

JBR Recovery Ltd

Incineration : Smelting : Refining



JBR

Refining Since 1760

Solar Panel Recycling Effects on Supply Demand and Overall Market Balance

Lee M Hockey – 15th November 2022

Agenda



- Introduction to JBR Recovery Ltd
- Overview of the silver market
- PV solar panels role in global decarbonisation
- Solar PV installations
- PV solar panel materials of construction
- PV Solar panel recycling
- Current and future processing options
- Conclusion

Introduction to JBR Recovery Ltd

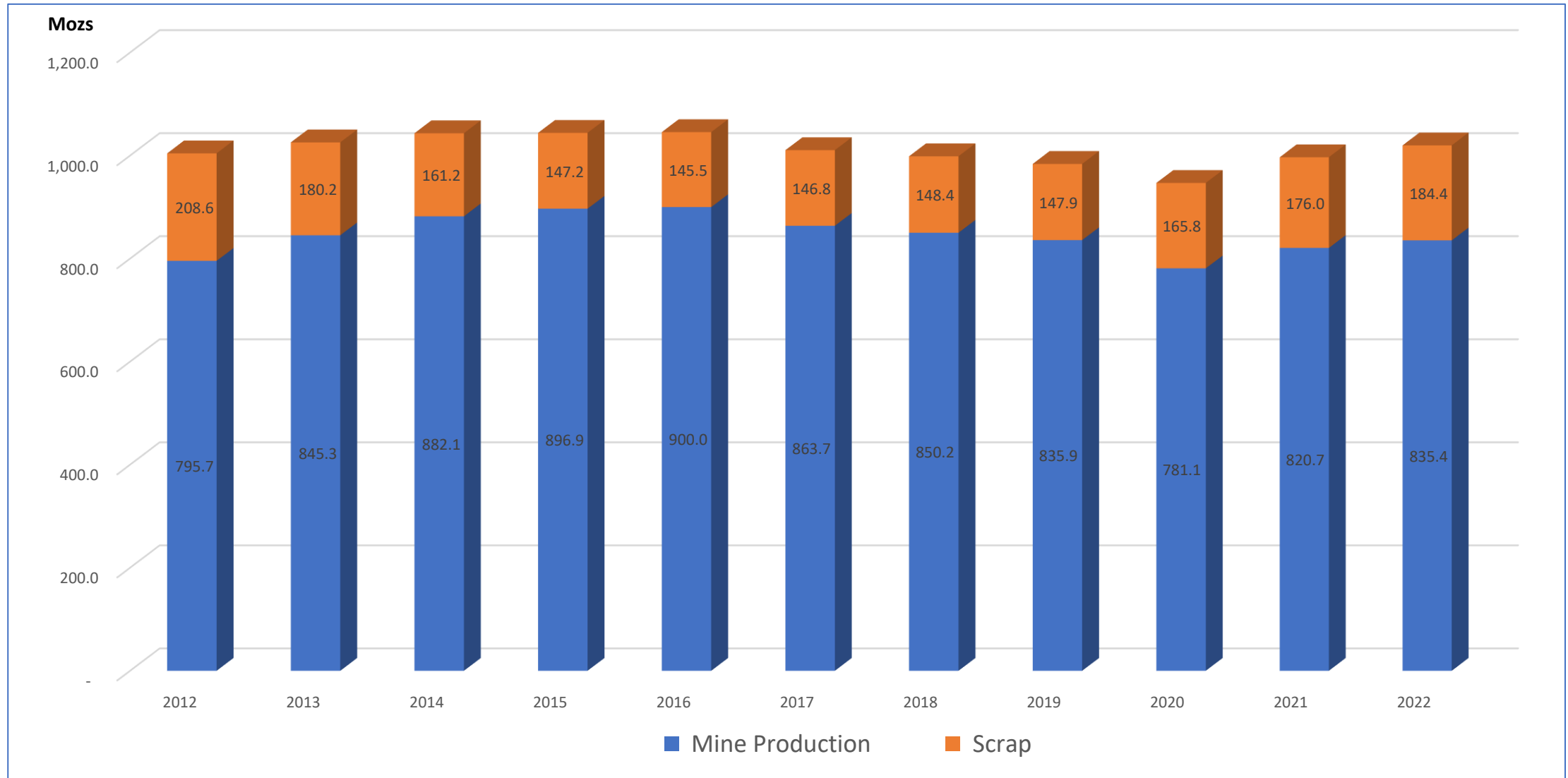
Background

- Over 260 years History of smelting and refining of precious metals in the UK
- Member of the LBMA with Ag outputs having London Good Delivery status
- Can process various materials, in many forms and grades containing Gold, **Silver**, Platinum and Palladium
- Refined and produced ~ 55 M ozs Good Deliver Silver in 2021
- Fully permitted site with EA permit number BJ9878 and hazardous waste registration NIB077
- ISO 14001 Environment Management System
- Fully secured site with 24/7 manned security and high value vault
- Members of the LBMA, IPMI and the Silver Institute
- Global customer base and from many market sector

