

PUBLIC



TINDO SUBMISSION

Premium Products and the Market

This submission is made to the Anti-Dumping Commission (the Commission) in response to the request from the Commission (**attachment 1**) for further information regarding the Tindo Manufacturing Pty Ltd (Tindo) submission of 17 February 2016 (Public Record No 163) and to supplement the information that was discussed during the meeting with the Commission on 17 March 2016.

Question 1 - Premium Product

Commission question:

Paragraph 21 on page 7 refers to a "premium product", can you please clarify which product this refers to? Ie: your AC or DC panel or both?

Tindo response:

Firstly, in the context of paragraph 21 of Tindo's above mentioned submission the term "premium product" refers to the direct current (DC) and alternating current (AC) panels or modules manufactured by Tindo. The point Tindo is making is that Tindo uses quality components and processes. Further details on these quality components and processes are provided in response to Question 2.

Secondly, Tindo would like to clarify that the terms "PV panel" and "PV module" are interchangeable and refer to a framed panel without a microinverter as well as a framed panel with a microinverter attached.

In its application Tindo provided a diagram showing the composition of an unframed Tindo solar PV panel, also known as a laminate.

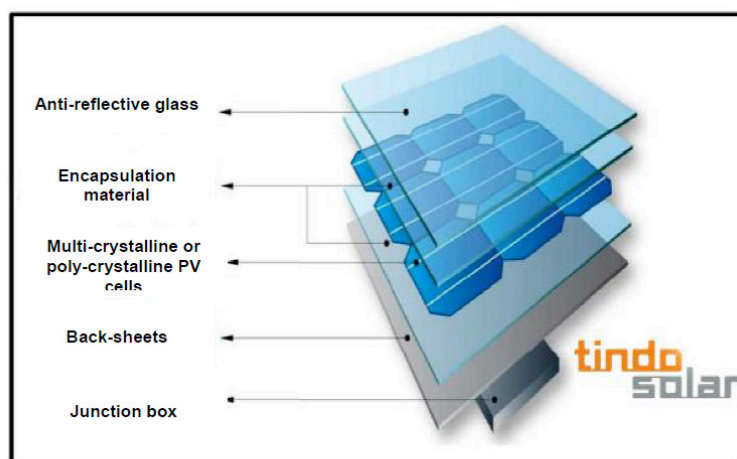


Diagram A-3.3.2 Composition of a Tindo Solar PV panel

The above illustrated DC laminates are used by Tindo for the manufacture of its:

- Tindo Karra 240W AC panel/module;
- Tindo Karra 250W AC panel/module
- Tindo Karra 240W DC panel/module; **and**
- Tindo Karra 250W DC panel/module.

Thirdly, Tindo further submits that the term 'premium product' is also used when referring to:

- monocrystalline (mono) cells versus polycrystalline (poly) cells;
- AC versus DC panels; and
- tiered pricing in the market.

1. Mono versus poly crystalline cells

As stated in Tindo's application¹ there are two types of silicon crystalline cells in commercial use for the manufacture of PV panels or modules:

- Mono crystalline cells; and
- Poly crystalline cells, also known as multi-crystalline cells.

Mono crystalline cells are manufactured from a mono crystalline rod that has been formed by slowly pulling a mono crystalline silicon seed crystal out of melted poly crystalline silicon. The rod is round with a 20cm diameter. The rod gets cut into round wafers that are subsequently trimmed to make them squarer so they can be arranged on a rectangular piece of glass.

Poly crystalline cells are manufactured from molten silicon poured into a square cast that has cooled and solidified. The rectangular block of silicon is generally cut into 156 mm square wafers.

Mono cells are usually distinguishable from poly cells because mono cells are darker in colour and not perfectly square, however, square mono-crystalline cells are also available albeit in much lower volumes. Mono cells are also generally more space efficient than polycrystalline.

A mono crystalline solar cell usually costs more than a poly crystalline solar cell however when assembled into a solar panel, the cost of the mono panel is generally slightly higher than the same poly panel in \$/Watt.

Tindo uses a particular type polycrystalline cell ² which has a lower temperature coefficient than the average monocrystalline cell. A lower temperature coefficient means that the cell used in the Tindo panel will not lose as much power as its temperature increases, meaning more energy is generated on hot sunny days compared with cells that have a higher temperature coefficient.

¹ ADC investigation 239, Public Record No 1, Page 8

² ADC Investigation 239, Public Record No 86, Page 12

Mono cells can be sold at a slightly higher price compared with poly cells as they are marketed as being more efficient. The efficiency being referred to is the power efficiency of the panel, or Watt / m². Space efficiency is different to energy efficiency. A solar panel with good energy efficiency is one that generates more kWh for each kW installed. Tindo chose to focus on energy efficiency rather than power efficiency when designing its module.

In the Australian market, poly cells have become the preferred cell type. Australia has had a solar rebate in place since 2000 and Australia has become an extremely price sensitive market mostly due to the value distortion to the end user that a rebate unfortunately provides.

Tindo's claim regarding the higher cost of mono-crystalline panels compared to polycrystalline panels is supported by the following importers:

Trina Solar (Australia) Pty Ltd noted in its importer visit report that:

poly-crystalline PV modules or panels are less costly to manufacture and are therefore cheaper³.

Tindo submits that this comment is important as it relates the issue of cost differences between poly cells and mono cells and the price differences between poly and mono PV modules or panels.

Similarly, in **the True Value Solar Pty Ltd** (TVS) submission of 7 January 2015, the end-user importer requested the Commission consider the application of a product margin for the:

two distinct types of goods the subject of the investigation, i.e. PV modules and panels that are made up of poly-crystalline cells, or PV modules and panels that are made up of mono-crystalline cells⁴.

