



# Australian Research for Global Power System Transformation (Stage 4)

## Request for Quote

ISSUE DATE	7 March 2024
CSIRO CONTRACT OFFICER	CSIRO Contact Officer details are provided at Clause 3.5

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# 1 About this RFQ

- 1.1.1 CSIRO seeking proposals for the provision of the Goods and Services described in this Request for Quote (RFQ).
- 1.1.2 This RFQ is to undertake research related to electricity system transformation in a number of areas as identified by the *Australia's Global Power System Transformation Research Roadmap* (the Research Roadmap), which was published by CSIRO through engagement with the Global Power System Transformation (G-PST) Consortium. We are requesting several – up to nine – research topics to progress.
- 1.1.3 Each proposal will focus on one of the following topics:
  - a. Topic 0: Program Management – Delivery of program support including, regular and ad hoc meetings with research topic leads and CSIRO, delivery of interim and final reporting, and coordination and facilitation of workshops.
  - b. Topic 1: Inverter Design - Development of capabilities, services, design methodologies and standards for Inverter-Based Resources (IBRs).
  - c. Topic 2: Stability Tools & Method - New tools and methods required to ensure reliability, security, and stability in power systems.
  - d. Topic 3: Control Room of the Future - Development of new technologies and approaches for enhanced real-time visibility and analysis in power system operator control rooms.
  - e. Topic 4: Planning - New planning metrics, methods, and tools to capture the characteristics and influence of a changing resource mix.
  - f. Topic 5: Restoration & Black Start - Creating new procedures for black starting and restoring a power system with high or 100% IBR penetrations.
  - g. Topic 6: Services - Quantifying the technical service requirements of future power systems to maintain the supply-demand balance reliably and at least cost.
  - h. Topic 7: Architecture - Identifying appropriate future power system architectures for coordinating new technology capabilities, regulatory approaches, market design, and the distribution/transmission interface in a highly distributed, variable renewable energy-based system.
  - i. Topic 8: Distributed Energy Resources - Challenges and opportunities from very high levels of distributed energy resources.
  - j. Topic 9: Distributed Energy Resources and Stability – Development and deployment of improved DER models to ensure system operators and network providers can maintain power system security with high levels of DERs.
- 1.1.4 Additional guidance for each topic can be found in Attachment A to this document: **Advisory Notes for Relevant Topics**. This should be read as guidance for responses rather than essential requirements. All responses will be considered and assessed against value for money and program needs.
- 1.1.5 Individual researchers / staff can propose to provide more than one research proposal. However, if they do so, each research proposal must be tendered for separately (i.e. provide a separate Part B response for each research proposal), and individual researchers may contribute to no more than 2 successful topic bids.
- 1.1.6 Responses from international research agencies and organisations are encouraged, though Australian relevance of the topic is vital. Collaborative responses with Australian researchers are viewed favourably.

- 1.1.7 CSIRO values the diversity in its workforce and recognises that unique perspectives lead to greater problem solving capability, collaboration and innovation. We encourage you to share with us how your contract team will address all dimensions of diversity, in particular gender diversity.

## 1.2 CSIRO Profile

- 1.2.1 CSIRO - the Commonwealth Scientific and Industrial Research Organisation - is Australia's largest scientific research organisation and one of the largest and most diverse scientific organisations in the world.
- 1.2.2 CSIRO's work touches every aspect of Australian life: from the molecules that build life to the molecules in space. Working from sites across the nation and around the globe, CSIRO's focus is on providing new ways to improve the quality of life, as well as the economic and social performance of a number of industry sectors through research and development.
- 1.2.3 CSIRO is an independent statutory authority constituted and operating under the provisions of the *Science and Industry Research Act 1949* and is a Commonwealth Corporate Entity under the *Public Governance, Performance and Accountability Act 2013*.
- 1.2.4 Further information about CSIRO can be found at [www.csiro.au](http://www.csiro.au)

## 1.3 RFQ Documentation

- 1.3.1 The following documentation forms part of this Request for Quote:
- Part A Request for Quote (Australian Research for Global Power System Transformation (Stage 4))
  - Part B RFQ Response Form (Australian Research for Global Power System Transformation (Stage 4))
  - Draft CSIRO Contract, including standard terms for Schedule 5.
  - Executive Summary Report for Australia's Global Power System Transformation Research Roadmap

This RFQ should be read in conjunction with the published "Australia's Global Power System Transformation Research Roadmap" by CSIRO at:

<http://www.csiro.au/en/research/technology-space/energy/G-PST-Research-Roadmap>, and the research recommendations in the G-PST Stage 3 Interim Reports available as part of this bid package.

## 1.4 Respondent Acceptance

- 1.4.1 By submitting a response to this RFQ, the Respondent accepts the terms and conditions as set out in Appendix A of this RFQ.

## 2 Definitions

2.1.1 Unless the context otherwise requires, the following expressions shall have the following meanings:

TERMS	MEANINGS
<b>CSIRO</b>	the Commonwealth Scientific and Industrial Research Organisation, operating under the <i>Science, Industry and Research Act 1949</i> (Cth).
<b>Closing Time and Date</b>	the final time and date for lodgement of Quotes as provided by clause 3
<b>Contract</b>	a Contract or Official Order (Purchase Order) or Work Order entered into between CSIRO and the Successful Respondent or Respondents (if any).
<b>CSIRO Primary Contact</b>	the person or persons nominated at clause 3.5 to represent CSIRO during the term of this RFQ process.
<b>Goods and Services</b>	the goods and/or services referred to in this RFQ to be provided and/or carried out under a Contract.
<b>Issue Date</b>	the date CSIRO issues the RFQ to potential Suppliers.
<b>Late Quote</b>	a Quote that is not lodged prior to the Closing Date and Time, as defined in clause 3.2.
<b>Quote</b>	an offer submitted by a Respondent in accordance with these RFQ requirements.
<b>Respondent</b>	a Supplier who submits a Quote in accordance with these RFQ requirements.
<b>Supplier</b>	a Supplier or Suppliers (if any) engaged under a Contract to perform the Services.

