



Australian Government
Department of Industry,
Science and Resources

Critical Technologies Challenge Program

Round 2 – Stage 1 Feasibility

Applicant Information Package

December 2024

| business.gov.au/ctcp2

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The purpose of this publication is to provide information for potential applicants for Round 2 Stage 1 Feasibility of the Critical Technologies Challenge Program.

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Frequently asked questions

Critical Technologies Challenge Program (CTCP) Round 2 Feasibility grant opportunity

The Program

1. How is the CTCP being delivered?

The CTCP is delivered via two rounds, both comprised of two stages. Stage 1 is Feasibility, and Stage 2 is Demonstrator. This document relates to Round 2, Stage 1 Feasibility grants (Feasibility).

Only projects that have completed the CTCP Feasibility stage can progress to CTCP Demonstrator stage.

2. How much grant funding is available?

The Stage 1 Feasibility grant opportunity offers funding of a minimum of \$100,000, up to a maximum of \$500,000. There is no requirement for matched funding or co-contribution. Up to \$5.25 million is available for Feasibility grants.

3. What are the objectives of the CTCP?

The objectives of the CTCP are to:

- build productive collaboration between researchers and businesses by supporting co-designed projects that focus on market-led challenges that can be solved by quantum technologies
- accelerate the commercialisation of quantum technologies by supporting promising projects in the early stages of technological readiness when private investment is difficult to source
- de-risk the adoption of quantum technologies to solve nationally significant challenges across the economy (including sectors as diverse as manufacturing, healthcare, environment and agriculture)
- foster gender equity and Aboriginal and Torres Strait Islander (First Nations) peoples' participation in the quantum industry.

4. What are the objectives of the Feasibility grant opportunity?

The objective of the Feasibility grant opportunity (Stage 1 of the program) is to investigate how quantum technologies can provide an innovative solution to a market-led nationally significant challenge, in line with the broader objectives of the program (see Q3). Solutions may also include component(s) that contribute to solving challenges of national significance.

5. What are the intended outcomes of the Feasibility grant opportunity?

The intended outcomes are to validate the feasibility of the proposed solution for the development of a Demonstrator project, and to expand collaboration networks and partnerships in the quantum sector.

6. How does the CTCP work?

The CTCP will test solutions to market-led challenges of national significance using quantum technologies, potentially in conjunction with other advanced technologies, and accelerate quantum technologies from an early-readiness phase when private capital is hard to secure. Details of each of the available challenges can be found within this Applicant Information Package.

Entities can apply for a competitive grant on behalf of a joint (consortia) collaboration to undertake a Stage 1 Feasibility project in relation to their proposed solution or component(s) that contributes to a solution for a selected challenge. Grantees who have completed a Stage 1 Feasibility project will be invited to apply for a further competitive grant to complete a Stage 2 Demonstrator project.

7. Am I eligible to apply as the lead applicant?

Lead applicants must apply on behalf of a joint (consortia) collaboration.

To be eligible to apply as the lead applicant for a Feasibility grant, you must:

- have an Australian Business Number (ABN)
- be registered for Goods and Services Tax (GST)
- be an entity, incorporated in Australia.

Entities that are ineligible to apply as the lead applicant but can participate as project partners include, but are not limited to, those listed at question 8 below.

You can find more information on eligibility in section 5 of the Stage 1 [Feasibility grant opportunity guidelines](#).

8. Am I ineligible to apply as the lead applicant?

Entities that are eligible to participate as project partners, but not as the lead applicant, include, but are not limited to:

- research organisations
- international organisations
- unincorporated associations
- trusts or an incorporated trustee on behalf of a trust
- Commonwealth, state, territory or local government bodies (including government business enterprises)
- non-corporate Commonwealth entities
- corporate Commonwealth entities.

You can find more information on eligibility in section 5 of the Stage 1 [Feasibility grant opportunity guidelines](#).

9. What do lead applicant, joint (consortia) collaboration, project partner and project participants mean?

The Department of Industry, Science and Resources (DISR) can only sign an agreement with one organisation – the **lead applicant**. The lead applicant is the main driver of the project and the primary contact throughout the project.

Joint (consortia) collaborations are a group of two or more entities that have joined together to work on a particular project.

Project partners are eligible entities that work with the lead applicant and are involved in joint (consortia) collaborations but are not the lead applicant for the project. The grant opportunity guidelines specify the types of project partners that must be part of an application, to be eligible for the CTCP.

Project participants are all of the entities involved in joint (consortia) collaborations, including the lead applicant.

10. What requirements do the joint (consortia) collaboration need to meet?

Eligible applications must be on behalf of a joint (consortia) collaboration that contains at least:

- one Australian industry-based partner and
- one Australian research organisation (as defined in section 15 of the grant opportunity guidelines).

Applicants for the Stage 1 Feasibility grant opportunity must include the lead applicant and at least one project partner: 2 project participants in an application as a minimum.

You can find more information on consortia requirements in section 5.2 and 8.2 of the [Feasibility grant opportunity guidelines](#).

11. What is the definition of Quantum Technology?

For the purposes of this opportunity, quantum technology is technology whose functionality employs quantum behaviours, such as quantisation, quantum entanglement, superposition, and quantum tunnelling. Refer to section 2.3 of the [Feasibility grant opportunity guidelines](#) for more details.

12. How long is the Stage 1 Feasibility stage?

The maximum project period for the Stage 1 Feasibility grants is 6 months.

13. Who owns the IP on completion of the project?

Consortia will retain Intellectual Property rights according to their agreed Intellectual Property arrangements and the right to sell in domestic and global markets, in compliance with Australian regulations.

14. Are the CTCP grants competitive?

Yes, eligible applications are assessed against the assessment criteria, against other applications and ranked within the relevant challenge outlined in section 7 of the Stage 1 [Feasibility grant opportunity guidelines](#).

15. Is it essential that all project participants are based in Australia?

Consortia which include international organisations as project partners are welcome to apply. However, the lead applicant must have an Australian Business Number (ABN), be registered for GST and be incorporated in Australia.

Further details on eligibility for consortia and lead applicants is provided in section 5 of the [Feasibility grant opportunity guidelines](#).

The Challenges

1. What is a ‘challenge’ within the CTCP?

Challenges selected for the CTCP are of national significance and have been identified through consultation with industry and quantum experts. They have been approved by the Minister for Industry and Science.

Solutions (or components of solutions) to challenges must involve quantum technologies, potentially in conjunction with other advanced technologies. Details of each of the available challenges can be found within this Applicant Information Package.

2. How many projects will be funded across each challenge?

Funding is available for multiple projects across each of the challenges. However, the exact number of projects funded per challenge will depend on the number of quality applications received, the amount of eligible expenditure requested by each application and the available funds.

3. As lead applicant, can I apply for more than one challenge?

Yes, you can apply for multiple challenges, **however the lead applicant can only receive grant funding for one project per challenge in this round.** You will need to complete and submit a separate application for each project for which you wish to apply.

4. Can I be a project partner in more than one application for Stage 1 Feasibility funding?

Yes, you can be a project partner in more than one application for Stage 1 Feasibility grant funding.

5. What Technology Readiness Level is required for participation in the CTCP?

Feasibility project proposals with technologies commencing at Technology Readiness Level (TRL) 4 and aiming to achieve a minimum of TRL 5 are required for Stage 1 of the CTCP.

Demonstrator project proposals with technologies commencing at a minimum TRL 5 and aiming to achieve at least TRL 6 or TRL 7 by the end of Stage 2 Demonstrator are required for Stage 2 of the CTCP.

Further information can be found in section 2.2 of the respective [grant opportunity guidelines](#).

6. If multiple challenge solutions are similar, how will the final list of applications to be funded be determined?

The CTCP Assessment Committee will assess eligible applications against the assessment criteria (section 7 of the grant opportunity guidelines) and against other applications within the relevant challenge.

The Assessment Committee will consider your application on its merits, based on:

- how well it meets the criteria
- how it compares to other applications within the relevant challenge
- whether it provides value with relevant money.

If applications are scored the same, the Assessment Committee will consider value with relevant money and the spread of proposed solutions to recommend applications for funding.

Further details on the grant selection process for this grant opportunity is provided in section 9 of the [Feasibility grant opportunity guidelines](#).

7. Will further rounds have different challenges?

Selection of challenges for each round of CTCP is at the discretion of the Minister for Industry and Science.

Applications

1. How do I apply?

To apply, you must:

- submit your completed application through our online [portal](#). (A sample of the application form is available to download at [business.gov.au](#))
- include all mandatory attachments (templates can be found at [business.gov.au](#).)

See section 8.1 of the [Feasibility grant opportunity guidelines](#) for more information on the required documents.

2. How much can I upload with my application?

Attachments are limited to 2MB per document, with a maximum of 20MB per application. Videos are not able to be submitted. We are unable to accept information provided outside of your portal application, unless that information is requested by the Department.

3. Who assesses my application?

Eligible applications are assessed by the CTCP Assessment Committee against the assessment criteria as outlined in section 9 of the Stage 1 [Feasibility grant opportunity guidelines](#).

