Optimising Returns from Downstream Investments

Dr Tom Farley
Innoval Technology Ltd
Outline of Presentation

- Innoval Technology

- Optimising Returns from Downstream Investments
  - Designing the Plant for Optimum Financial Returns
  - Choosing the Right Products
  - Choosing the Right Technologies and Minimising Capex
  - Adding value through Further Processing
  - Developing the Workforce
  - Maximising the ROI from the Operating Plant
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Innoval Technology – Our Background

- Innoval Technology is an independent company providing a unique resource of expertise to the downstream aluminium industry
  - Formed in 2003 as a result of closure of one of Alcan’s Global Technical Centres

- We are a group of 26 aluminium experts – our strength is the breadth of our aluminium knowledge
  - Rolling and extrusion process expertise
  - Metallurgy product expertise
  - Surfaces expertise

- Our engineers have an abundance of product and process experience
  - Most have been supporting the industry for over 20 years
  - Many have held Senior Management positions in global aluminium companies
Innoval Technology – Strategic Support

- Innoval has undertaken the following types of strategic support work for potential investors in downstream fabrication businesses:

  - Technical Due Diligence on existing plants
  - Pre-Feasibility Studies and Greenfield plant design
  - Plant investment and upgrade support
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Designing the Plant for Optimum Financial Returns

Market Analysis → products → Equipment Specification → equipment → Plant Design → capex & opex → Cost Modelling → IRR, NPV, etc. → Viable? (yes) → Bankable Study

Market Analysis → volumes → Equipment Specification → extra capacity

Viable? (no)
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Choosing the Right Products

- Consider all potential markets
  - Home and export

- Important to understand market price vs. production costs
  - High sales margin does not necessarily mean high profit
  - Some products are complex and require higher Capex and Opex to produce

- Consider technical resources required for certain advanced products
  - Aerospace, Automotive, Lithographic Sheet, Heat Exchangers
  - More products increase the complexity of the operations – some plants focus on a few products
  - Global FRP manufacturers spend ~0.5% of Sales Revenue on R&D

- Consider advantages of available sources of Aluminium
  - Smelter aluminium
  - Recycled aluminium
Choosing the Right Products – Smelter Metal

- Low levels of Fe and Si (typically less than 0.1% Fe and Si) is good for products needing high fracture resistance
  - difficult forming operations (Can end, Automotive sheet)
  - applications needing toughness (Aerospace products, Structural castings)

![Diagram showing yield strength and fracture toughness](image)

<table>
<thead>
<tr>
<th>Fracture Toughness (MPa.mm0.5)</th>
<th>1000</th>
<th>1500</th>
<th>2000</th>
<th>2500</th>
<th>3000</th>
<th>3500</th>
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7050 Sheet

Yield Strength (MPa)

Increasing Purity
Choosing the Right Products – Smelter Metal

- Low and consistent levels of trace elements is good for surface critical products providing a consistent electrochemical response and appearance
  - Etching and anodising (Architectural, Lithographic sheet)
  - Brightening operations (Lighting and Bright trim)

- High purity is good for highly reflective products
  - Lighting products

Source: AMAG
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  - **Choosing the Right Technologies and Minimising Capex**
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Choosing the Right Technologies - Assess Product Challenges

- Products vary in their complexity and in their difficulty of manufacture

- The products determine what equipment is required in the plant
  - Type of rolling or extrusion equipment
  - Type of finishing operations

Example – Can Body Stock (CBS)
A single can line manufactures 2,000 cans per minute (1 billion per year)

- Can line requires very high quality CBS
- CBS is technically demanding to produce
- Needs a high Capex hot mill configuration to produce CBS
## Choosing the Right Technologies – Rolling Mill Configurations

<table>
<thead>
<tr>
<th>Products</th>
<th>Hot Band Option</th>
<th>HRM + 4-stand HTM</th>
<th>coil-to-coil HRM</th>
<th>Belt Caster</th>
<th>Roll Caster</th>
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<tbody>
<tr>
<td>Typical Capacity (tonnes pa)</td>
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<td>200k</td>
<td>120k</td>
<td>20k</td>
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<tr>
<td>Can Body Stock (CBS)</td>
<td>✅✅</td>
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<td>✗</td>
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<td>Can End Stock (CES) &amp; Tab</td>
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<td>✅✅</td>
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<td>Foilstock</td>
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<td>Standards - Low Mg</td>
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<td>Surface Sensitive Products</td>
<td>✅✅</td>
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<td>Thick Products</td>
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</table>

NB capacity depends on ingot dimensions and mill operation

- ✅✅ meets world class quality requirements
- ✅ can be made but does not meet all quality requirements
- ✗ cannot be made or fails to meet most quality standards.
Choosing the Right Technologies – Options and Finishing

- Need to identify correct technology options to achieve current customer quality standards
  - Sensors, actuators, control systems
  - Finishing equipment

- There are significant variations in equipment performance and price
- Consider future-proofing the plant
Choosing the Right Technologies - Capacity Calculations

- Correct sizing and multiples of equipment type
  - For example - what size of furnace and how many?

