TIN TO RIDE THE TECHNOLOGY SUPERCYCLE

DATE: 26\10\18 PREPARED BY: DR JEREMY PEARCE
PREPARED FOR: E&D GROUP

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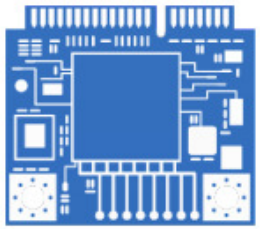
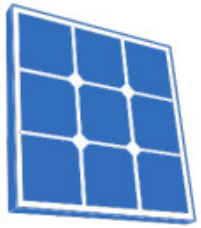
The imminent technology ‘supercycle’



Computing and robotics



Energy generation

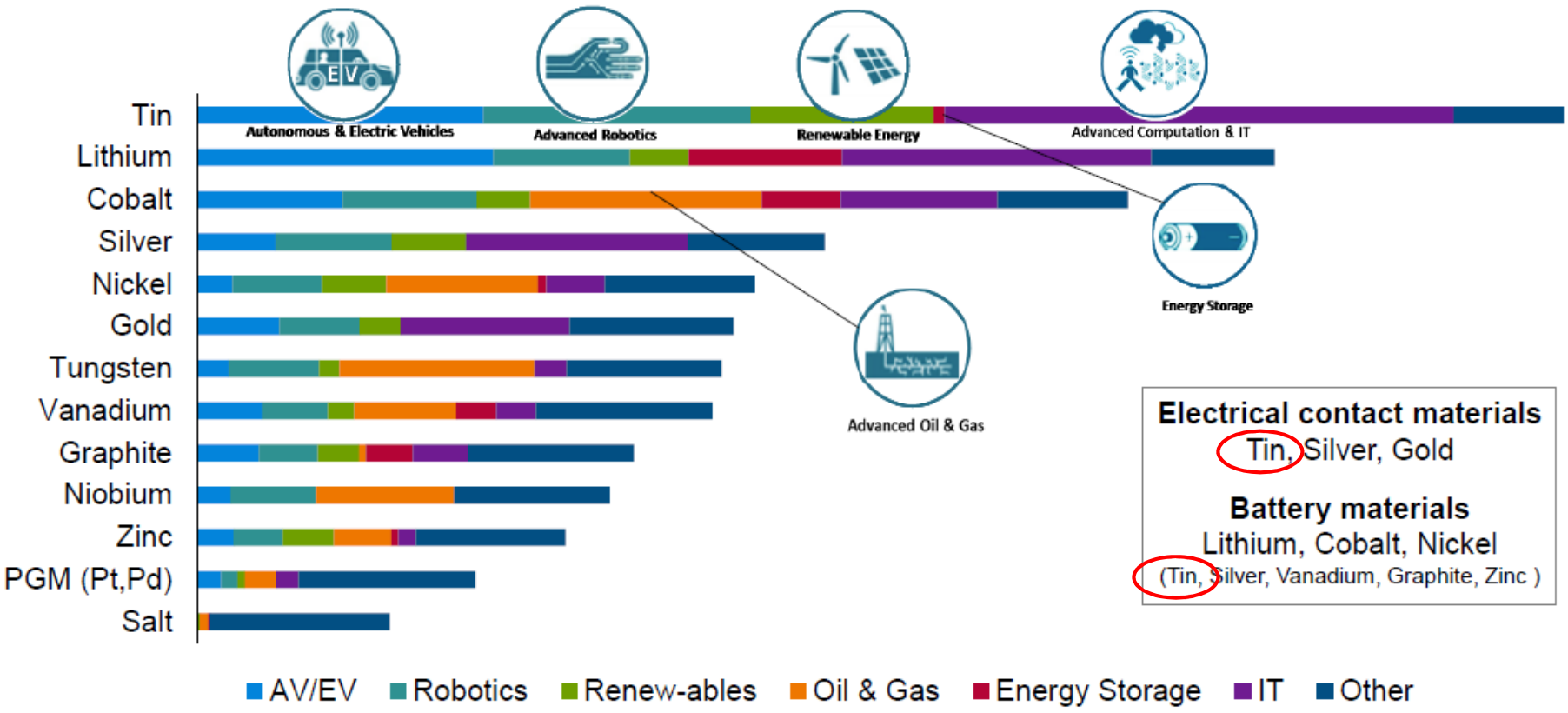
Autonomous and electric vehicles

Energy Storage

Energy Infrastructure

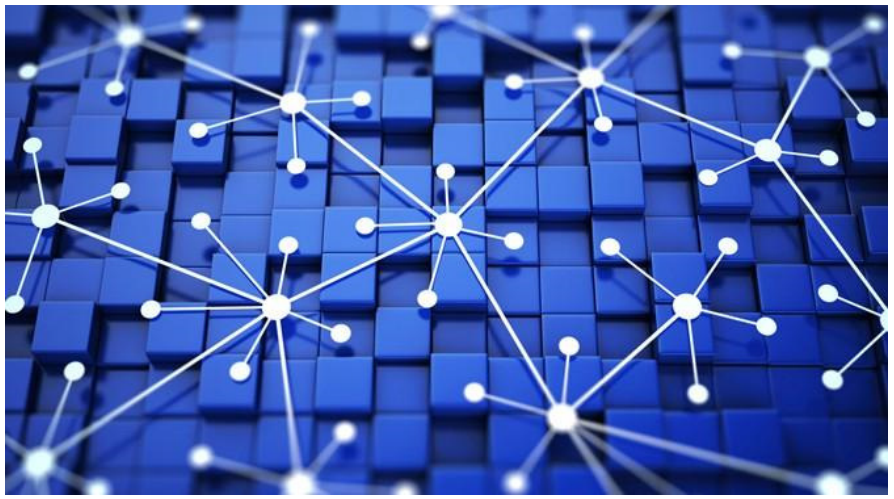
Energy and technology to drive tin demand significantly from 2025

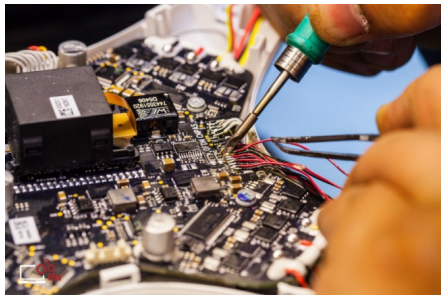
Metals most impacted by new technology