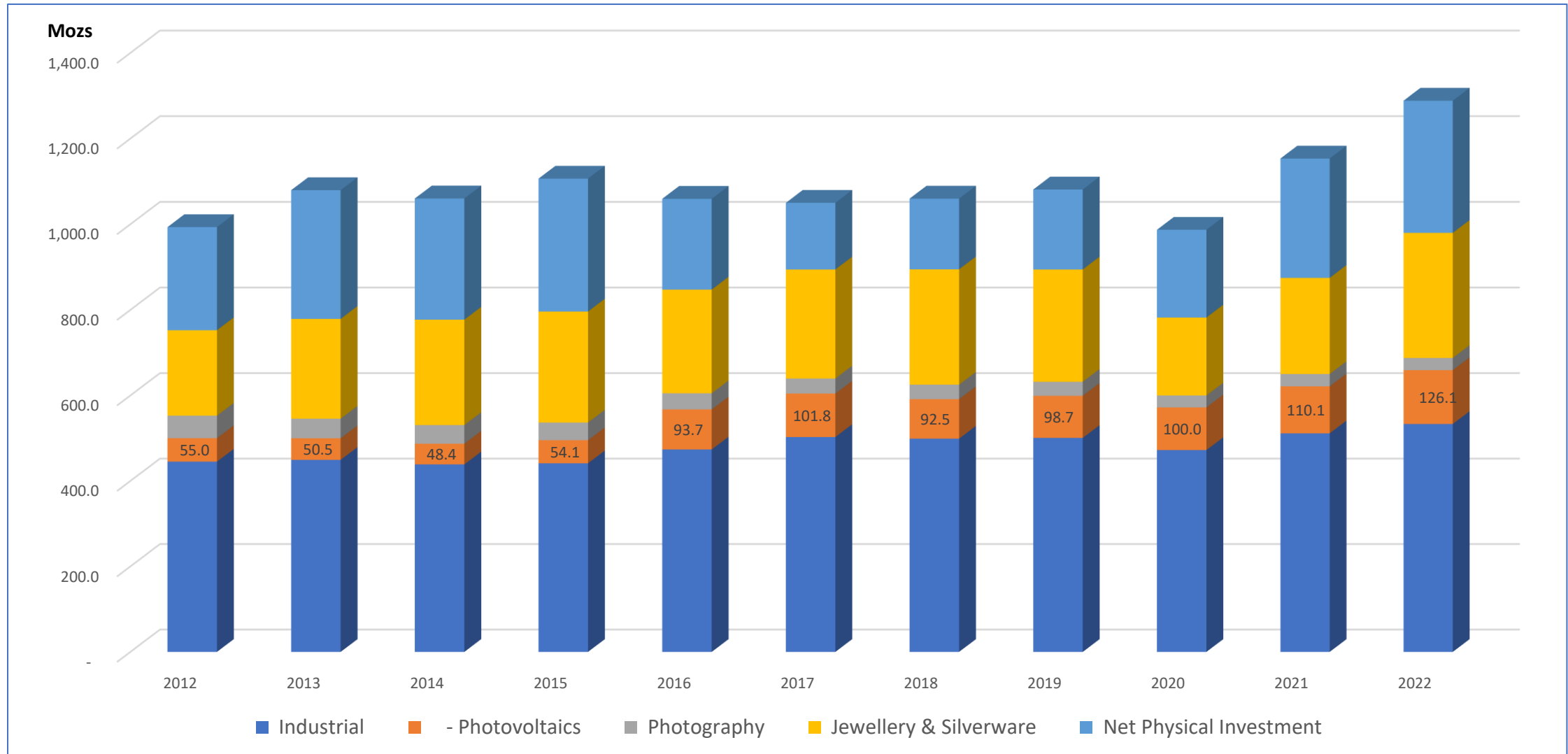
Materials Refined

- Photographic** Industrial film, medical x-rays, rolls, paper, emulsions, water treatment sludges, fixer solutions, recovery residues
- Electronics** Circuit boards, pastes, pots, inks, manufacturing rejects, MLCC's, impregnated wipes, ceramic substrates, targets, batteries
- High Grade** Dore, jewelry, coins, bars, bullion, non good delivery bar conversion, grain, flakes
- Others** EO Catalysts, other industrial catalyst, Ag Chlorides, litharge's, Lead wastes, solar panel wastes, sweeps & residues

