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The future of Australian battery manufacturing

Cell cans and current collector foils

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Document information

This is a summary document based on the findings from a more detailed report, *The future of Australian battery manufacturing: Cell cans and current collector foils*, by Geoffrey de Looze, report EP2026-1973, 25 May 2026.

If more detailed information is required on the topics raised in this summary, please refer to this document. A copy of the extended report can be provided upon request.

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Contents

Executive summary 1

Introduction.....2

Part 1. Cell cans for lithium-ion batteries 3

 Cylindrical battery cells and cans 4

 Prismatic battery cells and cans 4

 ‘Blade’ format battery cells and cans 4

 Assessments of Australian capability, capability gaps and investments required
 considering cell form factor, material and manufacturing process 5

 Manufacture of long prismatic (‘blade’) cell cans by roll forming and longitudinal welding 10

 General conclusions – battery cell cans 12

 Recommendations for Australian production of battery cell cans 13

Part 2. Current collector foils for batteries.....14

 Assessment of Australian capability, capability gaps and investments required
 for current collector foil manufacture 16

 General conclusions – current collector foils for battery cells.....21

 Recommendations for Australian production of foils for battery cell current collectors.....22

Executive summary

This report assesses the **technical requirements for producing two key lithium-ion battery cell components:** external cell cans and current collector foils used in the electrochemical portion of each cell. It then compares these requirements against the **known capabilities of Australian industry** to identify the strongest opportunities for domestic manufacturing.

The following combinations of product, material and manufacturing process were identified:

- Cylindrical battery cell cans made by deep drawing/wall ironing of nickel-plated steel.
- Manufacture of prismatic battery cell cans by two possible methods:
 - by deep drawing of aluminium sheet
 - by impact extrusion of aluminium slugs.
- ‘Blade’ cell cans made by roll forming and longitudinal welding of aluminium or steel sheet.
- Copper current collector foils made by two possible production routes:
 - the rolled annealed (RA) method
 - the electrolytically deposited (ED) method.
- Aluminium current collector foils made by the rolling process.

A general conclusion was that the availability (or otherwise) of Australian-produced input materials needed to be considered separately to the domestic manufacturing capability required to make the finished goods.

In terms of material supply, Australia produces suitable grades of coiled steel sheet appropriate for deep drawing, but not in the required nickel-plated form. Similarly, Australia is strong in production of pure and alloyed aluminium material, but no longer makes the sheet or foil forms needed. For the case of copper, Australia is a significant producer of electrical grade copper cathode, but does not produce copper foil, and no longer produces copper rolling slab.

To achieve a manufacturing capability producing coiled sheet for battery cans or foils for battery current collectors, new investment would be needed in one or more of the following:

- aluminium strip casting and rolling lines for sheet or foil production
- a nickel plating line for steel sheet
- casting and rolling plant for copper foil.

These are all capital-intensive operations. Australia has previously vacated capabilities in these or similar areas: domestic rolling of aluminium sheet and foil ceased in 2014 while electroplating of sheet steel (making tinplate) stopped in 2007. The quantities of materials needed for battery production are also unlikely to absorb a large portion of the capacity of new commercial-sized rolling plant, risking underutilisation.

With this as background, two opportunities were identified and recommended for further study:

- manufacture of prismatic cell cans by impact extrusion from locally produced aluminium slugs
- production of copper foil using the electrolytic-deposition method.

In each case, there is an existing domestic capability with production of the input materials and/or of the manufacturing methods required to produce the finished goods.

