

ARENA's Transformative Research Program Round 1: Ultra Low Cost Solar PV

Information webinar

16 Feb 2022



Australian Government
Australian Renewable
Energy Agency

ARENA

TRAC/ULCS team

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Business Development and
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Agenda

1. Welcome and introductions (3 mins)
2. ARENA and Ultra low cost solar strategic context (5 mins)
3. Guest speakers: Vince Allen (Sundrive), Dr Nicole Kuepper-Russell (5B)
Vince and Nicole Q&A (30 mins)
4. Program and Round overview (5 mins)
5. Application and assessment process (10 mins)
6. Key dates (2 mins)
7. Open Q&A (5 mins)



ARENA and Ultra Low Cost Solar Strategic Context

ARENA's Purpose

ARENA is the Australian Renewable Energy Agency - established by the Australian Government in July 2012.

Our objects are to:

- improve the competitiveness of renewable energy technologies, and
- increase the supply of renewable energy in Australia.

To support the global transition to net zero emissions by accelerating the pace of pre-commercial innovation, to the benefit of Australian consumers, businesses and workers.



INVESTED

\$1.83B



PROJECTS

618



VALUE

\$7.95B



INVESTMENT LEVERAGE

\$1:\$3.36



INVESTMENT BY TECHNOLOGY

BIOENERGY



\$131M

GEOTHERMAL

\$42M



GRID INTEGRATION

\$325M



HYBRID

\$111M



HYDROGEN

\$64M



OCEAN

\$44M



SOLAR PV

\$736M



SOLAR THERMAL

\$178M



STORAGE - BATTERIES/PHEVS

\$195M



RECENT ACTIVITY



\$100M funding round to support the next generation of grid-scale batteries with advanced inverters

\$8.6M for a distributed energy resource orchestration pilot in WA

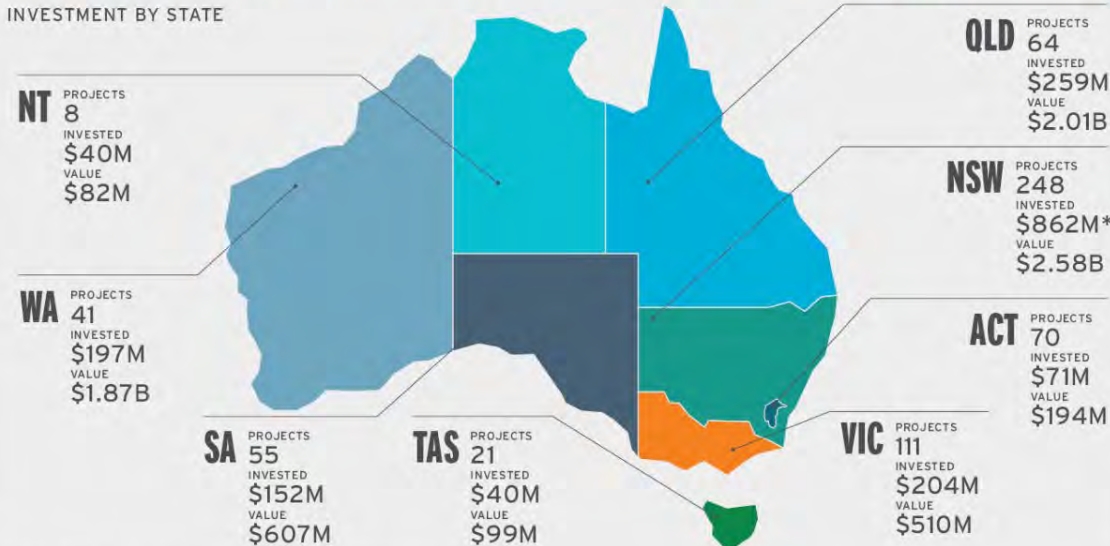
\$5M for Australia's largest electric bus fleet in NSW

\$3M for a hydrogen truck demonstration in Townsville, QLD

\$1.5M export hub for renewable hydrogen in Newcastle, NSW

RELEASED Australia's Bioenergy Roadmap to pave the way for Australia's bioenergy industry

INVESTMENT BY STATE



* Includes \$567 million contributed to projects inherited by ARENA in 2012.

INVESTMENT LEVERAGE ALONG THE INNOVATION CHAIN

| STUDY | R&D |
|-------------------|-------------------|
| \$1:\$1.71 | \$1:\$1.64 |
| DEMONSTRATION | DEPLOYMENT |
| \$1:\$1.87 | \$1:\$6.30 |

RECENT ENGAGEMENT

STARTUP EVENT @ COP26
Hosted a panel event featuring five of Australia's most promising clean energy startups. The event was attended by more than 300 people and livestreamed into the Australian Pavilion at COP26

HYGATE PARTNERSHIP
Announced a partnership to develop and deliver a German-Australian Hydrogen Innovation and Technology Incubator known as HyGATE

Strategic Priorities



OPTIMISE THE
TRANSITION TO
RENEWABLE
ELECTRICITY



COMMERCIALISE
CLEAN
HYDROGEN



SUPPORT THE
TRANSITION TO
LOW EMISSIONS
METALS



SCALE UP CCS &
REDUCE THE
COST OF SOIL
CARBON
MEASUREMENT

Focus area of 'ultra low cost generation' is aligned with LETS

ENABLE ULTRA LOW-COST RENEWABLE GENERATION

- **Increase solar module efficiency** by considering the four key elements of solar cell design: materials abundance, low toxicity, stability in the field and efficiency. Increased module efficiency would reduce balance of system (BoS) costs for the same output, which would further reduce total installed costs
- **Reduce solar PV BoS costs**, through improved module design, solar farm architecture, the use of automation to reduce labour costs in the field and other innovations.