- Assessment of spare capacity within key assets
  - What other products could the plant make to fill any spare capacity?

- Awareness of the magnitude of process scrap at every stage (recoveries)
  - 1000 tonnes of cast slabs may only produce 700 tonnes of finished product
  - Product dependent

Example – Rolling Mill
- The capacity of a rolling mill depends on the design and the products being rolled
- A rolling mill represents a significant component of Capex so must be specified very carefully
Choosing the Right Technologies – Being Near a Smelter

- All products are able to take advantage of energy savings arising from transporting molten metal from the smelter
  - Avoid remelting costs and associated extra Capex
  - Energy savings of around $30-40 per tonne

Source: Alcan
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Adding Value through Further Processing

- Additional finishing operations after rolling or extrusion
  - to supply to a particular market
  - tend to be higher value markets

- Additional fabrication operations
  - often required by customers
  - benefit of shorter supply chain

- Examples of Value-Added finishing operations
  - printing and/or laminating foil products
  - anodising or painting sheet and extrusions
  - quenching and ageing (Aerospace sheet, plate & extrusions, Automotive sheet)
  - laser cutting
  - drilling and machining

Source: Novelis

Source: Superior Metals
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Developing the Workforce

- Experienced Staff
  - Internal transfer from other group operations (if they exist)
  - Access to independent experts from world-class operations

- University Graduates
  - Need a good supply of Graduates with the correct disciplines
  - They will need further development and training

- Set up University-based “Centres of Excellence”
  - Specialised focus (e.g. Aluminium, Rolling or Extrusion, Surface Science)
  - Sponsor students, projects and departments

- In-house R&D Centre
  - Develop specific skills within R&D projects
  - Transfer R&D people to plants in operational roles

- Ongoing Development of Staff
  - Use specialist technical companies for training and mentoring
# Developing the Workforce – Specialist Training Example

### ALUMINIUM ROLLING TECHNOLOGY COURSE - Innoval Technology, Banbury 9-13th May 2011

<table>
<thead>
<tr>
<th>MONDAY 9</th>
<th>TUESDAY 10</th>
<th>WEDNESDAY 11</th>
<th>THURSDAY 12</th>
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<td>Outline of the Sheet Rolling Process</td>
<td>Thermal Aspects of Rolling</td>
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<td>Flatness Control</td>
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<td>Mechanics of Rolling Chris Davenport</td>
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<td>Lubrication Mark Foster</td>
<td>Control Systems with Workshops Dan Miller</td>
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**Free Social Event**
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- Maximising the ROI from the Operating Plant
Maximising Returns from the Operating Plant

- State-of-the-art equipment does not on its own guarantee world class products

- Many examples in aluminium rolling mills and extrusion plants
  - ROI took longer than planned
  - difficulty achieving the quality requirements of world-class products

- Maximum returns require improvements to machine performance
  - performance above the levels achieved during machine commissioning

- Need technical expertise and know-how to maximise returns
  - develop in-house technical and R&D resources
  - external support
Maximising Returns from the Operating Plant

- Improving machine performance is about producing quality products at acceptable or enhanced volumes
  - Not necessarily about improving productivity alone

- Improvements achieved through changes in practice
  - Requires deep knowledge of the process and how the process stream contributes to the final customer attributes

![Percent Improvement in Foil Mill Finishing Speeds](chart.png)

- Audit & Analysis
- Months
Summary

- Iterative plant design process
  - Consider advantages of available sources of aluminium – e.g. smelter aluminium
  - Match equipment specification to the optimum product mix to maximise the financial returns from the plant
  - Future-proof the plant
  - Consider adding value through further processing

- Develop the workforce

- Maximising returns from the operating plant
  - State-of-the-art equipment does not on its own guarantee world class products
  - Need technical expertise and know-how (in-house or outsourced)
  - Improve machine performance to world-class levels
Thank you for your attention ...
Innoval Technology

An independent company providing expertise to the aluminium industry

www.innovaltec.com