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8 September 2017

Senator Jane Hume  
Chair, Legislation Committee  
Senate Standing Committees on Economics  
PO Box 6100  
Parliament House  
Canberra ACT 2600

Dear Senator Hume

**Go8 submission on the Nation-Building Funds Repeal (National Disability Insurance Scheme) Bill 2017**

The Group of Eight (Go8) welcomes the opportunity to make a submission to the Committee on behalf of its members who may also make individual submissions.

The Go8 represents Australia's leading research-intensive universities, accounting for over two-thirds of Australian university research activity, spending around \$6 billion per year on research with the Go8 investing \$3.2 billion annually in applied research and experimental development. Go8 research has resulted in significant innovations with social, commercial and health applications including the cervical cancer vaccine Gardasil, the Cochlear implant to assist the hearing impaired, SNAP technology vital to anti-terrorism airport surveillance and the Nanopatch to painlessly deliver and efficiently store vaccine doses.

The *Nation-Building Funds Repeal (National Disability Insurance Scheme) Bill 2017* seeks to repeal the *Nation-Building Funds Act 2008*, and thereby abolishes the Education Investment Fund (EIF).

Importantly and upfront, it should be noted that the Go8 unambiguously supports the creation of the landmark National Disability Insurance Scheme (NDIS), however proposals to part fund the Scheme by using funds earmarked for critical research infrastructure are short-sighted.

The EIF has been deliberately positioned by successive governments to assist research, something the government claims is at the heart of our economic future and, whilst we absolutely agree that the NDIS should be funded adequately, using EIF monies is not appropriate.

The fact is that if you damage research, you damage not only the research-driven medical and other advances that could prevent or alleviate permanent impairment but indeed the economy which sustains many of the critical services we wish to have available in the long term.



## Recommendations

1. That the Committee recommend that the *Nation-building Funds Repeal (National Disability Insurance Scheme Funding) Bill 2017* be amended to exclude the abolition of the EIF and to include provision for new legislation that quarantines the EIF monies to fund both capital and operational costs of national research infrastructure over the long-term.
2. That the Committee note the significant contribution the EIF has made to Australian research and discovery, to changing the lives of Australians including through driving novel and ground-breaking solutions and enabling economic recovery and growth.
3. That the Committee find that the intent of the *Nation-building Funds Repeal (National Disability Insurance Scheme Funding) Bill 2017* to close the EIF and pave the way to redivert its funds is counterproductive and contrary to the intent of budget savings and long term insurance for the nation.

## Key points

1. The Go8 considers the National Disability Insurance Scheme (NDIS) if effectively implemented to be an important step change in how future governments, and indeed we as a society, can improve the services to and facility of life for those of our community adversely affected by disability and permanent impairment. The Go8 strongly supports the appropriate and effective funding of the NDIS.
2. However, Governments have choices in how to fund such landmark schemes. The Go8 contends that the Government can exercise its option not to use the remaining EIF funds for this purpose, in view of the devastating impact the loss of the EIF will have on the nation's research capability. The use of EIF, conversely, to alleviate the cost of the NDIS can only have a temporary, short-term and relatively insignificant impact on the scheme's budget.
3. While recognising the EIF was originally purposed for and has also supported significant infrastructure projects for higher education and vocational education and training, the Go8's primary concern is with the proposed loss of EIF monies as a future funding source for urgent renewal of vital, enabling research infrastructure<sup>1</sup>.
4. The Government's intentions are in direct opposition to independent advice it commissioned, but has not yet formally responded to. That advice, from the Review of Research Infrastructure, places the EIF – and its leveraging power to attract co-investment – at the centrepiece of a long-term, sustainable and well-premised funding solution for national research infrastructure.
5. Arguments are for the utility and benefits to the nation of the EIF in funding research infrastructure. The EIF has enabled research that has saved lives, enhanced lifestyles and ensured the survival of key economic sectors by modernising and making them more productive. It has created jobs and its benefits have flowed through local economies.
6. Our international competitiveness and reputation in higher education provision and as a research nation will be placed at risk. Benefits to industry, the Government's Industry portfolio and innovation agenda, and other functions and priorities of government will be compromised.

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<sup>1</sup> Such infrastructure comprises tools, equipment, instrumentation, services, assets and facilities that facilitate ground-breaking research that otherwise could not occur, would not be possible or would be significantly delayed.