Silver supply



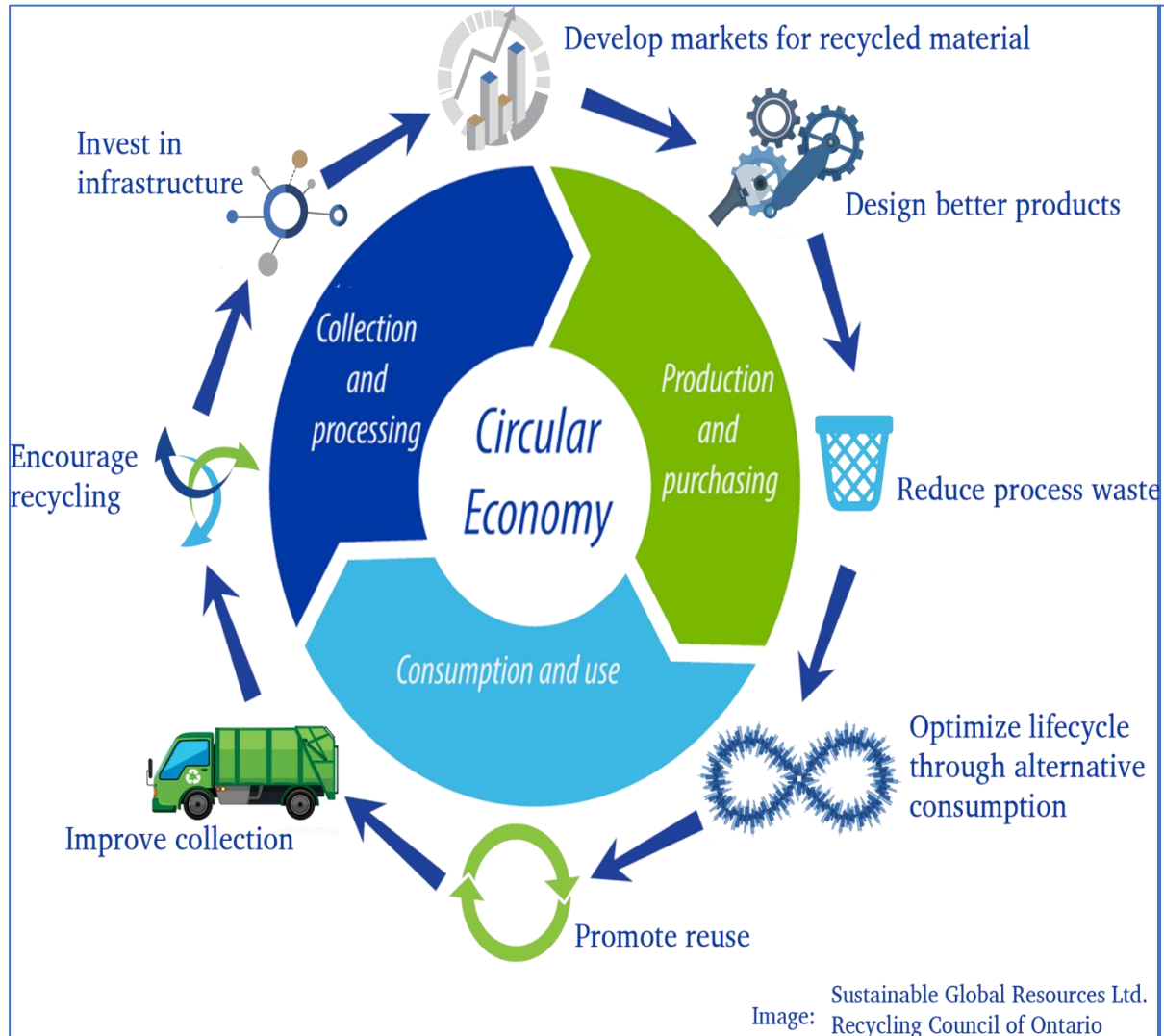
Gross silver demand



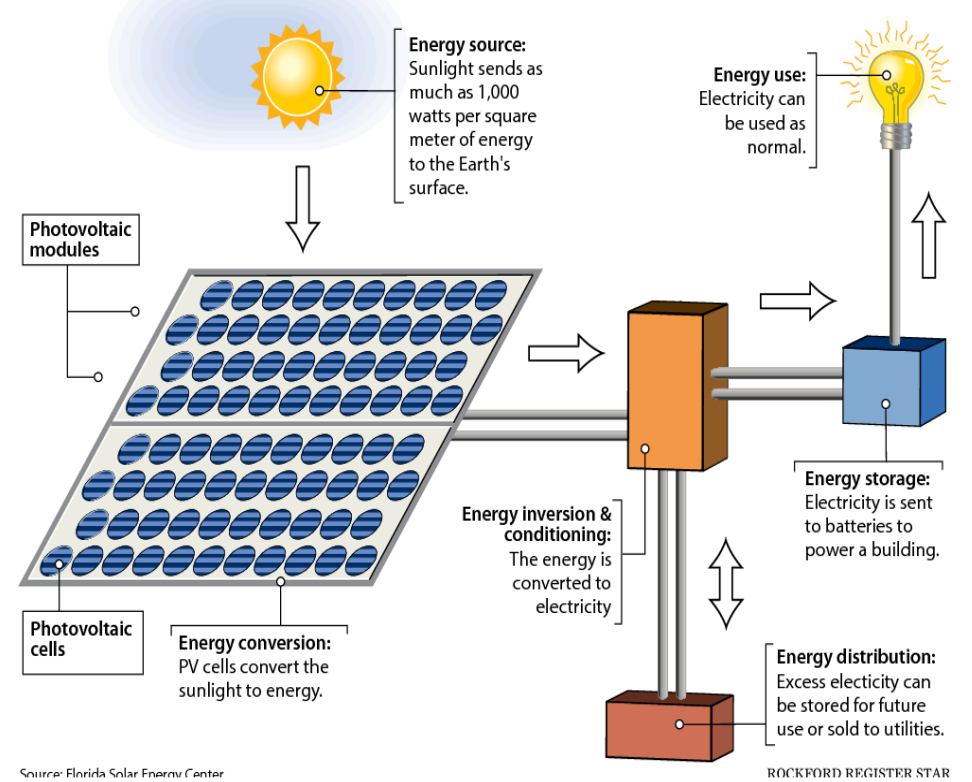
