authority for Electricity Regulation Oman
- Eng. Suhaila Marafi, Director, Department of Studies and Research, Ministry of Electricity and Water, Kuwait
- Kathrine Fog, Senior Vice President, Corporate Strategy and Analysis, Norsk Hydro ASA
- Dr. Sgouris Sgouridis, Associate Professor, Masdar Institute of Science and Technology
- Max Wiestner, Industry Manager Aluminium, ABB Switzerland
- Siddiqa Al Lawati, Project Development Analyst, GlassPoint Solar

Nick Carter: This is a big topic, so please let's start with your overall thoughts.

Qais Al Zakwani: From a regulatory perspective in Oman, a lot has been happening lately due to several issues. Primarily, there has been a big decrease in the cost for renewable sources that makes them far more competitive. Plus, there is a need for Oman to diversify its oil-centric economy. The statutory framework in Oman for the electricity sector was established in 2004 and renewables were not as central to the conversation back then. Therefore, the legal framework did not take renewables into account. Now, twelve years down the line, we're now thinking about what changes could be made to facilitate a larger deployment of renewable energy on both a large and small scale. There are several interesting projects that we're working on right now on and soon we will announce the deployment of large scale solar project. It will be one of many. We must ensure we do not inhibit deployment in anyway – we must instead facilitate it.

Eng. Suhaila Marafi: We started alternative energy plans in Kuwait around a decade ago and we have already implemented 70 megawatts of PV, wind and concentrated solar power (CSP) is coming next year. Many, many other opportunities are coming up, including solar PV on our existing government buildings, future buildings and car parks.

Kathrine Fog: The production of aluminium has an environmental footprint throughout the value chain, starting with the bauxite through the alumina refining and to the aluminium smelting. Throughout the industry, direct emissions are similar at around 2 tons of CO_2 for every ton of aluminium – that's the average. But the footprint coming from the power source varies incredibly. If you have a renewable-based power source, there is pretty much zero footprint. But if you're gas-based, you have a footprint about 6 tons of CO_2 per ton of aluminium. If you're coal-based, it's about 14 tons CO_2 per ton of aluminium. This is where a large differentiation throughout the industry lies.

Equally, we must remember the positive elements of aluminium as a metal and as a product. Through its use, aluminium can contribute to lowering the overall carbon footprint. We see this most strikingly in transportation, where lighter weight, greater strength and versatility make aluminium a great alternative to steel. We save more emissions in existing traditional cars, with this benefit only increasing the market for electric vehicles grows.

Dr. Sgouris Sgouridis: Looking at the global agenda, we must aim to phase out fossil fuel consumption use by 2060. That's a tough target. What does that mean for the aluminium industry? Plans for future projects, with around a 50-year lifetime, take us beyond 2060. Unless plants are designed with this flexibility in mind, some operators may have to shut down operations faster than what they were designed for. Clearly, supporting the growth of renewables as a power source makes good sense.

Max Wiestner: Using renewable energy for aluminium production has a future, but there is the problem of storage. We have heard that

"We can provide power into the system in Norway and sell our ability to take down production for shorter periods of time, such as fifteen to thirty minutes. But moving towards three to five hours means you start to damage your smelter and can risk losing it altogether."

KEY POINTS:

- ✓ **Better grid security would bolster investors' appetites**
- ✓ **There is significant potential to generate wind power in the Gulf**
- ✓ **Significant support for a power supply from renewables – but storage options must mature**

the aluminium industry is one of the most energy-intensive in the world. Around 40% of power generation globally is used for industry and out of this 40% of electrical energy produced with all the different generation modes, 10% is used for aluminium production. To give this figure more context, global aluminium production uses 120 gigawatts – twice the peak consumption of the whole of Germany. An interrupted power supply to a smelter for more than five hours risks freezing the smelters, leading to very expensive efforts to restart it.