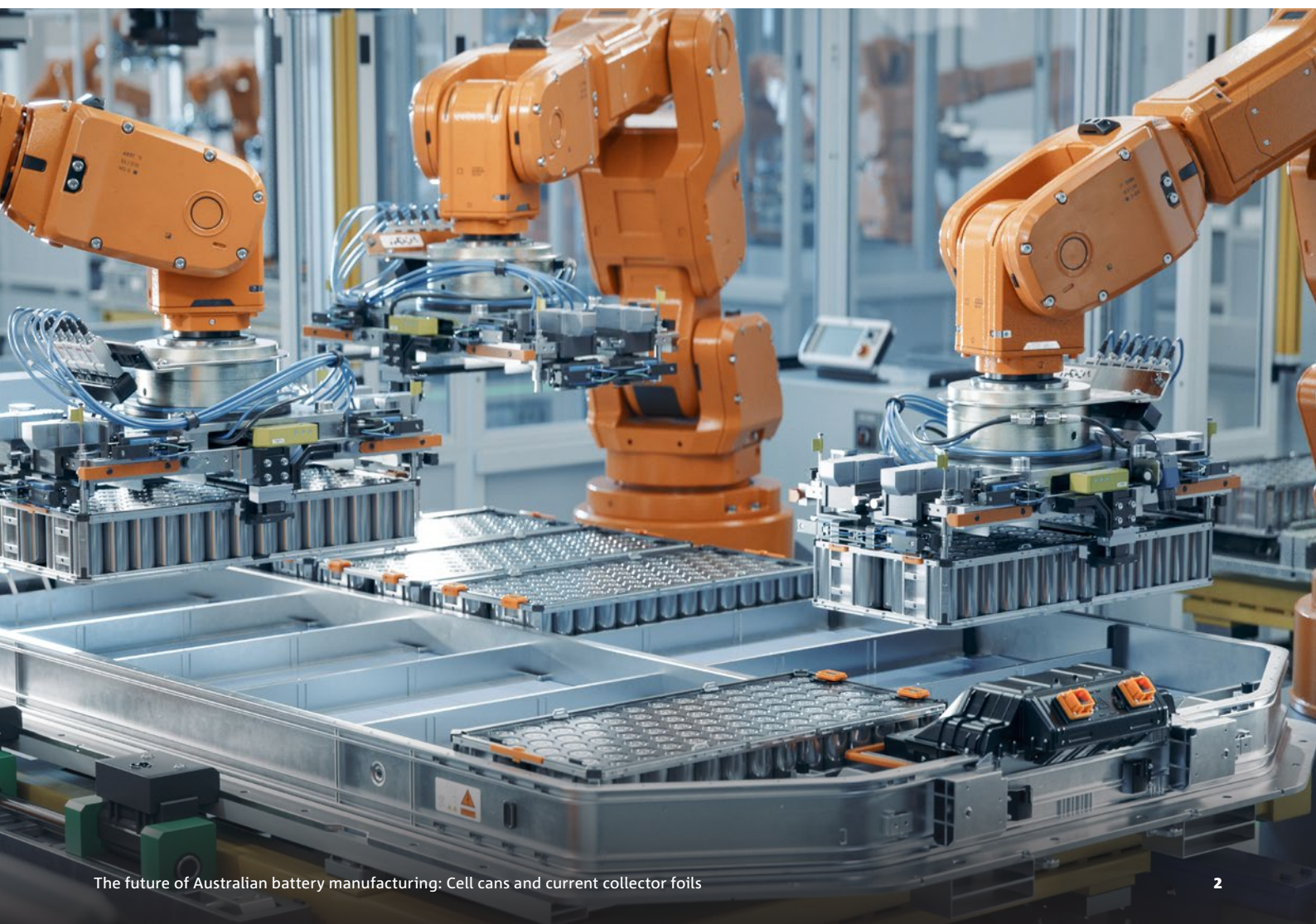
Introduction

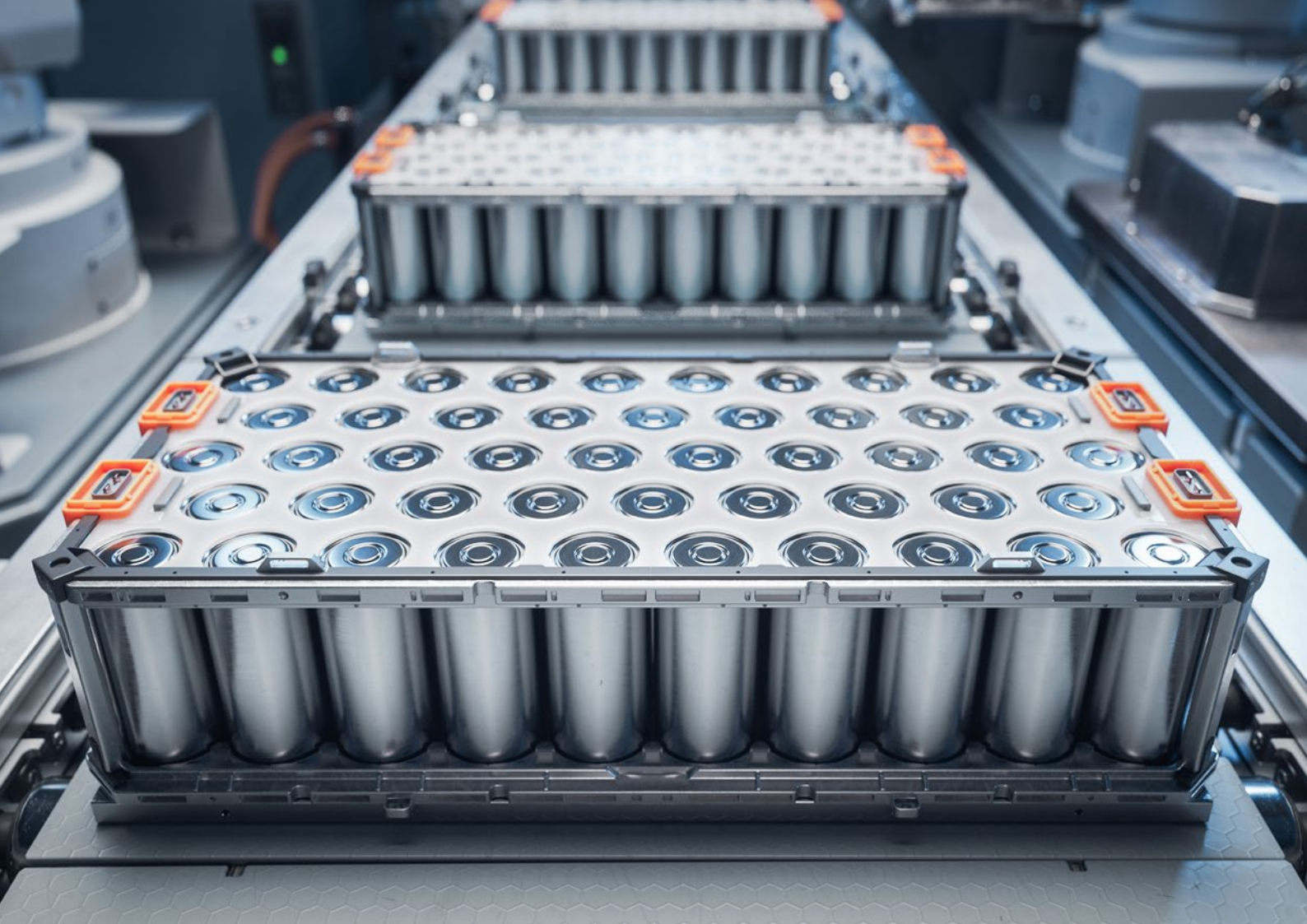
This document summarises the outcomes from a study with two primary considerations. The first consideration was the **technical requirements (manufacturing processes and materials)** for production of select components of lithium-ion battery cells. These components are the battery cell cans, and the current collector foils used in each cell. The second consideration was an evaluation of the identified technical requirement against the **known capabilities of Australian industry**, with the aim of identifying opportunities for domestic participation in the battery supply chain. The ideal outcome would be finding one or more direct matches between local capability and the technical requirement, so that the component or components could be 100% locally produced from Australian-sourced materials. 'Australian sourced' in this context means goods produced from Australian ore, locally concentrated, smelted and refined into the usable metal, then domestically processed into the applicable semi-finished forms, and then finally, transformed into the finished cell cans or current collector foils.

The summarised findings are derived from the report, *The future of Australian battery manufacturing: Cell cans and current collector foils*, report EP2026-1973, 25 May 2026. It is recommended that this more comprehensive report be consulted if further detail is required on any of the topics referred to in this summary. A copy of this report can be provided on request.

In the sections that follow, conclusions are reached for the different types of battery can and current collector foils, then general conclusions and recommendations are made which address next steps.

Battery cell cans and current collector foil are made using different materials and manufacturing processes. As a result, they will be discussed separately, as **Part 1** and **Part 2** of this summary.





Part 1. Cell cans for lithium-ion batteries

Lithium-ion batteries come in three different form factors:

- cylindrical
- prismatic
- the so-called ‘blade’ cells.

These cells differ not only in shape and size, but in the materials from which they are made. All three form factors are made in large quantities and are commercially important.

The cell cans – the object of this study – are a thin-walled hollow metallic container enclosing the electrochemical part of the cell.

There is a fourth battery form factor, known as the ‘pouch’ style. The can (enclosure) for this form factor is made from laminated polymer films. While not discussed further here, more information on pouch cells is provided in the full report.

Cylindrical battery cells and cans

Cylindrical battery cells and cans are shown in Figure 1. Such cans are typically made from nickel-plated steel, the can wall thickness ranges from 0.3 to 0.5 mm, and the popular 21700-size cell has a nominal diameter of 21 mm and a height of 70 mm. An example application is the battery pack of some versions of the Tesla Model Y electric vehicle, which uses 4416 of the 21700-size cells.



Figure 1. Cylindrical battery cells and cans: Cells of two different sizes (left) and a rendered image of an empty 4680 cell can (right).

Prismatic battery cells and cans

Prismatic battery cells and cans are shown in Figure 2. Prismatic cans are typically made from aluminium alloy. A typical cell size is 280 mm x 63 mm x 82 mm, and the can wall thickness ranges from 0.7 to 1.5 mm. An example application is the battery pack of a 2020 Tesla Model 3 vehicle which used 106 prismatic cells of this size.



Figure 2. Prismatic battery cells and cans: cells of various sizes (left) and empty cell can prototypes (right).

'Blade' format battery cells and cans

Blade battery cells and cans are shown in Figure 3. They represent a special category of prismatic cells due to their extended length. As produced, blade cell cans are open at both ends, unlike cylindrical and prismatic cell cans, which are produced with one end closed. Most often they are made from aluminium alloy; however, nickel-plated steel or stainless steel are also mentioned as possibilities. A typical (long format) blade cell is 980 mm long x 90 mm high x 13.5 mm thick; the wall thickness is believed to be in the range of 0.3 to 0.5 mm. Between 100 and 120 cells of this size are used in the battery pack of a Tesla Model Y RWD vehicle.

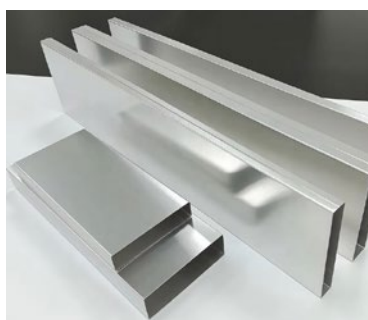


Figure 3. 'Blade' battery cells and cans: eight blade cells (left) and three blade cell cans with two short format blade cell cans (right).

Assessments of Australian capability, capability gaps and investments required considering cell form factor, material and manufacturing process

The form factor and the material determine which manufacturing processes will apply. The study has identified the following combinations of cell can form factors, material and manufacturing process as being most relevant:

- Cylindrical battery cell cans made by deep drawing/wall ironing of nickel-plated steel.
- Manufacture of prismatic battery cell cans in two subcategories:
 - by deep drawing of aluminium sheet
 - by impact extrusion of aluminium slugs.
- Blade cell cans made by roll forming and longitudinal welding of sheet.