7. The loss of the EIF will significantly further compromise the higher education sector if compounded by the cuts to university funding proposed under the Government's Higher Education Support Legislation Amendment (A More Sustainable, Responsive and Transparent Higher Education System) Bill 2017.



## Further discussion

### Budgetary options

The Committee, in being charged to consider and report on this Bill, is being asked to make a judgement call on the importance of one budget priority over another.

The EIF, originally the Higher Education Endowment Fund (HEEF), was created by the Howard Government as a mechanism to respond to an urgent and ongoing issue: the funding of capital works and research facilities in higher education institutions, with an initial investment of \$6 billion.

It was created as a perpetual fund that would generate earnings for this purpose<sup>2</sup>— drawing from the Future Fund established by the Howard Government. The intent and purpose was strongly recognised and supported by the subsequent Labor Government who retained the Future Fund but established the EIF as an alternative to HEEF, allocating initially \$11 billion to the new fund, including the \$6 billion from HEEF.

Bi-partisan support for a long-term approach to funding infrastructure in our higher education institutions showed significant foresight. The EIF as a fund has been employed flexibly to this end by subsequent Governments.

The then Labor Treasurer, the Hon. Wayne Swan, MP, noted in his 2008 Budget speech:

‘Our education infrastructure is in urgent need of attention, right now.’

**This remains a critical issue. Two recent reports to Government, the Report of the Higher Education Infrastructure Working Group (HEIWG) and the Review of Research Infrastructure have highlighted the significant gap that exists in infrastructure provision and funding.** The HEIWG<sup>3</sup> recommended that the Government ‘develop a long term plan to provide adequate funding for transformative institutional research infrastructure and teaching facilities, with co-investment and collaboration as prerequisites’. It also found:

- ‘If Australian universities are to maintain world class research undertaken in appropriate facilities there is a clear need for policy settings which provide appropriate direct funding for university research infrastructure, both transformative and at an operating level.’

The Review of Research Infrastructure<sup>4</sup> observed that Australian Government investment in national research infrastructure is critical, and recommended that the Government establish a long-term funding program for this purpose. **The Review’s expert panel recommended that the basis for this fund, the Australian National Research Infrastructure Fund (ANRIF), be the remaining monies in the EIF, then at \$3.7 billion, to which an additional \$2.9 billion generated in earnings and co-investment from various sources would be added.**

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<sup>2</sup> The Treasurer the Hon Peter Costello MP 2008, Budget speech 2007-08

<sup>3</sup> Higher Education Infrastructure Working Group Final Report 2015

<sup>4</sup> Research Infrastructure Review Final Report September 2015



**The Government has not yet formally responded to the Review of Research Infrastructure, submitted to it in 2015.** In seeking to expedite the repurposing of the EIF for another purpose, however important, it has failed to have due regard to the independent advice it commissioned. **It also disregards the advice of the 2014 National Commission of Audit**, which advised a previous Coalition Government that:

Quality research infrastructure is a critical component of Australia's research and development system [and that]

The Government take a more strategic, whole-of-government approach to the funding of research and development, including by committing to ongoing funding for critical research infrastructure in Australia, informed by a reassessment of existing research infrastructure provision and requirements.

In ignoring this advice, and the urgent imperatives to fund research infrastructure, the Government is in danger of re-enforcing for Australian research the same fiscal pitfalls and risks that form part of the challenges to be met by the NDIS. In effect, it is robbing Peter to pay Paul.

Using this analogy, the Go8 is not advocating that Paul not be paid. Simply, that in exercising budgetary discretion across the various portfolios, priorities and issues at play, **the Government – informed by judicious advice – must consider that it cannot afford to sacrifice the important work our researchers do and the critically important outcomes that research leads to, in order to achieve a gain of a different and important kind.**

**Therefore the Go8 recommends that the EIF remaining monies be protected and quarantined to serve the urgent need of funding national research infrastructure as recommended by the Review of Research Infrastructure.**

#### Urgently needed research infrastructure

This submission is premised on the Go8's support for a long-term fund, the ANRIF, to support national research infrastructure built on remaining EIF funds as recommended by the Review of Research Infrastructure.

It relates to research infrastructure that facilitates ground-breaking research of the type that might otherwise not occur, not be possible or that might otherwise be significantly delayed.

