Benchmarking Research on the Energy Transition

Australian Energy Transition Research Plan

A strategic research agenda to enable Australia's sustainable, reliable, affordable, and fair energy transition.

Combining the strengths of Australia's Learned Academies

ACOLA
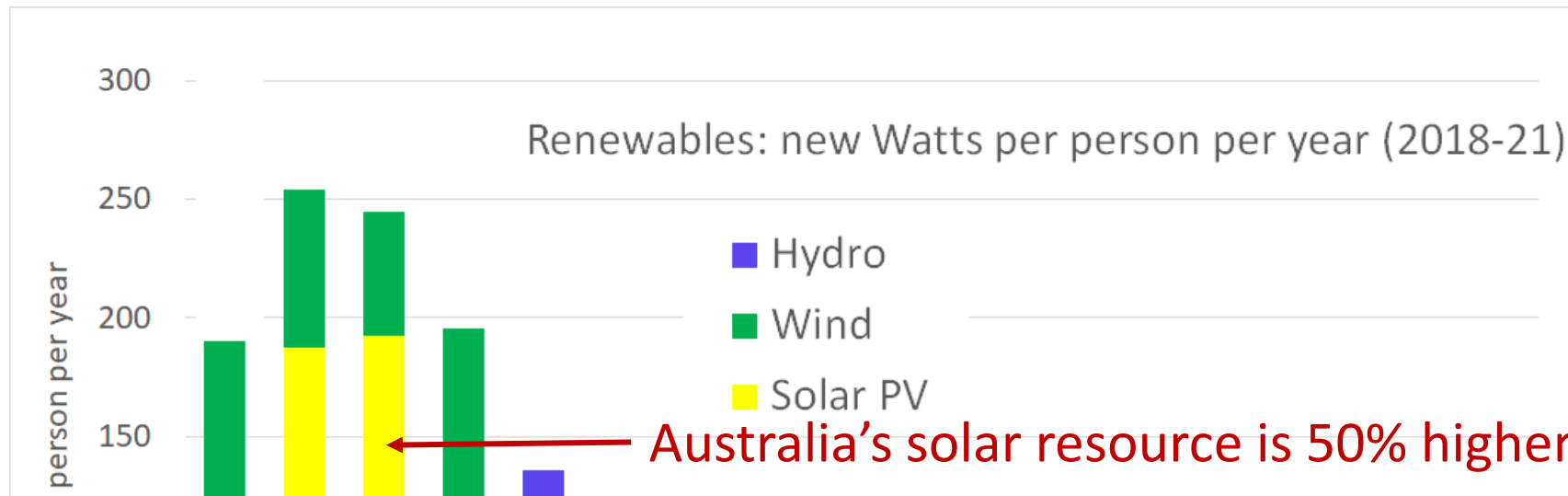AUSTRALIAN COUNCIL OF LEARNED ACADEMIES

Drawing on our network of Australia's leading minds, ACOLA produces independent, interdisciplinary and evidence-based advice to aid policy-makers and governments to make informed decisions.

As the convenor of Australia's five Learned Academies, we recognise that the complex challenges facing society are most effectively addressed by bringing together specialist expertise from across domains.

SYNTHETIC BIOLOGY
IN AUSTRALIA
AN OUTLOOK TO 2030

THE FUTURE OF PRECISION MEDICINE
IN AUSTRALIA

THE ROLE OF ENERGY STORAGE
IN AUSTRALIA'S FUTURE ENERGY SUPPLY MIX

THE EFFECTIVE AND ETHICAL DEVELOPMENT OF ARTIFICIAL INTELLIGENCE
AN OPPORTUNITY TO IMPROVE OUR WELLBEING

THE FUTURE OF AGRICULTURAL TECHNOLOGIES

THE INTERNET OF THINGS

Global per capita RE installation

Renewables: new Watts per person per year (2018-21)

Legend: Hydro, Wind, Solar PV

Australia's solar resource is 50% higher

Australia has the longest, skinniest and most isolated grid in the world, and cannot balance it's energy needs from its neighbours. We're at the cutting edge of the Energy Transition – so research will be an important contributor.