## 3 Request for Quote

### 3.1 Key Events and Dates

EVENT	DATE	TIME
Closing Time and Date	Friday 5 <sup>th</sup> April 2024	5:00 pm AEST
Expected Contract Execution Date	20 <sup>th</sup> May 2024	
The provision of the Goods and/or Services is required to be completed on or before	28 <sup>th</sup> April 2025	
Contract Term	Option A The Contract will remain in force for a period of 12 months from the date the Contract was entered into.	
Contract Extension Option (if applicable)	Not applicable	

### 3.2 Lodgement

- 3.2.1 In lodging a response, Respondents are required to comply with all requirements set out in this Request for Quote.
- 3.2.2 Completed Quotes should be lodged electronically via email to the address listed in CSIRO Primary Contact Details (at clause 3.5), on or before the RFQ Closing Time and Date.
- 3.2.3 Late Quotes **will** be excluded from the RFQ process and **will not** be admitted to evaluation.

### 3.3 Quote Validity

- 3.3.1 Quotes submitted in response to this Request for Quote must remain valid for a period not less than 90 calendar days from the Closing Time.

### 3.4 Preparing to Lodge a Response

#### File Formats, Naming Conventions and Sizes

- 3.4.1 CSIRO will accept responses in Microsoft Word 2003 (or above), Microsoft Excel version 2003 (or above) or PDF format.
- 3.4.2 The Response file name/s:
- should incorporate the Respondent's company name and
  - should reflect the various parts of the bid they represent, where the response comprises multiple files.

### 3.5 CSIRO Contact Officer

- 3.5.1 Respondents should direct any queries arising from this RFQ to the CSIRO Contact Officer:

<b>CSIRO Contact Officer Name</b>	Chris Knight
<b>Email</b>	Chris.Knight@csiro.au

- 3.5.2 All such queries are to be directed to the CSIRO Contact Officer via email only. Telephone enquiries will not be taken.

### 3.6 Assessment Criteria

- 3.6.1 Responses will be assessed based on the following criteria. An appropriate level of detail should be submitted by the Respondent to allow CSIRO to properly assess the suitability of the proposal.

- a. Capacity to provide the Requirements
- b. Demonstrated experience in delivering the Requirements

- 3.6.2 As in previous years, the contract with CSIRO will include the condition that all IP developed under the GPST contract will be owned by CSIRO, including data collected and software developed. Furthermore, CSIRO must be given licence to use background IP required to exploit the project IP that it owns under contract. It is the intention of CSIRO to make quality controlled project IP publicly available to the extent practical, in a way that maximises impact and permits the broader research and industrial community direct access to the artefacts created under this research program.

Consequently, RFQ’s that include, as explicit deliverables (including deliverable by being made publicly available on public repositories such as GitHub or a contractor hosted platform), specific data and software to be developed under the GPST research project will be preferred over those that develop IP that, despite being owned by the funding agency, are not specified in advance and are to be provided only in principle on request.

## Capability

### 3.7 Goods and/or Service Requirements

- 3.7.1 This RFQ is to undertake research related to electricity system transformation in a number of areas as identified by the *Australia’s Global Power System Transformation Research Roadmap* (the Research Roadmap), which was published by CSIRO through engagement with the Global Power System Transformation (G-PST) Consortium in March 2022. In addition Stage 2 research reports are available, and the recently published interim reports for implementing the Research Roadmap in Stage 3 (Financial Year 2023/24). We are expecting several – up to nine– research topics to progress.

The research proposal in response to this RFQ is to cover activities to be completed during the Financial Year 2024/25 as Stage 4 of the work described in the multi-year *Research Roadmap*.

- 3.7.2 Each proposal will focus on at least one, but up to two of the following topics:

- a. Topic 0: Program Management – Delivery of program support including, regular and ad hoc meetings with research topic leads and CSIRO, delivery of interim and final reporting, and coordination and facilitation of workshops.
  - b. Topic 1: Inverter Design - Development of capabilities, services, design methodologies and standards for Inverter-Based Resources (IBRs).
  - c. Topic 2: Stability Tools & Method - New tools and methods required to ensure reliability, security, and stability in power systems.
  - d. Topic 3: Control Room of the Future - Development of new technologies and approaches for enhanced real-time visibility and analysis in power system operator control rooms.
  - e. Topic 4: Planning - New planning metrics, methods, and tools to capture the characteristics and influence of a changing resource mix.
  - f. Topic 5: Restoration & Black Start - Creating new procedures for black starting and restoring a power system with high or 100% IBR penetrations.
  - g. Topic 6: Services - Quantifying the technical service requirements of future power systems to maintain the supply-demand balance reliably and at least cost.
  - h. Topic 7: Architecture - Identifying appropriate future power system architectures for coordinating new technology capabilities, regulatory approaches, market design, and the distribution/transmission interface in a highly distributed, variable renewable energy-based system.
  - i. Topic 8: Distributed Energy Resources - Challenges and opportunities from very high levels of distributed energy resources.
  - j. Topic 9: Distributed Energy Resources and Stability – Development and deployment of improved DER models to ensure system operators and network providers can maintain power system security with high levels of DERs.
- 3.7.3 Individual researchers / staff can propose to provide more than one research proposal. However, if they do so, each research proposal must be tendered for separately (i.e. provide a separate Part B response for each research proposal), and individual researchers may contribute to no more than 2 successful topic bids.
- 3.7.4 Each research proposal (10 pages max) must at least include:
- a. Title and broad description of the proposed project, including the topic area, project objectives and how the proposal is aligned with the prioritised research tasks as identified in the Stage 2 Interim Reports, or by the Research Roadmap. The proposal may differ from the Interim Reports and the Research Roadmap with justification.
  - b. Background information to provide a brief review of the current status of technology and solutions, and related activities underway by AEMO, networks, government, research organisations, and others, and a discussion of how the research proposal will contribute to the topic area.
  - c. Succinct technical description of the proposed approach to achieve the project objectives, including a list of the expected outputs and proposed project timeline.
  - d. Project outcomes and the significance of their contribution to the topic area.
  - e. Project resources and roles, including project team, key stakeholders to be involved, required data (including a data management plan) and other resources needed to deliver the project successfully. The capacity of the project team, including the key personnel and a short biography for each of them, and the qualification of the team (including the past experience on similar projects), must be demonstrated.
  - f. Proposed project budget with breakdowns, including in-kind contributions and external funding requirements.
  - g. Knowledge sharing plan including data, software, publications and, particularly, contribution to the continued engagement with the international G-PST Consortium