Market balance v's Ag price



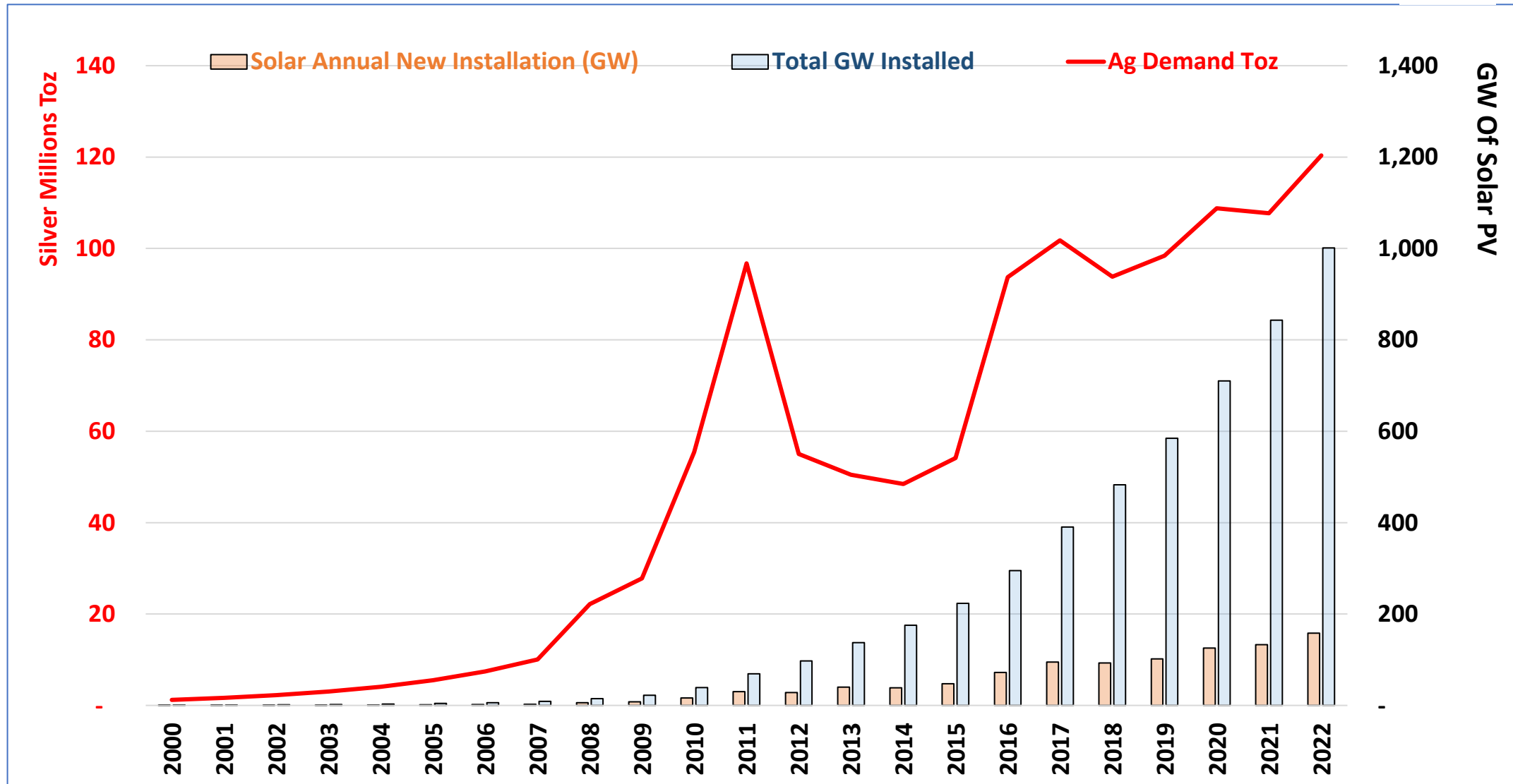
PV solar panels role in decarbonisation



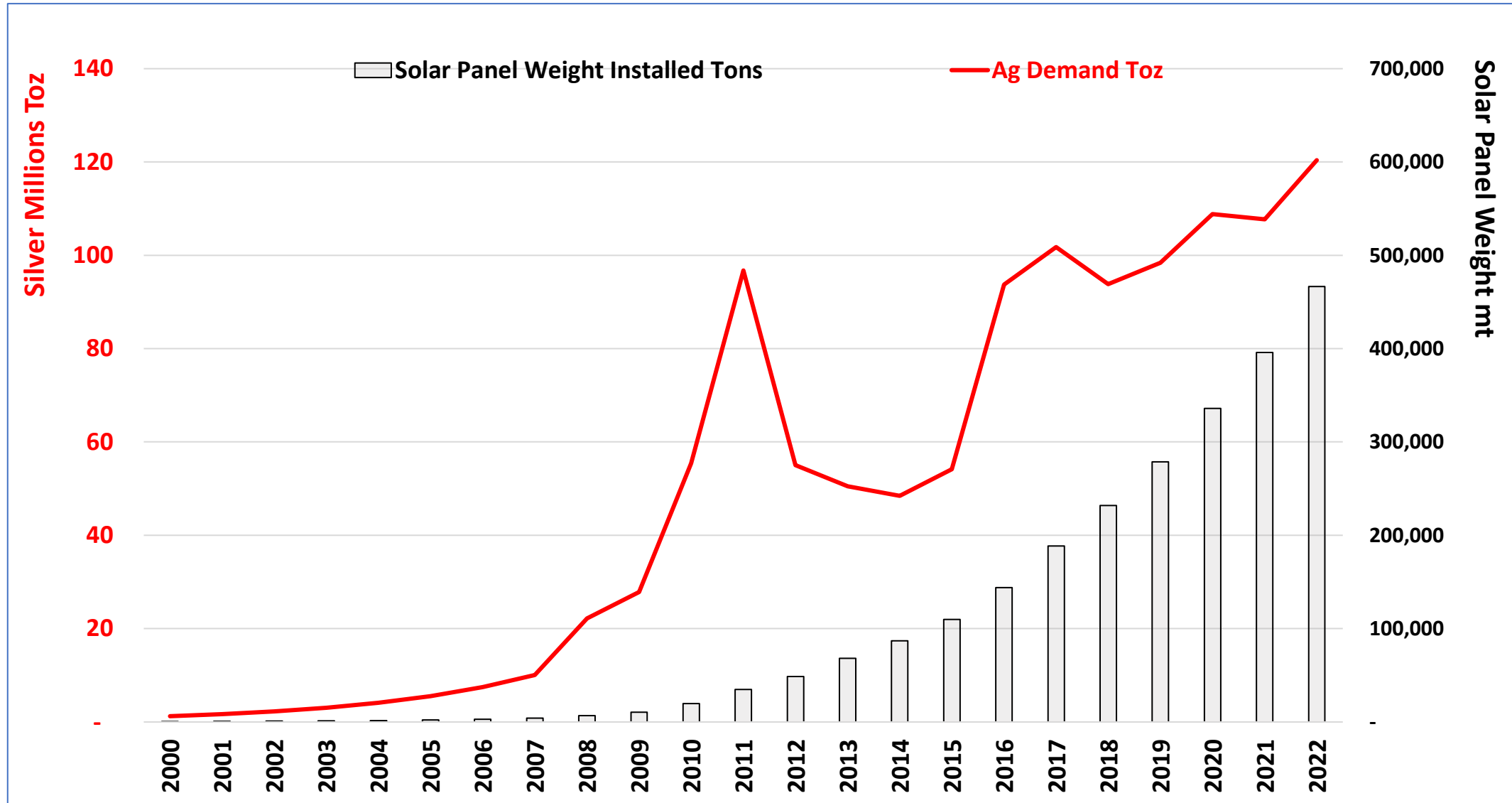