4. Who decides which applications will receive grant funding?

The Program Delegate, a Manager in the Business Grants Hub within DISR with responsibility for administering the program, decides which grants to approve, taking into account the recommendations of the Committee, the spread of projects across Challenge streams and the availability of grant funds. Full details on the grant selection process are provided in section 9.3 of the [grant opportunity guidelines](#).

5. After the closing date, what is the timeframe for decisions?

A decision on the awarding of Feasibility grants is expected to take approximately 14 weeks after the closing date for applications. You can find more information on expected timing of grant opportunity processes in section 8.3 of the Stage 1 [Feasibility grant opportunity guidelines](#).

6. Is there an opportunity to get feedback on the application prior to lodgement?

As this is a competitive grant program it is not appropriate for DISR to comment on individual applications prior to lodgement. If you have any questions during the application period, contact us at [business.gov.au](#) or by calling 13 28 46.

7. My CTCP Round 1 Feasibility application did not receive funding. Can I receive feedback on that application?

If you were unsuccessful in CTCP Round 1, we encourage you to contact us at DigitalPrograms@industry.gov.au to discuss the outcome of your application.

8. Can I resubmit my unsuccessful CTCP Round 1 Feasibility application for the same or a similar challenge for CTCP Round 2?

You may reapply for funding in CTCP Round 2 however, you should consider our feedback on your CTCP Round 1 application and ensure your application clearly aligns with the CTCP Round 2 Challenge. Please also note the eligibility criteria for CTCP Round 2 has changed from CTCP Round 1 and you must meet these to be eligible to apply.

Delivery

1. When are the grant funds paid?

The approved Feasibility grant amount will be paid on execution of the grant agreement.

You must not commence your project until you execute a grant agreement with the Commonwealth.

You can only spend the grant funds on eligible expenditure you have incurred on an agreed project as defined in your grant agreement. At the end of the project, the Commonwealth may recover any unacquitted grant funding.

2. How will my project be monitored?

We will monitor the progress of your project by assessing reports you submit in accordance with the grant agreement. We may also conduct site visits to confirm details of your reports if necessary.

You can find more information on how your grant activity is monitored in section 13 of the [Stage 1 Feasibility grant opportunity guidelines](#).

3. What happens if there are any changes during the project?

You should let us know if anything is likely to affect your project or organisation.

We need to know of any key changes to your organisation or its business activities. You must also inform us of any material changes in the circumstances of project participants.

We recognise that unexpected events may affect project progress. In these circumstances, you can request a variation to your grant agreement, including:

- changing project milestones
- extending the timeframe for completing the project but within the maximum 6 month period for Feasibility projects
- changing project partners
- changing project activities.

Please note, the program does not allow for an increase of grant funds.

If you want to propose changes to the grant agreement, you must put it in writing before the project end date. We cannot consider changes after the project end date.

4. Where do I find information on the program and stages?

You can find all information about this program within the published grant opportunity guidelines on [business.gov.au](#).

Need more information?

Visit [business.gov.au](#) or call 13 28 46.

Information of interest

Resource	Description
The National Quantum Strategy Department of Industry, Science and Resources	The National Quantum Strategy is the Australian Government’s plan to grow the quantum industry and leverage quantum technologies in Australia
National Reconstruction Fund Department of Industry, Science and Resources	The National Reconstruction Fund (NRF) will finance projects to diversify and transform Australia’s industry and economy, offering options such as loans, equity investment, and guarantees.
List of Critical Technologies in the National Interest Department of Industry, Science and Resources	The List of Critical Technologies in the National Interest, developed through extensive public consultation, aims to align Australia’s critical technologies ecosystem and support consistency and coordination across related government activities.
National Science and Research Priorities Department of Industry, Science and Resources	Australia’s National Science and Research Priorities and National Science Statement will shape a long-term vision for the Australian science system and re-energise conversations across the sector.
Diversity in STEM Department of Industry, Science and Resources	The report recommends a long-term strategy to increase diversity in STEM, including establishing an advisory council with expertise and lived experience to guide its implementation.
Office of Chief Scientist Department of Industry, Science and Resources	Australia’s Chief Scientist provides independent science advice to the government, champions the national science and research system. and contributes to improving Australia's scientific capability.
State of Australian Quantum report 2024 Department of Industry, Science and Resources	The State of Australian Quantum report 2024 reports on the implementation of the National Quantum Strategy, highlighting successes, challenges, and next steps for Australia's quantum industry.
Joint Statement of the United Kingdom and Australia on Cooperation in Quantum Technologies Department of Industry, Science and Resources	The statement aims to enhance each country’s quantum industry capabilities through improved market access and knowledge sharing.
Joint Statement of the USA and Australia on Cooperation in Quantum Science and Technology Department of Industry, Science and Resources	The statement aims to enhance each country’s quantum industry capabilities through improved market access and knowledge sharing.
Australian Research Council (ARC)	The Australian Research Council (ARC) aims to grow knowledge and innovation in Australia by

Resource	Description
	funding high-quality research, assessing research quality and impact, and providing advice on research matters.

Key changes to Round 2 Stage 1 Feasibility Guidelines

The grant opportunity guidelines remain consistent with the intentions of the National Quantum Strategy.

Please review the following list of key changes from Round 1 to Round 2 to the grant opportunity guidelines CTCP Stage 1 Feasibility.

- **Program objectives and outcomes:**
 - The guidelines now explicitly mention fostering gender equity and First Nations peoples' participation in the quantum industry.
 - A definition of quantum technologies has been added.
- **Technology Readiness Levels (TRLs):**
 - Stage 1 Feasibility project proposals must now aim to achieve a minimum of TRL 5 rather than exactly TRL5.
 - Stage 2 Demonstrator project proposals can now commence at a minimum TRL 5 instead of exactly TRL 5. The TRLs for the project proposals can now aim to achieve at least TRL 6 or TRL 7 by the end of the project, instead of exactly TRL 6 or TRL 7.
- **Challenges:**
 - The challenges in Round 2 are different from Round 1 Stage 1 Feasibility.
- **Lead Applicant:**
 - A lead applicant can now receive grant funding for one project per challenge.
 - Research organisations are no longer eligible to be a lead applicant.
- **Assessment Criteria:**
 - The assessment criteria have been updated to show specific point allocations for each criterion.

Key tips for preparing your grant application for CTCP Stage 1 Feasibility

This information is designed to help you prepare a CTCP Stage 1 Feasibility grant application.

It complements the guidance available on business.gov.au – specifically the ‘**Check if you're ready to apply for a grant**’ page. This resource will guide you through the grant process, including the time needed to prepare your application. It will also help you understand the guidelines, develop your objectives, and create a clear, concise, and compelling application.

Preparation

Ensure you familiarise yourself with the overall program requirements. Your application should clearly demonstrate how your project aligns with the objectives and outcomes of the CTCP, and supports the Australian Government’s vision for Australia’s quantum industry.

Read and review the CTCP grant opportunity guidelines and other referenced documents listed in the guidelines to gain an overview of the 2 stages of this grant program:

- CTCP: Round 2 – Stage 1 [Feasibility grant opportunity guidelines](#).
- CTCP: Round 2 – Stage 2 [Demonstrator grant opportunity guidelines](#)

Read the [National Quantum Strategy](#) to understand the Australian Government’s vision and broader Australian and global context for the CTCP. The State of Australian Quantum November 2024 report provides updates on how we've implemented the Strategy. It also highlights the successes, challenges and next steps for Australia's quantum industry.

General guidance

- To ensure a smooth submission process, avoid waiting until the last minute to submit your application in the portal. Prepare your application well in advance and aim to submit at least one day prior to the closing date.
- Your application will be scored against the 3 assessment criteria at section 7 of the CTCP Round 2, Stage 1 [Feasibility grant opportunity guidelines](#). Ensure you include key project details in your responses to these criteria.
- Use plain English to explain technical concepts and industry jargon. Always expand abbreviations the first time they are used.
- A good application will be easily understood by assessors, regardless of their area of expertise.
- If your application is based on an unsuccessful CTCP Round 1 application, we encourage you to contact us at DigitalPrograms@industry.gov.au to receive feedback well in advance of the application closing date and discuss the outcome of your application.
- Do not simply copy and paste from another application. Your application should specifically address the requirements of the CTCP Round 2 grant opportunity guidelines.
- Involve your partners in the co-design of the project proposal to ensure their input and collaboration.
- Verify your budget in the application portal matches the budget in your attached Excel spreadsheet.
- Set realistic and achievable project delivery dates.
- Proofread your application for spelling and grammar before submitting.
- If you have any technical issues with your portal application, please contact 13 28 46 during Australian Eastern Standard Time work hours.

Attachments

- Make sure you attach all required documentation using the templates provided on business.gov.au listed at section 8.1 of the Stage 1 [Feasibility grant opportunity guidelines](#).
- Submit only the requested attachments as any additional information will not be considered.
- The attached Project Plan should support your responses to the assessment criteria and align with the project milestones.