It is impelled by the danger that the only existing source for capital research infrastructure builds and upgrades will disappear, following a period when the Government has consistently failed to respond effectively to successive and compelling arguments<sup>5</sup> for holistically funding the national research infrastructure system.

**The Government has yet to formally respond to the 2016 National Research Infrastructure Roadmap**, which was expected to provide the latest analysis to help define its response to the repeatedly made case for funding.

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<sup>5</sup> The case has been made successively by the 2011 Strategic Roadmap for Australian Research Infrastructure, the 2015 Review of Research Infrastructure, and the 2016 National Research Infrastructure Roadmap.



Indeed the 2016 Roadmap – provided to the Government in February 2017 – identifies two national facilities<sup>6</sup> requiring urgent consideration for renewal, a situation directly due to the lack of significant funding for infrastructure build and upgrades since 2009-10. Other national facilities integral to Australian research and outcomes for the nation are teetering at the edge of this dire situation. There are at least two other major ramifications:

- The point at which previous investment in a facility can be successfully built on through a timely renewal and upgrade will pass, resulting in a failed opportunity to capitalise fully on the use of taxpayers' funds;
- Key skilled personnel at these facilities – faced with the uncertain prospects for their future – will be lost as they seek and find longer-term contracts, including overseas.

It is notable that while the Government in December 2015 announced funding into research infrastructure under the National Innovation and Science Agenda, this does not cater for capital builds and renewal – other than for the Australian Synchrotron and the Square Kilometre Array, two facilities that fall under the Government's Industry, Innovation and Science portfolio. The National Collaborative Research Infrastructure Strategy (NCRIS), which falls under the Education portfolio and has 27 facilities, has been propped up with funding for operation and maintenance only. **To compound the issue, the Government has allocated only two years of its announced forward investment over ten years to NCRIS facilities**, leaving them with the medium to long-term uncertainty that has plagued them over four successive Australian Government terms.

In effect, the Government – while yet to formally respond to key reviews and strategies – is, in the absence of any other viable solution, moving to make a major decision contrary to that consistent advice, the abolition of the EIF.

#### The utility of the EIF

It has created major research infrastructure whose collective footprint spans an extraordinarily wide scope of research.

It has enabled research that has saved lives, enhanced lifestyles and ensured the survival of key economic sectors by modernising and making them more productive.

A cursory scan of the infrastructure funded under the EIF provides only a superficial view of the advances in research and the diversity of areas it supported – ranging from health and medical, environmental, geoscience, advanced manufacturing, and energy. **Attachment A** provides a fuller list of the types of benefits the EIF has enabled – however a brief indication is provided below:

Among other health and medical outcomes from Go8 led projects alone, the EIF has enabled:

- research into the causes of autism spectrum disorder;
- more precise insulin dosage predictions;
- a national childhood diabetes database;

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<sup>6</sup> These are the National High Performance Computing and the Australian Animal Health Laboratory.



- antibiotic development;
- the use of crops to develop pharmaceuticals;
- the identification of a gene whose discovery will help treat the lethal disease sepsis;
- ground-breaking x-ray imaging to detect real-time changes in the lung;
- development of new wrist orthopaedic implants to speed healing of wrist injuries;
- better understanding of whether war veterans with Traumatic Brain Injury or Post Traumatic Stress Disorder are at increased risk of Alzheimer's Disease later in life;
- further research into: obesity; diabetes; cardiovascular conditions; infectious diseases such as flu viruses; preventative health; gastric and ovarian cancer; cystic fibrosis; mental health; neural diseases and brain disorders; immunological and blood diseases; population health; and endocrine disorders;
- regional health education including through the Joint Health Education Facility at Port Macquarie, a collaboration between the UNSW, the University of Newcastle and North Coast TAFE.

#### Economic impact

As expected, the EIF has generated jobs, initially for those involved in the construction of new facilities but extending well into the implementation and use of these facilities.

While figures are not available for the whole of the EIF, the impact of research infrastructure on the job market for a comparable program, the National Collaborative Research Infrastructure Strategy (NCRIS), is well-known.

Indeed, the **EIF supported at least 80 per cent of the National Collaborative Research Infrastructure Strategy (NCRIS) network (22 facilities)** at critical junctures when lapse of funding would have resulted in closure of facilities, discontinuation of key research, and adverse effects on thousands of researchers, technical staff and others.