How photovoltaic solar panels work



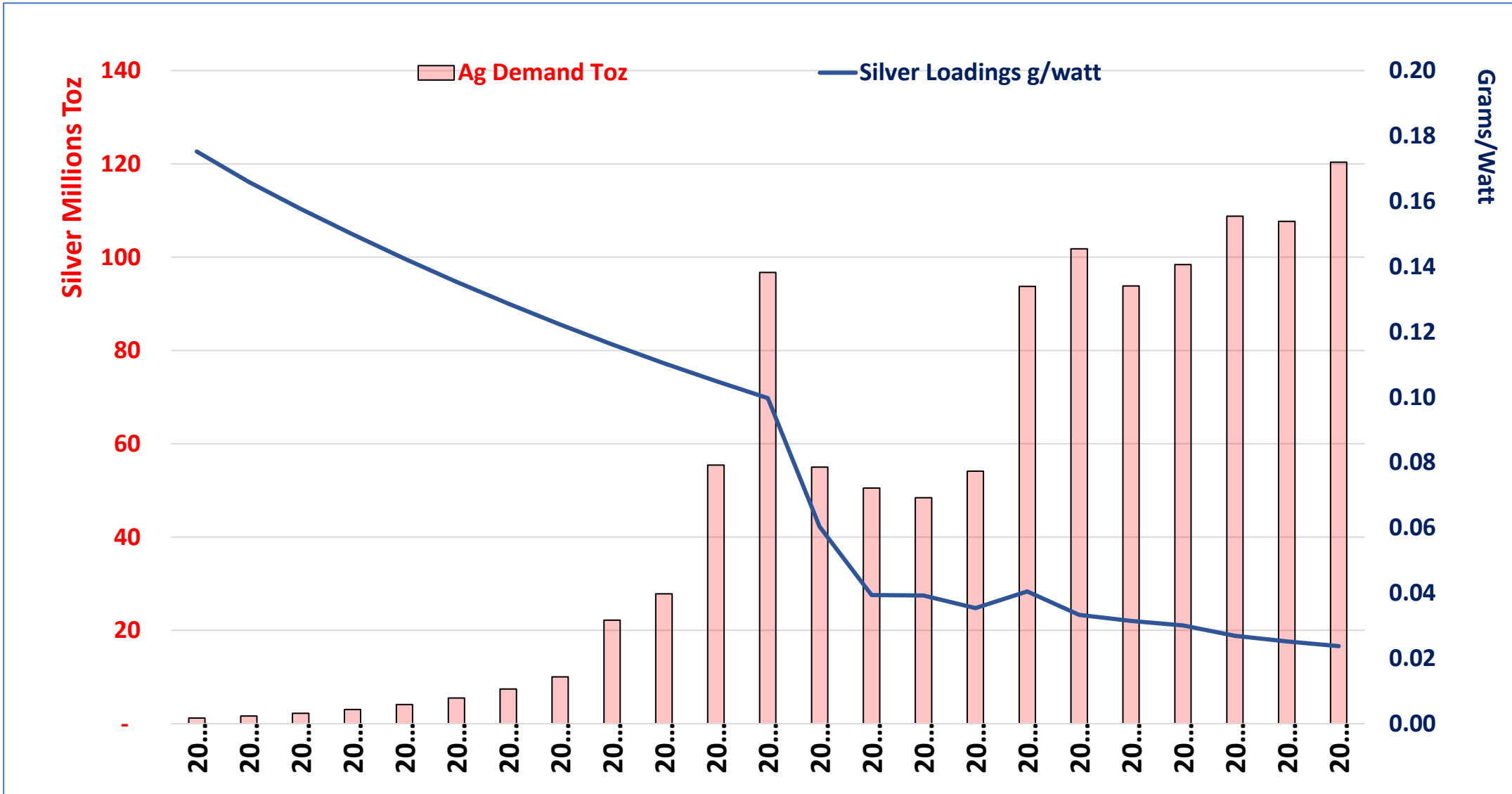
PV solar historical installations