activities, including development of white papers and presentations at relevant events such as webinars, workshops, conferences and meetings.

- 3.7.5 Project deliverables for each research topic is to at least include:
- a. Regular updates on progress with CSIRO and AEMO as directed;
  - b. A project plan;
  - c. An interim report, covering the work to be undertaken in the remainder of the project Stage 4 to the end of FY 24/25, and progress to date;
  - d. A refresh (that is, a revised update) of the multi-year *Research Roadmap* published in 2022 for the Topics addressed by the research proposal to address any differences from the current recommendations by the proponent;
  - e. The research tasks recommended by the proponent for the following project stage 5 (FY 25/26);
  - f. A draft final report and presentation;
  - g. A detailed final report, including the full report and a short executive summary report, and presentation; and
  - h. Other deliverables as agreed between CSIRO and the successful proponent.
- 3.7.6 CSIRO and AEMO will have joint oversight of the research areas, and research progress is to be shared within participants of the G-PST Consortium.
- 3.7.7 CSIRO is aware that respondents may use PhD students to complete all or some of these tasks. CSIRO is open to separate agreements covering multiple years for those students, even though the tasking in this RFQ is limited to 12 months. CSIRO or AEMO would usually be co-supervisors for these students, and funding arrangements would be separate to the funding arrangements from this RFQ.

## 3.8 Research Topics

Details of the individual research topics are included in the “Executive Summary Report for Australia’s Global Power System Transformation Research Roadmap” as included in this RFQ pack. The individual research plans for all focused topics under the Research Roadmap are available on CSIRO’s website: <http://www.csiro.au/en/research/technology-space/energy/G-PST-Research-Roadmap>, stage 2 final reports, and the research recommendations in the G-PST Stage 3 Interim Reports available as part of this bid package.

## 3.9 Timeframes

- 3.9.1 See milestones below

## 3.10 Specifications and Performance

- 3.10.1 The primary deliverables for this work include presentations, written reports (including an interim report, a draft report, a full report and a short executive summary report) and other deliverables as agreed by CSIRO and the successful respondents. The presentations and written reports must be written in a clear, concise language, which is appropriate for an informed, broad audience of industry specialists, and are expected to be easily understood by the breadth of Australia’s electricity industry, including researchers, engineers, policymakers, consumer advocates, start-ups, and others. Successful respondents are expected to engage with various stakeholders within the

energy industry to ensure their perspectives are considered in the development and execution of their research proposals.

### 3.11 Equipment

3.11.1 The provider to provide all equipment for the development and delivery of the project.

### 3.12 Service Delivery

3.12.1 Reporting and Project Management – Successful respondents are expected to provide regular updates to CSIRO staff on their progress. Updates should be no less regularly than bi-weekly and must include progress achieved, upcoming work, and any risks or issues identified. Email updates must be provided, and regular progress meetings/phone calls may be required at CSIRO’s discretion.

3.12.2 A project management plan, including risk management to identify the risks associated with the project and mitigation strategies, is to be provided by the proponent.

### 3.13 Delivery and Acceptance

3.13.1 The milestones should include the following items. However, other milestones necessary should be added subject to negotiation & confirmation before commencing the project. Both the Due Date and magnitude of the Milestone Payment are negotiable. The following table offers guidance.

MILESTONE DESCRIPTION	PLANNED DUE DATE	EXPECTED MILESTONE PAYMENT
<ul style="list-style-type: none"> <li>- A detailed work plan, including timeline and resourcing identification against agreed outcomes, expected data requirements.</li> <li>- Presentation of work to date and work to be undertaken.</li> <li>- Other deliverables as agreed between CSIRO and the successful proponent.</li> </ul>	June 2024	50% of contract value
<ul style="list-style-type: none"> <li>-An interim report and a presentation covering: 1) the work to date; and 2) the work to be undertaken in the remainder of the project.</li> <li>-Continued engagement within international G-PST consortium, including the development of materials and presentations for relevant events such as webinars, workshops, conferences &amp; meetings.</li> <li>-Other deliverables as agreed between CSIRO and the successful proponent.</li> </ul>	November 2024	15% of contract value
<ul style="list-style-type: none"> <li>- A draft final report and presentation.</li> </ul>	February 2025	20% of contract value

<ul style="list-style-type: none"> <li>- A refresh of the Australia’s G-PST Research Roadmap (published in March 2022) written for this topic.</li> <li>- The research tasks recommended by the proponent for the following project stage 5 (FY 25/26)</li> <li>-Continued engagement within international G-PST consortium, including development of materials and presentations for relevant events such as webinars, workshops, conferences &amp; meetings.</li> <li>-Other deliverables as agreed between CSIRO and the successful proponent.</li> </ul>		
<ul style="list-style-type: none"> <li>-Final report and presentation</li> <li>-Other deliverables as agreed between CSIRO and the successful proponent.</li> </ul>	April 2025	15% of contract value

3.13.2 CSIRO may accept or reject any deliverables in accordance with the Contract.

3.13.3 The total project cost shall not exceed AUD\$385k including GST.

## Capacity

3.13.4 CSIRO is seeking to engage experienced quality service providers who are leading organisations in power systems research, with detailed knowledge of the Australian electricity sector and international reputation within their field of expertise.