AETRP Steering Committee 2020 - 2023

Mr Drew Clarke AO PSM FTSE (Chair)

Emeritus Prof. Sue Richardson AM FASSA

Dr Bruce Godfrey FTSE

Emeritus Prof. Libby Robin FAHA

Prof. Kenneth Baldwin FAIP FInstP FOSA FAPS

Prof. Fran Baum AO FAHMS FASSA

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Australia's Energy Transition Research Plan (June 2021)

- The Research Plan has identified the *urgent* and *strategic* research priorities (and critical gaps) that require assessment for a successful Australian energy transition.

- Three themes for priorities were identified: energy system dynamics; social engagement dynamics and transition dynamics, with three topics under each.

- In considering the identified gaps and highest priority areas, researchers and research funders can direct research efforts and funding to accelerate national efforts.

- We encourage funders to utilise the priorities in their funding guidelines and assessment of applications, to help ensure funding has the most impact or benefit.

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Australian Energy Research Priorities

Research priorities: themes and high-level questions

Theme: Energy System Dynamics

Topic	Scope	Time
1. Technology	Low, zero and negative emission technologies are essential for the energy transition. The Australian Government has identified priority technologies (and several emerging, enabling and 'watching brief' technologies) for government and industry support, with an annual review cycle. It will be important to ensure that Australia has the appropriate energy mix to meet its future domestic needs, and to grow a clean energy export market.	
1.1	**Policy framework**: How might technology policies in Australia be further developed (additional or alternative energy technologies, energy efficient mechanisms R&D programs, industry participation, deployment support mechanisms) as our transition pathway evolves over time?	Urgent
1.2	**National advantage**: Where does Australia have a competitive or comparative advantage in clean energy technology research and development, and how can this be exploited to support the energy transition?	Urgent
1.3	**Research focus**: What are the specific core, niche or enabling technologies where Australia should make a concentrated research effort (should our energy technology research effort be more specialised)? How can this adapt to consider international developments?	Strategic
2. Transition pathways	There are multiple techno-economic pathways to a net zero emission energy system by 2050 (most assuming massive renewable electrification with storage, and a new hydrogen industry, to replace coal, oil and gas). The actual pathway and technology mix will evolve, with the extent and timing of sectoral coupling and clean energy exports being significant uncertainties.	
2.1	**Scenarios**: What are the main feasible transition pathways, and where are the greatest uncertainties, based on current knowledge and forecasts?	Urgent
2.2	**Pathway implications**: What are the costs, benefits, impacts and risks to the Australian economy, society and environment of these pathways (what parts are most difficult, how important are clean energy exports, do we have comparative advantages)?	Urgent
2.3	**Scaling conditions**: How will we reach the social, technical and economic conditions required for a successful transition of this scale? What are the scaling, economic adjustment and capital mobilisation issues?	Strategic
3. Systems integration	The energy economy is a complex system of systems with multiple interdependencies, all now being disrupted. There are interdisciplinary issues (technical, economic, regulatory, market design, equity and fairness) that must be addressed.	
3.1	**Integration**: What are the critical system integration issues for low/zero/negative emission energy technologies across sectors (including social, economic and technical considerations), and do we have the necessary interdisciplinary capabilities to address them?	Urgent
3.2	**Infrastructure**: What national energy-related infrastructure changes are required, what investment is needed to support these changes, how can this investment best be funded?	Urgent
3.3	**Digital**: How can emerging digital technologies be leveraged in energy systems integration; and are we well-placed to utilise these technologies (do all stakeholders, including local communities, have the necessary data and analytical tools)?	Strategic

Australia's Energy Transition Research Plan - publications

- **Report 1:** Australian Energy Transition Research Plan
- **Report 2:** Australia's Funding of Energy Research – Quantum and Comparison
- **Report 3:** Energy System Dynamics (Theme 1)
- **Report 4:** Social Engagement Dynamics (Theme 2)
- **Report 5:** Transition Dynamics (Theme 3)
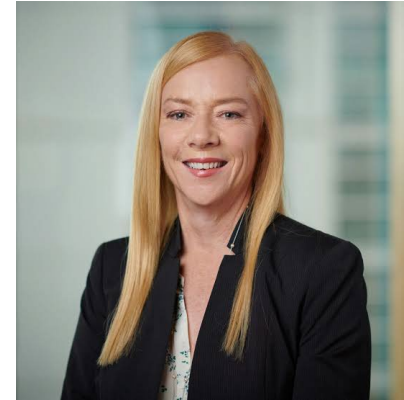- **Report 6:** Energy Research Translation

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AETRP Steering Committee 2024