How do I address the assessment criteria?

- Ensure your responses to the assessment address each element of the criteria. Take note of the allocation of points and the suggested character limits to understand the strength and value of the response required.
- To be considered competitive, your application must score above 50% on each criterion.
- Refer to the guidance provided in ‘**Check if you're ready to apply for a grant**’ available on business.gov.au for important tips on how to write a clear, concise and compelling application.

Tips for building a productive consortium

Preparation

- **Identify complementary skills and resources:** Consider the complementary skills and resources you need from partners to help develop the Feasibility project, and potentially through to Demonstrator project.
- **Check eligibility requirements:** Review the eligibility requirements for partners in section 5 of the Stage 1 [Feasibility grant opportunity guidelines](#).
- **Develop a clear project concept:** Create a clear and concise project concept that you can pitch to potential partners.
- **Potential partners will be keen to understand and discuss:**
 - Further information about the grant, including the obligations of grant recipients to the Commonwealth. Potential partners will want to understand their obligations to the grant recipient if the grant is successful. A sample grant agreement (available on business.gov.au) may be helpful for this discussion.
 - How the project and partnership will benefit their business or organisation.
 - What resources they can provide.
 - The role they will play in the management of the project.
 - What arrangements will be made regarding existing and future Intellectual Property (IP)
- **‘Letter of Support’ template:** Provide partners a copy of the ‘Letter of Support’ available on business.gov.au. Partners will be required to provide a signed version to demonstrate they have agreed to support the project and application.

NOTE: that the ‘Letter of Support’ is not a legally binding contract.

How to identify potential eligible partners

- **Research entities:**
 - Refer to [Higher Education Tables A and Table B](#) of the *Higher Education Support Act 2003* (Cth) for list of eligible research partners.
 - Review options in [Universities Australia](#).

- Universities often promote their research strengths on their websites and provide contact details to connect you with the right people.
- Most universities also have a research engagement office or industry ‘front door’ to help industry find the right researcher.
- **Government entities:** Government entities may be interested to support projects relevant to their portfolio focus. Consider the national policies and programs in the challenge overview when considering which government agencies to engage with. Some government entities are also classified as research organisations.
- **Industry associations:** An industry association aligned with the challenge you are planning to address may be able provide information, make connections and support for your project. The challenge overview may provide you with some guidance.
- **CTCP Contacts Directory:** Connect to others through the [CTCP Contacts Directory](#). You may register your organisation in the directory and search the directory for potential partners.
- **AusIndustry:** Connect with AusIndustry at business.gov.au. They may be able to provide you with information to assist with exploring the relevant business sector.

Longer term partnership planning

Beyond Feasibility: Stage 2 Demonstrator phase requires a minimum of 3 eligible partners. If your Stage 1 Feasibility project is invited to move to Stage 2 Demonstrator phase, you may need an additional eligible partner. This is a good time to consider possible partners and other organisations you may need to engage with throughout the project and beyond the Stage 1 Feasibility phase.

Guidance for Inclusion of First Nations peoples in the Critical Technologies Challenge Program

Purpose

The purpose of this guidance material is to support applicants to strengthen the inclusion of First Nations peoples in the CTCP.

In this way, First Nations peoples and businesses will also have the opportunity to benefit from and participate in the development of quantum technologies in Australia.

Why inclusion?

The CTCP aims to increase awareness and adoption of quantum technologies in Australia by strengthening connections between quantum researchers, businesses, and technology end-users. A key program objective is to promote gender equity and the participation of First Nations peoples in the quantum industry.

This focus on inclusion aligns with **Theme 5 of the National Quantum Strategy**¹:

To maximise the opportunities of quantum, we must push for greater inclusion and diversity. This includes increasing the participation of women, Aboriginal and Torres Strait Islander peoples and other underrepresented groups. The quantum community must engage with rural and regional Australia and connect with families, teachers and children. That way, the whole of Australia can understand and benefit from quantum technologies.

This supports the work being done nationally, by all levels of Australian government, to work with First Nations peoples, communities, organisations and businesses to implement the new **National Agreement on Closing the Gap**². Ensuring First Nations peoples are included in Australia's quantum opportunity can help reduce socio-economic gaps by providing meaningful opportunities for First Nations peoples to achieve their full potential.

Who are First Nations peoples?

First Nations peoples refers to Aboriginal and Torres Strait Islander peoples. First Nations peoples are Australia's first peoples and live throughout all areas of Australia – cities, regional, rural and remote communities. First Nations peoples are not a singular group but comprise hundreds of distinct groups that have their own distinct set of languages, histories and cultural traditions.³

Language will always change and evolve, so what once may have been used in the past is today offensive.⁴ When engaging with First Nations peoples, it's important to acknowledge and follow their preference in relation to the identification terms they prefer. Each First Nations person has their own specific preference for preferred identification terms. This is informed by a range of factors including the uniqueness of each clan, group, community, island and/or nation that they identify with. Ways of identifying are personal and individual, therefore it is always best to ask people what they prefer and to

¹ <https://www.industry.gov.au/publications/national-quantum-strategy>

² <https://www.closingthegap.gov.au/national-agreement>.

³ <https://www.aihw.gov.au/reports/australias-welfare/profile-of-indigenous-australians>

⁴ <https://aiatsis.gov.au/explore/australias-first-peoples#toc-language-use>

recognise that this may be their preference, and may not necessarily be the case for other First Nations peoples.⁵

Build the cultural capability of your project consortia

If you plan to engage directly with First Nations peoples during your project, you may consider the following approaches to ensure that you and your consortia are well-placed to develop effective partnerships with First Nations peoples:

- Partner with a First Nations project partner as part of your project consortia.
- Include a partner with First Nations staff such as a research organisation, a First Nations peak organisation, a health service, a non-government organisation or a business.
- Involve a partner with experience in working directly with First Nations peoples and organisations.
- Employ staff with skills in engaging with First Nations peoples.

Support inclusion of First Nations peoples in your CTCP project

The following ideas are provided to help you and your project partners consider how your project may support the inclusion of First Nations peoples in the quantum opportunity you are creating.

You are not limited by the following ideas and are strongly encouraged to develop your own approach. Your project plan should outline the specific actions and strategies you will implement to support participation of First Nations peoples in your solution, its design, and/or the opportunities it creates.

Identifying opportunities for First Nations peoples in your project

- Co-design of technology with a First Nations consortia partner.
- Commit to providing the technology for end-user testing by First Nations peoples and organisations.
- Prioritise the provision of technology to First Nations end-users.
- Offer targeted recruitment, traineeships and research opportunities.
- Provide skills-based training for First Nations businesses and technology users.
- Implement recruitment processes that are tailored to attract First Nations applicants. Greater representation of First Nations peoples in the workforce promotes inclusivity and diversity, which provide benefits to business.
- Establish mentorship and support systems within the workplace to ensure that First Nations employees have access to career development programs, guidance, and long-term employment opportunities.
- Procure goods and services from First Nations businesses.

Connecting with First Nations peoples, businesses and organisations

You may wish to connect with First Nations peoples, businesses and organisations through:

- [Supply Nation](#) - a not-for-profit organisation that maintains a searchable register of many certified First Nations businesses, covering nearly every industry sector.
- The [Coalition of Peaks](#), which lists more than 80 Aboriginal and Torres Strait Islander community-controlled peak organisations (ACCOs) and members. In addition to identifying

⁵ <https://aiatsis.gov.au/explore/australias-first-peoples#toc-language-use>

potential end-users on Supply Nation, you may wish to contact a peak body relevant to your challenge or location.

- The CTCP Contacts Directory on business.gov.au, which may include potential First Nations consortia partners.
- Applicants should keep in mind:
 - Not all First Nations businesses and organisations are registered with Supply Nation.
 - Not all First Nations organisations are registered with their peak bodies.

Potential use of quantum technology in regional and remote locations

- If you are considering the use of quantum technology in regional or remote locations, you should consider how you will adapt to the unique circumstances of these geographic areas, such as limited access to infrastructure, connectivity challenges, increased costs of transporting goods and services, climate, wide fluctuations in seasonal weather conditions and accessibility difficulties.
- If your project includes engaging with First Nations peoples, businesses or organisations, the resources set out below provide guidance on how to ensure your approach is genuine and leads to co-design, co-development, informed consent and mutual decision-making.

IP protection for First Nations project partners and participants

- When engaging First Nations peoples and knowledges it is important that you consider the protection of Traditional Knowledge as a part of your technologies, tools, research or product. You should ensure that you have free, prior and informed consent from the Traditional Custodians or communities who own or have stewardship of the knowledge. For further information you can engage with [IP Australia](#) for guidance.⁶

Research involving First Nations peoples and communities

- Research should include principles associated with protection of Traditional Knowledge. This needs to be a two-way exchange of information involving active collaboration, mutual respect, and benefit-sharing between researchers and First Nations peoples. We recommend actions be taken to ensure that the custodians of Traditional Knowledge have control over how it is used and applied^{7,8,9}.
- Indigenous Cultural and Intellectual Property (ICIP) includes cultural heritage, Traditional Knowledge, collected data and traditional cultural expressions that are passed down through generations. While current Australian law offers some protection for ICIP through mechanisms such as copyright, moral rights, and trademark law, there may be scope to supplement these with mechanisms such as non-disclosure agreements, contracts and protocols in order to provide enhanced recognition of communal ownership and/or the perpetual nature of ICIP rights.
- Further useful guidance on research ethics is available at sites such as the [Australian Institute of Aboriginal and Torres Strait Islander Studies](#) (AIATSIS) and the [Lowitja Institute](#).