LOW EMISSIONS TECHNOLOGY STATEMENT

A new prioritised technology: solar PV

- Economic stretch goal for solar electricity generation at \$15 per MWh
- Achieving \$15 per MWh for solar electricity generation could help deliver the world's lowest cost clean electricity, enabling Australian manufacturers and businesses to stay competitive and support the wider economy.

Improvements across the value chain required to meet LCOE target





From Research to Commercialisation Lessons Learnt from ARENA Funding Recipients

- Vince Allen (Co-founder and CEO, SunDrive)

DISCLAIMER:

Any guidance being given by the presenter is their own experiences and not authorised by ARENA.



SunDrive's R&D Journey
ARENA Webinar – 16th Feb 2022

Vincent Allen

Outline

- 1. Forming a Company and Building a Team**
- 2. Technology Development**
- 3. IP Management**
- 4. Industry Collaboration**

Forming a Company and Building a Team



- Founded 2015 by Vincent Allen and David Hu
- Copper plating technology first conceived during Vince’s UNSW PhD with supervisors: the late Prof Stuart Wenham and Prof Alison Lennon.
- Company formed to accelerate the commercialisation of the technology.
- Based in Kirrawee, current team consists of 14 full-time employees.



Board of Directors



Vincent Allen
Co-founder
Tech development



David Hu
Co-founder
Non-tech operations



Dr Zhengrong Shi
Founder of Suntech



Sylvia Tulloch
Founder of Dyesol



Niki Scevak
Co-founder & Partner of
Blackbird Ventures

Advisors



Prof Alison Lennon
Vincent’s PhD supervisor
SunDrive Chief Scientist



Dr Pierre Verlinden
Former Chief Scientist Trina
Director of Oxford PV



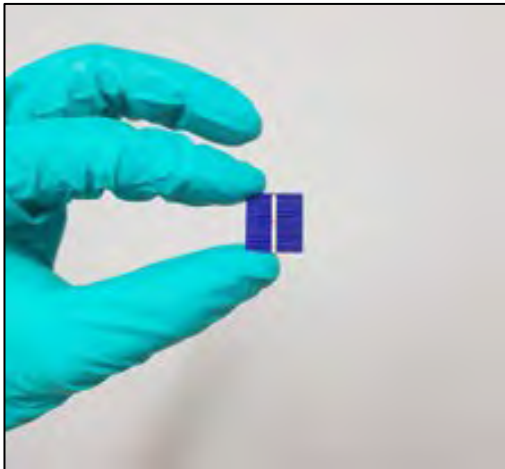
Dr David Mills
Founder of Ausra



Robyn Denholm
Chair of Tesla

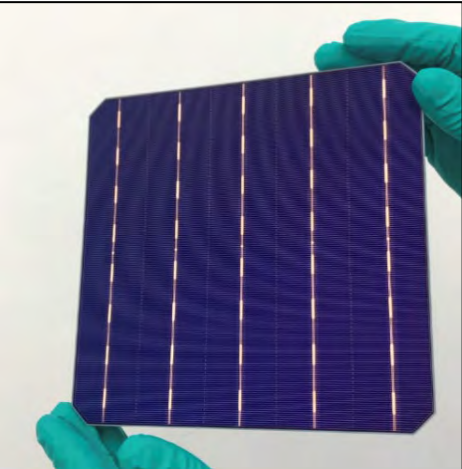
Technology Development

2015 - 2017



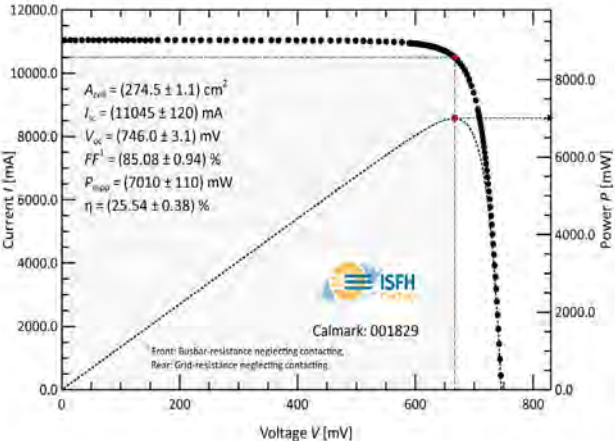