The following sections provide a summarised assessment of each of these cases in a tabulated form. The primary consideration was to provide a comparison of the technical requirement of battery cell can manufacture against the ability of the Australian industry to provide the input materials, and to manufacture the actual cans.

Manufacture of cylindrical battery cell cans from nickel-plated steel sheet

Table 1 summarises key items relevant to production of cylindrical battery cell cans in the Australian context. These are:

- the availability of locally produced input materials
- the capability of the domestic industry to produce equivalent product
- an assessment of the investments required to address the gaps.

A summary of outcomes and conclusions is presented after Table 1.

Table 1. Cylindrical battery cell cans – by deep drawing of nickel-plated steel sheet

INPUT MATERIAL REQUIRED	IS THE REQUIRED NICKEL-PLATED STEEL (NPS) SHEET INPUT MATERIAL MADE IN AUSTRALIA?	IS AUSTRALIA MAKING SIMILAR PRODUCTS TO CYLINDRICAL BATTERY CANS FROM NPS SHEET?	INVESTMENT REQUIRED FOR A CYLINDRICAL BATTERY CELL CAN MANUFACTURING CAPABILITY
NPS suited to deep drawing. Typical thickness range is 0.2–1.5 mm, ~0.5 mm is required for the latest 4680 cell can format. (Aluminium sheet is also mentioned, but NPS steel is seen as the primary option.)	Partly. • Australian-made extra-deep-drawing-grade sheet steel is available from BlueScope Steel (e.g. CA55N-E steel is supplied uncoated, not nickel electroplated). • Available thickness range of CA55N-E sheet is stated as 0.6–3.2 mm. Correspondence with BlueScope indicates that a 0.3 mm thickness should be possible – this would meet the need if it could be available nickel-plated. • There is no domestic nickel plating of steel sheet. • Tin electroplating of steel sheet (tinplate) was done in Australia from 1958 to 2007. • Hot-dip coating of sheet is done by BlueScope (e.g. ZincAlume (Zn-Al-Mg)).	Partly. • The production method for cylindrical cell cans is deep drawing and wall ironing of NPS sheet. • High-volume production of finished parts using this technique has not been identified in Australia. • Australia makes large quantities of steel cans from tinplate steel, e.g. paint tins and steel aerosol cans. This involves pressing/ stamping and seaming operations. • Imported tinplate is used for the above.	• Nickel (electro) plating line for steel sheet to produce NPS, using BlueScope steel as the input. • Production cell(s) for cylindrical battery can manufacture from sheet (e.g. an integrated blanking and transfer press facility as offered by Schuler (or others) as a turnkey system).

Observation 1: There are no hard barriers preventing local manufacture of cylindrical cell cans made from nickel-plated steel, but sourcing local input material presents challenges.

It is quite feasible for Australia to develop a cylindrical battery cell can production facility, since Australia has depth of expertise in sheet metal working, and already carries out high-volume production of some categories of sheet metal container product – even if not exactly in the class of battery cell cans. Production equipment for cylindrical cell cans is available to purchase as a turnkey system, and the scale of this plant is likely not prohibitively expensive. The technical/commercial challenge appears to be in **sourcing** locally produced coiled sheet material in the **grades and thicknesses** required – discussed below.

Observation 2: There are gaps in the Australian supply chain for nickel-plated steel sheet.

BlueScope locally produce sheet steel with the required physical properties; however, it is not available nickel-plated, and the minimum available thickness (0.6 mm) in the current product range is at the upper end of what is acceptable; the latest format 8650-sized cylindrical cell can requires ~0.5 mm thick sheet, while the smaller cell types require input sheet as thin as 0.3 mm. Private correspondence with BlueScope indicates that production of thinner deep drawing grade sheet – to 0.3 mm – should be feasible using existing plant by applying additional annealing stages.

Since nickel plating of sheet is not done domestically, a new nickel-plating line for coiled sheet steel will be needed. Australian capability in this field was demonstrated over five decades with a somewhat similar product: tin-plated sheet steel (tinplate). However, the economic challenge of new investment is illustrated by the closure of the tin-plating line in 2007 despite there being a comparatively large local market for tinplate in the packaging industry (lidded tins and food cans).

Conclusions – manufacture of cylindrical cell cans in Australia from nickel-plated steel sheet

In a technical and commercial sense, there is no fundamental obstacle to Australian implementation of a deep drawing production line for cylindrical cell cans, presuming that suitable nickel-plated coiled sheet steel is available in the correct thickness. The investment required for the deep drawing plant needed for actual can production is unlikely to be prohibitive.

The bigger commercial challenge is likely to be in obtaining domestic supply of the input material: substantial upgrades are indicated for the Australian sheet production capability. These include an extension of the existing product catalogue to include the thinner grades of sheet possibly needed, and more significantly, investment in a new nickel-plating capability for coiled sheet steel.

As a result, this option presents **significant commercial challenges** if a prerequisite is use of Australian-made nickel-plated sheet.

Manufacture of prismatic battery cell cans by deep drawing and wall ironing of aluminium sheet

Table 2 summarises key items relevant to Australian production of prismatic battery cell cans from aluminium sheet using the same methodology as the previous section. Outcomes and conclusions are presented after the table.

Table 2. Prismatic aluminium cell cans – by deep drawing aluminium sheet with wall ironing

INPUT MATERIAL REQUIRED	IS THE REQUIRED ALUMINIUM SHEET INPUT MATERIAL MADE IN AUSTRALIA?	IS AUSTRALIA MAKING DEEP DRAWN ALUMINIUM PRODUCTS SIMILAR TO PRISMATIC BATTERY CELLS?	INVESTMENT REQUIRED FOR AN AUSTRALIAN PRISMATIC CELL CAN MANUFACTURING CAPABILITY
3003 grade aluminium sheet	Partly. - In Australia, aluminium ore (bauxite) is mined, refined to alumina, then reduced to aluminium metal in large quantities. - Aluminium slab suitable for rolling into sheet is produced by several Australian smelters. - However, no aluminium sheet has been produced (rolled) in Australia since 2014*. * From 2025, Jamestrong Packaging in Taree NSW is producing aluminium slugs from thicker sheet for impact extrusion: via melting, belt casting, rolling and blanking.	Yes/partly. - The applicable prismatic cell can production method is deep drawing and wall ironing of aluminium sheet. - Two Australian companies are using this method to make billions of (cylindrical) aluminium beverage cans. - Imported aluminium can stock is used. - High-volume production of equivalent prismatic-shaped objects has not been identified in Australia.	An aluminium sheet production facility, including melting, belt casting, hot rolling, annealing, pickling and cold rolling plant or the equivalent hot rolling from slab approach. Production cell(s) for prismatic cans from sheet, i.e. sheet blanking, deep drawing and ironing transfer press facility for prismatic cell cans, e.g. as offered by Schuler (or others) as a turnkey system.

Observation 1: There are no technical barriers to local manufacture of prismatic cell cans made from aluminium sheet, but Australia will need to restart rolling of aluminium sheet at scale – this presents economic challenges.

It is feasible for Australia to develop a prismatic battery cell can production facility using the deep drawing of sheet method. Plant for prismatic cell can manufacture is available as a turnkey installation, while Australia has experience producing billions of similar deep-drawn and wall-ironed items in the form of aluminium beverage cans.

However, Australia will need to return to local production of aluminium sheet, as all general-purpose or deep-drawing grade aluminium flat products, including sheet, are currently imported. The economic challenge of such new investment is significant, and plant utilisation would need to be high to get a favourable assessment. As a point of reference, the Australian sheet production capacity, shut down in 2014, totalled some 200,000 tonnes/annum.

Observation 2: Cost of the necessary sheet production plant is the main barrier to Australian aluminium sheet.