In 2014, a Department of Education survey showed that **over 1700 highly skilled STEM workers – of which 74 per cent were technical staff – were employed directly due to NCRIS**. A total of 35,949 researchers used NCRIS research infrastructure.

Additionally, the EIF has enabled research that has or has the strong potential to have **direct impact on industries and their contribution to the economy**. A few examples are provided below:

- research into factors affecting cows becoming pregnant and their ability to successfully wean calves;
- research into new solar and plasma energy solutions;
- predicting flows of liquid through rock to aid mining outcomes – a development that resulted in a spin-off company, Lithicon, by the Australian National University and the University of NSW, that was so successful it eventually sold for record \$76 million;
- the use of imaging infrastructure to get a better view inside oil and gas pipelines, to inform solutions to the formation of hydrates that result in blockages, loss of production and safety issues; and
- the development of new more sustainable crop lines.



As indicated by the Review of Research Infrastructure<sup>7</sup>, public and private investment in research infrastructure flows through local economies. There is also an economic multiplier effect with the personnel employed also being customers in local markets which employ even more labour.

As an example, the Coalition's 2016 Election Policy for Jobs and Growth in Tasmania committed funding under NCRIS to the Integrated Marine Observing System – a facility that received \$52 million from the EIF under the Super Science Initiative – noting that by doing so it would enable the ongoing provision of data critical to the fishing industry, climate prediction and the resources sector.

#### The leveraging power of the EIF will be lost

'the importance of the Government's role cannot be overstated. It is not simply the leading architect of the national strategy but the major investor .. the anchor that provides state and territory governments, universities and research agencies with planning security to underpin their co-investment.'<sup>8</sup>

Government's investments of around \$4.207 billion through the EIF at last count have leveraged significant co-investment from local and international universities, research organisations and facilities, governments including state and territory in Australia, industry and other parties.

**Not only will \$3.78 billion be lost from the EIF, but so will the buying power it has to attract co-investment** from sources outside the Australian Government to support researchers. As a quantification, **an additional \$1.06 was attracted for every \$1** the Australian Government invested into NCRIS.

The repurposing of the EIF remaining funds only puts off a problem of similar nature if not magnitude – the undeniable necessity for the Government to find over the next decade funds for national research infrastructure, an amount equal to if not exceeding the monies left in the EIF.

By the sake of comparison only, we note that the monies left in the EIF, representing but a fraction of the yearly budget of NDIS – estimated by 2019-20 to reach \$22 billion at full scheme – even when added to the remaining monies in the Building Australia Fund (totalling under \$8 billion), will make an immediate but over the long-term negligible difference to the NDIS debt.

#### Australia will be internationally compromised

It is partly due to the EIF and notably through NCRIS – which the EIF has also enabled – that Australia has gained a reputation as a research heavyweight, attractive to overseas talent and prominent researchers, with proven capability in building and implement world class research facilities.

Our contribution as a country to global discovery and advances will be hampered not only by the potential loss of Australia's own research infrastructure, but also through the loss of our ability to subscribe as researchers to

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<sup>7</sup> Research Infrastructure Review Final Report September 2015

<sup>8</sup> 2016 National Research Infrastructure Roadmap





international research infrastructure and more significantly by endangering our strong record as international research collaborators.

A prominent example is Australia's successful bid to co-host with South Africa the Square Kilometre Array (SKA), which will be the largest, most capable radio telescope ever built – expected to significantly expand human understanding of the universe and in so doing to drive technological advancements – such as the management of exponential amounts of data – worldwide. The EIF provided \$80 million to establish Australia's second petascale capability high performance computer and related facilities housed at the Pawsey Centre in Perth.

Several EIF funded national research facilities are part of world wide networks or facilitate international research. Examples include:

- The Pawsey Centre and Australia's other petascale high performance computer, the National Computational Infrastructure in Canberra
- IMOS and the Terrestrial Ecosystem Research Network
- EMBL Australia (as a partner laboratory of the European Molecular Biology Facility – EMBL)
- Australia's participation in the international Giant Magellan Telescope including the construction and development of key instrumentation at Mount Stromlo
- The Australian National Fabrication Facility, critical to many global research advances, including in defence, medical delivery, and manufacturing.

