

Australia's Funding of Energy Research – Quantum and Comparison

Transitioning to a low-carbon energy system is one of humanity's most pressing, and amongst the greatest, challenges in modern times. The scale and complexity requires unprecedented investment in new research to develop and scale technologies, and to support and enable the significant cultural and societal shift needed.

Energy research, development and demonstration (RD&D) includes research, development and demonstration relating to the production, storage, transportation, distribution and rational use of all forms of energy, but excludes deployment. Energy in this context includes the entire chain, from primary forms found in nature, through secondary forms more convenient for transport and storage, through to end uses such as heat, light, motive force, and other energy services¹.

Summary points

- Australia's reported government RD&D spend is low relative to other key economies.
- From 2004–2020 Australia's public energy RD&D expenditure on energy has decreased both in absolute terms, as well as relative to comparable countries.
- The scope of the IEA's methodology does not reflect investments and measures used in Australia, specifically indirect supports such as R&D Tax Incentives (RDTI).
- Gaining a better understanding of Australia's energy RD&D spend, including RDTI expenditure, could provide important insights into our actual overall RD&D spend.

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Available data on international funding

Data from the International Energy Agency (IEA) provides the best and more robust data source for understanding and tracking energy research investments by nations over time.

The IEA database includes public energy RD&D spending of its member countries,ⁱ and the European Union, across eight technology categories: energy efficiency, fossil fuels, renewables, nuclear, hydrogen and fuel cells, other power and storage technologies, other cross-cutting technologies, and other investments that are unallocated. Despite the availability of this international data, international comparisons are still difficult to make given the differing investment, technology preferences and start points between nations, and differences in data reporting mechanisms.

Drawing upon this IEA data and accounting for some of the differences in energy RD&D context and data reporting mechanisms between the countries, this paper highlights how Australia's reported government energy RD&D spend has decreased significantly since 2013. As of 2020, Australia spends less on energy RD&D across the majority of technology categories relative to many key comparable countries. While the level of investment is not necessarily indicative of the quality of the outcomes that can be achieved, if Australia wants to reach net-zero by 2050 using a technology-focused approach, significant increases in energy RD&D funding are necessary.

How does Australia compare?

The Australian Government Low Emissions Technology Statement 2021 highlights that to reach net-zero by 2050, investment in RD&D, and early-stage commercialisation of low-emissions technologies needs support. This includes a focus on clean hydrogen, energy storage, low emissions materials, carbon capture and storage (CCS), soil carbon and ultra-low-cost solar which have been identified as 'priority' technologies.²

However, the IEA data shows that over time, Australia's reported government energy RD&D spend has decreased. Updated data received from the Australian Governmentⁱⁱ in early 2022 confirms this trend. Based on 2020 IEA data, Australia ranks 22nd out of the 30 countries for which data is available on total public energy RD&D spending per thousand units of GDP. Australia ranks last among the seven key comparator IEA countries that have been selected as the focus of this paper: Canada, Germany, Korea, Norway, United Kingdom, and the United States. These IEA members were selected due to their similarities in economies, energy mixes and policy settings relative to Australia.



i The total public energy RD&D includes data on government RD&D, and where relevant or included, state-owned RD&D.

ii From the Australian Department of Industry, Science, Energy and Resources (DISER).

Australia's investments over time

Overall, IEA members' budgets for energy RD&D increased by 6% on average in 2020.³ This constitutes the fourth consecutive annual increase following a five-year decline. This trend is mirrored in Figure 1 which shows how, aside from Japan and Korea, the public energy RD&D spend of the key economies with which Australia is compared has gradually increased overall from 2004–2020.

Critically, reported government energy RD&D spend in Australia dropped significantly between 2013–2014, in part the result of completion of major programs supporting CCS, solar energy and energy efficiency.⁴ Australia's reported spend on energy RD&D has declined further since 2013–14 and as of 2020, Australia spends the least on energy RD&D per thousand units of GDP relative to these other seven comparator economies.

Data note: this paper includes recent data from the Australian Government, which includes additional years not previously reported (2019 and 2020), plus revised data previously reported to the IEA. This outcome is a direct result of ACOLA's analysis that identified a range of issues with Australian data that contributed to previous under-reporting. This new data will appear in the next data release by the IEA, in mid-2022.ⁱⁱⁱ