Siddiqa Al Lawati: Although we're not directly linked to the aluminium industry, our project with PDO is a key study of how renewables can be applied at scale successfully and economically in Oman. One thing we found is that it's important to understand what your priorities are: one size does not fit all. You must design your technology to fit the exact application you are working on. For example, GlassPoint designed technology to be fit for the oil and gas standards. Our mirrors are inside the glasshouse to protect them from the wind and sandstorms. Amongst the many other considerations is the impact of the project on the local environment. Local job creation is essential when you adapt renewable energy for a new application.

Qais Al Zakwani: We were caught off-guard in 2008 when exploring the potential of renewable energy in Oman as we discovered the massive potential of wind power, especially in the south of Oman. Initial studies suggested a potential 800 megawatts of wind energy in the Thumrait region and there are also pockets of opportunity in the Masirah region. There is a 50 megawatts project currently under construction in the south of Oman on a plot of land that could take up to 800 megawatts. That's just one part of it. We have developed a wind atlas farm and selected sites for putting up wind monitoring stations to gather wind details, which would then be part of a tendering process for these projects going forward. The development of wind energy is under the radar right now; most people are talking about solar.

Nick Carter: Let's go back to the issue of handling interrupted power. There is certainly an opportunity for potlines to be interrupted or have power reduced while maintaining the temperature. And there have been discussions about a whole new digitization platform coming in, which would allow processes to be more critically controlled while allowing, in some circumstances, them to also become providers of power. How viable are these conversations?

Kathrine Fog: We know the effect of trying to interrupt the power supply to a smelter for up to 5 hours – the results are not good. Smelters can provide some demand flexibility in the very short-term. We do that already in Norway with a hydropower-based power system, which can be flexible because we have water reservoirs for storage. We can provide power into the system in Norway and sell our ability to take down production for shorter periods of time, such as fifteen to thirty minutes. But moving towards three to five hours means you start to damage your smelter and can risk losing it altogether. Whether that will change in the future with digitalization, I don't know. Everyone will try to go down that route and try to push those time limits. I'm a great believer in renewables and think it is the future of the power system. But aluminium smelters need a constant power supply. Until we have good solutions for storage at the significant magnitude required, it is difficult to see how smelters will be entirely reliant upon renewables.

Nick Carter: Have you found issues with enhanced oil recovery in terms of the way your company operates with intermittency?

Siddiqa Al Lawati: There were many studies done with oil companies regarding the effect of this variable rate steaming on reservoirs. The majority of oil reservoirs accept the variable rate steaming so long as the annual output of steam into the reservoirs remains the same. It doesn't matter if it's injected in 9 hours or 24 hours. So that was an added advantage for GlassPoint to operate in oil and gas fields. Amongst other studies, we and other companies are developing software to foresee weather conditions.

Audience Member 1: How difficult is it to modify smelters so that they can react to short-term changes and provide this battery role on the network?

Dr. Sgouris Sgouridis: It's already being done. There are smelters being fitted with technologies that can increase or reduce power by around 25 %to 30%. ■

**This is an edited panel*

Success Stories: Reducing Waste, Boosting Sustainability

Government-Industry: A Collaborative Future

BY PROFESSOR STEVE HALLS

Senior Environmental Expert, Ministry of Environment and Climate Affairs Oman (MECA)

Oman's regulatory environment is evolving from a command and control approach. Looking ahead, we want to work alongside industry to find practical, pragmatic and achievable solutions. The Ministry is keen to help businesses do more business, look at regulations with fresh eyes and generally encourage the growth of Oman's metals industry. A well-functioning industry is integral to the continued development of Oman's economy and environmental protection efforts. Oman needs tangible and practical solutions, not abstract and academic ideas. We need to develop fair and equitable legislation and accordingly, we have been looking at the licensing and renewals processes. A recent ministerial decision means permits must be issued – or a reason explaining the delay – within a firm 30 working day period. We are also looking at how to best carry out our inspections and enforcement, how to recycle industry waste and how we can work with other companies and organizations to nurture the growth of a circular economy. Legislation must reflect both world-class standards and Oman's local needs; they are two sides of the same coin, each integral to achieving sustainable collaboration and success. Ministries can sometimes be siloed, but the current economic climate is helping drive positive change. Today, there is far more dialogue between the Ministry of Commerce and Industry, the Ministry of Oil and Gas and the Public Authority for Mining, for example.