⁶ <https://www.ipaustralia.gov.au/understanding-ip/indigenous-knowledge>

⁷ <https://www.ipaustralia.gov.au/understanding-ip/indigenous-knowledge/how-to-engage-indigenous-knowledge>

⁸ <https://aiatsis.gov.au/research/ethical-research>

⁹ <https://www.lowitja.org.au/research/>

Resources

The following resources could support you in considering how to engage with First Nations peoples, businesses and organisations.

Resource	Description
Indigenous Partnerships¹⁰ Department of Climate Change, Energy, the Environment and Water (DCCEEW)	Guidance on engaging and building genuine partnerships with First Nations peoples and communities. Whilst environmentally focused, this guidance applies in many contexts.
Indigenous Partnership Principles¹¹	Downloadable booklet intended for people from non-First Nations organisations on building effective and respectful partnerships with First Nations organisations and communities.
Supply Nation	Supply Nation is a not-for-profit organisation that aims to grow the First Nations business sector through the promotion of supplier diversity in Australia. Contains a searchable public register of certified First Nations businesses. Please note: Not all First Nations businesses are registered with Supply Nation.
Closing the Gap	Guidance material in relation to the National Agreement on Closing the Gap, which was released in 2020, including information related to the four priority reforms and targets.
The Lowitja Institute	The Lowitja Institute is Australia’s only Aboriginal and Torres Strait Islander community-controlled health research institute. Lowitja delivers high-impact quality research, knowledge exchange, and works to support a new generation of Aboriginal and Torres Strait Islander health researchers.
List of 80 peak First Nations organisations	Lists 80 First Nations community-controlled peak organisations and members including health organisations, land councils and business networks
Australian Institute of Aboriginal and Torres Strait Islander Studies	Australia’s national institution focused exclusively on the diverse history, cultures and heritage of First Nations peoples.
IP Australia	Australian Government agency that administers Intellectual Property (IP) rights and legislation for patents, trademarks, design rights and plant breeder’s rights.

¹⁰ Linked with permission from Department of Climate Change, Energy, the Environment and Water.

¹¹ Linked with permission from Department of Climate Change, Energy, the Environment and Water.

Resource	Description
	IP Australia is working across government to strengthen the protections available to ensure First Nations peoples' Traditional Knowledge is acknowledged and used appropriately.
Cultural competency in the delivery of health services for First Nations people	Provides academics with selected strategies to make effective curriculum decisions and develop appropriate professional standards (i.e., code of ethics) which are culturally competent.
National Indigenous Australians Agency (NIAA)	Lead Australian Government agency for improving the lives of First Nations peoples. Provides policy advice, program delivery and coordination across government.
Indigenous.gov.au	Showcases the stories, achievements and initiatives of First Nations peoples and communities across Australia.
Inclusive and Respectful Language	Reconciliation Action Plan drafting resource from Reconciliation.org.au, providing guidance on inclusive and respectful language.

Challenge 1

Improve biosecurity outcomes by enhancing the detection of invasive pests or diseases, and cargo inspection processes

Challenge Overview

This challenge aims to leverage quantum technology to improve biosecurity outcomes. Innovative quantum-based solutions are needed to enhance the accuracy, speed, and efficiency of scanning and sensing processes, ensuring the safety and integrity of agricultural and fisheries products and industries. Solutions may include enhanced sensing, or the development of novel technologies in the geospatial intelligence sector. It may also focus on the development of innovative solutions to enhance the accuracy and efficiency of the cargo inspection process.

Australian agriculture is a priority sector for Australia. In 2022–23, Australian agriculture contributed to 13.6% of goods and services exports, 2.7% of Gross Domestic Product, and 2.2% of employment.¹² Biosecurity management and identified incursions are the cause of large-scale losses across the sector. For example, Australia has close to 3000 invasive alien species - estimated to cost approximately \$25 billion every year in losses to agriculture and management costs.¹³ For agriculture producers alone, vertebrate pest animals and weeds cost approximately \$5.3 billion annually, with \$3.8 billion expended on management and control efforts and \$1.5 billion in production losses.¹⁴ Enhanced detection of invasive pests or diseases in agricultural or fisheries products may help mitigate these losses. Improving Australia's biosecurity system will enhance market access and global competitiveness by preventing pests and diseases. Strong biosecurity outcomes also support agricultural traceability from country to consumer, providing opportunities to raise Australia's profile and leverage global market advantage.

Quantum technologies - particularly quantum sensors - offer significant advancements over traditional detection systems, allowing real-time detection capabilities at critical points. Australia has an established base of research in this area, with the ARC Centre of Excellence in Quantum Biotechnology listing agriculture as one of its target sectors.¹⁵

In responding to this challenge, applicants may wish to consider ways to use quantum technology for the detection of pests in crops.¹⁶¹⁷ Applicants may also consider the application of quantum technologies to enhance agricultural traceability systems.

Applicants may also focus on quantum technologies that can detect contamination in underground water resources. There is also potential to leverage quantum technologies to identify the presence of agricultural residues including herbicides and pesticides. This includes application in veterinary care situations, such as for livestock monitoring. Applicants may also consider the development of technologies to identify the origin of invasive pests and diseases or to contribute towards protection from emerging infectious diseases.

¹² <https://www.agriculture.gov.au/abares/products/insights/snapshot-of-australian-agriculture>

¹³ <https://www.csiro.au/en/news/all/news/2023/september/expert-commentary-invasive-alien-species>.

¹⁴ <https://www.agriculture.gov.au/abares/research-topics/biosecurity/biosecurity-economics/cost-of-established-pest-animals-and-weeds-to-australian-agricultural-producers>.

¹⁵ <https://www.qubic.au/about/>.

¹⁶ <https://www.sciencedirect.com/science/article/abs/pii/S0168169924000711>.

¹⁷ https://www.researchgate.net/publication/369214186_Pest_Localization_Using_YOLOv5_and_Classification_Base_d_on_Quantum_Convolutional_Network.

This challenge also applies to biosecurity for cargo inspection processes. Applicants are encouraged to discover how quantum can optimise the detection of biosecurity threats and anomalies, improve the speed of inspections and enhance overall cargo security measures. These improvements could assist in the movement of goods into and out of Australia, but also within Australia and into remote, isolated and pristine locations.

Working with First Nations peoples

If your project involves working directly with First Nations peoples or will impact the lives of First Nations peoples, your work should be based on genuine engagement that leads to **co-design, co-development, informed consent** and **mutual decision making**.

Please refer to the section ‘Guidance for Inclusion of First Nations peoples in the Critical Technologies Challenge Program’ on pages 15 – 19 for further information.

What is the relevance of the challenge to industry?

- **Enhanced biosecurity:** enabling real-time, high sensitivity screening for invasive pests, diseases, and contaminants – and reducing time and resources expended on removal and remediation of non-native pests, weeds and diseases.
- **Enhanced food safety:** real-time detection of invasive pests and diseases within agricultural products may reduce the instances of spoilage and contamination, ensuring contaminated goods are identified before they enter the supply chain.
- **Lower costs and increased efficiency:** leading to cost savings for farmers and producers, by shortening inspection timelines, reducing the need for extensive manual testing and minimising contamination risk.
- **Ease of regulatory compliance:** producers can more easily comply with biosecurity and food safety standards and adhere to quarantine requirements.
- **Improved processing and quarantine compliance timeframes.**

Please note that the possible solutions and expected benefits listed below are provided as suggestions. Certain suggestions may be more ambitious than others. Applicants should not feel limited to the suggestions listed below and are encouraged to present other innovative solutions which address the challenge.

Possible solution elements may include:

- **Quantum sensing for contaminant detection** – development of quantum sensors capable of detecting invasive pests or diseases in agricultural, meat or fisheries products.
- **Quantum imaging for pest and spoilage detection** – implementation of quantum imaging techniques for the detection of invasive pests or diseases, and other visual irregularities – enhancing the speed and accuracy of identifying contaminants.
- **Real-time quantum scanning systems** – development of technology to allow immediate detection of invasive pests and diseases.
- **Efficient quantum inspection techniques** – acceleration of cargo inspection process, ensuring a faster and more streamlined approach.
- **Enhanced cargo security measures** – bolstered cargo security, addressing vulnerabilities and ensuring the integrity of goods during transit.
- **Portable quantum detection devices** – development of portable or handheld devices using quantum sensing technologies which can be used in a point-and-shoot fashion as an alternative to human inspection.