Australian industry offers plentiful aluminium alloy input material: either as ingot for melting or slab suited to rolling. Australia did produce aluminium sheet and foil for many years by the hot rolling of slab method, so in a technical sense, the task is ‘doable’. This is in fact proven by the return of production of (thicker) aluminium sheet to Australia in 2025, using the modern ‘cast rolling’ method – noting that the form of this product is specific to the requirements of impact extrusion slugs, and the output from this plant is likely captive to the aluminium aerosol can manufacturing industry.

On the basis that any new plant for aluminium sheet production will likely be able to produce a range of grades and thicknesses of sheet material, the commercial opportunity for such capital investment would presumably be enhanced by assessing the entire aluminium sheet import replacement market. This means considering the other classes of flat aluminium product that could be produced with a new facility: can stock, general-purpose aluminium sheet and plate, and packaging foil, in addition to supply of sheet tailored to the needs of battery cell cans.

Conclusions – scope for Australian manufacturing of prismatic cells from deep drawn locally made aluminium sheet

Australia could feasibly enter the market for supply of deep-drawn aluminium prismatic cans. The supply of local aluminium is plentiful, and local production of similar deep drawn product is already being done in quantity by makers of beverage cans. However, new capital investment will be required. The new plant needed for high-volume production of prismatic cell cans is commercially available and is probably not prohibitively expensive. New plant for aluminium sheet production would also be needed. The commercial feasibility of such plant has in fact been demonstrated by the recent

Jamestrong Packaging investment in plant for production of (thicker) aluminium sheet specific to manufacture of extrusion slugs. Overall, however, a new commitment to scale production of thin-gauge aluminium coiled sheet probably presents the biggest economic challenge, considering previous decisions made to close Australian sheet rolling operations in 2014 due to the pressures of low-cost international competition.

As a result, this option presents **significant commercial challenges** if a prerequisite is use of Australian-made material inputs.

Manufacture of prismatic battery cell cans by impact extrusion of aluminium slugs with wall ironing

Table 3 summarises key items relevant to Australian production of prismatic battery cell cans by the impact extrusion route with aluminium slugs as the input, using the established methodology. Outcomes and conclusions are presented after the table.

Table 3. Prismatic aluminium cell cans – by impact extruding aluminium slugs and wall ironing

INPUT MATERIAL REQUIRED	ARE THE REQUIRED ALUMINIUM SLUG INPUT MATERIALS MADE IN AUSTRALIA?	IS AUSTRALIA MAKING IMPACT EXTRUDED ALUMINIUM PRODUCT SIMILAR TO PRISMATIC BATTERY CELLS?	INVESTMENT REQUIRED FOR A PRISMATIC CELL CAN MANUFACTURING CAPABILITY
Aluminium slugs in 3003 grade alloy	Yes – but possibly not commercially available for battery applications. 100% Australian aluminium is available in suitable grades and in forms for melting in large quantities from four domestic smelters. - Jamestrong Packaging is manufacturing aluminium slugs from Australian aluminium to input to its in-house impact extrusion of aerosol cans. Availability of slugs suited to battery cell can applications for external customers is unknown, as this is a commercial decision for company management.	Yes/partly. - The applicable manufacturing method for prismatic cell cans is impact extrusion of aluminium slugs with wall ironing. - Australian companies are using this method to make millions of (cylindrical) aluminium aerosol cans. - High-volume production in Australia of equivalent prismatic-shaped objects has not been identified.	Investment of ~AUD\$6–8 M in an additional slug production line. This presumes Jamestrong Packaging will not be supplying bespoke slugs for prismatic cells to external customers. Required plant would provide aluminium melting, belt casting, sheet rolling, slug blanking, annealing and slug surface finishing processes. Production cell(s) for impact extrusion and wall ironing of prismatic cell cans, as offered by Schuler (or others) as a turnkey system.

Observation: There are no barriers to local manufacture of prismatic cell cans by impact extrusion of aluminium slugs, but Australia will likely need to invest in additional capacity for aluminium slug manufacture.

It is feasible for Australia to develop a prismatic battery cell can production facility using the impact extrusion of slugs method. Investment will be required in new plant dedicated to prismatic cell can production, but this is available as a turnkey installation. Australia also has experience in producing millions of similar impact-extruded items in the form of aluminium aerosol cans. From 2025, the input material – aluminium slugs – has been locally produced from Australian aluminium, from a melting/belt casting/rolling/blanking and annealing cell investment that reportedly cost \$6–8 million. While the slugs produced by this plant may not be commercially available for other applications (they are allocated to aerosol can manufacture), a way forward for battery can slugs has been demonstrated. The technical requirements of sheet used to make relatively thick extrusion slugs will be less stringent than the thinner sheet needed for deep drawing. As a result, the cost of the plant needed for slug production will be comparatively lower.

Conclusion – scope for Australian manufacture of prismatic cells using impact extrusion

Australia is well placed to enter the supply chain for fully Australian prismatic cell cans. Australian industry offers plentiful aluminium alloy input material, either as ingot for melting or slab suited to rolling. While no standard flat (sheet) aluminium products are made in Australia, recent investment in aluminium slug manufacture for aerosol cans proves the feasibility of producing this semi-finished input product; presumably this could be repeated as necessary for battery cans.

Investment in new plant for impact extrusion and wall ironing of prismatic cell cans will be required. Such plant is commercially available as turnkey operations. The same process is used domestically for somewhat similar product (aluminium aerosol cans), showing there is a demonstrated local capability and supplier support base for this class of manufactured product.

Overall, this option presents one of the **lower-risk opportunities**. This is based on the known Australian capabilities with manufacture of similar product, and the comparatively moderate investment required to locally produce the required input materials (aluminium slugs).

Manufacture of long prismatic ('blade') cell cans by roll forming and longitudinal welding

Table 4 summarises key items relevant to Australian production of 'blade' cell cans using the sheet roll forming and welding process, applying the established methodology.

The analysis is complicated by consideration of three different candidate input sheet materials:

- coiled nickel-plated steel sheet
- stainless grades of coiled steel sheet
- coiled aluminium sheet.

While other forming methods for blade cell manufacture have been mentioned in the literature, roll forming with longitudinal welding has been selected as the process of most merit.

Table 4. Prismatic 'blade' cells – made from roll formed sheet material

INPUT MATERIAL REQUIRED	IS THE REQUIRED SHEET INPUT MATERIAL MADE IN AUSTRALIA?	IS AUSTRALIA MAKING SIMILAR PRODUCT TO BLADE CELL CANS?	INVESTMENT REQUIRED FOR AN AUSTRALIAN BLADE CELL CAN MANUFACTURING CAPABILITY
Several candidate materials are referenced: • NPS sheet, 0.3–0.5 mm thickness. • Stainless steel sheet (possibly 310 grade). • Medium to high strength aluminium sheet e.g. 5005 or 7075 grades, thickness 0.3–0.5 mm. • Confirming actual materials will require metallurgical inspection of blade cell samples.	No, or partly. NPS • Australian-made sheet steel suited to roll forming is available from BlueScope Steel, but this is supplied uncoated, not nickel electroplated. • Minimum thickness of BlueScope sheet, e.g. CA55N-E at 0.6 mm minimum, is likely not thin enough for blade cell manufacture. Stainless steel • No stainless sheet steel is produced domestically. Aluminium sheet • Australian aluminium rolling stock is available, but no domestic rolling of this material into sheet.	Yes, or partly. • Roll forming of thicker steel into rectangular closed shapes using inductive seam welding is done by several companies. • Roll forming of thin sheet (as needed for blade battery cells) is also done, but not into the welded closed forms required. • Closing of the rolled sheet sections by seaming may be done.	1. Investment needed for supply of the required sheet material: NPS • Nickel (electro) plating line for steel sheet to produce NPS, using BlueScope steel as the input. • Possibly an upgrade to BlueScope's rolling facilities to permit production of sheet thinner than the current 0.6 mm minimum. Aluminium sheet • Aluminium sheet production facility including melting, belt casting, hot rolling, annealing, pickling and cold rolling plant or the equivalent hot rolling from slab approach. Stainless steel sheet • Upgrade to existing BlueScope melting and rolling plant to enable production of stainless sheet, or a new facility. 2. Investment in a roll forming and welding line for blade cell cans.