Proof of concept on lab size 2cm x 2cm

2018 - 2020



Technology scaled to Commercial size 15cm x 15cm

2021

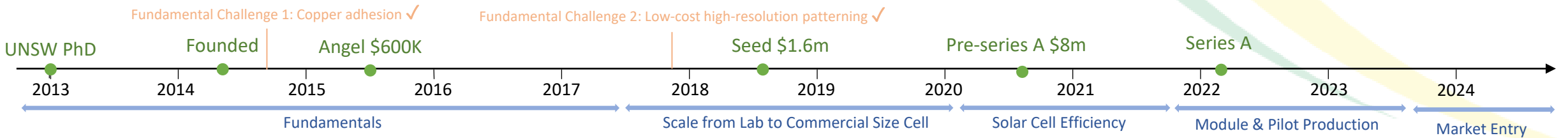


World record efficiency on full area commercial size solar cell

2022



From cell to module



IP Management

Patents

- Resource consuming particularly for a startup (less than 5% of patents generate actual financial return)
- Only patent if: IP easily policeable, IP is a 'piece of the puzzle' or IP clearly observable in final product
- Obvious disadvantage is public disclosure – have a mindset it will be copied (or improved upon)

Trade secrets

- Preferred for chemistry/materials related IP
- Preferred for tool/equipment design

Operational/Commercialisation

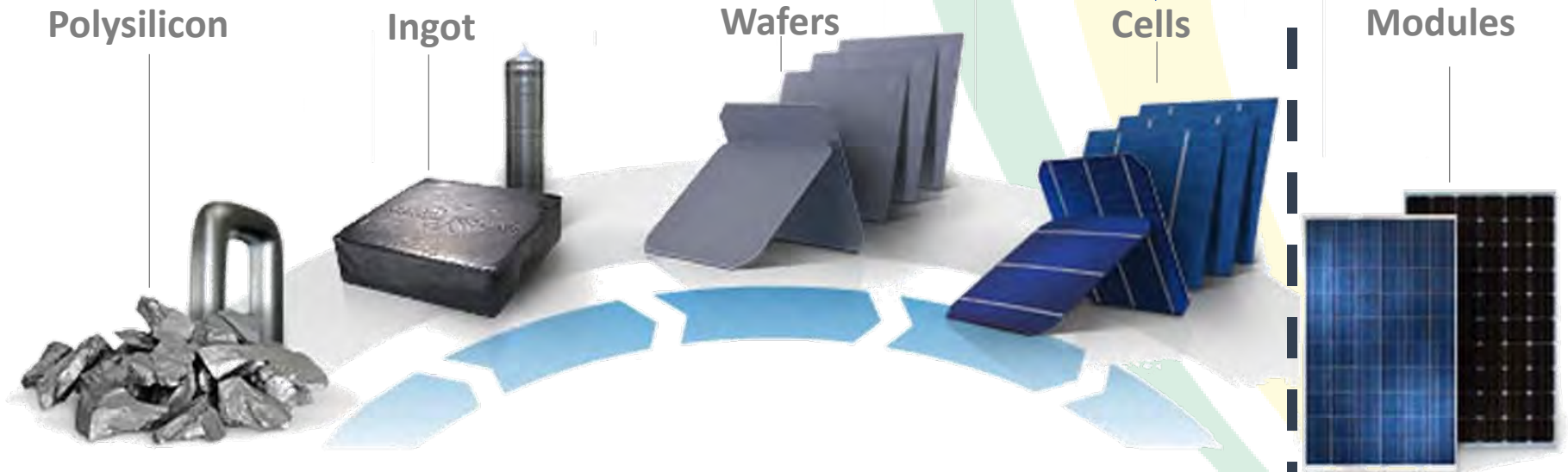
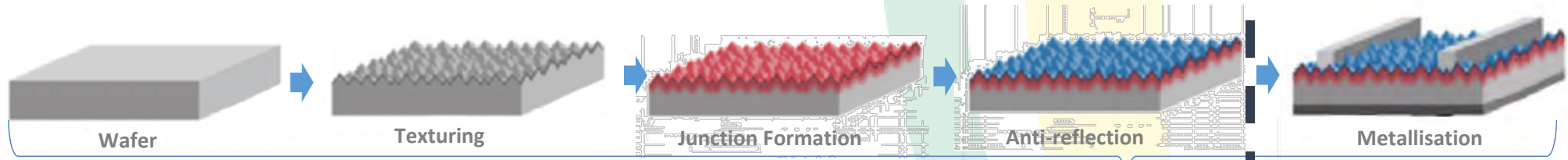
- Easier to manage and control IP with tech operations/development in Australia.
- Long term view on hiring (strict non compete clauses in employment contracts).
- Decided early not to pursue licencing model.
- SunDrive: develop process IP + design and build (critical) equipment + be the manufacturer. A closed loop.



Risk

Reward

Industry Collaboration



SunDrive focus on cell metallisation & interconnection only



1. Faster turnaround
2. Access to latest commercial precursors
3. Collaborations commercially driven

Thanks

Please DON'T tap the glass.
Engineers become aggressive when provoked.





From Research to Commercialisation Lessons Learnt from ARENA Funding Recipients

- Dr Nicole Kuepper-Russell (Chief Operations Officer, 5B)

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**5 Billion years of sun.
How will we use it?**

5B / ARENA Webinar

16 Feb 2022



Conventional solar versus our solution: 5B's Maverick solution is the next generation of solar

Conventional solar is not cheap, fast or flexible enough to materially impact global energy targets.