Expected benefits:

- **Advanced contaminant detection** – development of capacity to rapidly identify invasive pests or diseases present in products.
- **Reduction in product loss and waste** – increased potential for swift identification and intervention prevents a spread of issues, which minimises the impact on product quality and quantity.
- **Improved food security** – increased ability to detect invasive pests or diseases will facilitate interventions to ensure the safety of remaining stock.
- **Improved anomaly detection** – improved accuracy of detection and enhanced security measures, reducing the risk of anomalies going undetected.
- **Faster and more efficient inspections** – streamlined inspection processes, reducing delays, improving overall operational efficiency and reducing costs.
- **Enhanced cargo security measures** – ability to address vulnerabilities and ensure the integrity of goods during transit, reducing the likelihood of tampering or unauthorised access.
- **Minimised transportation delays** – optimised inspections resulting in quicker shipment clearance.
- **Improved detection of biosecurity threats** – enhanced accuracy and efficiency of processes used to detect biosecurity threats such as invasive species, pests and diseases in shipments.
- **Faster identification of quarantine risks** – improved ability to identify and inspect quarantine risks, reducing delays in clearing shipments at border control points.

Intended technology end users or customers may include:

- Agricultural operators.
- Cargo inspection organisations.
- Aquaculture operators.
- Logistics professionals.
- Large retailers and providers.
- Veterinary practices.
- Scientific instrument developers and manufacturers.
- Airport and flight quarantine officials

The policies and strategies listed below are provided for awareness of how this challenge aligns with broader government policy. Applicants should refer to relevant national priorities, but do not need to address all of these within their application.

National policies and strategies that align with this challenge include:

National strategy, plan, or policy	Areas of alignment with this challenge
National Reconstruction Fund Priorities	Priority 2: Value-add in the agriculture, forestry, and fisheries sectors Priority 6: Defence capability
National Science and Research Priorities	Priority 5: Building a secure and resilient nation
Critical Technologies in the National Interest	Advanced information and communication technologies Quantum technologies Autonomous systems, robotics, positioning, timing, and sensing
CSIRO Megatrends	Leaner, cleaner, and greener Diving into digital
National Research Infrastructure Roadmap	Frontier technologies and modern manufacturing
2023 – 2030 Cyber Security Strategy	Strong businesses and citizens
National Biosecurity Strategy	Adaptability and capacity Connected, efficient and science-based systems
Australia's Strategy for Nature	Tackling the impact of invasive feral species
Australian Centre for Disease Preparedness	Protection from emerging infectious disease threats
Growing Australia Together	Strengthen biosecurity to provide risk-based approaches and appropriate protection to Australia
Future Made in Australia	Net Zero Transformation Stream Economic Resilience and Security Stream
2023-33 National Agriculture Traceability Strategy	Modern national traceability system
Northern Australia Quarantine Strategy	Develop and implement measures for the early detection of targeted risk species Manage the biosecurity aspects of movements through the Torres Strait risk pathway
Northern Australia Biosecurity Strategy	Aims to improve the consistency of the biosecurity system across northern Australia by setting a framework to facilitate cross-jurisdictional collaboration on biosecurity

National strategy, plan, or policy	Areas of alignment with this challenge
NIAA Indigenous Rangers Program	Assists First Nations people in managing Country according to Traditional Owners' objectives

The programs listed below are provided for awareness. Applicants do not need to address these programs within their application.

National programs that align with this challenge include:

[Developing Northern Australia CRC](#) – \$75 million (2017 – 2027).

[High Performance Soils CRC](#) – \$39.5 million (2017 – 2027).

[Food Agility CRC](#) – \$50 million (2017 – 2027).

[Fight Food Waste CRC](#) – \$30 million (2018 – 2028).

[Future Food Systems CRC](#) – \$35 million (2019 – 2029).

[Blue Economy CRC](#) – \$70 million (2019 – 2029).

[CRC Projects selection round outcomes](#) – on-farm detection platform; mastitis-causing pathogens in dairy cattle (2020).

[Digital Finance CRC](#) – \$60 million (2021 – 2031).

[CRC-P Program](#) – next generation sensor for rapid detection of biosecurity threats & disease – October 2022.

[CRC-P Program](#) – measuring meat quality to improve Australia's sheep meat industry – July 2021.

[Solving Antimicrobial Resistance in Agribusiness, Food and Environments CRC](#) – \$34.5 million (2022 – 2032).

[CRC Projects selection round outcomes](#) – integrating quantum tech into space manufacturing for defence & agriculture (2022).

International initiatives that align with this challenge include:

Switzerland [Geneva Science and Diplomacy Anticipator](#) (GESDA) – the [Open Quantum Institute](#) (OQI) three-year CERN-based pilot will build on the efforts to date to help unleash the full power of quantum computing for the benefit of all (2024).

USA National Science Foundation Convergence Accelerator – [NourishNet – a Food Recovery Toolbox](#) awarded a grant to develop a product that uses quantum sensing technology to detect food spoilage (2022).¹⁸

¹⁸ <https://today.umd.edu/a-spoilage-sniffing-sensor-and-food-distribution-app-to-fight-hunger>.

Challenge 2

Improve life expectancy, health outcomes and access to health technology for First Nations peoples

Challenge Overview

The Challenge

This challenge aims to improve health outcomes for First Nations people by improving the ability to identify, treat and prevent health conditions that disproportionately impact First Nations peoples and improving access to health technologies in rural and remote Australia¹⁹. It aligns with the **National Agreement** and **Closing the Gap target 1: Everybody enjoys long and healthy lives.**²⁰

Accordingly, this challenge seeks to harness the capabilities of quantum technology to advance the field of medical imaging and sensing, focusing on health conditions which disproportionately impact First Nations peoples. It may also provide solutions which increase the availability of and access to health diagnostic and treatment technology in rural and remote communities.

Innovative solutions may include quantum-based approaches that advance or surpass classical methods, offering breakthroughs in capabilities such as resolution, speed, sensitivity, and real-time data collection whilst clearly addressing specific health priorities and accessibility issues which impact First Nations peoples. Areas of interest may include, **but are not limited to**, the development of technologies that assist in medical diagnoses, molecule identification/interaction, improved sensitivity, improved portability of equipment and improved timing mechanisms.

Accessibility

First Nations peoples face barriers to accessing health services compared with non-Indigenous Australians. These barriers include a lack of service availability (especially for people living in remote areas), services being too far away, lack of transport, cost, waiting times, and the availability of culturally safe and responsive health services.²¹

Health care is considered ‘accessible’ when it is available at the right place and time, taking account of different population needs and the affordability of care. Access to culturally appropriate, high-quality and timely health care throughout life is essential for improving health outcomes for First Nations peoples.²²

Health outcomes

Difficulty in access contributes to diminished health outcomes for First Nations peoples. Australia’s First Nations populations overall have higher rates of chronic diseases, such as cancer, diabetes, cardiovascular disease, and kidney disease, which significantly impact life expectancy.²³ For example, First Nations peoples are 4 times more likely to die from Chronic Kidney Disease (CKD) than non-

¹⁹ Australian Institute of Health and Welfare, [Rural and remote Australians – Links & other information](#) [website], 2023, accessed 28 October 2024.

²⁰ Closing the Gap, [Closing the Gap targets and outcomes](#) [website], n.d., accessed 28 October 2024.

²¹ Australian Institute of Health and Welfare (2024) [First Nations people and the health system](#), AIHW, Australian Government, accessed 28 October 2024.

²² Australian Institute of Health and Welfare and National Indigenous Australians Agency, [3.14 Access to services compared with need](#), indigenoushpf.gov.au, n.d., accessed 28 October 2024.

²³ Productivity Commission, [Aboriginal and Torres Strait Islander people enjoy long and healthy lives - Dashboard](#) [website], n.d., accessed 28 October 2024.

indigenous Australians.²⁴ Additionally, First Nations peoples have a greater burden of disease for many health conditions (including CKD) compared with non-indigenous Australians.²⁵ Chronic conditions pose a significant health burden on the individual, their community and society, and often require ongoing management that can have a profound impact on individuals' quality of life.

These diminished health outcomes impact the ability for long and healthy lives to be enjoyed by First Nations peoples. For example, between 2020 and 2022, the life expectancy for First Nations males was 71.9 years, compared to 80.6 years for non-First Nations males, resulting in a gap of 8.8 years. For First Nations females, the life expectancy was 75.6 years, while for non-First Nations females, it was 83.8 years - resulting in a gap of 8.2 years.

In general, life expectancy is lower in remote areas, with First Nations males and females living in major cities expected to live around 5 years longer than those living in remote and very remote areas.^{26 27} In general, the population in remote areas has a higher proportion of First Nations peoples.²⁸

Accordingly, applicants will consider how they can harness the capabilities of quantum technology to revolutionise the fields of medical imaging and sensing and advance the diagnosis and treatment of health conditions which disproportionately impact First Nations peoples whilst ensuring improved access to the technologies in rural and remote communities.