Observation 1: Setting up a blade cell can production line in Australia should be relatively straightforward, but sourcing local input materials is an issue.

Domestic implementation of a roll forming line for production of blade cell prismatic cans from coiled sheet should be relatively straightforward. Such a dedicated roll forming line should be commercially available as a turnkey operation.

The capital expense should be moderate, there is plenty of local experience with roll forming, and there is no reason to expect difficulties with the embodied laser-welding process. The technical/commercial challenge appears to be in sourcing locally produced coiled sheet material in the grades required – as these materials are not locally produced at present. This is discussed below.

Observation 2: There are gaps in the supply of locally produced input sheet material – for all three candidate materials.

Nickel plated steel

The status of the Australian industry to provide the needed grade of nickel-plated steel sheet has already been discussed for the case of cylindrical battery cell cans. BlueScope Steel locally produces sheet steel with the required physical properties; however, it is not available in the nickel-plated form, and the minimum available thickness of the coiled steel product in the current catalogue is 0.5–0.6 mm, which is too thick. Private correspondence with BlueScope states that extension of the product range to sheet as thin as 0.3 mm is likely possible using extra annealing stages, so the required base steel can probably be produced in Australia.

This being the case, investment will be needed in a new nickel-plating line for coiled sheet steel, as this is not done domestically.

Stainless steel sheet

Stainless grades of steel sheet are not produced domestically; the sheet produced in Australia is limited to the plain carbon and low-alloyed steel grades, and the sheet available has a minimum thickness around 0.6 mm. It follows that upgrades to both the steel melting/alloying/refining plant, and to the sheet rolling mills, will be required to achieve a production capability for thin gauge stainless sheet (0.3–0.5 mm). The investment required to achieve domestic production of battery-grade stainless steel sheet looks to be substantial.

Aluminium sheet

The status of the Australian industry to provide suitable aluminium coiled sheet has already been discussed for prismatic battery cell cans; the same applies to blade cell cans. The Australian industry offers plentiful aluminium alloy input materials, either as ingot for melting or slab suited to rolling. However, as mentioned, Australia left the field of flat aluminium products in 2014. Returning to sheet product will involve new investment in either the hot rolling or cast rolling sheet production methods. For the hot rolling option, on the basis that such new plant would be able to produce various grades and thicknesses of sheet aluminium material, the case supporting the required capital investment would presumably be enhanced by assessing the opportunity for replacement of imported aluminium flat product of all kinds, rather than limiting the scope to production of sheet suited only to battery cans.

The newer cast rolling method of aluminium sheet production probably offers lower capital and operating

costs by comparison to the more traditional slab rolling approach. Consideration of this technique is likely to assist with the investment case for new plant for flat aluminium product, including that suited to battery cell manufacture.

Observation 3: The most obvious customer for long blade cells – BYD – makes all its batteries in-house.

The centre of (long) blade cell can usage is BYD Motor in China. However, BYD is vertically integrated, with in-house supply of blade batteries reportedly at 100% – so selling blade cell cans to BYD is unlikely. Other manufacturers of blade cells are Geely and SVOLT. The technical approach adopted by these companies are the so-called ‘short’ blade cells. The market opportunities for Australian-made blade cells will thus reside with companies like the latter mentioned, unless a new integrated battery cell maker in Australia becomes established.

Conclusions – scope for blade cell manufacturing opportunity in Australia

There appears to be no obstacle for successful implementation of an actual roll forming production line for manufacture of either long or short blade cell cans in Australia, as the technology is available, reasonably straightforward, and well known to the local industry.

However, imported coiled sheet (one of nickel-plated steel, alloyed aluminium sheet, or stainless steel sheet) will need to be used until the local industry upgrades its capability to provide such materials – and each of the upgrade choices presents commercial challenges.

The most difficult (expensive) upgrade is probably that of production of thin stainless steel sheet. Deciding between the other two (aluminium sheet or nickel-plated steel sheet) will require further economic analysis, but the real driver of this choice will naturally be the customer’s preference of material, and general access to the battery can market.

Overall, the commercial challenges embodied in this option parallel that of the other processes requiring Australian-made sheet materials as the input (in this case, aluminium or steel) – being **reasonably high-risk**. The investment required to reinstate manufacture of thin aluminium sheet will be large, and the economics of upgrading the Australian sheet steel capability to the nickel-plated variety in the thinner gauges requires scrutiny. Accessing the international market for blade cells would also appear to be particularly challenging.

General conclusions – battery cell cans

The following combinations of battery cell can form factor, material and manufacturing process have been identified and considered:

- cylindrical cells made by deep drawing of nickel-plated steel
- prismatic cell cans made by deep drawing of grade 3003 aluminium sheet
- prismatic cell cans made by impact extrusion of aluminium slugs
- blade cell cans made by roll forming and longitudinal welding, using one of coiled nickel-plated steel sheet, coiled stainless steel sheet or coiled aluminium alloy sheet.

Regarding the actual manufacture of such cell cans in Australia, implementing the necessary **metal working processes is almost certainly technically feasible**, and probably commercially viable – whether it be deep drawing (of steel or aluminium), impact extrusion or roll forming. This is based on the assessment that:

- the required production equipment is commercially available as a turnkey production cell
- the capital costs involved would be relatively moderate in each case
- the processes will have a high degree of automation
- Australia possesses a skill base in each category, successfully manufacturing similar product.

It follows that at the level of actual cell can production, it is not possible to single out or exclude any of the product forms and materials as offering the best opportunity without first carrying out **more detailed analysis**. For the current purpose, they can all be considered technically feasible, and at the current level of knowledge, having a similar cost basis. The choice of which should be pursued could therefore be a matter of analysis of the battery cell market. For instance, which product is most in demand or offers the best commercial return, or alternatively, is most relevant to the Australian strategic requirement.

Greater obstacles are presented by the shortcomings of the Australian industry in providing the **required input materials**. Despite Australia being a producer of 100% locally made steel and aluminium, there are substantial shortfalls in the availability of these

materials in the semi-finished forms necessary for can manufacturing processes:

- Australia produces deep drawing and roll forming grades of steel sheet, but not in the required nickel-plated form, nor in stainless steel grades, and currently not in the required thinner sheet gauges.
- Australia is a globally significant supplier of pure and alloyed aluminium, in forms suited to either rolling or melting, but does not process this ingot into the semi-finished sheet product that is required.

There is, however, one example of an Australian operation producing a **semi-finished input material** suitable for battery can manufacture. The Jamestrong Packaging company is producing aluminium slugs for impact extrusion by the process of roll casting, hot rolling, cold rolling, blanking and annealing. These slugs are supplied to automated impact extrusion cells producing aerosol cans. As such, they are equivalent to what is needed to make prismatic cell cans by impact extrusion.

These gaps in the domestic capability mean that manufacture of wholly Australian battery cell cans will require **significant investment**. The metal working equipment needed to produce the finished cans could be considered the more straightforward part, be it setting up production facilities for cells by either the deep drawing, impact extrusion or roll forming processes.

Upgrading the local industry capability to **supply the necessary sheet materials**, be it nickel-plated steel sheet or aluminium sheet, involves a level of investment that may be prohibitive. Nickel-plated steel will certainly require investment in a new nickel-plating line for steel sheet. For aluminium sheet, an entire new production line will be needed. The equipment required runs the gamut of melting, direct chill (DC) casting and homogenisation (or melting and belt casting), then plant for hot rolling, annealing and cold rolling.