TVS further states that:

It is also generally accepted within the solar industry that the mono-crystalline cell manufacturing process is more expensive than the poly-crystalline process due to the time involved in creating the uniform silicon crystals required for mono-crystalline cells.⁵

Again, Tindo submits these comments by TVS are significant as they show the correlation between high costs and high prices. Basically, higher costs should lead to higher prices and customers are willing to pay for a higher price premium product.

2. AC v DC

AC and DC panels are identical except for the AC panels having a third party micro inverter attached.

³ ADC Investigation 239, Public Record No 96, Page 13

⁴ ADC Investigation 239, Public Record No 98, Page 1

⁵ ADC Investigation 239, Public Record No 98, Page 4

The benefits of AC panels with their own individual inverters over traditional DC string systems are:

- The ability to monitor each panel remotely from a smart phone anywhere in the world;
- The elimination of a large inverter mounted on the wall of a building and the labour, safety, hardware and cost associated with mounting the inverter to the wall;
- Micro inverter systems are extra low DC Voltage meaning fire risk is greatly reduced;
- Micro inverter systems individually control the performance of each panel whereas with a conventional solar system, if one panel is underperforming due to shade or other factors, then every other panel connected in series to this panel is reduced to the level of the lowest performing panel in the string
- Designing of the solar system is greatly simplified; and
- Micro inverter systems are generally regarded as being able to generate more electricity than a conventional inverter solar system.

In its submission of 23 July 2014, TVS stated that:

The key difference in terms of componentry between AC and DC PV modules or panels is that AC PV modules or panels have micro-inverters built into each PV module or panel whereas DC PV modules or panels have one inverter per solar PV system. The micro-inverters enable each PV module or panel to function independently to produce power in all conditions. As a result of the micro-inverter technology, AC modules or panels are generally a more expensive product than DC PV modules or panels.⁶

And the TVS Visit Report states that AC modules:

are more expensive to manufacture and hence more expensive to customers. AC modules are however more energy effective and flexible as they can be installed on most roofs.⁷

The above comments show that it is acknowledged by the market that micro inverter solar systems or AC solar panel systems are more expensive but more efficient than conventional DC modules or panels. Though the Australian market preference is for DC modules or panels there is also demand for the AC modules or panels. These panels compete and sell against the imports of PV panels from China.

In summary, Tindo submits that the Australian consumer does and will pay for a higher price the premium AC product.

3. Tiered pricing in the market

In its application, Tindo provided the Commission with price lists⁸ that clearly showed the tiered pricing of PV panels or modules in the Australian market. The tiered pricing

⁶ ADC Investigation 239, Public Record No 76, Page 3

⁷ ADC Investigation 239, Public Record No 91, Page 8

in these price lists demonstrate show that customers are prepared to pay a 'premium' for a higher cost product.

This observation of premium/tiered pricing was also noted in the following Importer Visit Reports.

True Value Solar Pty Ltd (True value)

The Importer Visit Report for True Value refers to it offering a premium poly-crystalline product.⁹

Solar Juice Pty Ltd (Solar Juice)

In its Importer Visit Report Solar Juice notes that there are Tier 1, 2 and 3 suppliers. Tier 1 supply good quality whereas Tiers 2 and 3 supply the lower quality that are more likely to be dumped and causing injury to industry and other importers/sellers in the market.

Solar Juice claims that if there was any dumping, it would be by the Tier 2 and Tier 3 Chinese suppliers of PV modules or panels and not by Tier 1 suppliers.¹⁰

Trina Solar Australia Pty Ltd (Trina Australia)

In its Importer Visit Report, Trina Australia also references suppliers in terms of Tiers 1 to 3 and notes it is a Tier 1 supplier:

Trina Australia claims that if there was any dumping, it would be by the Tier 2 and Tier 3 suppliers of PV modules or panels and not by 'Tier 1' suppliers. Trina Australia claims that Trina Solar is a Tier 1 company.¹¹

Renesola Australia Pty Ltd (Renesola Australia)

Renesola Australia makes similar observations as well:

*Renesola Australia claims that PV modules or panels supplied by 'Tier 3' companies are of **low quality and are distorting the prices** [emphasis added] of PV modules or panels in Australia. These suppliers are the 'price setters' and are driving prices of PV modules or panels down in Australia.*

Renesola Australia stated that any injury caused to the Australian industry is by suppliers of 'Tier 3' PV modules or panels. Renesola claims that 'Tier 3 suppliers are also hurting Renesola Australia's sales.'¹²

As mentioned above, Tindo provided the Commission with price lists showing the tiered pricing for PV products in the market and in its recent submission regarding causal link Tindo noted that:

⁸ ADC Investigation 239, Public Record No 6 (Non-Confidential Attachment A-9.5.15), Public record No 7 (Non-Confidential Attachment A-9.5.16) and Public Record No 8 (Non-Confidential Attachment A-9.5.17)

⁹ ADC Investigation 239, Public Record No 91, Page 18

¹⁰ ADC Investigation 239, Public Record No 81, Page 26

¹¹ ADC Investigation 239, Public Record No 96, Page 27

¹² ADC Investigation 239, Public Record No 97, Page 25

The number one selling solar panel during the investigation period, [REDACTED] was [REDACTED] higher in price than other tier 3 Chinese manufacturers. The market chose [REDACTED] even though it was more expensive – for qualitative and quantitative reasons. The evidence shows that in the market, there is a large group of customers who prefer to pay a premium for [REDACTED] over other tier 3 manufacturers. Solar panels are not a pure commodity product.¹³

The above examples show that customers will pay a higher price for recognised premium products, which Tindo is.