Possible outcomes

Quantum technology offers benefits for the whole of the Australian community, but solutions to this challenge must clearly demonstrate opportunities and outcomes for First Nations peoples, services and businesses. Solutions must drive advancements or accessibility improvements in health services, personalised medicine and health solutions tailored with a focus on addressing access limitations and conditions which disproportionately impact First Nations peoples.

New technologies, including those that can lead to earlier detection of disease, have the potential to reduce the mortality rates for chronic health conditions. Solutions to this challenge may therefore include technology that improves the ability to detect, treat and prevent health conditions which are experienced by First Nations peoples to a greater degree.

Factors such as lower socioeconomic status and limited access to quality healthcare also contribute to the health disparities between Indigenous and non-Indigenous Australians.²⁹ Accordingly, applicants may also consider how portability and affordability of medical equipment can be enhanced through quantum technologies, to ensure that their proposed solution is more accessible by First Nations peoples.

Working with First Nations peoples

If your project involves working directly with First Nations peoples or will impact the lives of First Nations peoples, your work should be based on genuine engagement that leads to **co-design, co-development, informed consent** and **mutual decision making**.

Please refer to the section 'Guidance for Inclusion of First Nations peoples in the Critical Technologies Challenge Program' on pages 15 – 19 for further information.

²⁴ Australian Institute of Health and Welfare, [Chronic kidney disease in Aboriginal and Torres Strait Islander people](#) 2011, AIHW, Australian Government, accessed 5 November 2024.

²⁵ Australian Institute of Health and Welfare, [Chronic kidney disease in Aboriginal and Torres Strait Islander people](#) 2011, AIHW, Australian Government, accessed 5 November 2024.

²⁶ Productivity Commission, [Aboriginal and Torres Strait Islander people enjoy long and healthy lives - Dashboard](#) [website], n.d., accessed 28 October 2024.

²⁷ Australian Institute of Health and Welfare (2024) [Health and wellbeing of First Nations people](#), AIHW, Australian Government, accessed 28 October 2024.

²⁸ Baxter, J., Hayes, A., & Gray, M. (2011). Families in regional, rural and remote Australia (Facts Sheet). Melbourne: Australian Institute of Family Studies, accessed 28 October 2024.

²⁹ Productivity Commission, [Rates of accessing/utilisation of health services](#) [website], n.d., accessed 28 October 2024.

What is the relevance of the challenge to industry?

- Reduction in size and cost, or increases in the portability of medical imaging devices, allowing transportation to previously inaccessible locations and markets.³⁰
- Potential for improvements in performance over classical systems can lead to better resolution and more precise images, which is especially crucial for diagnosing conditions at early stages.³¹
- Potential for real time diagnosis and treatment guidance, enabling earlier disease detection and personalised treatment plans based on continuous monitoring.³²
- Increased accuracy of imaging devices that could lead to faster, cheaper and more accurate diagnosis of certain tumours, for example, at a molecular level.³³
- Economic opportunities for First Nations businesses to be included as end-users and suppliers.

Please note that the possible solutions and expected benefits listed below are provided as suggestions. Applicants are encouraged to present other innovative solutions which address the challenge. These solutions will potentially benefit the whole Australian community. Your solution **must** be clearly targeted to benefiting the health of First Nations peoples.

Possible solution elements may include:

- **Quantum enhanced imaging techniques** – improve traditional imaging modalities (e.g., MRI, CT, PET, OPM³⁴) with increased resolution, reduced scan time and enhanced contrast.
- **Quantum sensing for biomedical applications** – sensing for biomarker detection, disease monitoring, real time neurological measurements, improving on classical technologies.
- **Quantum health monitoring** - using quantum sensors for highly sensitive health monitoring, enabling early detection of diseases and health issues prevalent among First Nations people.
- **Quantum enhanced diagnostics tools** – develop quantum sensors for early detection of diseases such as diabetes, cardiovascular conditions, and cancers.
- **Portable quantum health devices** – create portable health monitoring devices using quantum sensing technologies that can be deployed in rural and remote communities to perform routine health checks and detect anomalies early.
- **Telehealth and Quantum Telemedicine Network** – develop telehealth platforms and a quantum-secure telemedicine network to provide continuous, real-time health support to First Nations communities, particularly in remote areas. These systems can facilitate virtual consultations, remote diagnosis, follow-up care, and ensure access to specialist care regardless of geographical location. This approach addresses the issue of limited healthcare access for First Nations peoples due to transportation challenges.
- **Quantum-assisted healthcare logistics** –

³⁰ Senate Community Affairs Committee Secretariat (2018), [Availability and accessibility of diagnostic imaging equipment around Australia](#), Parliament of Australia, Australian Government, accessed 28 October 2024.

³¹ Shams M, Choudhari J, Reyes K, Prentzas S, Gapizov A, Shehryar A, Affaf M, Grezenko H, Gasim RW, Mohsin SN, Rehman A, Rehman S. *The Quantum-Medical Nexus: Understanding the Impact of Quantum Technologies on Healthcare*. Cureus. 2023 Oct 31;15(10):e48077. doi: 10.7759/cureus.48077. PMID: 38046499; PMCID: PMC10689891, accessed 28 October 2024.

³² Swayne M, 'Quantum Technologies Could Provide Oncologists Powerful Tools to Research, Treat Cancer, Scientists Say', The Quantum Insider, 22 May 2024, accessed 28 October 2024.

³³ Trounson A, 'Quantum boost for medical imaging', University of Melbourne, 29 March 2018, accessed 28 October 2024.

³⁴ Brookes, M.J., Leggett, J., Rea, M., Hill, R.M., Holmes, N., Boto, E. and Bowtell, R., 2022. Magnetoencephalography with optically pumped magnetometers (OPM-MEG): the next generation of functional neuroimaging. [Trends in Neurosciences](#).

- Optimising healthcare logistics and resource allocation using quantum optimisation algorithms, ensuring efficient distribution of medical supplies and personnel to remote communities.
- Implementing quantum enhanced GPS technologies for accurate navigation of medical transport vehicles in remote and rural areas, reducing response times for emergency medical services.
- **Quantum biomarker discovery** – develop quantum enhanced sensors for real-time monitoring of biomarkers in clinical settings, enabling early detection of health risks and personalised interventions.
- **Remote monitoring devices** – develop wearable health monitoring devices that track and analyse health metrics, allowing early detection of potential health issues and timely intervention.

Expected benefits:

These benefits will potentially apply to the broader Australian community, however applicants must demonstrate how their project will ensure First Nations peoples and communities are major beneficiaries.

- **Improved health outcomes** – increased life expectancy of First Nations peoples through the provision of advanced diagnosis, therapeutic and preventative services using cutting edge quantum technologies.
- **Enhanced medical imaging and disease detection**³⁵ – higher resolutions, faster scans, and improved diagnostic accuracy and precision. This enables earlier disease detection, reduces strain on the medical system, and allows for rapid analysis of imaging and sensing data for quicker diagnosis and timely decision-making.
- **Streamlined imaging practices** – reduce the need for patients, particularly children, to remain still for extended periods during scans, leading to increased accuracy and shorter consultation durations.
- **Improved patient outcomes** – accurate and timely diagnostics, facilitating tailored, well informed treatment plans for improved patient outcomes.
- **Precise treatment plans** – ability to implement medical treatments personalised to individual patients, optimising effectiveness, and minimising side effects.

Intended technology end users or customers may include:

- Indigenous health services – Aboriginal Community Controlled Health Organisations (ACCHOs) and other community-controlled health organisations.
- Rural and remote healthcare providers.
- Australian Non-Government Organisations (NGOs) delivering health programs in rural and remote communities.
- Medical technology and device developers and manufacturers.
- Medical staff and medical service providers.
- Royal Flying Doctors or other mobile remote area services.
- First Nations peoples.

³⁵ <https://dellmed.utexas.edu/news/new-quantum-sensing-center-aims-to-transform-disease-diagnostics-and-prevention>.

The policies and strategies listed below are provided for awareness of how this challenge aligns with broader government policy. Applicants should refer to relevant national priorities, but do not need to address all of these within their application.

National policies and strategies that align with this challenge include:

National strategy, plan, or policy	Areas of alignment with this challenge
Closing the Gap	Target 1: Everyone enjoys long and healthy lives Target 2: Children are born healthy and strong Target 4: Children thrive in their early years
National Aboriginal and Torres Strait Islander Health Plan 2021–2031	Improving the health system Focusing on prevention
National Reconstruction Fund Priorities	Priority 4: Medical science Priority 6: Enabling capabilities
Australia’s National Science and Research Priorities	Priority 2: Supporting healthy and thriving communities Priority 3: Elevating Aboriginal and Torres Strait Islander knowledge systems
Critical Technologies Statement	Solving national challenges here in Australia – Healthy ageing
List of Critical Technologies in the National Interest	Biotechnologies Quantum technologies
CSIRO Megatrends	The escalating health imperative
National Research Infrastructure Roadmap	Medical products Frontier technologies and modern manufacturing
2023 – 2030 Cyber Security Strategy	Strong businesses and citizens

The programs listed below are provided for awareness. Applicants do not need to address these programs within their application.