The economics of these upgrades require serious scrutiny. In particular, to maximise the utilisation of the investment in plant, the aluminium sheet upgrade route would need to be assessed against the opportunity for supply of the full suite of aluminium flat products that are currently imported into Australia. These are general-purpose aluminium sheet and plate, can stock and packaging grade foil, plus foil for battery cell current collectors.

Recommendations for Australian production of battery cell cans

The primary recommendation, based on the easiest path forward, is to first consider production of prismatic format battery cells made from Australian aluminium, using the impact extrusion route.

Two key investments will be required:

1. An aluminium slug production facility equivalent to that commissioned by Jamestrong Packaging in 2025 for \$6–8 million – but tailored to the requirements of prismatic cells.
2. An automated, high volume, production cell specific to impact extrusion of prismatic type battery cell cans.





Part 2. Current collector foils for batteries

Spools of current collector foils are shown in Figure 4. Two types of foil are used in a battery:

- copper foil, which is used in the anodic current collector of the battery
- aluminium foil used as the cathode current collector.

Both foil types are first coated in electrochemical materials, then wound into a 'jelly roll' (Figure 5, upper). The foils physically support the chemical layers – the black coatings seen in Figure 5 (lower) make the battery work electrically.

The foils also 'collect' and conduct the electrical current to the battery terminals. Both types of foil are equally applicable to the different battery formats: cylindrical, prismatic or blade. The battery pack of a Tesla Model 3 vehicle provides an example of how much current collector foil is used: approximately 312 m² (~10 kg) of 12 µm aluminium foil and 335 m² (~15 kg) of 5 µm copper foil is used in one vehicle.

Figure 4. Spooled current collector foil for batteries: copper foil (left) aluminium foil (right).

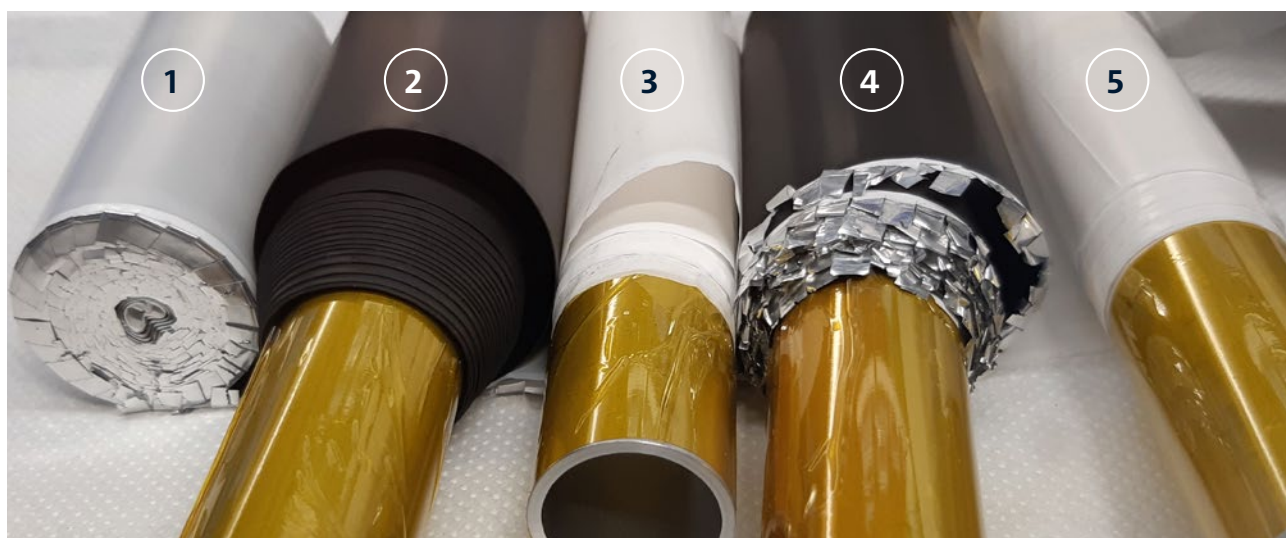
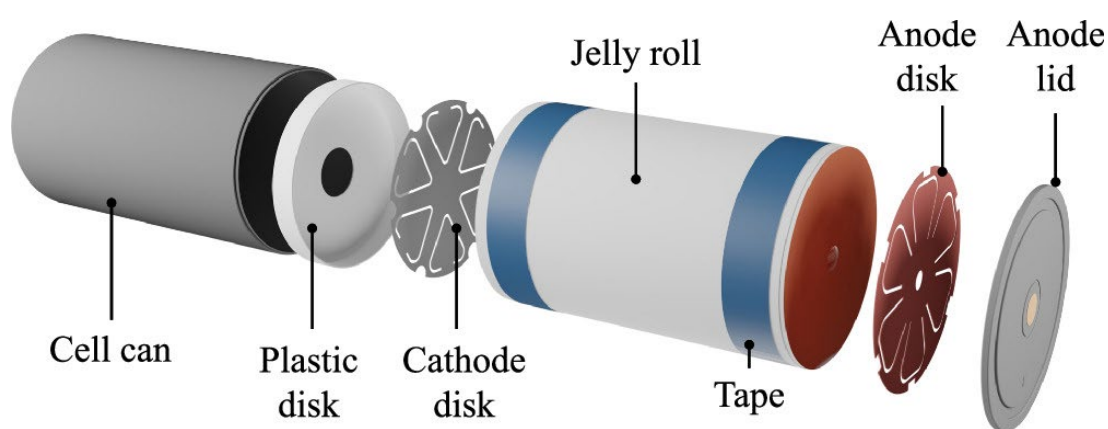
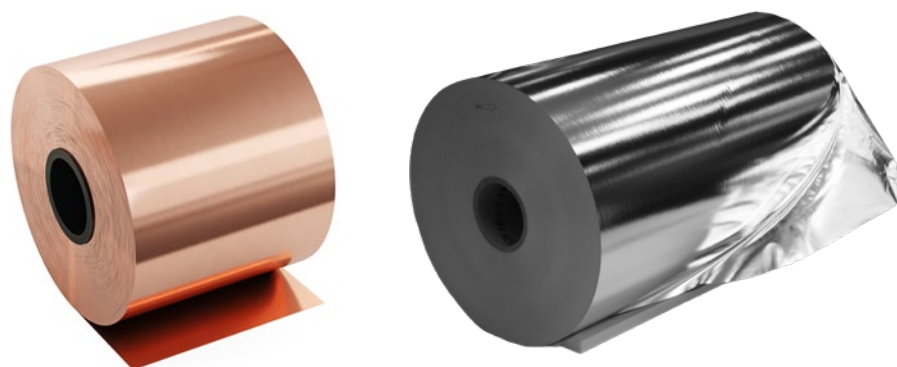


Figure 5. 4680 cylindrical battery cell internal components: identifying the 'jelly roll' portion of the cell, which is comprised of wound sheets of coated current collector foils with interwound separator sheets (upper image) and after partial unrolling of the jelly roll into the four components (lower image), from left to right: 1. remainder of the jelly roll; 2. unrolled and re-spooled anode [copper foil (current collector) with black graphite coating on both sides]; 3. unrolled and re-spooled separator (white); 4. unrolled and re-spooled cathode [aluminium foil (current collector) with black lithium-iron-phosphate coating on both sides]; 5. unrolled and re-spooled separator (white). Ank et. al. (2023), Lithium-Ion Cells in Automotive Applications: Tesla 4680 Cylindrical Cell Teardown and Characterisation. *J. Electrochem. Soc.* 170 120536. DOI 10.1149/1945-7111/ad14d0 (Images used with permission).

Assessment of Australian capability, capability gaps and investments required for current collector foil manufacture

The study has identified the following relevant combinations of foil types and manufacturing processes:

- Copper current collector foils made by either of two production routes:
 - the rolled annealed (RA) method
 - the electrolytically deposited (ED) method.
- Aluminium current collector foils by the rolling process.