Conclusion Premium Products

Tindo submits that the Australian consumer can identify premium attributes and does and will pay a for what it perceives as a “premium” product whether it is mono crystalline versus poly crystalline, AC versus DC or Tier 1 versus Tier 3 panels or panels.

In addition, Tindo notes that the market recognises that costs are related to prices and those higher costs should realise higher prices. Tindo further submits that if the panels or modules exported from China were undumped, Trina and Renesolar would not have had the price advantage they did and would have had to have set higher prices and this would have enabled Tindo to set its prices higher and be more competitive.

Question 2 - Tindo production costs

Commission question:

In the same paragraph you indicated the following costs that Tindo incurs in producing its panels that are additional to costs incurred by competing products:

- 1. Laminating solar panels for 19 minutes to maximise gel content of the ethylene-vinyl acetate*
- 2. Bridgestone EVA (rather using the cheaper Chinese EVA)*
- 3. Silicone (rather than using a double sided tape to frame the module)*
- 4. Dow Corning PV804 (rather then (sic) using a Chinese equivalent edge seal and silicone)*
- 5. DuPont Tedlar (rather then (sic) using a PET back sheet from a Chinese company)*
- 6. Decommission 100% electroluminescence testing of panels*
- 7. German aluminium junction box (rather a Chinese plastic junction box)*

Can you please provide a full breakdown of these costs, by \$/watt including labour and materials?

Tindo response:

¹³ ADC Investigation 239, Public Record No 163, Page 6

It is not correct to state that Tindo's costs incur additional expenses to 'competing products'. As outlined above, Tindo produces high quality PV products.

Tindo submits that its manufacturing costs are similar to the costs of the competing products from other Chinese manufacturers.

It is correct to state that the cost of materials used in a Tindo panel are higher than other lower quality solar panels due to the quality of the materials used in a Tindo panel.

Both the Trina and Renesolar importer reports note the cost differences between tier 1 and lower tiered manufacturers.

In terms of assisting the Commission to understand the cost differences, Tindo provides the following information in response to each component raised by the Commission.

Laminating solar panels for 19 minutes to maximise gel content of the ethylene-vinyl acetate (EVA)

It is important to laminate a solar panel for enough time and temperature to ensure there is sufficient gel content in the EVA. Some manufacturers cut corners and reduce the time needed to properly laminate their PV panels resulting in a low gel content.

A lower gel content of the EVA means the integrity of the panel is seriously compromised and the panel will not last as long. The panel looks exactly the same whether it has been laminated for 12 or 20 minutes however the solar panel will not last as long once it has been installed.

By reducing the laminating time there is a saving in production time as well as in laminator running costs. The laminator is a costly machine to run. It usually consumes around 100kW when it is heating and also has an expensive consumable in a diaphragm, which costs around [REDACTED] to replace, plus downtime. Tindo estimates the laminating machine costs around [REDACTED] in electricity to run and the diaphragm (the consumable on the machine) also costs around [REDACTED].

Bridgestone EVA Encapsulant (rather than using the cheaper Chinese EVA)

It is possible to buy ethylene vinyl acetate (EVA) copolymer film with ultra violet (UV) blockers varying from 0 nanometers (nm) to 300 nm.

Some of the power generated from PV panels is harvested in UV spectrum light and if an EVA with less UV blockers is used, or blockers that operate at a lower wavelength, then the solar panel will generate more power and produce more electricity. However, EVA with less UV blockers will ultimately result in premature failure of the solar panel.

The Bridgestone EVA used by Tindo blocks light less than 300nm, a high level of blockage, meaning the panel will generate less energy, but it will last longer. This Bridgestone EVA is a premium product and costs more than lower quality EVA.

In addition, using poorer quality laminating material can result in discoloration and breakdown of the EVA, as can be observed in the following photo.



Silicone (rather than using a double sided tape to frame the module)

Refer to the response at No 4 below.

Dow Corning PV804 (rather than using a Chinese equivalent edge seal and silicone)

It takes longer to manufacture a solar panel with silicone as an edge sealant compared to using double-sided tape.

Silicone-sealed panels need to cure for 24-48 hours before shipping, and silicone is a more expensive material than double sided tape.

Silicone edge sealing is considered a better approach as it provides an air tight seal between the edge of the glass and the aluminium frame.

The quality of the seal is important because if water finds its way into the gap between the frame and the glass edge, it could freeze and expand and can pop off the frame during expansion. This can be observed in the following photo.



Tindo uses high quality Dow Corning PV804 silicone as an edge sealant. A 25.5kg pale of PV804 costs around [REDACTED].

Dow Corning commercialized silicone around 80 years ago and has extensive experience in its use. Dow Corning produces varying grades however environmental laws in Australia prohibit use of the cheaper silicone that is available in China.