National programs that align with this challenge include:

[Digital Health CRC](#) – \$55 million (2018–2025).

[CRC Projects selection round outcomes](#) – Nanoparticle manufacturing and its application in brain cancer radiotherapy (2022).

[CRC Projects selection round outcomes](#) – AI-based Portable Digital Slit-lamp for Anterior Segment Eye Diseases (2023).

[Allied Health in Remote Schools Project](#) – \$1 million – This project aims to improve education participation and outcomes for vulnerable Aboriginal and Torres Strait Islander children through providing specialised allied health services and health screening in schools (2023).

[ARC Centre of Excellence for Nanoscale Bio Photonics](#) – \$29 million – This explores nanoscale interactions between light and matter (2014–2020).

International initiatives that align with this challenge include:

Canada³⁶ [Internet of Things: Quantum Sensors](#) (2021)

- Advanced quantum sensor for reliable adult neuromonitoring
- Photons in the brain: Imaging biophotons with quantum detectors
- Quantum bio-sensing for next generation health diagnostics.

US [Quantum Sensing Challenges for Transformational Advances in Quantum Systems](#) (2022).

UK [Using optically pumped magnetometers \(OPMs\) and magnetoencephalography \(MEG\) to create wearable brain scanner OPM-MEG system to improve epilepsy diagnosis and treatment](#) (2023).

UK [Quantum Strategy Mission number 3](#) – By 2030, every NHS Trust will benefit from quantum sensing-enabled solutions, helping those with chronic illness live healthier, longer lives through early diagnosis and treatment (2023).

UK [Quantum Strategy Mission number 5](#) – By 2030, mobile, networked quantum sensors will have unlocked new situational awareness capabilities, exploited across critical infrastructure in the transport, telecoms, energy, and defence sectors (2023).

Switzerland [Geneva Science and Diplomacy Anticipator](#) (GESDA) – The [Open Quantum Institute](#) (OQI) three-year CERN-based pilot will build on the efforts to date to help unleash the full power of quantum computing for the benefit of all (2024).

Other initiatives that align with this challenge

[QLD Quantum 2032 Challenge outcomes](#)³⁷ - Queensland Government. Examples of quantum health products include:

- Revolutionising iron deficiency detection through development of scalable commercial products and services by advancing quantum sensors for the ultrasensitive measurement of iron.
- Quantum concussion diagnostics through development of low-cost portable quantum magnetoencephalography (MEG), facilitating MEG availability in rural and remote communities, doctors offices and imaging centres.

³⁶ <https://nrc.canada.ca/en/research-development/research-collaboration/programs/funded-collaborative-rd-programs-initiatives>.

³⁷ <https://science.desi.qld.gov.au/industry/quantum/programs/grant-recipients#q2032:~:text=The%20%E2%80%98Strike%20While,by%20iron%20deficiency>.

Challenge 3

Optimise transport routes, logistics and supply chain operations

Challenge Overview

This challenge aims to develop and implement quantum technology solutions to optimise transport routes, logistics and supply chain operations. The Australian Bureau of Statistics found, in June 2022, that approximately 41% of Australian businesses reported experiencing supply chain disruptions. These disruptions include issues such as domestic and international delivery delays, supply constraints and increased transportation costs.^{38 39}

Rural and remote areas, including many First Nations communities, often face higher transportation costs and longer delivery times due to their isolation. This impacts the affordability and availability of goods and services, especially during disaster events.^{40 41}

Optimisation may involve new technologies that support cost reduction, cold chain logistics, emissions reduction, improved route planning, enhanced inventory management, supply chain optimisation and improved access to goods and services.

Supply chain optimisation may also include enhancing importation and exportation practices at Australian ports. This challenge allows for the application of quantum technologies to transform cargo inspection practices. Applicants are encouraged to consider how quantum can improve the planning and speed of inspection operations and increase efficiency of cargo processing including non-intrusive inspection methods and sensing applications that are currently dominated by x-ray technologies.

Applicants are also encouraged to explore opportunities to redesign traditional logistics strategies to achieve greater efficiencies including decarbonisation and strengthening of sovereign supply chains. Solutions may also deliver improvements in existing logistics and transportation routes for rural and remote communities.

Applicants are not limited to Earth-based technologies and may leverage sensing technology that could be deployed on satellites including Low Earth Orbit Satellites. Applicants are also encouraged to consider different scenarios including disaster preparedness that might affect transport routes, logistics and supply chains.

Working with First Nations peoples

If your project involves working directly with First Nations peoples or will impact the lives of First Nations peoples, your work should be based on genuine engagement that leads to **co-design, co-development, informed consent** and **mutual decision making**.

Please refer to the section ‘Guidance for Inclusion of First Nations peoples in the Critical Technologies Challenge Program’ on pages 15 – 19 for further information.

³⁸ <https://www.abs.gov.au/statistics/economy/business-indicators/business-conditions-and-sentiments/latest-release>.

³⁹ <https://www.abs.gov.au/media-centre/media-releases/less-businesses-supply-disruptions>.

⁴⁰ <https://www.infrastructureaustralia.gov.au/2021-australian-infrastructure-plan-implementation-and-progress/recommendation-4.2>.

⁴¹ <https://www.apec.org.au/remote-areas-development>.

What is the relevance of the challenge to industry?

- Efficient distribution systems decrease costs associated with supply of goods (time, fuel, environmental impacts).⁴²
- Reduced service and distribution costs may increase access to rural and remote customers and communities.⁴³
- Reduction in costs associated with asset loss, delivery delays and spoilage.
- Improved security and reductions in insurance premiums through enhanced accuracy and efficiency (for example, real time tracking of shipments, vehicles, and assets).
- Improved disaster preparedness capability.
- Optimised transport routes, logistics and supply chain operations will support decarbonisation efforts.

Please note that the possible solutions and expected benefits listed below are provided as suggestions. Certain suggestions may be more ambitious than others. Applicants should not feel limited to the suggestions listed below and are encouraged to present other innovative solutions which address the challenge.

Possible solution elements may include:

- **Enhanced route planning** – optimised forecasting and route planning in response to real time traffic conditions resulting in improvements in delivery time and fuel efficiency. This may include solutions that harness quantum-enabled communications systems.
- **Supply chain optimisation** - optimised end-to-end supply chain logistics and operations to improve efficiency, effectiveness and performance. This may involve addressing challenges related to global supply and distribution, demand forecasting, and integrating elements from external subsectors into the supply chain.
- **Navigation and routing** – quantum enhanced satellite-based navigation systems may provide accurate positioning and navigation services for vehicles and shipments. Quantum enhanced Global Positioning Systems (GPS) and Global Navigation Satellite Systems (GNSS) could potentially optimise routing decisions based on real time satellite data, minimising transit times, fuel consumption and environment impact.
- **Improved inspection techniques** – acceleration of cargo inspection process, ensuring a faster and more streamlined approach, reducing losses due to spoilage.

Expected benefits:

- **Cost reduction and improved resource management** – potential to reduce costs associated with fuel, labour, and inventory holdings by optimising routes and minimising overstock.
- **Enhanced supply chain responsiveness** – improved responsiveness to demand fluctuations, enabling more agile and adaptive supply chain management.
- **Enhanced supply chain resilience** – quantum driven logistics have the potential to contribute to building resilient supply chains that could better withstand disruptions, ensuring continuous flow of essential goods to rural and remote areas, and during adverse weather events or natural disasters.

⁴² <https://aifs.gov.au/resources/policy-and-practice-papers/relationship-between-transport-and-disadvantage-australia>.

⁴³ <https://www.infrastructureaustralia.gov.au/listing/speech/challenges-and-opportunities-regional-infrastructure-investment>.

- **Reduced environmental impact** – optimised route planning, leading to more fuel-efficient transportation, reduced carbon footprint and promotion of environmentally sustainable logistics practices.
- **Optimised inventory management** – minimised delays, reduced holding costs, and improved overall inventory management, ensuring goods are delivered efficiently and at the right time.
- **Equitable distribution of resources** – contribute to more equitable distribution of resources, ensuring remote and under-served communities have access to essential goods and services.
- **Enhanced cargo security measures** – ability to address vulnerabilities and ensure the integrity of goods during transit, reducing the likelihood of tampering or unauthorised access. Identification of illicit or contraband substances (including precursor drugs) may also be supported by new technologies.

Intended technology end users or customers may include:

- Logistics companies.
- Transportation professionals.
- Importers and exporters.
- Large wholesalers and retailers.
- Communications equipment manufacturers and providers.

The programs listed below are provided for awareness of national priorities. Applicants should refer to relevant national priorities, but do not need to address all of these within their application.