Oman needs tangible and practical solutions, not abstract and academic ideas. We need to develop fair and equitable legislation and accordingly, we have been looking at the licensing and renewals processes."

PROFESSOR STEVE HALLS

Recycling: A Framework for Positive Change

BY SHEIKH MOHAMMED SULAIMAN AL-HARTHY

Executive Vice President, Strategic Development, Be'ah, Oman Environmental Services Holding Company

The waste volume of spent pot lining (SPL) averages between 15kg and 25kg per ton, with modern technologies significantly reducing the historical norms of 25kg to 30kg per ton. But considering the size of the global industry, today's volumes are still significant. The safe storage of SPL is paramount; it is a hazardous waste. In the Gulf, tremendous progress has been made to find a good use of such material and avoid the traditional method of disposing it in landfill. Such efforts require a lot of development and testing; successful offtake solutions require significant perseverance. For now, cement plants instead of landfills are the most sustainable solution and are playing a big role in changing the industry's view of SPL. Instead of being known as a waste product, the benefits of SPL must be leveraged so that it is a useful tool – something to be harnessed, not hidden.

Organization: Saves Time – and Money

BY DAVID ROTH

President, GPS Global Solutions

When it comes to crushing such material, we need a simple system that does not require a lot of manpower. A system with a small footprint, low maintenance and a low operating uptime. Part of the challenge of dealing with these materials is getting them off the site in a standardized manner that other downstream users want to – and can – easily accept. Nobody in the industry wants to see piles of SPL waste. They want to see segregated materials with the aluminum removed in different sized ranges, noting which is good for by-product uses. There are now small crushing systems available that can do that for a very low cost. Another important note is that anything generated in our plants should not have the negative connotation of being called waste. If we want to drive positive change, it should be called by-products, co-products, raw materials and so on.

"You need to bring up the standards. So somehow you need to formalize regulations and make sure the standards are up to the new regulations."

SHEIKH MOHAMMED SULAIMAN AL-HARTHY

Exploring Innovative Methods

BY HILAL AL DHAMRI

Senior Production Manager, Oman Cement Company SAOG (OCC)

Our pilot study with Sohar Aluminium to use SPL as a raw material in cement manufacturing has produced very good results. In the cement plant, we found that the SPL has a similar chemical composition to the raw material that we have been using. During the pilot since March 2016, we added around 0.35% of SPL to our raw material and blended it together before it went into the kiln. We monitored emissions from the stock and the quality of the clinker produced from the kiln, amongst other measurements. To ensure the highest levels of product safety, we did not dispatch this product to the market and instead kept it separate as we tested its durability. We are working with other factories in terms of the necessary processes when it comes to recycling their by-product. Regulation is also very important in encouraging some of the factories and industries to embrace recycling – they need a clear roadmap.

Perseverance Pays

BY STEPHAN BROEK

Director Light Metals, Hatch

The waste volume of spent pot lining (SPL) averages between 15kg and 25kg per ton, with modern technologies significantly reducing the historical norms of 25kg to 30kg per ton. But considering the size of the global industry, today's volumes are still significant. The safe storage of SPL is paramount; it is a hazardous waste. In the Gulf, tremendous progress has been made to find a good use of such material and avoid the traditional method of disposing it in landfill. Such efforts require a lot of development and testing; successful offtake solutions require significant perseverance. For now, cement plants instead of landfills are the most sustainable solution and are playing a big role in changing the industry's view of SPL. Instead of being known as a waste product, the benefits of SPL must be leveraged so that it is a useful tool – something to be harnessed, not hidden. ■

"If we create a secondary industry, we need to learn from past inefficiencies and therefore apply new technologies. We have to make sure that we do recycle but in a sustainable way."