PV solar potential scrap volumes

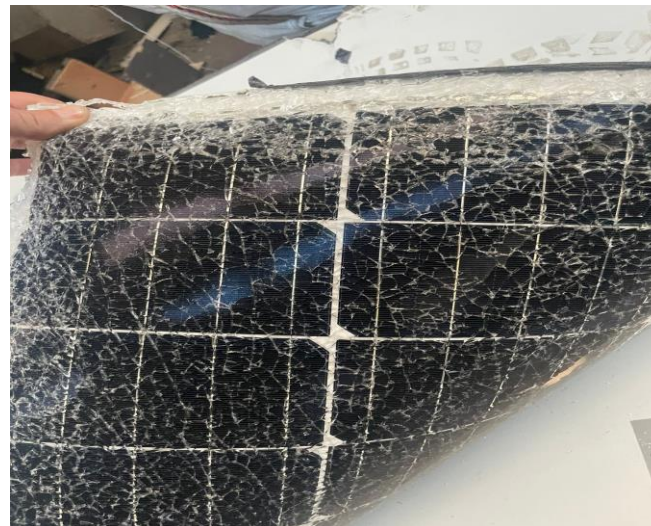


PV solar historical Use



Source Matt Watson

Make up of a PV solar panel



PV solar panel recycling

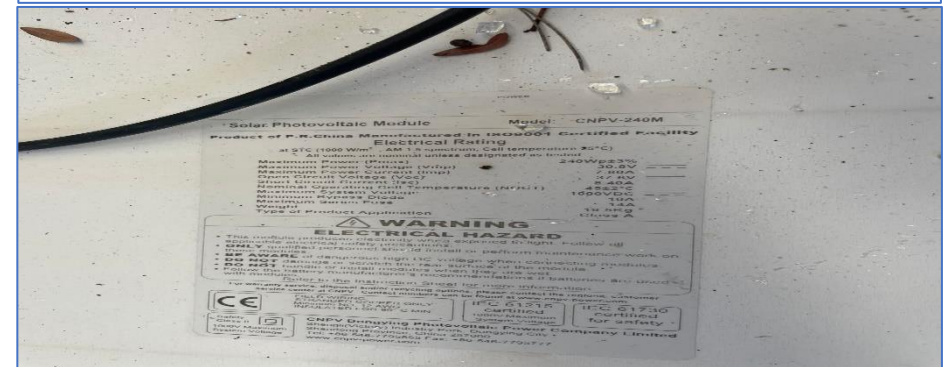
PV Solar Panels Materials of construction