National policies and strategies that align with this challenge include:

National strategy, plan, or policy	Areas of alignment with this challenge
Closing the Gap	Target 8: Strong economic participation and development of First Nations people and communities Target 17: People have access to information on and services enabling participation in informed decision-making regarding their own lives
National Reconstruction Fund Priorities	Priority 2: Value-add in the agriculture, forestry, and fisheries sectors Priority 3: Transport Priority 5: Renewables and low emissions
National Science and Research Priorities	Priority 5: Building a secure and resilient nation
Critical Technologies Statement	Solving national challenges here in Australia – Manufacturing
List of Critical Technologies in the National Interest	Advanced information and communication technologies Quantum technologies Autonomous systems, robotics, positioning, timing, and sensing

National strategy, plan, or policy	Areas of alignment with this challenge
CSIRO Megatrends	Increasingly autonomous Diving into digital
National Research Infrastructure Roadmap	Frontier Technologies and Modern Manufacturing
Net Zero plan	Industry
National Disaster Risk Reduction Framework	Built environment
Vulnerable supply chains report	Includes a framework to identify supply chains that are vulnerable to disruption
National Biosecurity Strategy	Integration supported by technology, research and data
Australia's Long-Term Emissions Reduction Plan	National Research Infrastructure Roadmap
Future Made in Australia	Net Zero transformation stream Economic resilience and security stream
2023 – 2030 Cyber Security Strategy	Strong businesses and citizens

The programs listed below are provided for awareness. Applicants do not need to address these programs within their application.

National programs that align with this challenge include:

[iMove CRC](#) – \$55 million – (2017 – 2027).

[Developing Northern Australia CRC](#) – \$75 million (2017 – 2027).

[CRC Projects selection round outcomes](#) – live Inbound Milk Supply Chain Monitoring and Logistics for Productivity and Competitiveness (2019).

[Heavy Industry Low-carbon Transition \(HILT\) CRC](#) – \$39 million (2021 – 2031).

[CRC Projects selection round outcomes](#) – integrated CO2 Capture–Electrolysis for Production of Renewable Methanol (2022).

[CRC Projects selection round outcomes](#) – a novel and sustainable lift technology for low-emission gas production – (2023).

International initiatives that align with this challenge include:

UK [Quantum Strategy Mission number 4](#) – by 2030, quantum navigation systems, including clocks, will be deployed on aircraft, providing next-generation accuracy for resilience that is independent of satellite signals (2023).

UK [Quantum Strategy Mission number 5](#) – by 2030, mobile, networked quantum sensors will have unlocked new situational awareness capabilities, exploited across critical infrastructure in the transport, telecoms, energy, and defence sectors (2023).

Other initiatives that align with this challenge

[QLD Quantum 2032 Challenge outcomes](#) - Queensland Government, quantum optimisation of transport and logistics for Brisbane 2032 (2024).

Challenge 4

Optimise the performance, sustainability, and security of energy networks

Challenge Overview

This challenge aims to leverage quantum technologies to enhance the performance, sustainability, and security of Australia's energy networks. The challenge will focus on the integration of renewables into both new and existing energy networks, improving the efficiency, reliability, and security of the energy infrastructure.^{44 45}

In the 2022-23 period, the energy sector accounted for approximately 85% of Australia's net emissions, with electricity being a significant contributor, responsible for about one-third of that amount. In parallel, the National Electricity Market has acknowledged the rise in electricity prices and anticipates further increases.

Quantum technologies provide a unique opportunity to address these issues by improving energy network management. The integration of renewable energy into Australia's energy grid can enhance efficiency, lower emissions, and reduce energy costs. This challenge will explore solutions that ensure the resilience and security of energy networks while contributing to reducing energy costs for Australian households and businesses.

Working with First Nations peoples

If your project involves working directly with First Nations peoples or will impact the lives of First Nations peoples, your work should be based on genuine engagement that leads to **co-design, co-development, informed consent** and **mutual decision making**.

Please refer to the section 'Guidance for Inclusion of First Nations peoples in the Critical Technologies Challenge Program' in the on pages 15 – 19 for further information.

What is the relevance of the challenge to industry?

- Management and optimisation of a changing, increasingly decentralised electricity network.⁴⁶
- Supports businesses to meet emission targets and Australia's goals of becoming a renewable energy superpower, while addressing environmental, social and governance related issues.
- Increased security and reliability of critical infrastructure and critical energy supply chains.⁴⁷
- More effective emergency management responses to catastrophic events.

⁴⁴ <https://consult.dcceew.gov.au/electricity-and-energy-sector-plan-discussion-paper>

⁴⁵ <https://www.dcceew.gov.au/climate-change/publications/australias-emissions-projections-2023#:~:text=Australia%27s%20emissions%20trends&text=Between%202023%20and%202035%2C%20emissions,82%25%20national%20renewable%20electricity%20target>

⁴⁶ <https://www.energynetworks.com.au/resources/reports/electricity-network-transformation-roadmap-final-report/>

⁴⁷ <https://www.cisc.gov.au/legislation-regulation-and-compliance/soci-act-2018#:~:text=Critical%20infrastructure%20is%20interconnected&text=This%20can%20affect%20our%20security,supply%20of%20food%20and%20groceries>

- Reduce associated energy costs.
- Better access to reliable and cost-effective energy solutions in rural and remote areas.

Please note that the possible solutions and expected benefits listed below are provided as suggestions. Certain suggestions may be more ambitious than others. Applicants should not feel limited to the suggestions listed below and are encouraged to present other innovative solutions which address the challenge.

Possible solution elements may include:

- **Load balancing** – quantum algorithms to optimise power loads across energy networks.
- **Fault detection and correction** – rapid detection, reporting and correction of faults in energy networks.
- **Enhanced timing for synchronisation** – uses quantum properties to achieve highly precise timing, enabling optimal coordination of events in energy networks.

Expected benefits:

- **Improved energy network efficiency** – optimise load distribution, reduce energy cost, and reduce wastage.
- **Enhanced energy network resilience** – minimise downtime, increase access to energy, improve reliability and increase sustainability of communications infrastructure.
- **Reduction in energy costs** – improved cost of doing business and reduced cost of living.
- **Enhanced integration of renewable energy sources and ability to meet emissions targets in key markets.**
- **Better access to reliable and cost-effective energy solutions for rural and remote customers.**

Intended technology end users or customers may include:

- [Australian Energy Market Operator \(AEMO\)](#) - (Western Australia and the Northern Territory are not connected to the National Energy Market).
- Energy providers.
- Mining and resources.
- Data centres including communications providers.

The policies and strategies listed below are provided for awareness of how this challenge aligns with broader government policy. Applicants should refer to relevant national priorities, but do not need to address all of these within their application.

National policies and strategies that align with this challenge include:

National strategy, plan, or policy	Areas of alignment with this challenge
National Reconstruction Fund	Priority 5: Renewables and low emission technologies Priority 7: Enabling capabilities

National strategy, plan, or policy	Areas of alignment with this challenge
Australia's National Science and Research Priorities	Priority 1: Transitioning to a Net Zero future Priority 5: Building a secure and resilient nation
Critical Technologies Statement	Solving national challenges here in Australia – Emissions reduction
List of Critical Technologies in the National Interest	Quantum technologies Clean energy generation and storage technologies
Net Zero Plan	Electricity and energy Industry
First Nations Clean Energy Strategy	Key priority under the National Energy Transformation Partnership.
National Disaster Risk Reduction Framework	Built environment
Powering Australia	National energy transformation partnership
Australia's Long-Term Emissions Reduction Plan	Achieve Net Zero emissions by 2050
National Research Infrastructure Roadmap	Recycling and clean energy Environment and climate Frontier technologies and modern manufacturing
CSIRO Megatrends	Leaner, cleaner, and greener Adapting to climate change
Critical minerals strategy 2023 – 2030	Use our critical minerals to help Australia become a renewable energy superpower
Future Made in Australia	Net Zero transformation stream Economic resilience and security stream
2023 – 2030 Cyber Security Strategy	Strong businesses and citizens

The programs listed below are provided for awareness. Applicants do not need to address these programs within their application.

National programs that align with this challenge include:

[Future Battery Industries CRC](#) – \$25 million (2019 – 2025).

[Blue Economy CRC](#) – \$70 million (2019 – 2029).

[Future Energy Exports CRC](#) – \$40 million (2020 – 2030).

[Heavy Industry Low-carbon Transition \(HILT\) CRC](#) – \$39 million (2021 – 2031).

[Marine Bioproducts CRC](#) – \$59 million (2021 – 2031).

[Regional Microgrids Program](#) – renewable energy technologies, energy efficiency technologies and electrification technologies (2023).

International initiatives that align with this challenge include:

Switzerland [Geneva Science and Diplomacy Anticipator](#) (GESDA) – the [Open Quantum Institute](#) (OQI) three-year CERN-based pilot will build on the efforts to date to help unleash the full power of quantum computing for the benefit of all (2024).

UK [Quantum Strategy Mission number 5](#) – by 2030, mobile, networked quantum sensors will have unlocked new situational awareness capabilities, exploited across critical infrastructure in the transport, telecoms, energy, and defence sectors (2023).

US [Advanced Scientific Computing Research](#) – for Research on Quantum Networks (2022).