Ryan Winn
(ACOLA CEO)

Professor Kenneth
Baldwin FTSE (Chair)

Emeritus Professor
Sue Richardson AM
FASSA

Merryn York
FTSE (AEMO)

Professor Fran Baum
AO FASSA FAHMS

Professor Lesley
Head FASSA FAHA

Professor Thomas
Maschemeyer
FAAS

2024 Ongoing priorities

- Periodically review and update the Research Plan to identify gaps in the Energy Transition that research can inform – particularly internationally

- Work with CSIRO on its Energy Transition modelling and technology analysis – see presentation by Dietmar Tourbier in today's panel

- Internally assess the performance of the AETRP committee

- Establish benchmarks for national progress on the Research Plan

- Work with Government to improve Australia's contribution to the IEA comparative measures of energy research funding by governments

# Benchmarks for national progress on the Research Plan

- State of Energy Research Conference
  - Canberra, July 2019
  - Melbourne, December 2021 (virtual)
  - Sydney, January 2023
  - Perth, February 2024
- Potential metrics
  - Number of SoERC papers/attendees
  - Industry/government engagement (attendees, panels ….)
  - Summary communique from SoERC on key directions
  - Number of Australian-led energy publications
  - Number of research-led submissions to government inquiries
  - ………….

IEA comparisons of energy research funding

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.