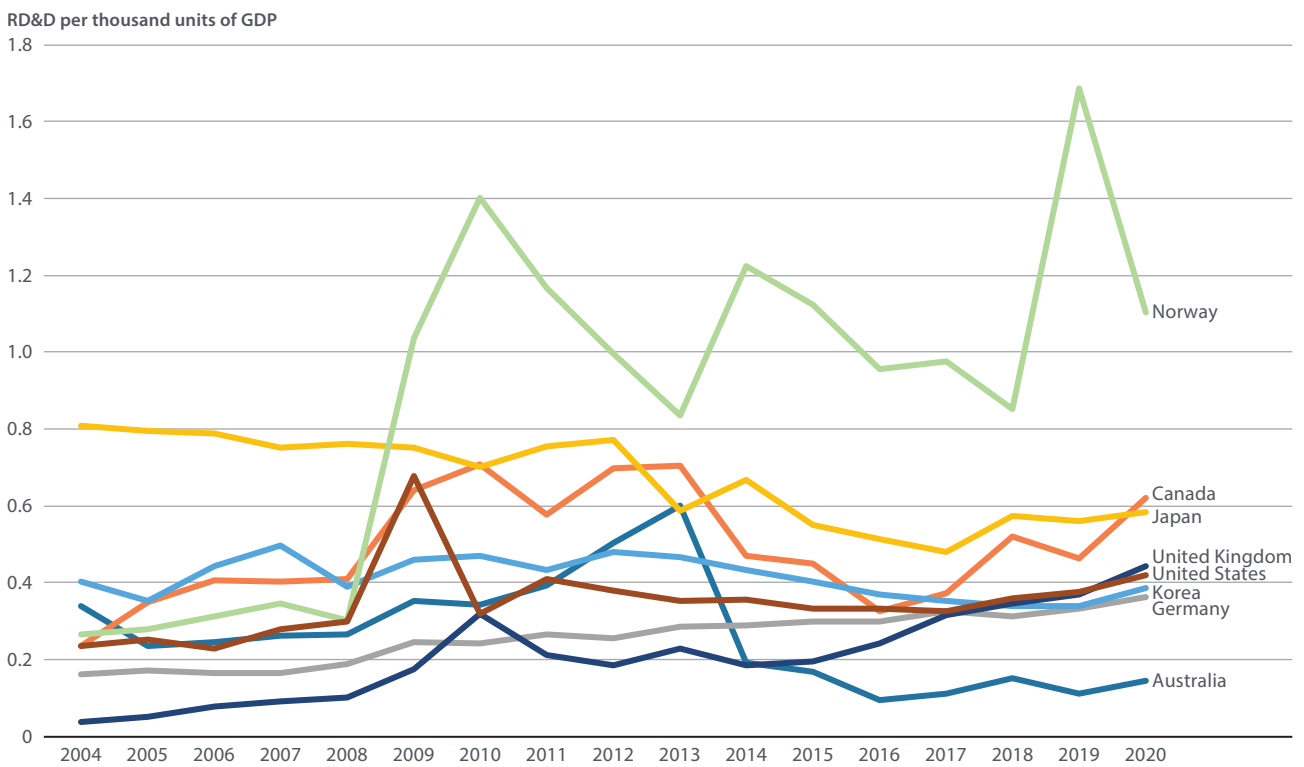


Figure 1: Total public energy RD&D per thousand units of GDP from 2004–2020 for IEA comparator countries. This data includes both historical IEA data and updated data for Australia (2018–2020) provided by the Department of Industry, Science, Energy and Resources (2022)

iii This data has yet to be taken through the data standardisation and verification processes by the IEA.

Australia's spending in 2020

The updated Australian data, received in March 2022, demonstrates that Australia's overall RD&D investment portfolio largely focuses on low-carbon technologies (Figure 2).^{iv} However, the category in which Australia reportedly invests the most government RD&D is fossil fuels,^v followed by investments in renewables and in energy efficiency. For each of these technology categories, Australia reported investing in research and development as well as demonstration.

The total reported government energy RD&D spend per thousand units of GDP for Australia

and the seven comparator IEA countries used here is shown in Figure 3. Spending on nuclear (fusion and fission) is removed from this analysis as Australia does not spend much on, nor prioritises nuclear RD&D compared to many other countries (noting that nuclear power is currently prohibited by Commonwealth legislation in Australia)^{vi}. Even without this category, the data demonstrates the large disparity between Australia's reported government energy RD&D spend and that of the other key economies. Interestingly, all countries invest far less on non-low carbon activities,^{vii} relative to low-carbon activities.^{viii}