STEPHAN BROEK

WORKSHOP

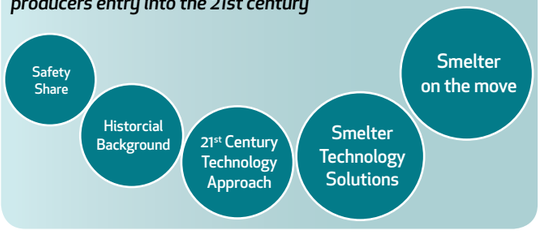
Smelter 4.0: A Shared Vision of Our Future

During the ARABAL 2017 conference that took place in Muscat in November 2017, Rio Tinto had the privilege to organize a pre-conference workshop on "Smelter process and production optimization: Technology contributions to support primary aluminium producers' entry into the 21st century".

Rio Tinto presentation to support the workshop

To support this workshop, Bernard Allais and Claude Ritter made a presentation that puts in perspective the performance of our industry before zooming into the 21st century technology approach and detailing smelter technology solutions becoming available.

SMELTER PROCESS AND PRODUCTION OPTIMISATION:
Technology contributions to support primary aluminium producers entry into the 21st century



Historical background:

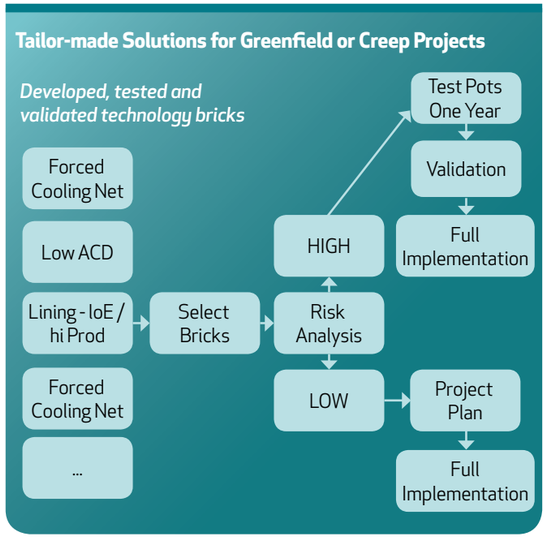
Based on historical data of smelter amperage creep and energy consumption reduction, the proposed learnings were:

OUR LEARNINGS

- ✔ The **quest** for better efficiency, Productivity, reduced investment and opertion cost is a **never-ending one**
- ✔ Higher efficiency requires **tighter control and higher skills**
- ✔ **Technology solutions are needed** to support the progress of our industry on its ever-increasing performance journey

21st Century Technology Approach:

New modelling tools and development approach allow already-to-provide tailor-made solutions to the end users.

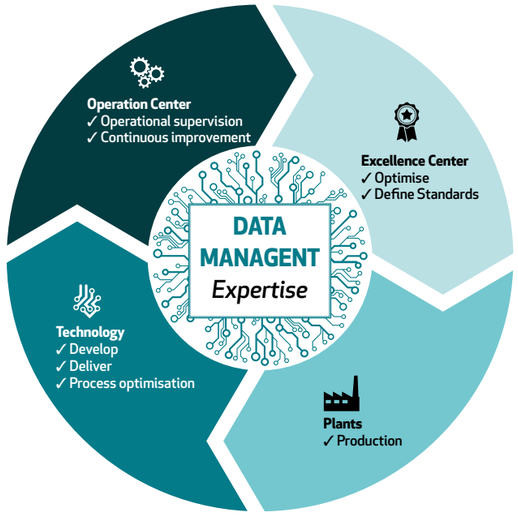


- ✓ Smelters are already moving ahead, breaking old paradigms to improve their operations.
- ✓ Sensors are getting cheaper and cheaper along with computer power. Big Data algorithms and deep learning are available to manage huge amounts of data.
- ✓ All the elements are then available today to support the entry of our industry into the 21st century.