Getting solar modules into the field **remains slow, labour intensive, risky and costly**; despite solar modules being cheaper than ever.



Our solution



0-30% LOWER
cost of energy



5-10x FASTER
deployment



5x LESS LABOUR
on site



INCREASED
SAFETY



2x ENERGY
per land area

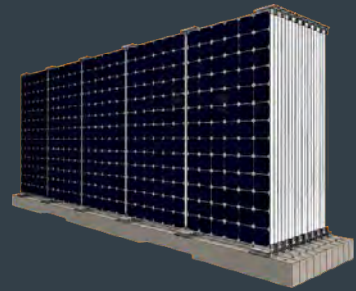


CIRCULAR
LIFECYCLE





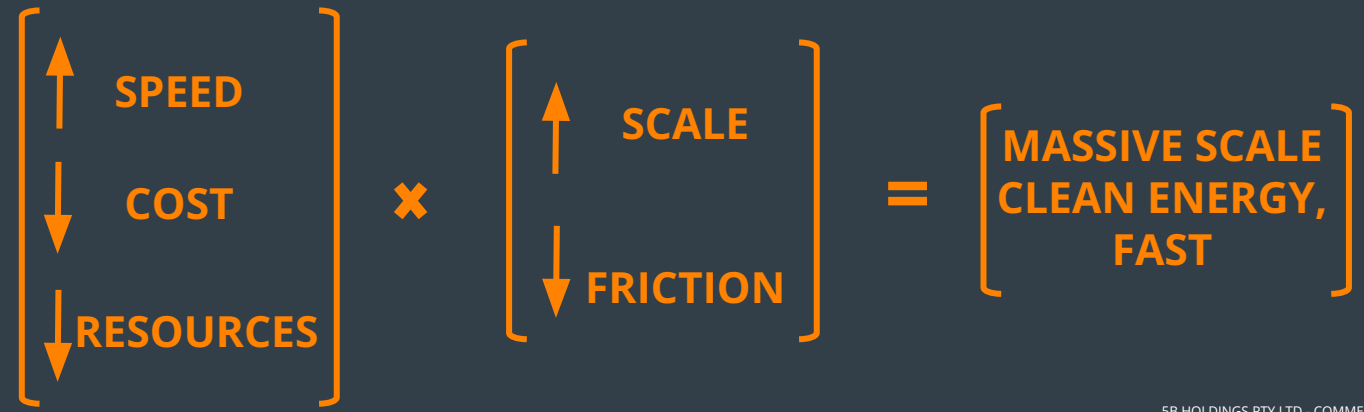
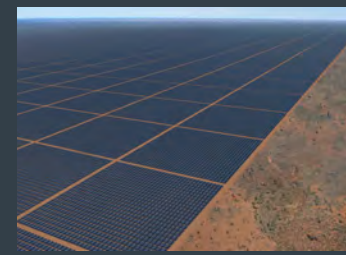
5B's solar PV deployment platform is the answer - next generation solar tech, delivered by our global ecosystem



5B Maverick



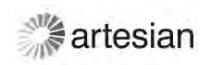
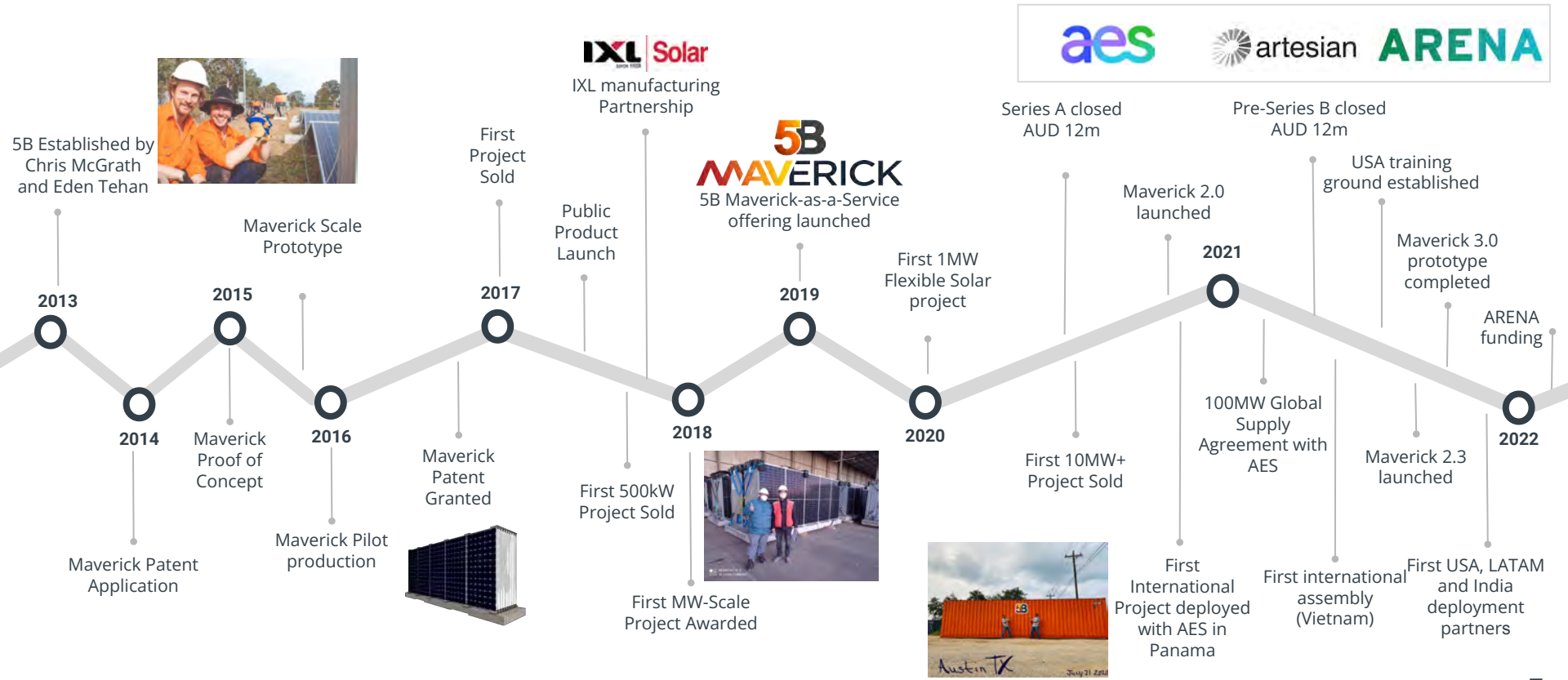
5B Ecosystem