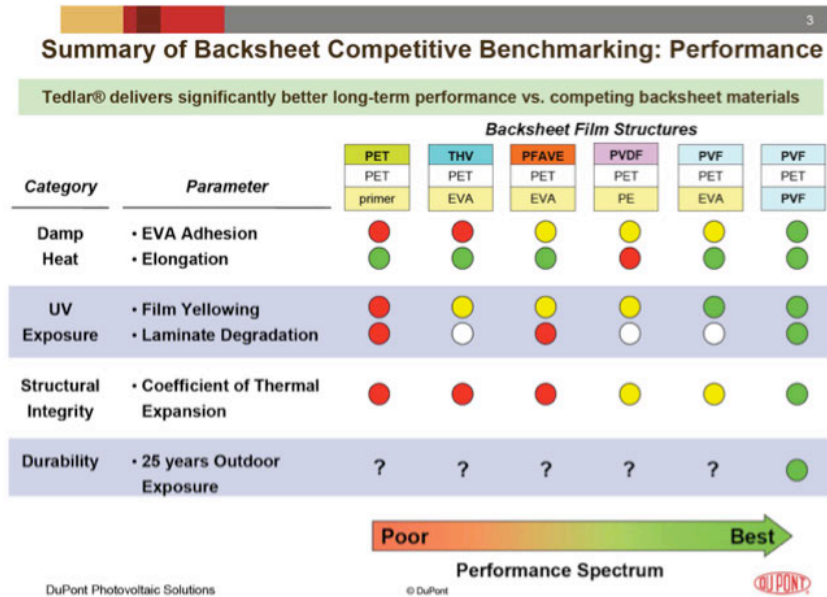
In China this cheaper Dow Corning grade silicon is still able to be used as are cheaper imitations from other silicone manufacturers and the price is less than half the price that Tindo pays for its PV804 silicon. It is likely that, where Chinese PV panel or module manufacturers do use silicone (instead of tape) the silicone is of poorer quality than that used by Tindo.

DuPont Tedlar (rather than using a PET back sheet from a Chinese company)

The backsheet of the solar panel insulates and environmentally protects the silicon cells and cell interconnections. It needs to withstand 25+ years of sunlight, UV degradation and thermal cycling.

Tindo uses the high quality DuPont Tedlar (PVF PET PVF) backsheet. DuPont Tedlar is the only material that Tindo is aware of that has actually been used for 25+ years in real world conditions in PV panel applications. It is therefore a trusted material for PV panel manufacturers. However, it does cost more to purchase than an equivalent material that has less of a proven track record in PV panel applications.

The following table shows the performance spectrum of DuPont Tedlar backsheet compared to other backsheets. As can be seen the DuPont Tedlar (PVF PET PVF) backsheet is rated as having the best performance for all categories in the long-term.



In addition, a cheaper backing material may use less UV blockers resulting in material discoloration and eventual breakdown of the backsheet as can be observed by the following photo. As the EVA is transparent (refer No 2 above) discoloration of the backsheet is visible as can be seen in the following picture.



100% electroluminescence testing of panels

Tindo finds one cracked cell in every 1,000 cells (in the form of micro cracks). Micro cracks result in a power drop from the solar panel which affects every panel in the series string so it is important that micro cracks are identified and eliminated prior to lamination.

Tindo understands that many imported Chinese PV panels are not tested for micro cracks and hence panels are imported and installed with micro cracks present. These can develop into larger cracks over time.

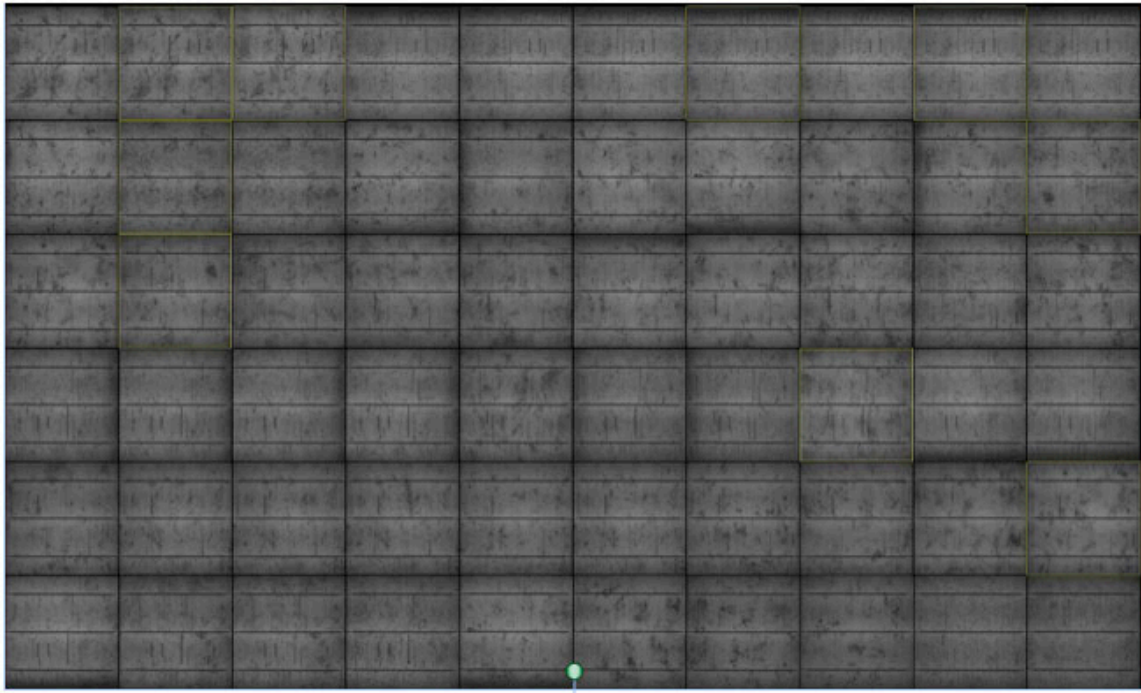
Below is photo of a Chinese panel with cracks.



Tindo detects the cracks by electroluminescent (EL) testing **every** panel. As each Tindo panel uses 60 cells Tindo needs to rework around one in every [REDACTED] panels due to it containing a cracked cell. Reworking involves identifying the cracked cell, replacing it with a new cell, and then running the panel through the electroluminescence tester again to ensure all is working as required.

Running the EL tester is estimated to cost Tindo around [REDACTED] in labour and running costs. The reworking needs to be done by hand and not machine.

Below is a photo of an EL test.