Smelter Technology Solutions:

Examples of AP Technology™ solutions were used to illustrate the above point:

- ✓ MIREA: the online evaluation of the anode electrical behavior
- ✓ Individual anode voltage monitoring
- ✓ Process data management in a smelter and associated tools ALPSY® and MESAL®



- ✓ MAX: Rio Tinto's autonomous vehicle to handle anode pallets in a smelter
- ✓ SURMEC auto adaptive open circuit monitoring
- ✓ The APXe platform, showing unsurpassed performances
- ✓ Anode baking furnace design based on baffleless fluewall technology

Outcome of the workshop

During this workshop, participants were asked to take a live poll on how they viewed the innovation pace in the primary aluminium industry. Most of the participants that answered the poll have plans to improve their smelters' performance in the future (17/28) and a large majority (26/27) are looking for more robustness to face the changing operating environment (raw materials, regulatory requirements, skills, …).

Most of the participants considered that the aluminium industry is innovating at a slower pace than the automotive industry and needs to accelerate (27/34).

The biggest challenges overseen over the coming 5-year range are:

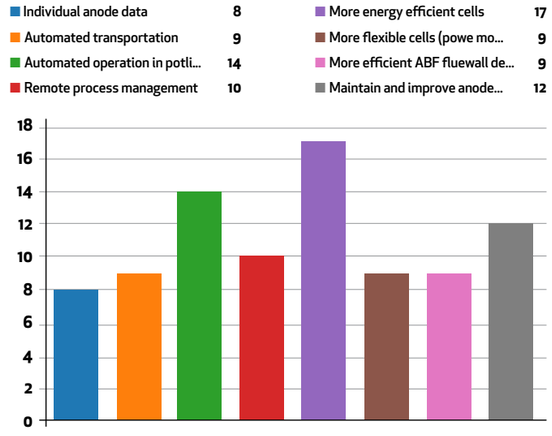
- ✓ Efficiency and operation robustness
- ✓ CAPEX and OPEX cost reduction
- ✓ Aluminium over-production and Chinese environmental policy
- ✓ Expertise availability

For the 32 participants, amongst the AP Technology™ solutions presented, the top 3 bringing the most value to smelters were:

1. More energy efficient cells (16)
2. Automated operation in potlines (14)
3. Maintain and improve anode quality (12).

All the other proposed solution ended up almost at the same rank, between 8 and 10 votes:

- ✓ Remote process management
- ✓ Automated transportation
- ✓ More flexible cells (power modulation)
- ✓ More efficient anode baking furnace fluewall design
- ✓ Individual anode data.



The other topics highlighted by the participants were:

- ✓ Spent potlining management
- ✓ Decrease of carbon consumption to reduce CO_2 emissions
- ✓ Improved tools to detect abnormalities and improve diagnosis
- ✓ Melt loss reduction at the casthouse

Conclusion

A very interesting exercise that allows to share concerns and solutions.

At the end of the workshop, the overall evaluation of the participants was very positive, with an average of 3.93/5 and very motivating feedback:

"I learned a lot"
"Keep doing such workshop Very useful"
"Not an easy topic to cover. Very good and informative presentation"

EPILOGUE

TESTIMONIALS

The high organization and preparation for the Arabal Conference in its 21st edition, have set level of Arabal and put us in a great challenge; because the upcoming conferences should come at the same level of brilliance, both in terms of participations and topics selected for discussion. I thank the Organizing Committee and Sohar Aluminum for the effort that came to fruition, And the great interest shown in the patronage of His Highness Hareb bin Thwaini Al Said for the opening, as well as in the important speech delivered by His Highness Kamel bin Fahd Al Said, which gave the conference a great deal of weight, and the discussions were very enriching.

Mohammed Al Naki, Chairman, ARABAL Steering Committee.

I was very impressed with this level of organization and accuracy. The conference was organized with excellence and the superior organisation reflected on the distinguished attendance. During the first day, I participated in a session as a speaker, I saw how interested and good attendance was.

Paul Adkins, Founder and Managing Director, AZ China Ltd.