We have grown into a global team with a proven track record

PILOT MODEL

GROWTH MODEL



Important to think through sources of funding for various stages of growth

GRANTS

Grant funding supports higher risk, R&D activities to drive a step change in outcomes

ARENA

VENTURE EQUITY & DEBT

Equity supports core investment activities across tech dev, sales, ecosystem establishment and growth opportunities

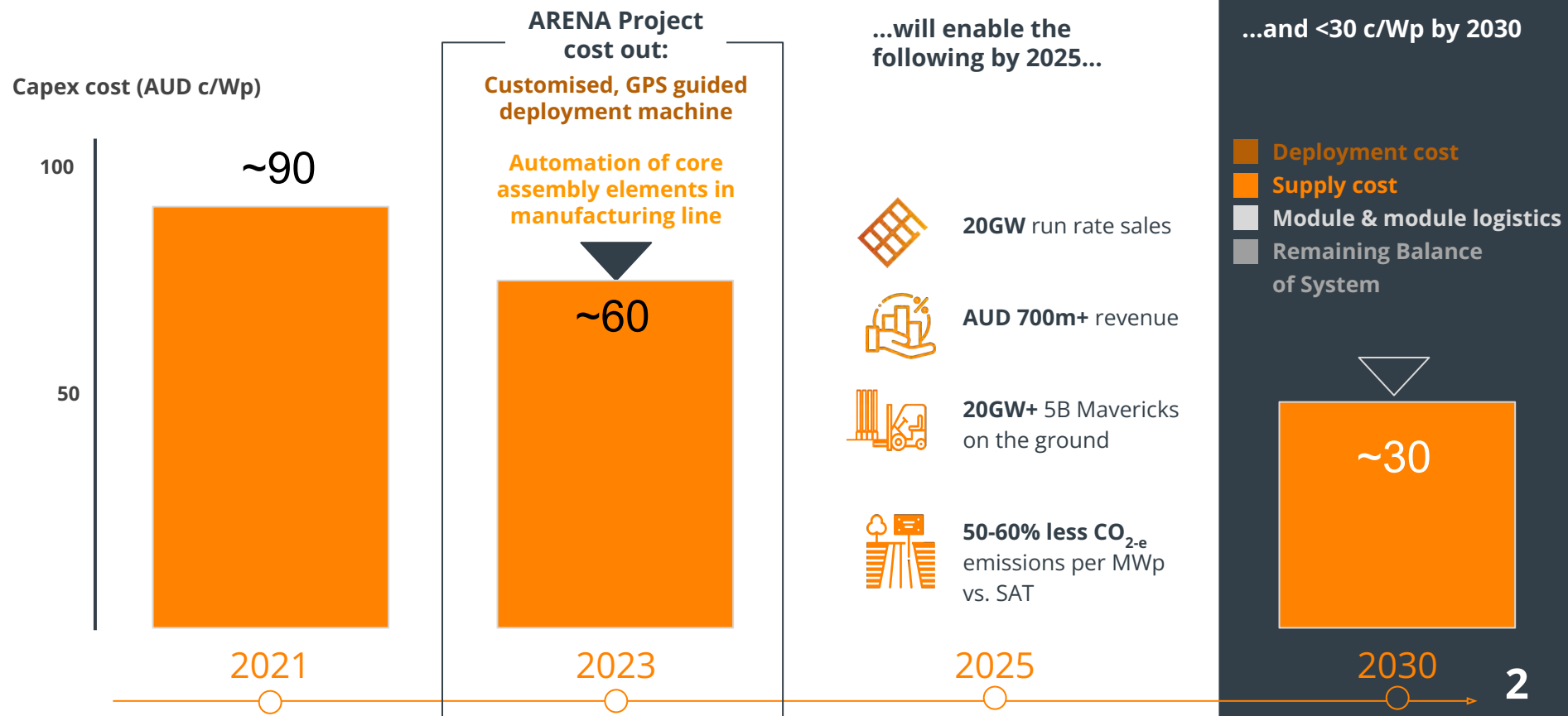
aes
artesian

REVENUE

Grow a scalable business model that will result in strong financial returns over time