## Quality Systems

### 3.14 Health, Safety and Environment (HSE)

3.14.1 Prior to commencing delivery, CSIRO and the Supplier will identify any potential HSE issues and assign management of each issue identified to the party best able to manage it.

## Additional Information

### 3.15 CSIRO Material

Details of the individual research topics are included in the “Executive Summary Report for Australia’s Global Power System Transformation Research Roadmap” as included in this RFQ pack. The individual research plans for all focused topics under the Research Roadmap are available on CSIRO’s website: <http://www.csiro.au/en/research/technology-space/energy/G-PST-Research-Roadmap> and the research recommendations in the G-PST Stage 2 Interim Reports available as part of this bid package.

## 3.16 Additional Response Recommendations

- 3.16.1 To aid in our assessment of responses submissions must:
- a) indicate how sub-consulting contracts and non-disclosure agreements (NDAs), if any, will be executed in a timely fashion, and not adversely impact the overall project timeline;
  - b) identify the project inputs and information, where this is intended to be sourced and how it will be procured in a timely fashion that will not delay completion of the project;
  - c) identify the use or requirement of proprietary software that is needed to carry out the research project and/or to use the project deliverables;
  - d) clearly state the research program tasks that the project will advance, and how far the Stage 3 work will advance the particular tasks, or what additional tasks are being proposed, how they are associated with the proposed research topic, and why this is recommended as a higher priority than existing tasks;
  - e) outline intended publications beyond the required deliverables in the RFQ, that will be produced by the researchers, where such publications may include papers, reports, webpage that shares research outputs etc.;
  - f) identify any potential contingency plans that can be actioned if problems arise, such as data access, travel restrictions, or outcomes that might impact delivery.
- 3.16.2 Acceptance of any proposal by CSIRO will be subject to the Respondent's agreement to the Terms and Conditions set out in the draft contract (Attachment B).
- 3.16.3 CSIRO requires the Respondent's quotation to be made according to the proposed Terms and Conditions.
- 3.16.4 **IMPORTANT:** If respondents anticipate they may require confidential / protected information from third parties such as AEMO, then:
- a) These discussions should take place at the earliest possible time between the researchers and that third party (eg AEMO) so as not delay progress.
  - b) AEMO have indicated that they will need to be satisfied that the objectives and outcomes of the work are aligned with AEMO's purpose,
  - c) The researcher will need to enter into a consultancy agreement that describes the scope of work and data requirements, though in general AEMO do not anticipate any financial amount associated with this type of engagement..

## 3.17 Contract Agreement

- 3.17.1 Acceptance of any proposal by CSIRO will be subject to the Respondent's agreement to the Terms and Conditions set out in the draft contract (Attachment B).
- 3.17.2 CSIRO requires the Respondent's quotation to be made according to the proposed Terms and Conditions.
- 3.17.3 Respondents should include a statement in their response of any items of non-compliance against the proposed Contractual terms and conditions including an

explanation. Where a Respondent provides no comment, they will be deemed to comply.

## Appendix A Conditions and Acknowledgements

### A.1 Right Not to Proceed

- A.1.1 CSIRO is not bound contractually, or in any other way to the Respondents who respond to this RFQ. CSIRO reserves the right not to proceed with this RFQ or any part of it, and to suspend or vary the RFQ and/or its requirements at any stage.

### A.2 Unintentional Errors of Form

- A.2.1 If an unintentional error of form in a Tenderer's response is identified prior to award of a Contract, CSIRO may in its absolute discretion allow correction of that error by the Tenderer by the submission of a correction, variation or additional information.
- A.2.2 An unintentional error of form is an error that CSIRO is satisfied in its absolute discretion:
- a. represents incomplete information not consistent with the Tenderer's intentions and, if relevant, capabilities at the time the submission was lodged
  - b. does not materially affect the competitiveness of the Tenderer's response.

### A.3 Costs Borne by Respondent

- A.3.1 All costs and expenses incurred by Respondents in any way associated with the development, preparation and submission of the RFQ response, including but not limited to attendance at meetings, discussions, presentations and providing any additional material required by CSIRO, will be borne exclusively by the Respondents.
- A.3.2 All prices are required to be quoted in Australian dollars \$ (unless otherwise specified). Quoted prices must not vary according to the mode of payment or alter during the quote validity period. **The Respondent must assume the risk of any currency fluctuations in respect of those underlying costs of its technical solution or Services that the Respondent incurs in a currency other than Australian dollars.**

### A.4 No Legal Relationship

- A.4.1 No binding legal relationship will arise out of this RFQ.

### A.5 Information

- A.5.1 The statements, opinions, projections, forecasts or other information contained in this RFQ may change. Where any such information relates to future matters, no steps have been taken to verify that the information is based upon reasonable grounds, and no representation or warranty, expressed or implied, is made by CSIRO, or any of its officers, employees, advisers or agents that the statements contained in this RFQ will be achieved.
- A.5.2 This RFQ is designed to reflect and summarise the information concerning the Requirements only and is not a comprehensive description of them.
- A.5.3 Except as required by law, and only to the extent so required, neither CSIRO, nor its respective agents or advisers will in any way be liable to any person or body for any loss,

damage, cost and expense of any nature arising in any way out of or in connection with the statements, opinions, projections, forecasts or other representations, actual or implied, contained in or omitted from this RFQ or other information provided to any Respondent or by reason of any reliance thereon by any person or body.