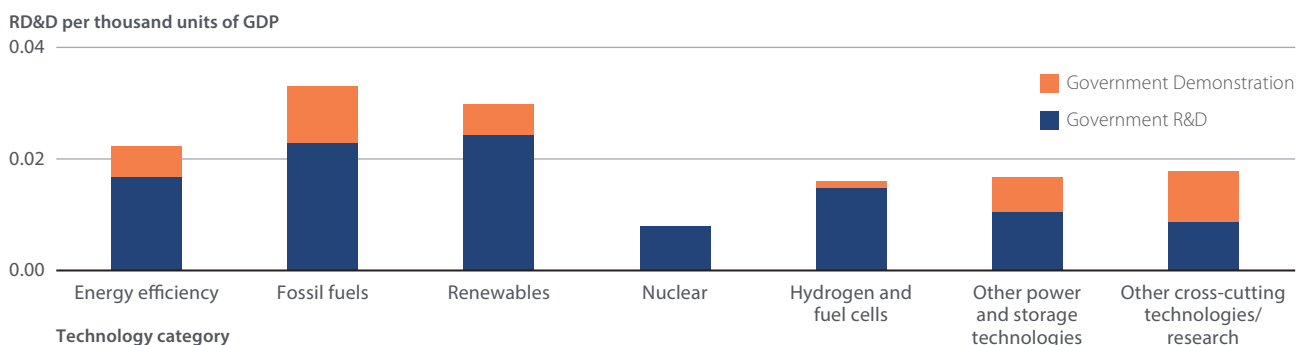


Figure 2: Australia's energy RD&D investment portfolio for 2020 by IEA category using updated data provided by the Australian Government

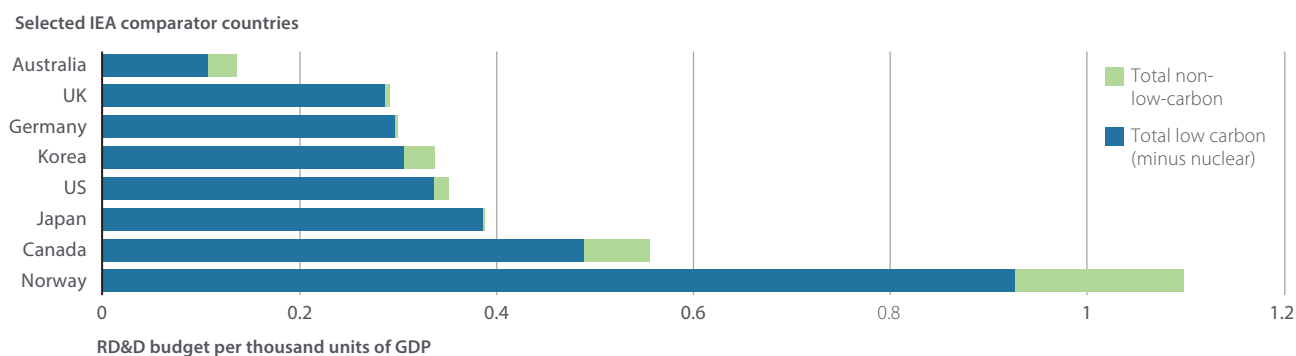


Figure 3: Total public energy RD&D budgets per thousand units of GDP by IEA comparator country for 2020^{ix}. Comparator country data has been obtained from the IEA, Australian data has been provided by the Australian Government

^{iv} Low carbon includes: energy efficiency, carbon capture and storage (CCS), renewable energy sources, nuclear, hydrogen and fuel cells, other power and storage, and other cross-cutting technologies and research & unallocated.

^v This includes solar, wind, geothermal and ocean energy, biofuels, and hydroelectricity.

^{vi} The *Australian Radiation Protection and Nuclear Safety Act 1998* (Cth) (ARPANS Act) and the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) prohibits Australia from the construction or operation of a number of nuclear installations, including nuclear power plants.

^{vii} Non-low carbon includes coal, gas, oil and other fossil fuel RD&D with the exception of CCS.

^{viii} Nuclear has been excluded from the analysis for Figure 3.

^{ix} Expressed in thousand units of GDP.

Looking more closely at the specific technology categories across the different countries, Figure 4 illustrates how different countries prioritised different technologies in 2020.^x In comparison to other countries, Australia's largest investment was in fossil fuels (including CCS) relative to other technology categories. In comparison, Germany and Korea invested more on renewables relative to the other technology categories (omitting the unallocated category). Australia ranks poorly across the full spectrum of technology categories.

Limitations of the data

Data does not reflect recent commitments

The *IEA World Energy Investment 2021* report notes that momentum from net-zero pledges and sustainable finance is yet to translate into large increases in actual spending on clean energy projects.⁵ Consequently, it does not include (1) the Australian Government's commitment to a technology-focused approach to achieving net-zero

emissions by 2050 and related \$20 billion investment into low emissions technology over the next decade,⁶ and (2) other countries' increases in funding related to COP26 to meet their net-zero and interim targets. These changes will likely be reflected in future RD&D data submitted to the IEA.