We are on a journey to achieving ultra-low-cost solar by 2030



ARENA funding will drive a step change in the cost outcomes we can achieve

Project investment

- Advanced Manufacturing Pilot Line (AMPL):** design, commission and demonstrate a high volume and scalable manufacturing pilot line to produce high quality 5B Mavericks

| |
|------------------|
| 5B: AUD 12.8m |
| ARENA: AUD 9.5m |
| Total: AUD 22.3m |
 - GPS Guided Deployment (GGD):** design, develop, and manufacture field robotic systems to automate the process of deploying the 5B Maverick solar array

| |
|------------------|
| 5B: AUD 6.6m |
| ARENA: AUD 4.5m |
| Total: AUD 11.1m |
-
- | |
|-------------------------|
| 5B: AUD 19.4m |
| ARENA: AUD 14.0m |
| Total: AUD 33.4m |

Project outcomes

Enable ultra-low-cost solar:

- Reduce capex by ~AUD 20c/W, on path to < AUD 30c/W by 2030
- Take LCOE to AUD 20-26/MWh by 2030 (industry leading)

Automate solar manufacturing & deployment:

- Enable localised manufacturing through scalable, low cost assembly
- Unlock GW-scale projects through faster, cheaper deployment

Build Australian solar industry capability:

- Share knowledge & learnings with industry
- Add Australian skills and adjacent job opportunities in solar installation, automated manufacturing, and field robotics



Australia has the opportunity to be a **renewable energy super-power**, it's incumbent on us to collectively charge after this opportunity



5 Billion years of sun... how will we use it?

info@5b.co

5b.co

Join us on social





Q&A with Vince and Nicole

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Program and Round Overview

Transformative Research Accelerating Commercialisation Program

ARENA's new transformative R&D Program, builds on the success of ARENA's original R&D Program with greater ambition.

The TRAC Program aims to provide R&D funding to:

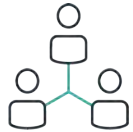
- enhance Australia's World-Class research position and/or address conditions specific to Australia
- progress core research and commercialisation activities to support a disruptive, transformative approach to R&D
- increase skills, capacity and knowledge within Australia
- improve technology and commercial readiness of Priority Technologies.

One overarching program (Guidelines) with each Round announced via a separate Funding Announcement. Applications will be accepted during open rounds.

Round Objectives



support **ambitious and sustainable cost reduction and improved efficiencies for utility scale solar PV** across Cells and Modules and Balance of systems costs and Operations and Maintenance



facilitate **collaboration between research groups and industry** by building on core research to drive commercialisation activities as part of an integrated project approach.

Round Priorities

To support the Australian Government's stretch goal of \$15 per MWh for the LCOE for utility scale solar PV, the following intermediate technology targets (Technology Targets) have been identified.

Proposals should target significant progress against these:

Higher module efficiency: ARENA seeks to accelerate the development of commercially competitive modules with efficiencies above 30 per cent.

Longevity: In order to meet the LCOE stretch goal, utility scale solar farms should have a minimum asset life of 30 years, with longer asset operating lifetimes expected.

Lower costs of deployment: ARENA seeks to accelerate cost reductions for utility scale solar PV deployment toward 30 cents per watt. Achieving this is expected to require novel approaches to constructing solar farms.

ARENA is providing up to \$40 million across two streams

| Stream | Funding Allocation | Scope Description |
|--|--------------------|---|
| Cell and modules | \$20 million | Improvement in the efficiency of cells and modules is a key lever for reducing LCOE. Cells and modules also need to be cost competitive, offer longevity and consider sustainability issues when manufactured and deployed at scale. |
| Balance of System costs and Operations and Maintenance | \$20 million | Significant reduction of Balance of System (BoS) costs and Operations and Maintenance (O&M) costs are also required to achieve the LETS stretch goal for ULCS. Innovative plant design configurations and the use of advanced automation in assembly and construction are potential pathways to lower utility scale solar PV construction costs. In the O&M phase, automated maintenance technology and intelligent plant monitoring systems are potential cost reduction pathways. |