- A.5.4 Any time and/or date in this RFQ is for the sole convenience of CSIRO. The establishment of a time and/or date in this RFQ does not create an obligation on the part of CSIRO to take any action or any right in any Respondent that any action is taken on the date established. CSIRO may change any date or time. The Department will notify affected Respondents if it changes the date and/or time but will not be obliged to provide any reasons for its actions.

## A.6 Respondents to Inform Themselves

- A.6.1 Respondents are considered to have:

- a. examined this RFQ, any documents referenced in this RFQ and any other information made available by CSIRO to Respondents for the purpose of responding
- b. examined all further information which is obtainable by the making of reasonable inquiries relevant to the risks, contingencies, and other circumstances having an effect on their RFQ response
- c. undertaken their own professional advice in respect of this RFQ, any other information provided to Respondents and the RFQ process generally, as appropriate
- d. satisfied themselves as to the correctness and sufficiency of their RFQ response including submitted prices.

## A.7 Respondent Acknowledgements

- A.7.1 Responses are submitted on the basis that Respondents acknowledge they do not rely upon any warranty or representation made by or on behalf of CSIRO, except as are expressly provided for in this RFQ, but they have relied entirely upon their own inquiries and inspection in respect of the subject of their RFQ response.

## A.8 Relevant Legislative Provisions

- A.8.1 CSIRO policy is to not to enter into a contract with suppliers who have been named in Parliament as not complying with the *Workplace Gender Equality Act 2012*.
- A.8.2 CSIRO expects its suppliers to always act in a safe manner and perform all relevant services in a way that is without risk to the health, safety or welfare of any person and eliminates health and safety risks so far as is reasonable practicable.
- A.8.3 CSIRO will not enter into a contract with suppliers who are listed as designated entity by the Minister of Foreign Affairs by notice in the Gazette under s 15 of the *Charter of the United Nations Act 1945 (Cth)* or who intend to engage subcontractors who are listed as a designated entity by the Minister for Foreign Affairs by notice in the Gazette under s 15 of the *Charter of the United Nations Act 1945 (Cth)*. A consolidated list of such persons, entities and associated assets is maintained by the Department of Foreign Affairs and Trade under the *Charter of the United Nations (Dealing with Assets) Regulations 2008* and can be found at: [http://www.dfat.gov.au/icat/UNSC\\_financial\\_sanctions.html](http://www.dfat.gov.au/icat/UNSC_financial_sanctions.html)
- A.8.4 CSIRO will not enter into a contract with Respondents engaging illegal workers. For more information refer to 'A Guide on Work Rights' available at [www.immi.gov.au/employers](http://www.immi.gov.au/employers).

## A.9 CSIRO Rights

A.9.1 The issue of this RFQ does not in any way commit CSIRO to proceed with any aspect of acquisition of the Requirement, whether from any of the Respondents to this RFQ or from any other source.

A.9.2 Without limiting any other part of these RFQ conditions CSIRO may:

- a. amend this RFQ at any time in any way including any aspect of the RFQ process
- b. choose to negotiate with (if applicable), any Respondent including one whose RFQ:
  - i is a non-compliant RFQ, or
  - ii does not have the lowest indicative price of all RFQs
- c. not negotiate with (if applicable), any Respondent at any time whose RFQ complies with this RFQ
- d. at any time (including in negotiations) disqualify any Respondent from participating in the RFQ process or exclude their RFQ from further consideration
- e. allow any Respondent to change their RFQ at any time
- f. stop or suspend negotiations with any preferred Respondent
- g. select preferred Respondents or choose not to do so
- h. request all or certain Respondents participate in a further procurement process for the Requirement
- i. at any time use non CSIRO personnel in assessing RFQs
- j. at any time use a probity auditor in connection with this RFQ
- k. terminate the RFQ process at any time (including in the course of contract negotiations)
- l. contract with more than one party for supply of the Requirement
- m. enter into a contract outside the RFQ process
- n. negotiate with a Respondent whose RFQ is for a different requirement than set out in this RFQ
- o. undertake or allow any other actions or inaction in relation to this RFQ, on such terms as CSIRO deems appropriate
- p. use information gained through the RFQ process to feed into any further procurement CSIRO may undertake in connection with the Requirement (or one similar to it), including further development of the Requirement
- q. allow, or not allow, any Respondent to enter into a contract for the Requirement in the name of a different legal entity from the one that provided an RFQ.

## A.10 Disclaimer

A.10.1 This RFQ is an invitation to treat and is not to be taken to be or relied upon as an offer capable of acceptance by any person or as creating any form of contractual (including a process contract), quasi contractual, restitutionary or promissory estoppel rights, or rights based on similar legal or equitable grounds.

A.10.2 CSIRO will not be liable to any Respondent on the basis of any promissory estoppel, quantum meruit or other contractual, quasi contractual or restitutionary grounds whatsoever or in negligence as a consequence of any matter relating or incidental to a Respondent's participation in this RFQ including instances where:

- a. a Respondent is not invited to participate in any subsequent process following completion of this RFQ
- b. CSIRO varies the RFQ



- c. for reasons of public interest, CSIRO decides to terminate this RFQ or not to contract for all or any of the requirements or
- d. CSIRO exercises or fails to exercise any of its other rights under or in relation to this RFQ.

## Attachment A

### Advisory Note for relevant topics.

The following notes are provided for each of the major topics. While CSIRO considers this guidance as useful for EOI submissions, potential respondents may submit against alternative research areas within a Topic.

Your submission will be considered along with all others. CSIRO would suggest respondents spend some time offering an explanation why an alternate path should be considered.

## **Topic 0**

Topic 0 is focussed on delivery of the remaining GPST topics. This is expected to be 9 separate topics but may vary based on CSIRO deciding not to move forward with a topic, or splitting a topic between separate recipients, which may lead to more topic meetings.