- Aluminium framing *Recoverable*
- Glass *Non recoverable*
- Silver *Recoverable*
- Copper *Recoverable*
- Some nasties such as Cd

Current Market Dynamics

- Starting to see (10 years) first panel recall / change overs
- Earlier solar panels are much richer in Silver
- Aluminium framing is a \$3-5 billion per year business
- Grades of Silver vary (after Aluminium) removal
 - Shredded panels 0.25 – 0.5 % Ag
 - Wafers after removal of silica panels 0.5-1.0 % Ag
- Material after Aluminium removal would be cost neutral even may get a refining credit for Ag, wafers will definitely obtain a credit

Currently treated same as e scrap in terms of licences and shipments



Most panels are landfilled and are charged to be disposed of

| Type | €/Ton |
|------------------------------|-------|
| With alumina frames | 160€ |
| W/out alumina frames | 300€ |
| Amorph | 350€ |
| CIS (Copper Indium Selenium) | 400€ |
| CCS (carbon capture storage) | 450€ |
| Tellurium Cadmium | 500€ |

Current and Future Processing Options



Traditional Refining

Current smelters and Ag refiners such as JBR Recovery can handle **ALL** materials currently supplied

Material needs to have Aluminium backing removed

Ag credit will be made after sampling and assaying

New projects (looking to recover other elements and streamline the processing) being set up

France

Rosi Solar

Ademe

Envie 2e Aquitaine

Sorem

Germany

ReProsolar

Veolia

Laxres

Evonik

Technalia

Italy

Enea

Alternative Energy

Enel Green Power

CEA

Photor

- [Photorama \(photorama-project.eu\)](http://photorama-project.eu)
- [Rystad Energy - Your Energy Knowledge House](#)
- [New PV module recycling tech from France – pv magazine International \(pv-magazine.com\)](http://pv-magazine.com)
- [German experts closer to silicon PV recycling solution • Recycling International](#)
- [European consortium develops pilot line for complete PV module recycling – pv magazine International \(pv-magazine.com\)](http://pv-magazine.com)
- [Belgian glass recycler prepares for 1 million tons of solar panels • Vakblad Recycling Magazine Benelux](#)

Conclusion



- Global climate change is driving the world to decarbonisation
- Use of Solar as an energy source and recycling of materials rather than land fill are crucial to make the above happen
- Silver demand within the PV solar panel market continues to be strong with ~1 M ozs fresh Silver demand per year and an installed capacity of over 1 B ozs Silver
- Fresh mine supply is just over 800 M ozs this year and rising, with total supply just over 1B ozs
- We are starting to see thrifting of Silver within new modules to try to limit fresh Silver demand as GW demand continues to grow
- Therefore recycling of Silver and other elements will become crucial to balance the Silver market and reduce landfill and overall support our de carbonisation goals
- We are starting to see material available for recycling but mainly being landfilled which is not politically or economically efficient
- There is current technology to process the current demand for recycling panels, but this needs to be increased and new technologies / supply chains found to continue to manage the feed going forward

JBR Recovery Ltd

Incineration : Smelting : Refining



Please take a look at our website for further information about the company and detailed descriptions of our processes:

www.jbr.co.uk

JBR Recovery Ltd

Argentor House, Oldbury Road

West Bromwich, B70 9BS

Phone : +44 (0) 121 525 1691

Disclaimer & Copyright @ JBR Recovery 2022

Although every effort has been made to undertake this work with care and diligence, JBR Recovery Ltd cannot guarantee the accuracy of any forecasts or assumptions. Nothing contained in this presentation constitutes an offer to buy or sell securities or commodities and nor does it constitute advice in relation to the buying or selling of investments. It is published only for informational purposes. JBR Recovery Ltd does not accept responsibility