Application and Assessment Process

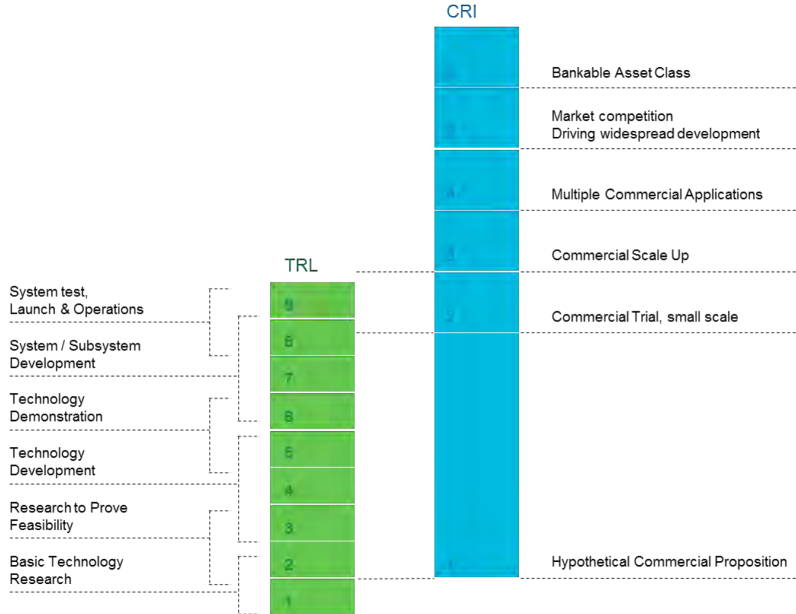
Background

- Program 'rules' are outlined in the **TRAC Guidelines and ULCS Funding Announcement**
- Must read the Guidelines and Funding Announcement (located on funding page)
- Must submit applications via **ARENANet**
- Application process is similar to previous Rounds
- Please refer to **FAQs** in the first instance for any questions
- If your question is not answered, please email trac@arena.gov.au

Round scope

- Scope is now an eligibility requirement (Eligibility criterion B - Eligible Project)
- All ARENA funding will be in the form of grants (up to \$40 million in total)
- Earliest Project start date is 1 September 2022
- Project length - up to 5 years (3 for R&D, 2 for commercialisation)
- ARENA grants must be between \$2 and \$8 million for each project with commercialisation activities capped at 50%, to a limit of \$2.5 million
- Projects must align with only one of the two Round Streams and target significant cost reductions
- Projects must have achieved a minimum Technology Readiness Level of 3 at the time of applying. Projects should aim to progress the relevant technology beyond its starting TRL
- Projects must include a proposed commercialisation pathway, to be refined during the Project.

Minimum Technology Readiness Level (TRL) 3



TRL 1: Basic principles observed and reported

TRL 2: Technology concept and/or application observed and reported.

TRL 3: Analytical and experimental critical function and/or characteristic proof of concept.

TRL 4: Component and/or system validation in laboratory environment.

TRL 5: Laboratory-scale, similar system validation in relevant environment.

Further explanation at Appendix A of the Guidelines

ARENA's assessment process

| | |
|----------------------|--|
| Two-stage process | <ul style="list-style-type: none">▪ Expression of Interest (less detail required, no mandatory attachments)▪ Full Application (invitation only, detailed information and attachments required)▪ Same process for both stages (Full Application more detailed with firm R&D budget). |
| Eligibility criteria | <ul style="list-style-type: none">▪ Eight eligibility criteria (new modern slavery criteria and additional eligible project requirements)▪ <u>All</u> must be met to proceed to merit assessment |
| Merit criteria | <ul style="list-style-type: none">▪ All 4 merit criteria <u>equally</u> weighted▪ ARENA Advisory Panel will assess applications against merit criteria.▪ Applications numerically scored▪ Projects ranked within each stream – top ranked projects progress▪ ARENA will allocate funds across streams as appropriate |
| Portfolio approach | <ul style="list-style-type: none">▪ Considers how a project uniquely contributes to the Program and Round objectives, or as part of a suite of complementary ARENA projects▪ May not fund if similar to existing ARENA project or other project under assessment |
| Value for money | <ul style="list-style-type: none">▪ Applications assessed for overall value for money and risk against the merit criteria |

Eligibility Criteria

Guidelines pp. 6 - 8,
Funding Announcement p. 5

| | |
|---|---|
| A - eligible applicant | <ul style="list-style-type: none">● Must be an Australian research institution <u>OR</u> entity incorporated under the Corporations Act 2001 (Cth) |
| B - eligible project | <ul style="list-style-type: none">● Must meet definition of “R&D” and involve Ultra Low Cost Solar PV;● Must address one of the Stream requirements (cells and modules, balance of systems/operations/maintenance)● Must meet both Round Objectives (cost reduction/increased efficiency, research industry collaboration)● Must have achieved at least TRL 3 at the time of applying (can move from this during the project);● Must be no more than 5 years (3 years for R&D, 2 years for commercialisation)● Must request a total ARENA grant of between \$2-8m● Must request no more than 50% of the ARENA funding towards commercialisation activities, up to \$2.5m |
| C - take place in Australia | <ul style="list-style-type: none">● Majority of activities must take place in Australia● No more than 10% of ARENA funds may be spent overseas, with exception of purchase or use of equipment and materials. ARENA will consider requests to increase this cap at EOI stage. |
| D - intellectual property | <ul style="list-style-type: none">● Must have ownership or access to any IP necessary to complete the project, and provide evidence to that effect at full application as necessary. |
| E - workplace gender equality | <ul style="list-style-type: none">● Applicant must not be named as being non-compliant with the Workplace Gender Equality Act 2012 (Cth) |
| F - modern slavery (NEW) | <ul style="list-style-type: none">● Must agree to take reasonable steps to identify, assess and address risks of modern slavery practices● Must comply with any obligations under the Modern Slavery Act. |
| G - knowledge sharing | <ul style="list-style-type: none">● Must agree to ARENA's Knowledge Sharing Plan for this Round |
| J - compliance with other requirements | <ul style="list-style-type: none">● Completeness and comprehensiveness of application against merit criteria● Disclose any legal proceedings● Accept all requirements in Part 6 of the Guidelines |

Project Overview - new section

Technology overview

- An overview of the technology that will form the basis of the Project, key research activities undertaken to date and key research activities proposed under the Project scope. *(600 words)*

Transformative potential

- How the technology is innovative and has the potential to deliver transformative change to the sector. *(300 words)*

Applicant overview

- An overview of the Applicant and Project Partners, their relevant experience and the proposed contributions from each party in delivering the Project. *(400 words)*

ARENA Grant request

- The respective ARENA Grant request for each of the R&D and Commercialisation Stages of the Project.