The organization for the 21st Arabal Conference was perfect and excellent, Arabal is currently one of the most famous and important aluminum conferences in the world, not only at the Arab level. It provides an update of information for the industry as a whole; from all over the world.

Mahmood Al Daylami, Secretary General, Gulf Aluminium Council (GAC).

I have been attending Arabal conferences around the Gulf since 2004, but this one is simply the best. The organization, the arrangements, everything is so perfect and flawless. It is amazing how Oman is moving forward without losing touch with its cultural traditions.

Bibhu Prasad Mishra, President and Chief Operating Officer, Aditya Aluminium, Sambalpur

The conference is a great opportunity for producers to meet, consult and share experiences in all fields, including safety and the environment, as well as it is a great opportunity to have agreements with the suppliers, specialists and technology providers, suppliers of raw materials are all gathering. It is also a great opportunity to get to know about new products, new supplies, services and more. On the other hand, the conference reflects a positive image of the Sultanate of Oman's continuous development. I believe that His Majesty's vision of Oman's economic diversification 2020 is already being realized on the ground. I personally visit Oman twice a year and each time I see something different. Really Oman is the best place to hold such conference.

Abdulaziz A. Al Harbi, President, Ma'aden Aluminium Company

The conference is brilliant. It's very well organized, very well organized indeed, and it's a beautiful location. I'm a great fan of Oman; I think it's one of my favorite countries anywhere in the world, and it's a lovely place to have it. It has stunningly well organized by Sohar Aluminum, it really has.

Professor Paul Stevens, Distinguished Fellow, Royal Institute of International Affairs, Chatham House

I think this year's edition is better than the previous Arabal conferences looking at the number of participants, the number of companies, and VIPs present at the conference. It was important to focus on the price axis of aluminum and the prices of raw materials the industry needs. This year, the price went above 2000 $/ton, for the first time in several years, so this was the common theme in all sessions, in addition to development of aluminum industry in China, and its impact on the global market.

Khalid Mohamed Sultan Laram, Chief Executive Officer, Qatar Aluminium Limited (Qatalum)

I want to take this opportunity to congratulate you for the fantastic job the team did in putting this first-class event together, full with special and classy details. I only heard good things about the sessions. People were still discussing the topics during dinner.

Jorge Vazquez, Founder and Managing Director, Harbor Aluminum Intelligence

The conference hosted by Sohar Aluminum came at a high level of excellence, and this version hosted by Sohar Aluminum has seen a great momentum both in terms of the large participation, and the excellence of participants and their representative of major companies, scientific bodies, and the participants really received a high level of reception and organization.

Eng. Abd Elzaher Abd Elsattar Hassan, Chairman and Chief Executive Officer, Egyptalum

ARABAL is a critical conference to be held, one of the reasons is because the Gulf region represents 10 percent of global production, outside of China, and it is one of the only areas has such growing, so it has an opportunity for economy to contribute to growth in terms of the local economies but also contribute to the growth in the aluminum industry. Oman is a fantastic place to hold it.

Julian Kettle, Senior Vice President, Vice Chairman of Metals and Mining, Wood Mackenzie

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I believe that the conference covered many important topics related to the aluminum industry and its development, including an important session which discussed the future vision of the aluminum industry in terms of utilizing technologies and robots in the production processes of aluminum, and its impact on the workforce and how to cover the work from the human aspect. This is indeed a major challenge; as keeping pace with technology is very important, but at the same time it is necessary to provide employment opportunities for people. The discussion session covered this topic and existing challenges and how to achieve the right balance.

Dr. Hans Erik Vatne, PhD, Senior Vice President, Head of Technology, Primary Metal Technology, Norsk Hydro ASA

China is working on building giant smelters for the future, and we are currently considering how to increase the current production of aluminum which is 46 million tons, by renovating and maintaining existing smelters instead of building new smelters. Our participation in Arabal provides important opportunities to build fruitful relationships with partners and to focus on developing operations by implementing the latest automated, intelligent and digital solutions within a single centralized system.