German aluminium junction box (rather a Chinese plastic junction box)

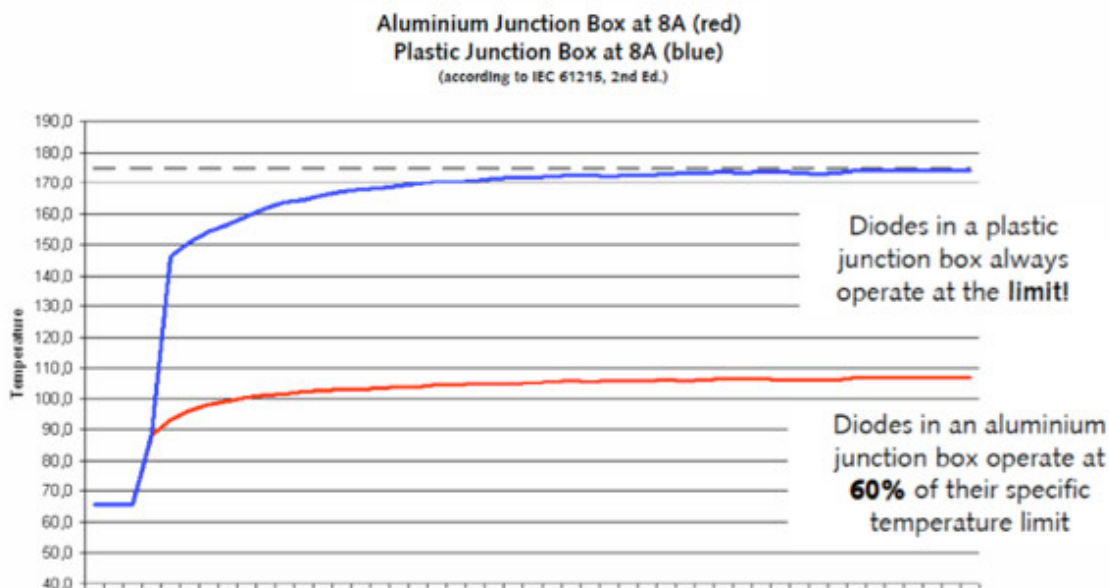
Solar panels have bypass diodes installed in junction boxes to help with shade protection for series string installations. When these diodes are operating, they can get very hot and their life is reduced significantly.

As plastic is an insulator, in a plastic junction box heat is trapped and takes a long time to dissipate. Diodes in plastic junction boxes are shown to operate at 185 degrees Celsius.

Diodes mounted on aluminium heat sinks operate at a much lower temperature at 105 degrees Celsius, ensuring a longer and more reliable life.

The FPE junction box used by Tindo has diodes mounted on an aluminium heat sink. Tindo understands that imported solar panels use plastic junction boxes.

The following diagram compares differences in the operating temperatures of aluminum versus plastic junction boxes.



Can you please provide a full breakdown of these costs, by \$/watt including labour and materials?

Here are our costs for the non-silicon components during the investigation period:

55mm Aluminium Frame		
Corner Key for 55mm Frame		
Bridgestone EVA Front		
Bridgestone EVA Back		
FPE Aluminium Junction Box		
DuPont Tedlar Back Sheet		

Labour can be priced at [REDACTED] per month for a labourer on the production line. At full capacity, seven people can manufacture [REDACTED] solar panels per hour.

Question 3 - Other features and functions

Commission question:

Can you please also list any other features and functions of your manufactured product which differentiates it from the imported PV module?

Tindo response:

Tindo is a Tier 1 quality supplier and considers the quality of its product differentiates it from the Tier 2 and 3 suppliers. The majority of the physical differences that make Tindo's PV modules Tier 1 products are discussed above.

However, it is important to note that Chinese imports include Tier 1 products, that can include similar high quality materials (though they may not contain every component at a high quality that Tindo does e.g. may use a silicone edge sealant but not a DuPont Tedlar backing sheet, or all panels might not be EL tested).

In addition, Tindo's PV modules use a 55mm aluminum frame. This compares to say Suntech which has a 35mm frame. A more rigid frame means a stronger panel for cyclone conditions, as well as less flexing during installation and transport meaning less change of micro cracking.

Tindo also attracts a premium for being a local supplier¹⁴.

Other - Tindo sales to end-user

The Commission notes in its Australian Industry Verification Report ¹⁵ that Tindo stopped selling to dealers in November 2012 and sold direct to end users. That is, for the majority of the July 2012 to December 2013 investigation period Tindo was selling direct to end users. However, in the Termination Report the Commission has focused its analysis on sales to the wholesale market. Tindo requests the Commission to have regard to Tindo's injury with regard to sales to end users as well.

Other – Estimate of the AC Market in Australia

Tindo notes that the Commission's Termination Report also fails to address the injury to Tindo from DC panels exported from China and fitted with micro-inverters in Australia that convert those panels into AC Panels that compete directly with the Tindo's AC panels or modules.

In its commentary on the Australian market in the Termination Report, the Commission noted:

*The Australian industry predominantly produces AC PV modules or panels, which are more expensive, compared to DC PV modules or panels due to various advantages as discussed in this report. None of the four selected exporters in this investigation exported AC PV modules or panels to Australia during the investigation period.*¹⁶

Tindo does not dispute the above claim in terms of what was exported from China. What Tindo is concerned about is the Commission methodology for analysing the price advantage of the Chinese panels from dumping.

Tindo submits that the AC modules or panels manufactured and installed by Tindo are competing against significant numbers of AC modules or panels comprising DC panels

¹⁴ ADC Investigation 239, Public Record No 144, Page 3

¹⁵ ADC Investigation 239, Public Record No 86, Page 17

¹⁶ ADC Investigation 239, Public Record No 157, Page 21

exported from China (including imports from the four selected exporters) that are fitted in Australia with micro-inverters.