Current IEA methodology

IEA data currently excludes activities that are part of the innovation process, yet don't fall under the IEA's definition of RD&D. This includes policy-related studies and feasibility studies, except when conducted solely or primarily for the purpose of supporting an R&D project.⁷ However, these studies will play a critical role in developing the solutions needed to support a quick and fair transition to net-zero emissions. In addition, for Australia, as well as for other countries, the scope of the IEA's methodology notably does not include indirect support measures, such as the R&D Tax Incentives (RDTI). Australia's RDTI initiative is used to encourage energy innovation and outlay, aimed at accelerating diffusion and adoption of technologies.

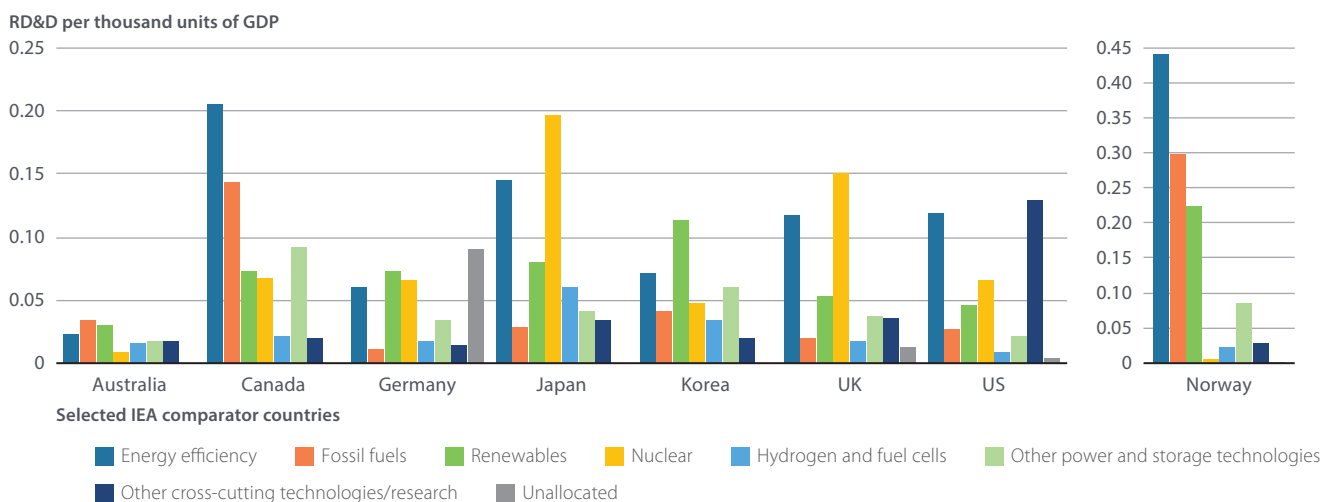


Figure 4: Public energy RD&D spending for different technologies by IEA comparator countries in 2020. Comparator country data has been obtained from the IEA, Australian data has been provided by the Australian Government

x Expressed in thousand units of GDP.

Conclusion

There continues to be opportunities to improve the quality of Australia's data on energy RD&D reported to the IEA, including ensuring all activities and programs that fall within scope are captured (across all levels of government and ministerial portfolios).

Regardless of the IEA reporting requirements, gaining a better understanding of Australia's RDTI expenditure, including at the sectorial level, could provide important insights into Australia's actual overall RD&D spend, including in the energy sector. Greater transparency and accessibility of Australian data will provide insights into current activities and potentially reduce duplication in the research sector and industry.

There may be opportunities to explore whether there is interest with the IEA and member countries to review the underlying IEA methodology to include a broad range of RD&D activities, such as Australia's RDTI.

However, despite data and methodology limitations, the best data available from the IEA and the Australian Government itself shows that Australia is lagging behind other key economies. If it is to deliver upon its technology-focused approach, Australia must ramp up its government energy RD&D spend significantly in the years ahead.

Endnotes

- 1 IEA (2011), *IEA Guide to Reporting Energy RD&D Budget/Expenditure Statistics*.
<https://iea.blob.core.windows.net/assets/a2f370cf-873e-486f-935d-c2a117e14ba6/IEAGuidetoReportingEnergyRDDBudget-ExpenditureStatistics.pdf>
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<https://www.industry.gov.au/sites/default/files/November%202021/document/low-emissions-technology-statement-2021.pdf>
- 3 International Energy Agency. (2021). *Public energy RD&D in IEA countries*.
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<https://www.industry.gov.au/sites/default/files/November%202021/document/low-emissions-technology-statement-2021.pdf>
- 7 International Energy Agency. (2011). *IEA Guide to Reporting Energy RD&D Budget/ Expenditure Statistics*.
<https://iea.blob.core.windows.net/assets/751c1fce-72ca-4e01-9528-ab48e561c7c4/RDDManual.pdf>



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