Total public energy RD&D budgets per thousand units of GDP by country for 2019.
Source - IEA website
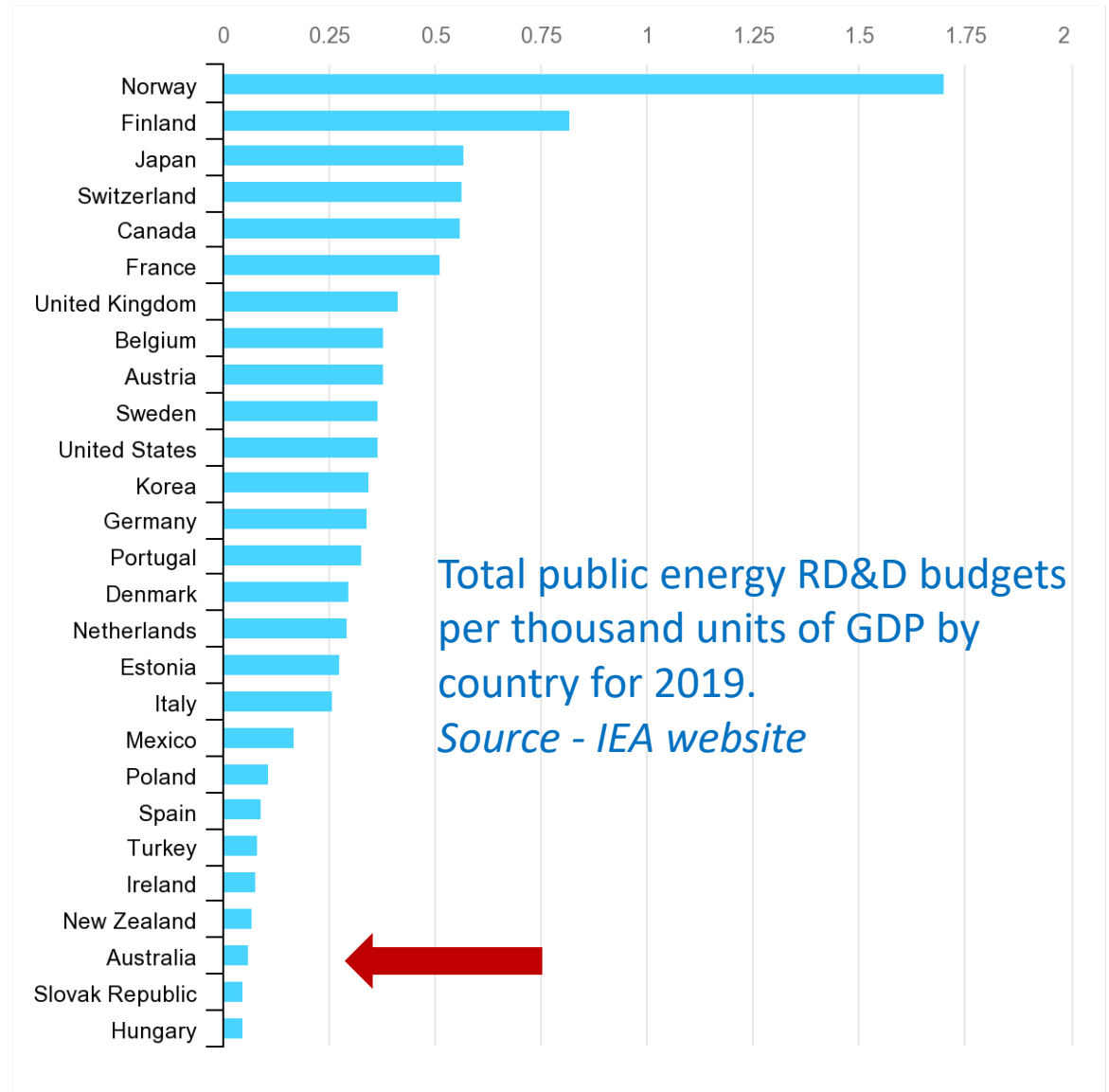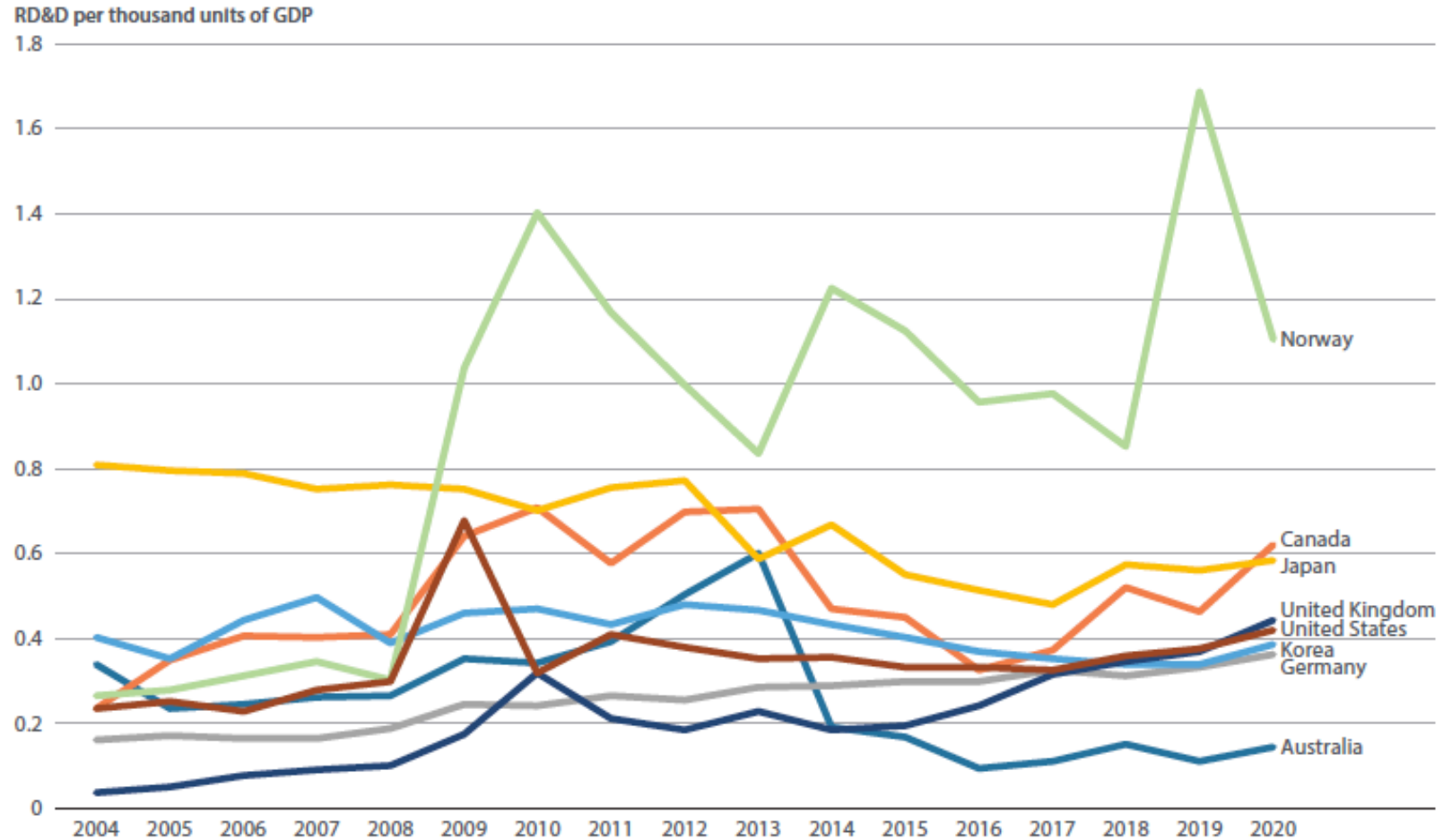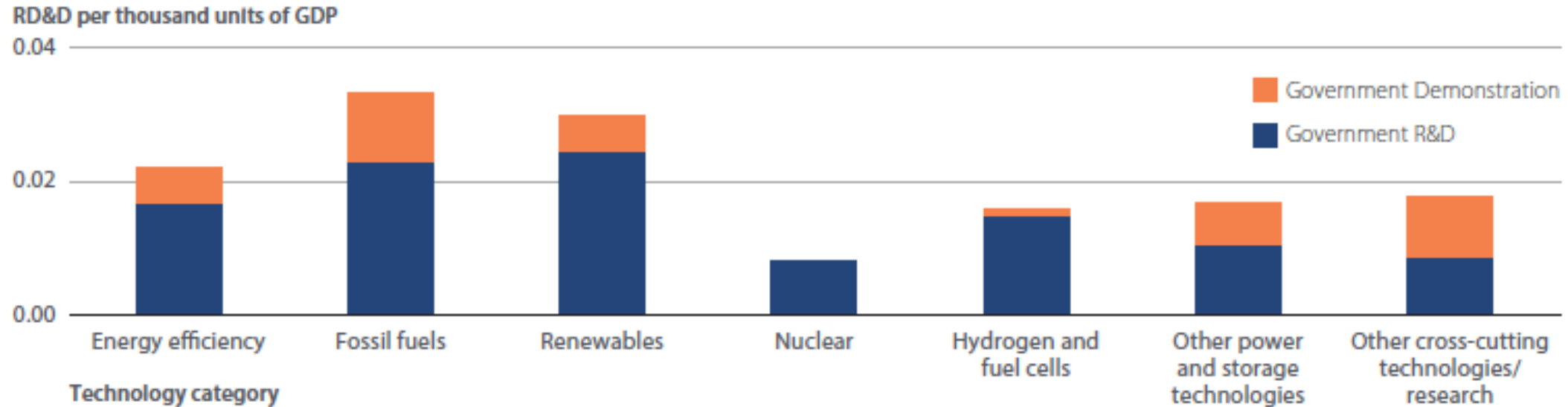
AETRP comparisons of energy research funding