Prior to contract signature, CSIRO will know how many topics there will be and if a change is required to topic 0 deliverables, this will be discussed.

Though not specifically completing technical research, a high level of domain knowledge will be required to supervise delivery of the remaining topics.

Other requirements include:

- Compilation of feedback on proposed research projects, timelines, and resource allocations within one month of project commencement or after at least one meeting with CSIRO-appointed GPST researchers.
- Preparation of a high-level twelve-month delivery timeline for successful research proposals.
- Conducting coordination meetings with appointed researchers, CSIRO staff and AEMO advisors, to track progress and offer feedback.
- A formal monthly progress report to CSIRO summarising research plan developments, with informal updates as needed until the project's final due date in May 2025.
- Provision of general project management services, including ad hoc meetings with CSIRO and AEMO leadership and officers.
- Coordination and facilitation of quarterly workshops with relevant parties to report on progress, planned work, and identified issues.
- Conducting reviews and quality assurance of research project deliverables.
- Organisation of a final workshop upon completion of all research projects for researchers to present outcomes and discuss next steps.
- Provision of general advice to assist CSIRO in developing the next phase of GPST research plans.

### **Topic 1**

GPST roadmap for Topic 1 outlines 10 major research tasks, classified into urgent, medium, and low priorities. In the ongoing Stage 3 research, the primary focus was on transient stability analysis, subdivided into tasks such as adopting various network topologies, developing tools for transient analysis in multi-inverter-based systems, studying the effect of negative sequence current injection on transient stability, and exploring current limiting strategies for stability.

Based on the ongoing research in Stage 3, CSIRO emphasise the following list of research topics:

#### **Urgent:**

- Advanced control methods (predictive control, artificial intelligence, etc.) for GFM inverters.
- Investigation to show the impact of assumed GFMI parameters on transient instability in the proposed research will be required.
- Exploration of the quantification of limits to IBR penetration due to system technical performance requirements
- Frequency stability in high IBR penetration power systems.
- Voltage stability in high IBR penetration power systems.
- Interaction Mitigation and Oscillation Damping in high IBR penetration power systems.

#### **Medium:**

- Power quality improvement in, and harmonic analysis of, high IBR penetration power systems.
- Advanced grid synchronization, protection, and reliability in high IBR penetration power systems.

## **Topic 2**

GPST roadmap on topic 2 categorizes 21 research topics in Critical, High, Medium and Low priorities. The ongoing Stage 3 has continued to investigate the **small signal stability screening methods** from the critical priority list which can be used in the **stability margin evaluation** topic of the same priority.

Given the flow of the current stage work and the priorities that can be tackled somewhat independently, CSIRO emphasise the following proposed list of research topics:

### **Urgent:**

- Exploration of the quantification of limits of IBR penetration owing to inability to evaluate small-signal stability, and the increase in those limits due to improved evaluation.
- Stability margin evaluation
- Small signal stability screening methods
- Voltage stability boundary identification
- Voltage collapse and recovery

### **Medium:**

- Real time simulation
- Development of relevant tools like impedance scanning or other transient analysis tools.

### Topic 3

## Operations Technologies Applications

Bidders are advised to strongly link their expected research to the tools, processes, and outcomes for Operations Technologies (OT). That is, the work must have clear and demonstrable benefits to AEMO's control room, including its systems, processes, and human operators. Identified areas include:

- **Outage Management and Reporting:** Automated logging systems and integration with other tools; Network Outage Scheduler (NOS) enhancements with risk assessments and forecasting.
- **Frequency Management and Control, Ramping, and Inertia:** Ramping assessment tools; Distributed Energy Resources (DER) demand control architecture and implementation.
- **Electricity Market Management System (EMMS):** General improvements for NEM2025 and WEM market reforms.
- **Protection, Control, Blackstart, and Restoration:** Special Protection Scheme (SPS) and protection wide area coordination tools; Blackstart and Restoration tools using Variable Renewable Energy (VRE) and DERs.
- **Voltage and Reactive Power Management:** Voltage reactive power management tool with look ahead capability.
- **System Strength and Electro Magnetic Transient (EMT):** Study automation tools and Real Time Simulations (RTS)
- **Dynamic Security Assessment (DSA) and Constraints:** Prediction tools for Transient, Voltage, Frequency, and Small Signal stabilities.
- **EMS SCADA and System Monitoring:** Continued enhancement and integration of Energy Management Systems (EMS) and Wide Area Monitoring Systems (WAMS)
- **Compliance Monitoring:** Systems for generation demand, DER, model validation and compliance monitoring.
- **Operational Forecasting:** Integration of operational forecasting tools with general OT tools
- **Operational Data and Models:** Governance and management system for operational and modelling data; Network Model Management (NMM) framework to service operations, markets, planning and connections.

## Research Areas

Topic 3 is defined as the *“Development of new technologies and approaches for enhanced real-time visibility and analysis in power system operator control rooms”*.

Applied research that serves the above OT applications are welcomed, including (but not limited to) recent advances in generative AI, human computer interfaces, physics-informed neural networks, data governance/stewardship techniques, and human-AI collaboration. However, they must be firmly grounded in use-cases for control rooms and have practical benefits within the 1-year time frame.

#### **Topic 4**

New planning metrics, methods, and tools to capture the characteristics and influence of a changing resource mix.

Deliverables: Developing and sharing the planning tools and data, monthly presentations on progress and outcomes, and reports.

##### **Urgent**

- Modelling and assessment of integrating distribution and transmission network planning within the expansion planning process.
- Modelling investment decisions (including demand response at high DER penetration) at the distribution network level and determining the methodologies to integrate them in power system planning.
- Impacts and benefits of other infrastructure and sector coupling (Electricity + gas + hydrogen) on reliability and resilience.
- Modelling the steady-state operation of the system (at least 220KV and above) considering the trade-off between computational efficiency and model precision including network security to accurately capture the operational flexibility of different technologies.