The following sections provide a tabulated assessment of each of these cases. The primary consideration was to compare the **technical requirements of foil production** against the ability of the **Australian industry** to provide the input materials and to carry out actual foil production.

Following each summary table, conclusions are listed for each of the three cases. After the assessment of the individual material and process combinations, general conclusions are reached on current collector foil manufacture in Australia. Finally, recommendations provide the potential ways forward.

Copper current collector foil production by the Rolled Annealed (RA) route

Table 5 summarises key items relevant to Australian production of copper foil by the RA process, considering:

- the availability of locally produced input materials
- the capability of the domestic industry to produce equivalent product
- the investments required to address the gaps.

The outcomes and conclusions are provided after the table.

Table 5. Copper foil for battery current collectors – manufacture by the RA process

INPUT MATERIAL REQUIRED	IS THE REQUIRED INPUT MATERIAL MADE IN AUSTRALIA?	IS AUSTRALIA MAKING ROLLED COPPER SHEET OR FOIL?	INVESTMENT REQUIRED FOR AN RA COPPER FOIL MANUFACTURING CAPABILITY
Rollable slab of electrical grade pure copper	Partly. • Electrical-grade copper is made domestically. Three Australian smelters produce electrolytic copper cathode from Australian copper ore. • No rollable copper slab is cast in Australia. • However, other copper product forms are cast locally from Australian cathode: round extrusion billet by Kembla Metals, copper rod for drawing wire by Tyree Cables.	No. • Neither copper sheet nor copper foil is rolled in quantity.	Plant for production of RA copper. Starting material for rolling: • copper slab casting facility, or • belt casting facility. Sheet/foil production equipment: • hot rolling plant • homogenisation plant • strip milling • cold rolling plant • plant for intermediate annealing or pickling/annealing • coiling and uncoiling plant.

Observation 1: Setting up an RA copper foil production line in Australia is not necessarily difficult, but the new plant required will be capital intensive as there are significant gaps in the domestic capability.

Australia is a significant producer of electrical grade copper cathode made from Australian ore. Australian expertise in manufacture of finished and semi-finished copper products extends to casting of extrusion billet and copper rod, extrusion of copper pipe, and drawing of wire. No copper foil is domestically produced, and copper is no longer locally cast into rolling slab. It follows that production of copper foil using the RA method will require substantial investment. Obtaining material in the form necessary for rolling of foil first indicates investment in either a copper slab casting facility, or alternatively, a belt casting installation. Investment in a full rolling line for foil production will then be needed. Such a production line will involve hot rolling mills, homogenisation plant, strip milling, cold rolling mills, plant for intermediate annealing (or alternatively, a pickling and annealing line), plus coiling and uncoiling plant. The investment required will be substantial.

Observation 2: RA copper foil may be seen as a 'premium' product compared to ED foil.

RA copper foil is generally expected to cost more than equivalent ED copper foil. However, in the current collector application, it has some superior attributes. Customers looking for higher levels of battery cell performance may be prepared to pay this premium depending on the battery application and the market position of the finished battery cell.

Conclusions – production of copper foil by the RA process

Production of RA copper foil in Australia is feasible, using Australian-produced copper cathode as the starting material. However, relatively **large investments in plant** will be required, namely casting, hot and cold rolling mills, annealing, and other processes. Unless a case is made justifying this investment in terms of the nominally superior properties of RA copper foil, the alternative production route of ED is likely to be an easier or lower cost option.

Manufacture of copper foil by the Electrolytically Deposited (ED) production route

Table 6 summarises key items relevant to Australian production of ED copper foil, using the assessment method used previously. Outcomes and conclusions are included after the table.

Table 6. Copper foil for battery current collectors – manufacture by the ED process

INPUT MATERIAL REQUIRED	IS THE REQUIRED INPUT MATERIAL MADE IN AUSTRALIA?	IS AUSTRALIA MAKING SIMILAR COPPER FOIL BY ELECTROLYTIC DEPOSITION?	INVESTMENT REQUIRED FOR AN ED COPPER FOIL MANUFACTURING CAPABILITY
Clean, easily dissolvable copper. • Ideal material is scrap copper wire, stripped of insulation. • Alternative is granulated/finely divided solid copper from scrap pipe (or similar), or from new cathode copper.	Yes. • Input material (as scrap) can be obtained from the existing Australian copper recycling industry. • Scrap could be supplemented, if needed, with new Australian copper cathode, processed into granules.	No. • However, an Australian skill and industry supply base resides in the substantial domestic copper electrorefining/ electrowinning industries. These have considerable technical commonality to ED foil production.	Electrolytic copper foil deposition facility. This will comprise: • dissolving/electrolyte preparation plant • foil electrodeposition cell(s) • foil post-treatment plant. The smallest plant with the minimum investment has one electro-deposition cell. Capacity can be increased by adding extra cells. Ultimate capacity is dictated by the size of the copper dissolving plant.

Observation 1: Use of recycled copper as the input material for ED foil production potentially reduces costs and the dependence on otherwise readily available Australian-produced copper.

ED foil production requires a supply of clean copper in a form that is easy to dissolve into copper sulphate electrolyte. The ideal/lowest cost feedstock is scrap copper wire stripped of insulation; the Australian scrap metal industry should be able to provide substantial quantities. If the supply industry for scrap wire cannot meet the quantity required for ED copper production, any deficit could be met by milling other types of scrap (e.g. copper pipe) into a granular form, or else by introducing new Australian cathode copper into the feed, also in a granulated form, to make it easier to dissolve.

Observation 2: Establishing an ED copper foil production capability requires a smaller investment than the alternative RA production route.

Establishing an ED copper production plant is relatively modest compared to the large and extensive plant required for RA copper production. The ED process is also more easily scalable, in the sense that ED foil production capacity can be increased by adding additional deposition cells and/or additional dissolving tank capacity.

Observation 3: The significant Australian capability with electrorefining and electrowinning of copper provides a supplier base and a body of local experience relevant to ED copper production.

Copper electrorefining or electrowinning is undertaken at three Australian sites. This involves handling of large

amounts of copper-bearing sulphate solutions for copper electro deposition, thus providing considerable technical overlap with the electrolyte handling and deposition processes intrinsic to ED copper foil production.

Conclusions – production of copper foil by the ED process

ED copper foil production could be established in Australia for a relatively modest capital investment. This is based on the feasibility of an ED foil production facility which is comprised of a circuit with a dissolving tank system feeding a single deposition cell (plus the necessary foil post treatment process). An advantage of the ED approach is that the production capacity can be expanded by adding more dissolving and deposition cells in a parallel arrangement.

A further advantage is that a body of relevant experience resides in Australia due to the considerable investment in the similar electrolytic processes for copper refining and electrowinning currently undertaken in Queensland and two places in South Australia.

The required input material is available as Australian-sourced copper. Whether this is from scrap, new copper cathode, or a combination of both, is arguably a matter of lesser importance.

Considering the advantages listed, the production of copper foil in Australia using the ED method is probably **a more viable option** than the RA route.

Aluminium foil for cathodic current collectors (rolling process)

Table 7 summarises key items relevant to Australian production of aluminium foil, considering:

- the availability of locally produced input materials
- the capability of the domestic industry with rolling sheet or foil
- an assessment of the investments required to address the gaps.

Outcomes and conclusions are provided after the table.