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)
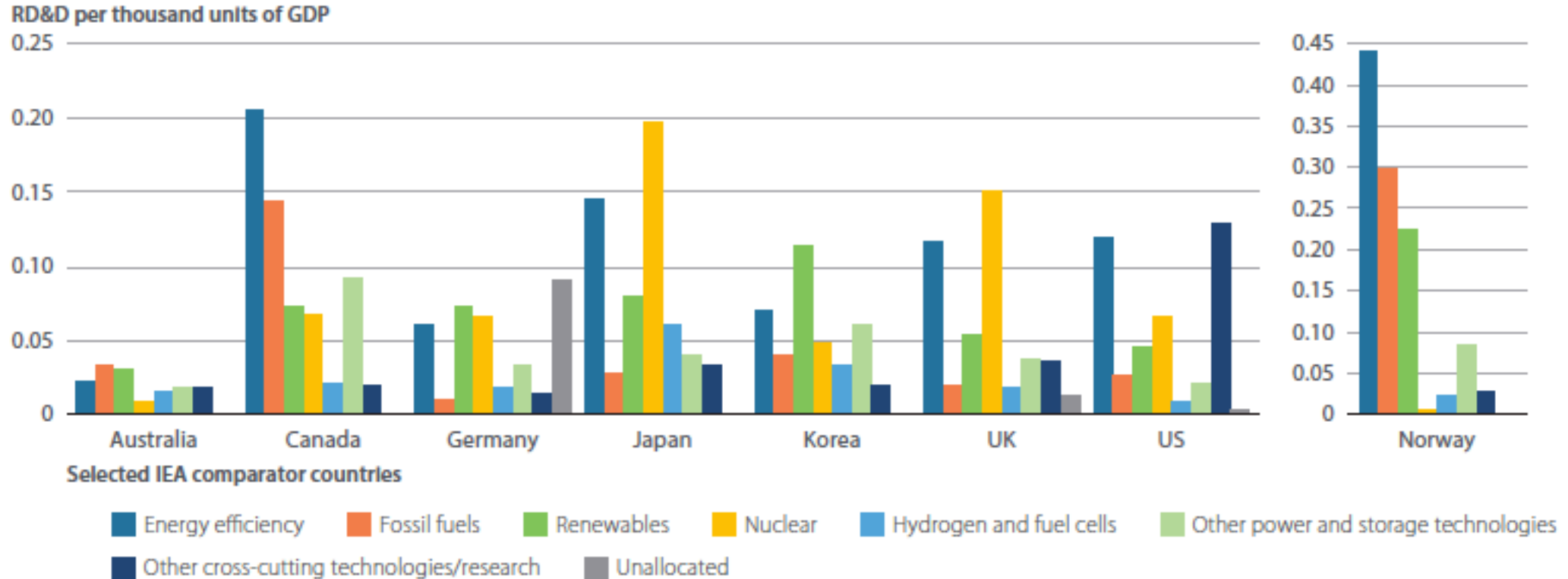
AETRP comparisons of energy research funding

