Please note: the substantive content of the 2026 NRI Roadmap Survey begins at Question 20 (with prior questions dealing with administrative and other information).

As such all submissions that are published include the responses submitted from Question 20 onwards only.

Q20.

Part 2: Research themes

2.1 NRI comprises the assets, facilities and associated expertise to support leading-edge research and innovation in Australia and is accessible to publicly and privately funded users across Australia and internationally. We are seeking your input on possible directions for future national-level investment - i.e., where the requirements are of such scale and importance that national-level collaboration and coordination are essential.

The 2021 Roadmap used a challenge framework to support NRI planning and investment. With this in mind, consider likely future research trends in the next 5 - 10 years, and with respect to one or more of the 8 challenge areas identified in the 2021 Roadmap as listed below:

- describe emerging research directions and the associated critical research infrastructure requirements that are either not currently available at all, or not at sufficient scale and
- describe current national infrastructure requirements that you anticipate will no longer fit the definition of NRI in 5-10 years.

Do not limit your commentary to NCRIS funded capabilities.

Q21.

Resources Technology and Critical Minerals Processing

Q22.

Food and Beverage

Q23.
Medical Products

Q24.
Defence

Q25.
Recycling and Clean Energy

Q26.
Space

Q27.
Environment and Climate

Neutron-based characterization techniques are crucial for battery research, offering unique capabilities beyond other methods. Unlike X-rays, which interact with electron clouds, neutrons penetrate deeply and are highly sensitive to light elements like lithium and hydrogen. This makes them ideal for studying battery performance and degradation non-destructively. Neutron techniques enable operando studies by tracking lithium transport, electrolyte distribution, and electrode structural evolution in real-time. They also allow bulk-sensitive investigations of commercial-scale cells. Their isotopic sensitivity supports research on electrolyte decomposition and SEI layer formation, while magnetic neutron scattering aids in understanding transition-metal migration in cathodes—critical for high-energy-density batteries. As battery technology advances and the need for sustainable energy storage grows, neutron-based research will be essential. It provides insights into next-generation lithium-ion batteries, including high-nickel cathodes, silicon-rich anodes, and solid-state electrolytes. Sodium-ion, lithium-sulfur, and multivalent systems also benefit from neutron studies that clarify solvation structures, charge transport, and interfacial reactions. Additionally, neutron techniques help investigate degradation and failure mechanisms, focusing on stress evolution in electrodes, dendrite formation, and gas evolution inside sealed cells. Battery recycling efforts can also be supported through neutron imaging to assess electrode delamination and residual lithium content in spent cells. To leverage these advantages, increasing neutron beamline availability at the Australian Centre for Neutron Scattering (ACNS) is vital. Demand for beamtime exceeds supply, limiting the progress of critical studies. Expanding beamline capacity would enable broader neutron imaging, diffraction, and small-angle neutron scattering (SANS) applications in battery research. Enhanced operando capabilities, including dedicated sample environments for simultaneous electrochemical cycling, temperature control, and gas analysis, would strengthen neutron-based studies. Advanced data processing and AI-driven analysis tools would accelerate the interpretation of large neutron datasets. Strengthening national collaborations between ACNS, Australian universities, industry stakeholders, and international neutron facilities would further enhance research impact. Over the next five to ten years, neutron-based battery research will drive energy storage advancements. Without national investment in neutron infrastructure, Australia risks falling behind in this critical field. Expanding ACNS's neutron beamline capabilities is essential to ensure Australia remains at the forefront of battery innovation, supporting both fundamental discoveries and industry-driven advancements. Coordinated investment is necessary to address future research challenges and leverage neutron science for energy solutions.

Q28.

Frontier Technologies and Modern Manufacturing

Q29.

2.2 The 2024 statement of National Science and Research Priorities (NSRPs) includes outcomes linked to each priority to assist in identifying critical research needed in the next 5 to 10 years.
Consider the priority statements and, with respect to one or more of the 5 priority areas as listed below:

- describe emerging research directions and the associated critical research infrastructure requirements that are either not currently available at all, or
- not at sufficient scale and describe current national infrastructure requirements that you anticipate will no longer fit the definition of NRI in 5-10 years.

Do not limit your commentary to NCRIS funded capabilities, and where relevant, refer to the underpinning outcomes and research identified in the NSRPs document.

Q30.

Transitioning to a net zero future

Q31.

Supporting healthy and thriving communities

Q32.

Elevating Aboriginal and Torres Strait Islanders knowledge systems

Q33.

Protecting and restoring Australia’s environment

Q34.

Building a secure and resilient nation

Q35.

2.3 The case for a new NRI capability, or enhancements to existing capabilities, typically emerges through advocacy from research communities clustering around rigorously identified needs and goals. Such a concept could respond to a requirement for novel or expanded capacity within a domain, or across domains, and must be such that it could only be made available with national-level investment.
If you have identified such a requirement, briefly describe the need, the proposed infrastructure capability, the medium-term goals, impacted research communities, and the timeframe over which you advocate its establishment. Your response can include links to relevant existing reports.

Q36.

Part 3: Industry perspectives

This section is seeking input specifically from industry-based respondents. Other respondents can skip this section.

Recommendation 6 of the 2021 Roadmap related to improvements in industry engagement with NRI. To complement work on this topic that has occurred since then, we are seeking additional advice on NRI requirements as perceived by current or potential industry-based users.

Q37.

3.1 Have you (or your organisation) interreacted with or used Australia's NRI?

- (●) Yes

- ◯ No

Q38.
3.2 If so, please briefly outline the NRI capabilities you (or your organisation) have interacted with or used. Do not limit your response to NCRIS capabilities.

We have used the ACNS infrastructure for several beamtimes.

Q39.
3.3 Please indicate your (one or more) primary reasons for interacting with NRI:

- ☐ For expertise or advice
- ☑ Access to research resources or products
- ☑ Access to equipment for research
- ☐ Access to equipment for operational reasons
- ☐ Help in translating research
- ☐ Access to data
- ☐ Support for clinical trials
- ☐ Other (please specify)

Q40.
3.4 If you answered no, please indicate your (one or more) primary reasons:

This question was not displayed to the respondent.

Q41.
Part 4: Other comments
4.1 Please elaborate on any of your above responses or add any other comments relevant to the development of the 2026 Roadmap. Your response can include reference or links to existing reports that you recommend be considered during the 2026 Roadmap development process.