Expected timeframes

- The expected timeframes for the R&D Stage and the Commercialisation Stage of the Project (in accordance with the parameters of Section 4 of the Funding Announcement). *(50 words)*

Merit criterion A - Contribution to the Program Outcomes and Round Objectives (EOI)

| | |
|--------------------|--|
| Round Objectives | <ul style="list-style-type: none"> • The Project's alignment to the Round Objectives including technology targets (<i>300 words</i>) |
| Potential Impact | <ul style="list-style-type: none"> • The potential impact of the Project within the selected Stream, (<i>300 words</i>) describing the extent to which the work can: <ul style="list-style-type: none"> ○ improve cost-effectiveness and/or efficiency ○ contribute to the achievement of sustainable outcomes through: <ul style="list-style-type: none"> ■ sustainable manufacturing process and inputs; and ■ circular economy considerations ○ be replicated and provide a clear path for further cost reduction |
| Project definition | <ul style="list-style-type: none"> • The level of Project technical definition and the pathway to complete further research activities, including a summary of feasibility or design work undertaken to date (<i>300 words</i>) |
| World Class | <ul style="list-style-type: none"> • How the Project is world class or innovative compared to research already being done in this field (domestic and international) (<i>300 words</i>) |
| Other | <ul style="list-style-type: none"> • Other contributions the Project will make in the achievement of Round Objectives not already mentioned (<i>200 words</i>) |

Merit criterion B - Applicant capability and capacity (EOI)

Research capability

- Project team's (applicant and partners) track record of research excellence and skills as relevant to the proposed Project *(200 words)*

Commercialisation capability

- Project team's (applicant and partners) track record of undertaking commercialisation activities and skills as relevant to the proposed Project *(200 words)*

Capacity

- Demonstrate the applicant organisation and any partner organisations and key personnel have the resources, skill, expertise and research infrastructure (or that these will be accessible or made available) to achieve the Project outcomes. *(200 words)*

Merit Criterion C - Project design and methodology

Project design

- Technical design or methodology that will be employed to achieve the Project outcomes.
- Timeline for the Project, including milestones, stage-gates, dependencies and deliverables associated with the Project.
- Main risks to achieving the outcomes of the Project and how these risks will be mitigated (eg. risk in - technology, scale-up, commercialisation, project planning, infrastructure and equipment access, personnel and WHS risks).

(500 words)

Commercialisation Plan

- Outline the high-level commercialisation plan for the technology/ solution that is the focus of the Project *(300 words)*

Merit Criterion D - Financial viability and co-funding commitment

Budget Table

- Simple budget table in ARENANet
- Budget may vary up to 10% between EOI and Full Application before being considered a material change

Written Justification

- Written justification for the requested funding (*300 words*)

Check against eligible expenditure guide in Appendix B of the Guidelines

Other important points

Guidelines:

- Part 5 - Funding Agreements
- Part 6 - Further Program Information
- Appendix A - Technology Readiness Levels
- Appendix B - Eligible expenditure

Funding Announcement:

- Appendix A - Additional Information Requirements

Timeline for application and assessment process

| EOI STAGE | |
|--|---|
| EOI Open Date | Monday 7 February 2022 |
| EOI Due Date | 5:00 PM Australian Eastern Standard Time (AEST), Monday 11 April 2022 |
| FULL APPLICATION STAGE | |
| Applicants invited to submit a Full Application | ARENA aims to issue invitations to submit a Full Application in May 2022 |
| Full Application Due Date | Full applications will be due eight weeks after the invitations to submit a Full Application are sent |
| Offer to Negotiate or communication of outcome of the Full Application stage | ARENA aims to issue outcome letters from the Full Application stage prior to 30 August 2022 |

ARENA will not accept an EOI or a Full Application submitted after the relevant due dates.

Key links

ULCS Round webpage

<https://arena.gov.au/funding/ultra-low-cost-solar-pv-research-and-development-round/>

ARENANet Application portal

<https://arenaomnistar.f1solutions.com.au/>

Guidelines

<https://arena.gov.au/assets/2022/01/transformative-research-accelerating-commercialisation-program-trac.pdf>

Funding Announcement

<https://arena.gov.au/assets/2022/01/ultra-low-cost-solar-pv-funding-announcement.pdf>

FAQs

<https://arena.gov.au/assets/2022/01/frequently-asked-questions-ultra-low-cost-solar-pv.pdf>

Further questions?

Email: trac@arena.gov.au

Open Q&A



It's over to you....

Thank you and good luck!