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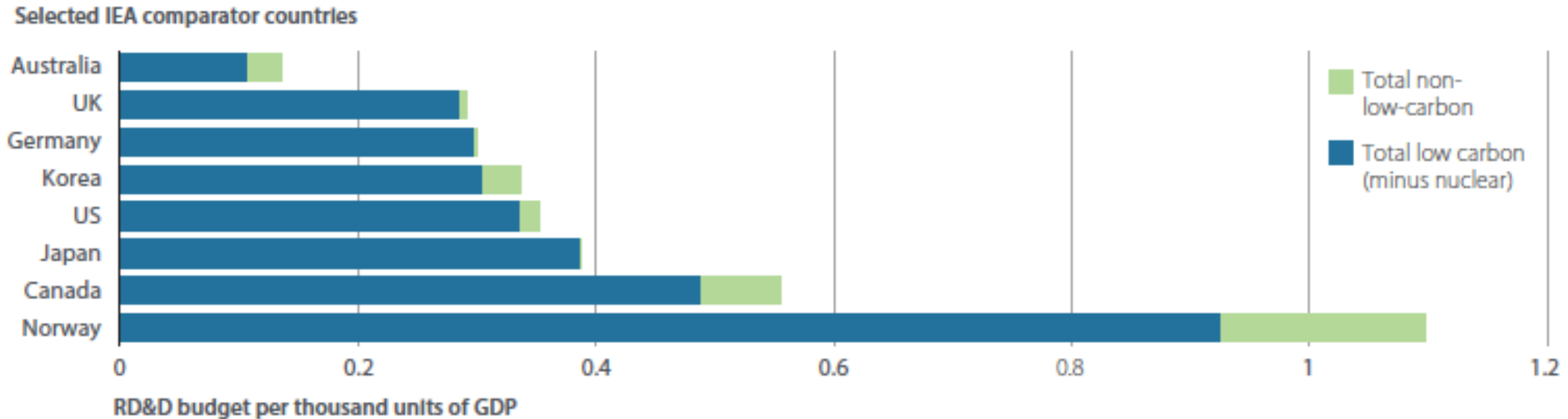
AETRP comparisons of energy research funding

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

AETRP comparisons of energy research funding

Selected IEA comparator countries

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

Note: expenditure on nuclear research is excluded

AETRP comparisons of energy research funding

- Key issues:
  - Australia still spends less than our comparators - no matter how you cut it
  - Nuclear research is expensive and can distort the figures for nuclear countries
  - Indirect expenditure isn't counted e.g. the Australian R&D Tax Incentive

- Path forward:
  - Continue to liaise with the IEA and DCCEEW to harmonise country reporting
  - Encourage energy research organisations to lobby harder to improve energy RD&D funding
  - Note that Australia performs poorly across all forms of RD&D funding: 1.68% in 2021 c.f. world average of 2.71%
  - If overall RD&D funding were to be raised to 3% and Energy RD&D were raised proportionately, we'd still be behind the AETRP comparator countries!

Thank you
and
Questions