Tindo requests the Commission consider the fact that numerous Chinese DC panels are imported to Australia and then fitted domestically with a micro-inverter when determining injury and causal link in the context of this investigation (as well as Chinese panels imported as DC panels and installed as DC systems).

In support of its claims in relation to the importation of DC panels that are later installed as AC panels Tindo notes the following:

Import duties

Firstly, Tindo seeks clarification from the Commission that panels and inverters entered under tariff subheading 8501.31.00 (DC generators of an output not exceeding 750W) are being included in the Commission's investigation. Tindo considers these goods to meet the goods description and hence should be included in the Commission's assessment of dumping and material injury.

Additionally, if the investigation results in anti-dumping measures, Tindo considers that measures would need to be implemented against the above classification as well as those listed below to ensure collection of anti-dumping measures against the full scope of the goods.

Secondly, Tindo notes that the varying duty rates under subheading 8501 and 8542 make it commercially more attractive for importers to import AC panels (duty free) separate to the microinverter (5% duty) than to import the AC panel with microinverter attached (5% duty), to minimise the overall duty liability on those imports.

The following is an extract from the Termination Report regarding the tariff classification of the goods under investigation.

3.3 Tariff classification

The goods are classified to the following tariff subheadings in Schedule 3 to the *Customs Tariff Act 1995*:

- 8541.40.00, statistical code 53;
- 8501.61.00, statistical codes 33 and 24;
- 8501.62.00, statistical code 34;
- 8501.63.00, statistical code 40; and
- 8501.64.00, statistical code 41.

The then Australian Customs and Border Protection Service's¹² (ACBPS) tariff branch advised the Commission that the goods can be imported under tariff classification subheadings 8541 and 8501. The Commission notes that the goods are defined by the description, not the tariff classification.

The rate of Customs duty payable under each of the tariff subheadings is as follows:

- 8541.40.00 (statistical code 53); 8501.63.00 (statistical code 40) and 8501.64.00 (statistical code 41) are duty free; and
- 8501.61.00 (statistical codes 33 and 24) and 8501.62.00 (statistical code 34) have a duty rate of 5 per cent for all countries except for DCS countries (4 per cent) and DCT (5 per cent). China is defined as DCS therefore duty is payable at the rate of 4 per cent.

There is currently no tariff concession order (TCO) applicable to the goods.

Tindo concurs with the advice that the goods can be imported under subheadings 8501 and 8541 and that the goods are defined by the description not the tariff classification.

In its appeal to the ADRP Tindo noted that

The majority of Tindo customers have opted for a micro inverter to be factory fitted to the solar panel. By contrast, Chinese manufacturers do not pre-attach inverters as this would result in a reclassification of the imported solar panel. If a Chinese exporter pre-attaches an inverter on a solar panel, the panel and inverter are then subject to a 5% duty under tariff subheading 8501.31.00, as opposed to importing solar panels duty free under tariff subheading 8541.40.00 without an inverter.

Hence the installation of inverters to solar panels is generally undertaken in Australia and not imported pre-attached to solar panels imported from China. Tindo understands that the vast majority of micro inverters imported into Australia are then matched with the imported solar panels or modules (imported without an inverter).¹⁷

The above commentary was provided to the ADRP to assist in its understanding of the implications of the varying duty rates in terms of the commercial decisions made by importers with regard to importing AC panels or modules. This was not intended as new information to the case but to complement information previously provided to the Commission during the course of the investigation.

¹⁷ Tindo ADRP application, Page 9

Evidence from Importer Visit reports

The Solargain Pty Ltd (Solargrain) importer visit report explains how micro-inverters are fitted to DC modules or panels.

*Solargain stated that it generally supplies DC PV modules or panels in the Australian market. When specifically requested by the customers, Solargain attaches micro-inverters (converting the DC PV modules to alternating current (AC)) on the PV modules.*¹⁸

Evidence from Tindo

In Tindo's application¹⁹, industry visit report²⁰ and submission dated 7 September 2015²¹ the Commission was provided with examples of Tindo competing against China AC modules.

Also, in its submission dated 18 September 2015 Tindo outlined to the Commission that:

*Australia has businesses such as [REDACTED] and [REDACTED] both multi million dollar operations dedicated to selling microinverters. Microinverters are hugely popular in Australia with hundreds of thousands of units deployed nationally.*²²

Further, the attached article from Business Spectator dated 4 October 2013 (**attachment 3**) states that:

*the **majority** of micro inverter manufacturers sell their products as a retrofit option to suit **any** solar module. (Emphasis added)*

In terms of the size of the market for installing microinverters, according to the article *Solar Enlightenment* in *Solar Progress* (the Australian Solar Council's regular industry magazine) there has been a recent increase in the market for AC modules with on-board microinverters:

- *Back in January 2014 just 2 per cent of people asked for micro inverters; one year on the figure is 4.4%.*

*"Small but doubling in 12 months, and at that growth rate micro-inverters will comprise two thirds of the market within four years."*²³

Earlier on in its application, Tindo stated that:

AC modules are different to DC modules as they generate 240V AC power ready to be plugged into the grid by use of an on-board micro-inverter. On the

¹⁸ ADC Investigation 239, Public Record No 95, Page 11

¹⁹ ADC Investigation 239, Public Record No 1, Pages 37-38

²⁰ ADC Investigation 239, Public Record No 86, Page 41

²¹ ADC Investigation 239, Public Record No 144

²² ADC Investigation 239, Public Record No 147, Page 5

²³ See page 19, *Solar Progress*, Issue 1 No 3/15, available at https://issuu.com/solarcouncil/docs/solar_iss_1_march_2015_web

*other hand the DC module needs to be connected to a separate inverter that converts the energy generated to 240V AC power. In both cases, the goods perform the same function, namely the conversion of solar energy to a form of electrical current. **The key difference is whether the inverter is included with the module or not.***²⁴ (Emphasis added)

The Commission's Termination Report notes that:

*The Australian industry predominantly produces AC PV modules or panels, which are more expensive, compared to DC modules or panels due to various advantages as discussed in this report*²⁵

What is not clear from the Commission's Termination Report is that Tindo's AC modules are manufactured from DC panels with a micro-inverter attached to each panel.