Table 7. Aluminium foil for battery current collectors (rolling process)

INPUT MATERIAL REQUIRED	IS THE REQUIRED INPUT MATERIAL MADE IN AUSTRALIA?	IS AUSTRALIA MAKING PRODUCTS SIMILAR TO ALUMINIUM FOIL?	INVESTMENT REQUIRED FOR AN ALUMINIUM FOIL MANUFACTURING CAPABILITY
High purity aluminium rolling slab (e.g. 1045 grade)	Yes. • Australian aluminium ore (bauxite) is mined, refined to alumina then reduced to aluminium metal in large quantities at four Australian smelters. • The smelters offer aluminium slab suitable for rolling into sheet and foil, and also, ingot suited to melting.	No, or only partly. • Aluminium sheet and foil production in Australia ceased in 2014 when Alcoa Australia closed its two rolling plants. • From 2025, production of aluminium sheet (not foil) returned to Australia, when Jamestrong Packaging of Taree NSW, commissioned an aluminium slug production facility, reportedly for ~AUD\$6–8 M. This includes sheet making by the ‘cast rolling’ process: a melting furnace, belt caster for thick sheet, plus hot and cold rolling mills to reduce the sheet thickness.	A foil production facility based on either the ingot hot rolling process or the cast rolling process. The ingot hot rolling process will involve plant for: • ingot (rolling slab) scalping • ingot homogenising and pre-heating • multi-stage hot rolling • multi-stage cold rolling with intermediate annealing • coiling/recoiling • final annealing and lubricant removal with pickling, washing, drying and foil cutting. The alternative cast rolling process will involve investment in: • melting furnace and holding furnace • twin roll or belt casting machine • uncoiling/recoiling equipment • multi-stage cold rolling mills • plant for intermediate and final annealing • brushing, washing, drying and cutting plant.

Observation 1: Australia produces large quantities of aluminium and has produced aluminium foil before. New investment in a foil production line will be required – and this will need to be economically justified.

Aluminium foil represents a special category of aluminium sheet. Essentially it is the ultimate expression of the process of rolling aluminium into thin material; the ‘front end’ of foil production will parallel that used for sheet, and some of the same equipment could be used. However, most, or all, of the foil cold rolling stages will use mills dedicated to foil production because of the specific technical demands of foil manufacture.

The status of the Australian industry to provide suitable coiled aluminium sheet has already been discussed for prismatic battery cell cans and blade cell cans. Australian industry offers a plentiful supply of aluminium input materials: either as ingot for melting or slab suited to rolling. However, Australia left the field of rolled flat aluminium products, including foil, in 2014. All aluminium foil (and sheet) used in Australia in 2026 is imported.

Returning to foil production will involve new investment in either hot rolling, or more likely, the increasingly important cast rolling sheet production method. The following quote by Woodward (TALAT Lecture 1301) suggests that the economic challenge should not be underestimated:

A modern complex including melting furnaces, DC casting facilities, pre-heat furnaces, hot mill, cold mill and annealing furnaces involves a very large capital investment which can only be fully justified on financial grounds if a big market is assured. Obviously, if such facilities are not fully utilised the economic viability is threatened. As indicated above, however, hot mill coil can be obtained for further reduction in cold mills of lower capacity/speed/complexity.

Clearly, decisions on Australian investment in aluminium foil production would need to address the need to maximise utilisation of any new plant. This could be done by considering the ‘whole of market’ opportunity based on replacement of imported flat aluminium product, spanning the categories of commercial aluminium sheet, beverage can stock, food packaging grade foil, and battery current collector grade foils. Cast rolling, hot rolling and annealing plant could provide starting strip material for all these products, with the specialised requirements of sheet and foil cold rolling being met using separate cold rolling lines, perhaps of the ‘mini-mill’ class.

Conclusions – production of rolled aluminium current collector foil in Australia

Australian-produced aluminium feedstock is available for foil manufacture, but none of this is locally converted to commercial-grade aluminium sheet or foil. New investment in foil production would likely involve plant for cast rolling of sheet, hot rolling, annealing, and a dedicated cold rolling line dedicated to foil production. Such plant will be **substantial and expensive**. The question of whether the financial viability of such an investment could be enhanced by capturing the wider market for currently imported flat aluminium product (for instance, commercial sheet, can stock, packaging foil and battery current collector foil) is a complex matter needing **detailed technical, commercial and market analysis**.

General conclusions

– current collector foils for battery cells

The following options for manufacture of foils for battery cell current collectors have been identified:

- copper foil made by the traditional RA route
- copper foil made by the ED process
- aluminium foil made by the cast rolling, annealing and cold rolling process
- aluminium foil made by the traditional hot rolling, annealing and cold rolling process.

Australia can provide the following base input materials for **current collector foils**, but as noted, not in the required finished or semi-finished forms:

- electrical-grade refined copper in the form of raw cathode (but not as foil, nor as slab suitable for rolling into foil)
- scrap copper in various forms such as scrap copper wire or scrap copper pipe
- electrical-grade aluminium either as slab suited to rolling, or ingot suited to melting (but not as sheet or foil).

Copper foil can be produced by the RA or ED method.

The challenges of upgrading the Australian capability to produce RA copper foil parallels that for producing aluminium sheet or foil: large and expensive investment in plant is required, and such plant would need a high utilisation to have any chance of being economically viable. Such plant will include a slab casting facility (or a melting and belt casting facility), then plant for hot rolling, homogenisation, strip milling, cold rolling, and an intermediate annealing or a pickling/annealing line.

By comparison, a smaller investment will be required to set up a plant for production of ED copper foil. This approach has other attributes:

- the capacity of the plant is more easily scalable
- there is an existing Australian supplier and experience base in similar activities
- the input material will, at least partly, comprise locally sourced copper scrap.

In terms of the **aluminium foil** opportunity:

- upgrading Australian capability to produce aluminium foil requires a new production line for ‘flat product’
- to maximise the utilisation of the ‘flat product’ equipment, replacement for the full range of currently imported flat products may be necessary, including general aluminium sheet product and plate, can stock, packaging foil and battery current collector foil
- input of aluminium sheet to the foil production rolling line could absorb a portion of the capacity of any new rolling plant, noting that rolling of foil will require a dedicated cold rolling line, additional to that producing finished sheet.

The economics and costs of any upgrades require serious scrutiny. Maximising plant utilisation would need to be targeted by replacing a significant portion of all flat aluminium products currently imported into Australia, not just producing foil for battery current collectors. These include general-purpose sheet and plate, can stock and packaging grade foil.

Recommendations for Australian production of foils for battery cell current collectors

- 1.** Production of copper foil in Australia using the ED method should be considered as the first priority, as it is the option more likely to offer a viable commercial case compared to RA copper foil or rolled aluminium foil.
- 2.** A study should be carried out to confirm that ED copper current collector material is an appropriate material to target for investment. Consideration should be given to the requirements for current and future lithium-ion batteries, taking into account the market demand for this product, and any relevant technical developments in the field of battery technology. Points of reference for this study are the alternative forms of copper current collector, such as copper foil made using the RA process.
- 3.** An ED copper foil facility should be scoped and costed. The design of the plant should be on the lines of a 'scalable' facility. This will enable a smaller up-front investment to reduce the barrier to entering the market but also offer scope for straightforward expansion of the production capacity by adding additional parallel production cells.
- 4.** An assessment should be undertaken of the capacity of Australian sources to supply suitable copper input material for ED foil production. The recommended starting point is the Australian scrap metal industry's ability to provide stripped scrap copper wire. The cost and availability of such material should be compared with the alternatives, such as new copper cathode processed into granulated form.
- 5.** Following the study of ED copper, production of aluminium foil for current collectors could be considered as a second priority. In this case, market analysis should be carried out based on planning for 're-shoring' the full range of aluminium flat products currently imported into Australia, such as aluminium sheet and plate, aluminium can stock, and aluminium packaging foil. This would be supplemented with the new opportunity for aluminium foil battery current collectors. The aim of this analysis is to explore ways to maximise the utilisation of plant to improve the potential economics of the investment.
- 6.** Based on recommendation 5, a technical and commercial study could be undertaken on the design and commercial viability of new manufacturing plant needed to re-shore the identified flat product, including production of current collector foil.

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