##### **Medium**

- Development of a conceptual framework, consistent with the planning method developed to date, for assessing the benefit of reducing uncertainty associated with limits of average and instantaneous IBR penetration for secure power system operations.
- Modelling the system strength requirements and incorporating them into the network expansion problem.
- Modelling the uncertainty regarding the future operation of synchronous generating units, emerging technology, and innovations that enable IBR to provide sought-after system services, demand levels, regulatory change, operational measures, and other emerging security issues in pre- and post-security events.
- Modelling the uncertainty associated with short-term and long-term system adequacy conditions in the planning decisions under extreme conditions such as low reserve conditions.

## **Topic 5**

The GPST Topic 5 Roadmap investigates the potential role and impact of inverter-based resources during power system restoration. Stage 3 research has considered the ability of multiple grid following inverters and the limits of grid forming inverters in to restart a power system, considering the influence of location relative to load and other generators and the impact of distributed energy resources. It has also considered the suitability of system normal technical requirements of inverter-based resources during restart circumstances.

Informed by the priority research areas listed in the Topic 5 Stage 3 Interim report, CSIRO emphasise the following proposed list of research topics

### **Urgent**

- Impact of distributed energy resources behaviour during system restart
- Technical and Regulatory Requirements for Inverter Based Resources to provide or support system restart services, particularly for grid following inverters
- Role of grid following inverters during system restoration
- Impact of network control and protection settings on IBR system restart
- Estimation of time frame over which retirements of conventional plant are likely to make IBR system restart necessary and/or comparable in cost to convention restart options.

### **Medium**

- Integrating protective relay response into power system restart modelling and simulation tools
- Grid forming control strategies and their relative merit for system restoration
- End to end system restoration from the transmission network with high share of IBR
- Assessment of an appropriate time frame for Australia to undertake practical demonstrations of IBR based system restart.
- Investigation into recommended changes to methodologies, guidelines, equipment requirements, etc, for this work to provide meaningful outcomes



## **Topic 6**

GPST roadmap on topic 6, has developed 5 open questions with short-, mid- and long-term priorities. These 5 open questions were around services to support:

1. Technical requirements (necessity and adequacy) of Australia's future grid,
2. Frequency regulation,
3. Voltage regulation,
4. Metric development for new services, and
5. Financial benefits.

While based on the stage 2 report on topic 6, second and fourth open questions on frequency support and metric development have been respectively addressed around 60% and 25%, the other three open questions have not been discussed so far. It is, however, interesting to note that research questions 1 and 5 on technical requirement and market design have had higher priorities according to the topic 6 initial roadmap.

Services are the enablers of the market-control interactions, the **market-control-service** trio should be considered in a holistic way. This is in line with the ultimate transition to transmission-distribution-customer (TDC) model of operational coordination suggested in GPST, topic 7, stage 2, final report.

CSIRO offers the following proposed list of research questions to be investigated at stage 4. Note the question number in parentheses are the relevant questions in the initial GPST roadmap at stage 1.

### **Urgent**

- Developing a catalogue of essential system services and provision of estimates of the time frames over which it is reasonable to expect that existing mechanisms for the provision of these services will be no longer adequate, and identification of consequences of such inadequacy.
- Future Underfrequency Load Shedding / Emergency Underfrequency Response requirements
- Evaluation of services required to manage Interconnector drift & ramping risks
- Develop tools and models for quantifying the system inertia requirements and remediations in case of variations in the future 100% renewable operation scenario of least/no synchronous generating units, more emerging technology, and innovations that enable IBR to provide sought-after system services, demand levels, regulatory change, operational measures, and other emerging security issues in pre- and post-security events.
- What is the baseline load and flexibility of the Australian grid and its application in mid- and long-term planning and topology improvement? (**Q 1.3**)
- How to unlock local flexibility through active coordination of DERs and distributed flexible loads or by providing a new level of system preparedness through applications such as virtual power plants (VPPs)? (**Q 1.2**)
- How DERs and distributed flexible loads on the distribution grid can provide voltage (local flexibilities to DSOs) support services? (**Q 1.1**)

### **Medium**

- How flexibility measures, such as the flexibility chart and Insufficient Ramping Resource Expectation, can help in dynamic monitoring of the Australian grid flexibility? (**Q 4.3**)

- Develop tools and models for quantifying the system strength requirements and remediations in case of variations in the future 100% renewable operation scenario of least/no synchronous generating units, more emerging technology, and innovations that enable IBR to provide sought-after system services, demand levels, regulatory change, operational measures, and other emerging security issues in pre- and post-security events.
- How DERs and distributed flexible loads on the distribution grid can provide frequency (balancing services to TSOs)
- Evaluation of service provision for operation of the NEM with 100% RE, WEM with no coal generation
- How to integrate distributed flexibility into a holistic TSO-DSO coordinated market? **(Q 5.1)**
- What (wholesale, distribution, retail) market frameworks can produce a sustainable power grid transformation, promoting demand response mechanisms and encouraging peak load mitigation? **(Q 5.2)**

## **Topic 7**

This GPST topic explores the applicability of the discipline of systems architecture to the characterisation and planning of large scale electrical power systems undergoing a transition from conventional, centralised, dispatchable generation to variable, inverter-based, and distributed energy resources. Previous work has progressed development of a power systems architecture for a whole-of-power-system that is relatively extensive. Previous work has also applied the methods and tools of systems architecture to a relatively narrow subsystem to focus in more detail on three specific, contemporarily relevant, power systems functions, all involving the operational management of distributed energy resources. These functions are

- Emergency distributed PV curtailment
- Integration of operational forecasting of variable energy resources (both large scale and distributed)
- Joint scheduling of large scale and distributed energy resources

Informed by the Topic 7 Stage 3 Interim report, CSIRO emphasise the following priorities for Stage 4

### **Urgent**

- Recommendations for the future use of systems architecture tools and methods by either the academic power systems research community, power systems industry, or policy makers.
- Demonstration of the use of a power systems architectural model to evaluate two or more alternative deep design options for a power system in terms of one or more metrics characterising the power systems functional requirements identified in Stage 1.
- Demonstration of the use of a power systems architectural model to identify, more deeply understand, elucidate, or communicate, a cross-cutting systemic issue to either a technical or non-technical audience.
- Demonstration of the use of a power systems architectural model to facilitate collaboration or communication among technical experts that is significantly more productive than in absence of the model.