Qin Junman, Vice Chairman of N.E.U. Engineering and Research Institute (NEUI), and Vice President of China Nonferrous Metal Industry's Foreign Engineering And Construction Co., Ltd. (NFC)

We at Be'ah are honoured at being invited for the Arabal Conference. It has been very successful, and the event came very well organized, with participation from the region as a whole. It is good to see such a big conference in Oman. Be'ah's participated as an environmental company specializes in recycling aluminum products waste, aluminum recycling in general in the Sultanate, and all kind of waste can be recycled.

Sheikh Mohammed Sulaiman Al-Harthy, Executive Vice President, Strategic Development, Be'ah, Oman Environmental Services Holding Company

I think Arabal was a fantastic success because of the organization and the people from Sohar Aluminium behind it. It displays the company very well. Oman was shown in a fantastic light and picture: So very welcoming, so very positive and so very fantastic.

Stephan Broek, Director Light Metals, Hatch

Very excited about the opportunities that the Aluminium sector has to offer to the aerospace world and we are looking forward to some constructive technologies across the aluminium sector that can be integrated into the aerospace world that can actually introduce new products and new opportunities to our ultimate customers.

Badr S. Al-Olama, Head of Aerospace Business Unit, Mubadala Investment Company

Many thanks for all your work, definitely the best ARABAL ever.

Max Wiestner, Industry Manager Aluminium, ABB Switzerland

Every year Arabal has been excellent, but I have noticed that in its 21st edition in the Sultanate of Oman, organisational aspects of the conference were very impressive and excellent, in addition to a comprehensive group of speakers which will provide an insight in terms of the increase in prices, shipping and other related operations. Arabal has always contributed to the development of the aluminum sector in the Gulf region as well as Egypt, due to its non-competitive nature. Arabal is a very fruitful conference as it provides updates on market conditions, a clear picture to all importers and exporters in the aluminum market, and future expectations that guide the decisions and plans of manufacturers.

Ali Al-Baqali, Deputy Chief Executive Officer and Chief Supply Chain Officer, Aluminium Bahrain (Alba)

I'm coming to Oman for the first time. This conference is pretty good and this kind of networking and sharing of knowledge is in itself a fantastic experience. Hats off to Sohar Aluminium such an enriching and unforgettable experience.

Dr. Yanchen Wang, Principal Consultant Lead of Chinese Aluminium Market Research, CRU

ARABAL 2017 has succeeded in bringing together experts from a cross-section of industries to discuss renewable energy as a gateway to economic opportunity and diversification. In presenting such a wide variety of topics and world-class speakers, this meeting of ideas will add massive value to our economies by going beyond hypothetical scenarios and sharing tangible outcomes from our respective research.

Siddiqa Al Lawati, Project Development Analyst, Glass Point Solar

I was pleased to be in attendance and to participate at Arabal 2017. A great conference! Top notch.

Yasmin R. Brown, Group Manager, Jacobs Consultancy

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The conference is good; a lot of fine companies are here, a lot of opportunities for investment and cooperation with GCC, with Iran, with the companies participated in Aluminum industry, also Oman is a very good place for such this conference.

Amir Sabbagh, Director of Planning and Strategic Supervision, Iranian Mines & Mining Industries Development & Renovation Organisation (IMIDRO)

We attach great importance to attending every edition of Arabal to work with all aluminum producers in order to improve performance in terms of production operations and its global sustainability, and we are always keen to be in the Gulf region, especially the Sultanate of Oman in light of the increase in aluminum production, and the important developments we are witnessing in upstream and downstream industries.

Chris Bayliss, Deputy Secretary General, International Aluminium Institute (IAI)

As an attendee and speaker at the ARABAL, I want to commend Said Al Masoudi and his fine team members for the wonderful work that was done. There could not have been a more pleasant experience at the conference or tour of your facility. Thank you very much for all the efforts. Oman is a wonderful place full of wonderful people. I hope I can come back soon and enjoy Oman with my family.