Further, Tindo is concerned that the Termination Report did not appear to factor into its analysis of the market that:

- AC modules are more expensive to manufacture due to the incorporation of a micro-inverter for each module compared to DC modules that are attached to a single inverter for multiple modules; and
- the price of AC modules with micro inverters is more expensive than the price of DC modules with an inverter for multiple modules.

Another concern is that it is not clear from the Termination Report that the Commission understood the size of the Australian market for installed AC panels.

Using information on the public record Tindo has estimated the market for AC and DC panels or modules, refer **Attachment 2**. Based on Tindo's analysis at least [REDACTED] of the installed panels or modules are AC with [REDACTED] sourced from China. Given that Tindo's sales are direct to end-users this implies that Tindo's AC PV panels or modules are competing directly against panels imported from China and installed as AC modules or panels for at least [REDACTED] of the market.

Other – Causal Link - Statistical correlation

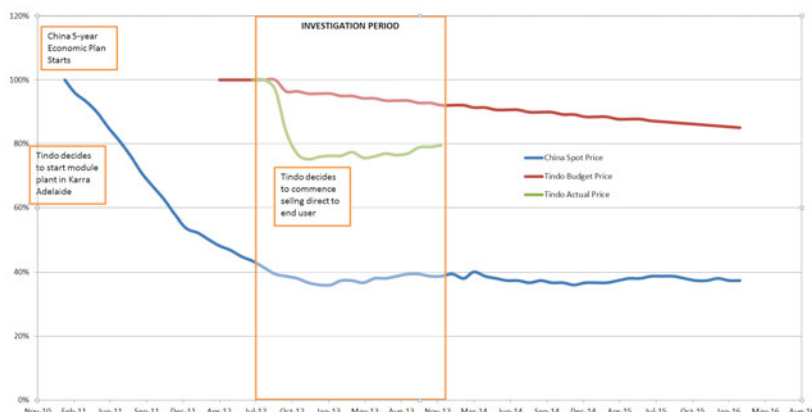
As noted in the Tindo Submission to the SEF²⁶ there was an unexpected reduction in Chinese prices from mid-2011 through to 2012. This sudden and deep decline in PV prices that was at a greater rate than the drop in the price of cells was around the time that Tindo commenced operations in May 2012.

The following diagram illustrates the strong correlation between the declining spot price for cells and Tindo's PV prices.

²⁴ ADC Investigation 239, Public Record No 1, Page 8

²⁵ ADC Investigation 239, Public Record No 157, Page 21

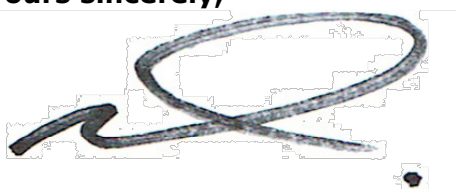
²⁶ ADC Investigation 239, Public Record No 118,



In terms of showing a correlation between Tindo's injury and imports from China any such findings would be statistically irrelevant given that Tindo's sales volume (AC + DC) are [REDACTED] of the market compared with Chinese imports at [REDACTED] of the market.

Tindo submits that it has shown causation with evidence of specific lost sales AC and DC to goods exported from China in its application and subsequent submissions.

Yours sincerely,



Adrian Ferraretto
Managing Director

LIST OF ATTACHMENTS

Attachment	Description
Attachment 1	Request from ADC for further information
Attachment 2	Business Spectator article
Attachment 3	Estimate of Australian Market - AC and DC

Non Confidential Attachment 1

----- Forwarded message -----

From: [REDACTED]
Date: 29 February 2016 at 11:27
Subject: Tindo Submission #2 - PV Panels Resumption [SEC=UNCLASSIFIED]
To: [REDACTED]
Cc: [REDACTED]

Dear Adrian

My name is [REDACTED] and Im working with David Peters regarding the Resumption investigation.

In relation to your recent submission attached I have the following queries:

1. Paragraph 21 on page 7 refers to a “premium product”, can you please clarify which product this refers to? Ie: your AC or DC panel or both?

2. In the same paragraph you indicated the following costs that Tindo incurs in producing its panels that are additional to costs incurred by competing products:

1. Laminating solar panels for 19 minutes to maximise gel content of the ethylene-vinyl acetate
2. Bridgestone EVA (rather using the cheaper Chinese EVA)
3. Silicone (rather than using a double sided tape to frame the module)
4. Dow Corning PV804 (rather then using a Chinese equivalent edge seal and silicone)
5. DuPont Tedlar (rather then using a PET back sheet from a Chinese company)
6. Decommission 100% electroluminescence testing of panels
7. German aluminium junction box (rather a Chinese plastic junction box)

Can you please provide a full breakdown of these costs, by \$/watt including labour and materials?

3. Can you please also list any other features and functions of your manufactured product which differentiates it from the imported PV module?

Any queries please contact me on [REDACTED]

Kind regards

[REDACTED]

[REDACTED]

Anti-Dumping Commission

Department of Industry, Innovation & Science

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Has the micro-inverter revolution begun?