### **High**

- Verification of the sufficiency of a given power systems architectural model to make valid predictions about the behaviour, and preferably performance metric, of specific instantiations of the model.
- Evaluation of the consistency between power system architectural models developed to investigate various alternative power systems functions. To what extent would a particular model developed for one investigation provide a suitable starting basis for investigation of a second? To what extent would two models developed for alternative investigations be inconsistent? How simple or complex would it be to combine two alternative power system architectural models into a single, common, consistent architectural model?
- Demonstrate the applicability of a power systems architectural models to provide insight into the components of the system of interest relevant to one of the other eight GPST topics.
- Demonstrate the applicability of a power systems architectural model to provide insight into the relationship among the system(s) of interest relevant to two or more GPST topics.

## **Topic 8:**

This section provides recommendations and prioritization for future research activities within G-PST Topic 8 research roadmap focusing on Distributed Energy Resources (DERs). In Stage 2 of the GPST roadmap, multiple Operating Envelope (OE) calculation algorithms were developed at the LV level. Stage 3 focused on enhancing the scalability of these algorithms for integrated HV-LV networks, where only the ideal approach can ensure all network constraints are met while incorporating DERs effectively.

Informed by insights from the Topic 8 Stage 3 Interim report, CSIRO underscores the following priorities for Stage 4:

### **Urgent:**

- Investigate the implications of Australian PV inverter Volt-Watt and Volt-var requirements on the effectiveness of Operating Envelopes (OEs). Understanding how these requirements affect the DOEs of the network is crucial for optimizing DER integration and ensuring grid stability.
- Implement PV inverter Volt-Watt and Volt-Var models for passive and active customers in OE calculation algorithms. Integrating these models into the algorithms will enable more accurate and efficient calculation of operating envelopes, taking into account the dynamic behaviour of PV inverters and their impact on network performance.
- Develop or enrich non-Ideal OE calculation algorithms to address voltage violation issues in HV-LV integrated networks. Enhancing these algorithms will allow for better management of voltage levels and mitigation of violations, especially in scenarios where DER penetration is high and network conditions are dynamic.

### **Medium:**

- Explore the fairness concept in HV-LV integrated networks and determine standardization requirements. Assessing fairness ensures equitable distribution of resources and benefits among network participants, which is crucial for fostering collaboration and acceptance of DER integration efforts.
- Assess communication requirements for OE calculation algorithms in integrated HV-LV networks. Understanding the communication needs for these algorithms will facilitate efficient data exchange and coordination among different network components, enabling seamless integration of DERs and improved grid management.
- Address network model issues at HV/LV levels and propose recommendations for resolution.

## **Topic 9**

The GPST roadmap on Topic 9, Stage 1 defined a program of work to deliver five practical deployment outcomes to ensure that ISOs and TSOs can maintain power system security under very high penetrations of IBR such as distributed PV, energy storage, and other resources including inverter-based demand, namely:

1. Support AEMO toolset development for load-DER modelling relevant to high IBR penetration throughout LV distribution networks.
2. Support technology development and deployment.
3. Inform standards revisions.
4. Support AEMO's need for technical expertise and testing capabilities of IBR.
5. Contribute to increase stakeholder engagement.

The activities in Stage 3 focused on:

- DER flexible load bench testing (air conditioners, refrigerators, and freezers, also expands testing to BESS, Hybrid ESS, EV charging infrastructure, and various IBR capable of responding to grid disruptions.
- Inverter reconnection testing, implementation of a testing procedure and modelling updates.
- Point of wave testing, investigating potential inverter malfunction sensitivity to disturbances occurring at different angles in the AC waveform (not yet completed at the time the draft report was reviewed).

The load testing aligns with modelling tasks required for the development of a generic *WECC dynamic composite load model (CMPLDW)* that includes a representation of the distribution feeder, and the aggregate behaviour of various loads and DERs connected to distribution systems (WECC stands for Western Electricity Coordinating Council, an independent organization that works with entities across North America West to further the common theme of [electrical grid reliability](#)).

The component-based approach is based on the knowledge of detailed physical models of different load components and their composition, which can be obtained from measurement experiments such as those performed in Topic 9.

The CMPLDW is a model structure to model various loads at the end of a feeder that has become increasingly popular in the industry with wider availability of digital fault recorders [1].

### **Research priorities for Stage 4:**

- Review existing methodologies for model validation (testing) for the aggregate WECC composite load models developed by AEMO based on bottom-up DER testing.
- Identify or develop a set of realistic Australian representative network + load models to estimate, validate and benchmark competence of aggregate load models such as the WECC CMPLDW, e.g. based on recorded fault data such as Fault Induced Delayed Voltage Recovery (FIDVR) events.
- Identify suitable mathematical and probabilistic formulations of aggregate models such as WECC CMPLDW to explore maximum likelihood methodologies for aggregate load model parameter estimation.
- Explore and benchmark machine learning methodologies to parametrise aggregate load models such as WECC CMPLDW based on measured data.