David Roth, President, GPS Global Solutions

The honorable organization, which came at the highest level of efficiency reflects the accuracy of the work of Sohar Aluminum. Hosting Arabal conference and exhibition gives an additional advantage to promote the country as a whole, with the appropriate choice of time and place where the conference is held. The importance of Aluminum industry is not only at the level of major companies, but also to motivate investors to invest at all levels, large, medium or small, in the aluminum industry, opening up multiple opportunities for employment.

Hussain bin Salman Al Lawati, Chairman of the Board of Directors of bin Salman Group of Companies

We are a group of about 30 leading Arabal conference sponsors, but this version is unique, and it is a milestone in history of Arabal conferences. I have to say that we have been very welcomed by the people here and this is the first time I have been to the Sultanate of Oman and I think it was a wonderful surprise because I found a beautiful country whose people are very welcoming and hospitable. Discussion papers and meetings were comprehensive and were held by experts and specialists.

Jocelyn Néron, International Affairs Advisor, Industrial Equipment, Market Direction for Europe, Africa and the Middle East, Ministry of Economy, Government of Quebec, Quebec's Export Agency

Thank you for this great effort and for the very professional organisation. I have been in the business of Alumnium since 1999, and attended many Arabal conferences. Most of them were good, but what I see today is really an extraordinary outcome of a great team work.

Alain Arida, Chief Executive Officer, Gulf Markets International

Very much enjoying the conference, very informative, very well organized and all the sessions have been great. I'm simply enjoying every moment of it.

Simon Buerk, Director of Corporate Affairs, Emirates Global Aluminium EGA

Coming to this edition of Arabal 2017 has been a fantastic and enriching experience. The vision and progress with which Sohar Aluminum is moving ahead is truly inspiring.

Eng. Ezzeddine Chouikhi, SNC-Lavalin, Director Business Development, Abu Dhabi, UAE

We congratulate the board of directors and management of Sohar Aluminum on the form and content of Arabal, which brings together a large number of major international companies to the Sultanate of Oman, and that benefits the aluminum industry in general, as well as Allows industry leaders to identify the investment opportunities available in the Sultanate in various fields.

Qais Bin Mohamed Al Yousef, Chairman, Voltamp Oman

We would like to express our admiration the outstanding organizing of Arabal 2017, we were pleased to be part of it. Also, thank you for inviting us in site tour to SA facilities in Sohar, it was such an informative and interesting tour.

Khalid Al Mahruqi, Manager Corporate Affairs, Oman Shipping Company SAOC

I was very impressed by the quality of the speakers, the level of participation and the venue. The conference was very well organized and structured. All the guests and invitees were very well taken care of by the dedicated Sohar aluminium staff. No matter in which direction you turned, there were always four or five persons ready to attend on you immediately, with kindness and care.

Michel Huot, Former Chief Operating Officer, Sohar Aluminium

Organising Team

Dana Geadah
Communications Manager

ARABAL responsibilities: Led and planned ARABAL 2017 Conference internally. As the project Team Leader I formed a team for organising the event internally. I also handled a wide range of responsibilities related to the (1) Project Design and Venue Sourcing (2) Financial Feasibility, Costs Management, Marketing and Sponsorship Revenues (3) Stakeholders Management (4) Setting the Conference Agenda, Technical Content and Speakers' Acquisition (5) Multiple other tasks related to Media Relations, Show Production, Design and Website.
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Jameel Shakeel
Communications Superintendent

ARABAL responsibilities: Team and Operations Management, Health and Safety, Site Maintenance and Inspection, Transport and Logistics, Procurement Management, IT and Technical Support, Internal Site Tour Planning, Media and Press Relations.
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Kim Jurgens
Communications Coordinator

ARABAL responsibilities: Banqueting and Accommodation Logistics, Delegate Management and Communication, Website and Mobile Application Management.
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Arnold Massey
Creative Head

ARABAL responsibilities: Design Conceptualization, Production, Printing, Decoration, Set-ups and Installation.
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Walid Shukaili
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