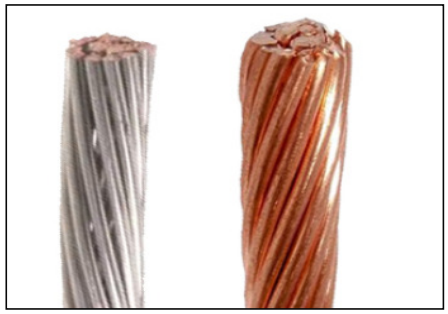


Future tech to impact tin most

Source (MIT)







- **Increased electronics**
  - Electric vehicles
  - Energy infrastructures
  - Drones \ IoT
  - Robotics
  - Computing \ 5G
- **Solar cell solders**
- **Tinned wire & cable**
- **Tinned connectors**

Tin connects everything together

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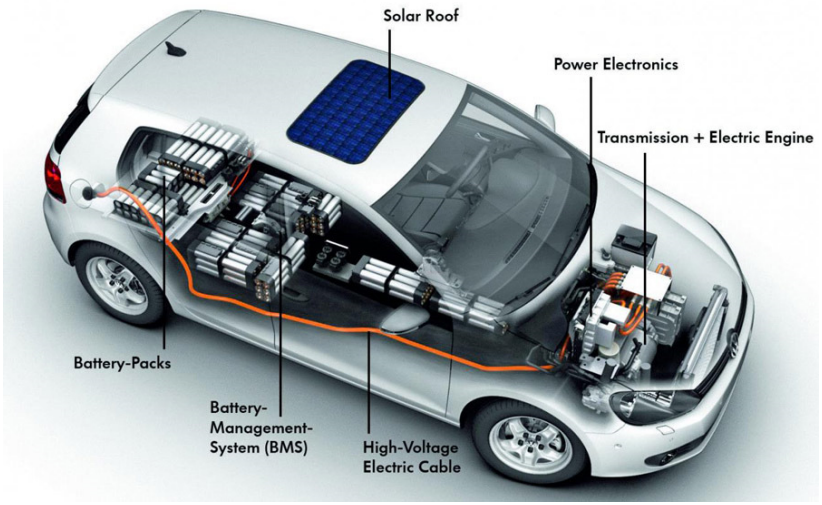

Zero-emission targets

Transport

Renewable energy

Tin technologies

Advanced Lead-acid

Lithium-ion

Sodium-ion ++

Liquid metal ++

Energy storage

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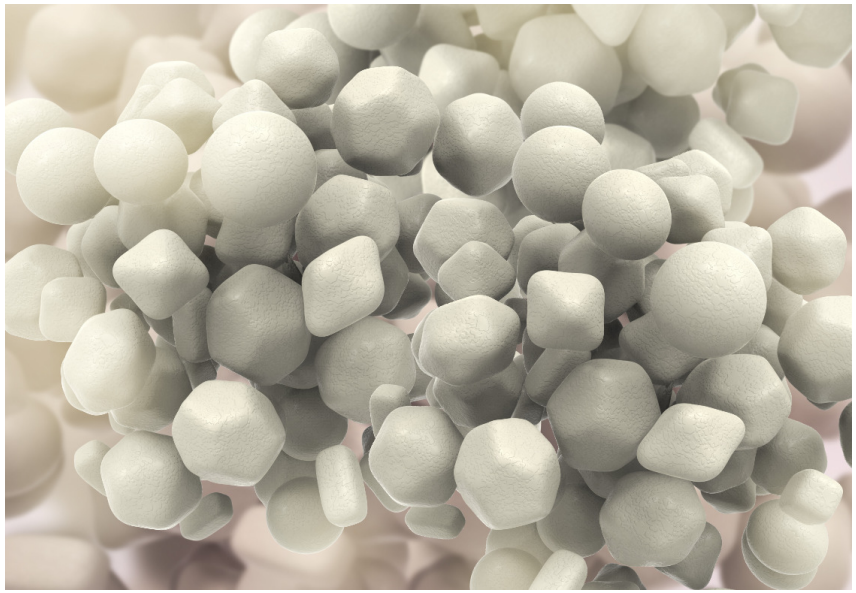

