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

The composition of the atmosphere impacts climate, air quality and the stratospheric ozone layer. Atmospheric measurements of the key gases and aerosols causing these impacts can quantify anthropogenic emissions and the emissions and uptake by natural systems. Suitable networks of ground-based measurements combined with satellite data and surveys from mobile platforms are increasingly being used to quantify emissions across dimensions ranging from facilities to countries. These emissions data are independent and often significantly different to those found from the inventory techniques traditionally used in emissions accounting. An integrated national capability for atmospheric composition monitoring is needed to bring together our world leading capabilities in agencies across the country. Australia has many of the necessary parts of a regional atmospheric monitoring network- ground based and total column monitoring stations from the tropics to the Antarctic, the Kenaook-Cape Grim premier atmospheric facility, the RV Investigator (Marine National Facility), a central calibration laboratory. It has advanced modelling systems to infer emissions from monitoring observations and earth systems models including ACCESS that use these data to predict future states of the carbon cycle, atmospheric chemistry and climate. These are operated by organisations including the CSIRO, Universities, BoM, AAD and ANSTO. An integrated capability would build and operate the infrastructure to significantly improve the spatiotemporal density of these observations in the Australian region needed to quantify regional and global emissions. The national benefit to Australia would be -the first national atmospheric composition observing network, combining capabilities across multiple organisations efficiently and without the short-term funding constraints of individual research groups; -to quantify the emissions of greenhouse gases (carbon dioxide, methane, nitrous oxide and industrial gases), verify mitigation efforts and detect responses of land surfaces and oceans to climate change (for example, emissions from bushfires, carbon uptake by oceans); -to quantify the emissions of gases influenced by climate mitigation and developments in the energy sector (hydrogen, carbon monoxide, carbon dioxide, methane); -to locate and quantify the emissions of methane which emanates from a wide range of sources, including natural gas and agriculture, where mitigation would lead to rapid improvements in atmospheric concentrations as well as potential productivity gains; -a detection system for changes to the uptake of carbon dioxide in the oceans south of Australia, one of the largest sinks of anthropogenic CO2 which is vulnerable to weakening as the planet warms; -to quantify the emissions and atmospheric levels of gases that contribute to destruction of the stratospheric ozone layer which impacts the Australian region and further south to the Antarctic and Southern Ocean.

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

The level of greenhouse gases in the atmosphere will be the ultimate metric of whether net zero is being achieved. Global concentrations should decline after emissions peak globally and fall thereafter as net zero is approached. Concentrations of the main greenhouse gases at a regional to hemispheric and global level can be measured with existing infrastructure assuming it is available and maintained into the future. Isotopes of CO2 (13C and 14C) can be used to partition the emissions causing atmospheric growth. These measurements are mature at several observing sites in the Australian region, but 14C could be improved (frequency, number of locations) and both 13C and 14C must at least be maintained. At a national level, the emissions of greenhouse gases can be determined from atmospheric concentration measurements, combined with atmospheric transport modelling, if a suitable observational network is established. Emissions quantified by atmospheric methods provide an independent estimate to compare with and validate national emissions inventories compiled from book-keeping methods. An observational network to infer national emissions will require many new stations in addition to the ~5 existing in our region. A minimum of 12, together with a central calibration laboratory, is recommended by the National Emissions Monitoring Roadmap (Superpower Institute).

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.

The case for an integrated atmospheric composition observing network has consistently been advocated by the main atmospheric and climate research organisations across Australia over the past 5 years with support from collaborators in our region and across the planet. As well as addressing the growing research and policy demands that an enhanced atmospheric composition monitoring network could answer, it is clear that there would be significant operational efficiencies, continuity of monitoring as well as the versatility to focus on regions and research questions that emerge. The concept reached broad community support with a proposal to NCRIS* through AuScope in 2019/20 which was unsuccessful. Workshops and discussions continue across the research community. To fulfil the needs outlined earlier, quantum increases in the number of observing stations, the capacity of a central development and calibration facility and enhancements in a data management centre would be needed. These would be enabled by the rapid improvements in commercially-available monitoring instruments that are fit for purpose. Installations (monitoring locations, compounds and frequency) would be guided by network design, with examples for Australia already available (see Ziehn et al.). A timeframe of several years to reach the goals outlined above, depending on the resources made available, should be expected. *AuScope Atmosphere Lead authors: David Etheridge (CSIRO), Zoe Loh (CSIRO), Robyn Schofield (University of Melbourne) Collaborators: University of Wollongong (Nicholas Jones), AAD (Andrew Klekociuk), ANSTO (Alastair Williams), BoM (Peter May) Ziehn, T., Law, R. M., Rayner, P. J., and Roff, G.: Designing optimal greenhouse gas monitoring networks for Australia, Geosci. Instrum. Method. Data Syst., 5, 1–15, https://doi.org/10.5194/gi-5-1-2016, 2016.

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.

ACCESS NRI, TERN, AuScope

Q39.

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

- [x] For expertise or advice
- [x] Access to research resources or products
- [ ] Access to equipment for research
- [ ] Access to equipment for operational reasons
- [ ] Help in translating research
- [x] 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.

Q49.
4.2 Optional Document Attachment.
Note: Our strong preference is that answers are provided against the relevant questions in the survey. However, this file upload option is available for submissions in file format, where needed. Please ensure the document includes your name or organisation.