NIGEL MORRIS | 4 OCT 2013, 8:16 AM |
CLIMATE | SOLAR ENERGY

A glance through recent solar trade publications reveals a proliferation of advertisements from micro inverter suppliers. Micro inverters, which are embedded into PV modules or, directly adjacent on the roof top are clearly gaining popularity, but has an AC photovoltaics revolution begun, or is this just hype?

Micro inverters are not a new phenomenon to Australia. Back in the late 1990s, Pacific Solar were embedding micro-inverters into "Plug'n'Power" systems using BP Solar panels and although it was early days for roof mounted electronics. Although many are still operational today, it's true that the heat stress caused an unsatisfactory failure rate and since Pacific Solar's (unrelated) closure not long afterwards, micro inverters have been virtually unheard of.

Fast forward 10 years.

Micro inverters started emerging again, particularly in US markets and soon afterwards, several innovators in Australia started supplying them locally into a tiny market niche. With the benefits of hindsight and rapid advances in electronics, micro inverter manufacturers around the world ramped up production, convinced they had overcome the reliability and cost issues, and extolling the virtues of the product. Even the incumbent string inverter kings (SMA and PowerOne) launched micro inverter products.

Just three years later, it is estimated that around 10 per cent of all inverters sold in Australia this year will be micro inverters, hence the burst of advertising activity. Compared to an estimated market share of 40 per cent in California, it seems Australia could be on the cusp of a micro inverter boom.

Why?

Talking to solar integrators around the country it's clear that with the dramatic fall in PV cost, balance of systems and installation costs are an area of increasingly intense scrutiny. Despite a higher cost per watt for micro inverters, many integrators are suggesting that the final installed cost of micro inverter based systems are equal and in some cases lower than string based systems. Data from US studies confirms this potential. Berkeley Lab released a [report](#) in

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July as part of the US SunShot program analysing data from PV systems installed between 1998-2012. Among many fascinating findings, the report noted that “among larger systems sizes (>10kW), no appreciable difference in installed price is evident between those with micro inverters and those with central inverters”.

A second issue is, of course, the eternal challenge of optimising system yield. Micro inverters have a natural advantage here because they provide module level maximum power point tracking; every single solar module gets individually optimised inversion, overcoming mismatch and variations in output caused by soiling, different degradation levels, and other real world variables including the solar killer – shading.

A 2012 National Renewable Energy Laboratory [report](#) quantified this in its own testing suggesting yield benefits of 3.7 per cent to 12.3 per cent were likely from micro inverter based systems, validating the claims of manufacturers. Local testing facilities and pilot sites in Australia have found similar results.

This provides another clue as to why solar integrators are increasing selecting micro inverter based systems. With rapidly rising roof penetration rates (around 20 per cent nationally) the proportion of shaded, or non-optimal, multi-faceted roofs is increasing. Surveys conducted of installers over the last month confirmed this with suggestions that between 30-40 per cent of all sales enquires have shading of non-optimal roofs. This provides an ideal opportunity to use micro inverters as an alternative to a lost sale or, complex multi string installations using traditional inverters.

Lastly, there are the issues of safety and upgradeability. An AC based system has inherent Arc fault detection built into the inverter and reduces DC system voltages to 30-40V; a huge advantage. In the event of a module or AC system fault, micro inverters isolate each and every solar module and don't technically require DC isolators (although the standards still require string isolation). In addition, the complete modularity of ACPV allows system owners to add panels one at a time, of differing types without the worry of string voltage or exceeding inverter power ratings.

The majority of micro inverter manufacturers sell their products as a retrofit option to suit any solar module. One company SolarBridge supplies to PV manufacturers only, preferring to embed their products into PV modules at the factory.

International and local solar market analysts predict that micro inverter market share will continue to grow as the price gap decreases, improvements occur and confidence builds in the technology; estimates are consistently for around 30 per cent of total inverter sales by 2017 on a global basis with some markets even higher.

Micro inverters and ACPV are not a silver bullet, but it seems that the market has figured out it's an increasingly good option in a wider array of circumstances; and Australia has those circumstances in spades. Welcome to the ACPV Revolution.

Nigel Morris is the director of [SolarBusinessServices](#).

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Australian Market PV Module or Panel Installations - Estimated Annual Volume (Watts)

Origin	% TOTAL MARKET	Watts	Source	Assumptions
TOTAL MARKET	100%	790,000,000	Termination Report	
China Imported - DC - installed as DC		638,416,667	Calculated	
China Imported - AC	1%	7,031,000	Termination Report	
Other countries DC	11.0%	51,100,000	Calculated	Assume 60% DC
Other countries AC		34,066,667	Calculated	Assume 40 % AC
Tindo manufactured AC	0.2%	1,733,333	From IP volume converted to annual 2/3	
China imported as DC and converted to AC	7.3%	57,652,333	Calculated	
Total China (CHECK)		703,100,000	Calculated	
Estimated Total installed AC market	12.5%	98,750,000	Two sources, for 2013, one est 15% the other 10%.	
Total China Installed AC	8.2%	64,683,333	Calculated	
Total China Imports (AC + DC)	89%	703,100,000	Termination Report	

China AC /Total AC installations 65.5%

China AC estimations

Total AC market of 12.% of market.

Estimated other countries split 60/40 DC AC. This is only based on Europe being 60/40. The actual percentages may be different.

China AC comprises imported AC plus estimated DC to AC conversion in Aust using microinverters.

This China AC presence in Australia should be a part of the focus for Tindo's injury assessment.

Tindo AC is competing against China AC negating many of the arguments of Tindo AC competing against China DC.

If Tindo could have achieved 5% of the China AC sales in an undumped market this would equate to approx 3.4 MW which was double the actual volume Tindo sold.

Figures are estimates and would appreciate Tindo's views and input.