- **Tin additive to anode**
  - Small existing use
  - Alongside silicon
  - Other uses possible
- **Markets exponential**
  - Electric vehicles
  - Utility grid
  - Capacity triples by 2023
- **Significant uncertainty**

Tin in lithium-ion batteries

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Technology	Tin Content (Average)	Tin per vehicle battery	Tin Use 2030 (tonnes)	Tin Use 2050 (tonnes)
Carbon-Tin Anode	10-60%	15 kg	20,000	-
Tin Anode	30-100%	25 kg	20,000	?
Silicon-Tin Anode	2-80%	1 kg	10,000	>90,000
Lithium-Tin Anode	0.1-2%	0.3 kg	500	10,000
TOTAL			**55,500**	**>100,000**

Tentative modelling of future potential, with high uncertainty

Courtesy

Solar cell materials

Copper Zinc Tin Sulphide

Tin Perovskites

Heat harvesting

Solar heat transfer

Thermoelectric materials

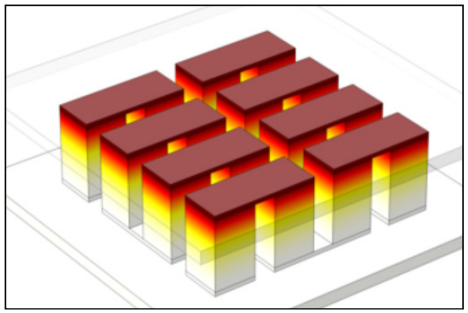
Hydrogen tech

Water splitting

Fuel cell catalysts

Carbon capture

Tin catalysts



Energy generation

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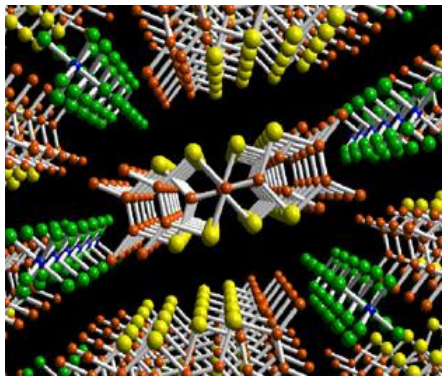
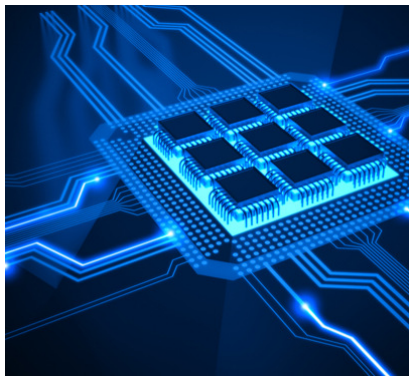
- **Conductive films**
  - Display screens
  - Solar cells
- **Semiconductors**
  - Transparent components
  - Superconductive
  - Lasers
  - Opto-electronics
  - Sensors





Electronic materials

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Long-term tin potential very promising

- **Technology ‘supercycle’ will benefit tin**
  Set to significantly impact 2025-2030
- **Tin as solder the key interconnect material**
  Joining new electronics & electrical infrastructures
- **Some impact already measured**
  Solar cell solders and advanced lead-acid batteries
- **Lithium-ion batteries may be an important new tin use**
  High R&D volume, multiple possible anode materials
- **Versatility of tin opens many new tech opportunities**
  New uses in energy generation, electronics materials

2 minutes

A bright future ahead for tin?

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Thank You

We believe that global co-operation on markets, technology, sustainability and regulatory issues is the most cost effective route to achieve long-term success for the industry. If we work together effectively then the outlook for tin is very positive.

Global co-operation for long-term success

International Tin Association
Unit 3, Curo Park
Frogmore St. Albans
Hertfordshire
AL2 2DD
United Kingdom
+ 44 (0)1727 875544
www.internationaltin.org

ITRI China
Rm 1501, Office Tower 1
Henderson Centre
18 Jianguomennei Street,
Dongcheng District
Beijing
100005 China,
+86-10-6808-0915 / +86-10-8833-3688
chinaoffice@internationaltin.org
www.internationaltin.com.cn

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