The loss of the EIF endangers not only our research capability and activity, but the resulting benefits. Research infrastructure of the quality funded by the EIF has contributed strongly to the Go8: being consistently the highest ranked Australian universities in international rankings; providing half the research graduates in Australia; and educating over 100,000 students from international countries. One in three international students that choose to come to Australia study at a Go8 university, while the excellence of our research contributes to the higher education sector's overall attractiveness as an international education provider, contributing to the \$23.5 billion international education industry.

The importance of research infrastructure to international education is recognised by the Government – for example the Department of Industry, Innovation and Science notes the importance of access to and training at national research infrastructure facilities in attracting international students and supporting Australia as an education destination<sup>9</sup>.

#### There is widespread support for the effective and long term funding of research infrastructure

As demonstrated by **Attachment B**, beyond the university and publicly funded research sectors, the arguments are being made and supported by diverse parties who refer to the impacts in various areas of activity:

1. Industry
2. The Australian Government itself

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<sup>9</sup> Department of Industry, Innovation and Science 2016, Submission to 2016 National Research Infrastructure Roadmap Capability Issues Paper



3. State and territory governments
4. International stakeholders

Many cite the power of research infrastructure to ignite a passion for science and in underpinning learning programs for students of school age. Others cite onshore revenue from technology export, the creation of spin-offs and start-up companies, the engagement of local SMEs, and benefits to rural and regional Australia<sup>10</sup>.

#### The risk to Australia's innovation capability

A key enabler of innovation and discovery in Australia – including of novel health and medical solutions – is at risk. The Government's innovation agenda will be seriously compromised, and emerging and future transformative enablers of our economy will be jeopardised.

Research infrastructure is a key factor in our members' international ranking performance, which attracts international innovation investment such as the Go8 – IP Group \$200 million commercialisation fund.

We note the risk of a discontinued EIF, as a source of research infrastructure funding, to the Government's key portfolio for innovation – the Industry, Innovation and Science portfolio.

- Outside of the universities, the portfolio's publicly funded research organisations – CSIRO, the Australian Institute of Marine Science, and the Australian Nuclear Science and Technology Organisation (ANSTO) – are custodians of and highly dependent on key infrastructure facilities that have been directly funded, supported or could be in future assisted by EIF funds. These include the national research vessel, the RV *Investigator* – which was established with \$120 million of EIF funds – as well as the OPAL research reactor and the Synchrotron.
- The role of research infrastructure in fostering industrial competitiveness and improving linkages with industry will also be compromised.
  - For instance, Australia's 10 per cent share in the Giant Magellan Telescope, enabled through over \$88 million from the EIF, places Australia in a strong position to bid for design and construction contracts - that would not be otherwise possible. The Australian Astronomical Observatory, sited in the Department of Industry, Innovation and Science, is already building an optical fibre instrumentation system for the GMT, while the ANU's Advanced Instrumentation and Technology Centre is developing an Integral Field Spectrometer for the telescope<sup>11</sup>.

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<sup>10</sup> Astronomy Australia Ltd notes the benefits over decades to the regional NSW towns of Coonabarabran, Parkes and Narrabri (Submission to the 2016 National Research Infrastructure Roadmap Capability Issues Paper)

<sup>11</sup> Astronomy Australia Ltd and National Committee for Astronomy 2016, Submission to 2016 National Research Infrastructure Roadmap Capability Issues Paper



- Vaxxas is a venture capital funded technology start-up company developing technology – the Nanopatch – that originated from Professor Mark Kendall's research group at The University of Queensland. The Queensland node of the Australian National Fabrication Facility, an NCRIS facility that received \$50 million from the EIF, was integral in the development of this viable alternative to needle injections and the transport issues associated with liquid vaccines<sup>12</sup>.

We will reiterate a point that the Go8 made in response to the Review of the R&D Tax Incentive.

Programs that have been highly successful internationally that assist in driving an innovation agenda and therefore productivity and jobs, have one thing in common – they have been allowed time to succeed quarantined from political vagaries and changes of Government.

#### The risk to Australia's higher education sector

The sector is already facing 10 per cent cuts in direct Government support through the Commonwealth Grants Scheme, touted in the Government's *Higher Education Support Legislation Amendment (A More Sustainable, Responsive and Transparent Higher Education System) Bill 2017*.

Measures in that bill compound the research funding issues faced by Australian universities. Research – both in terms of direct project costs and indirect costs are underfunded. Demonstrating the magnitude of this issue, in 2014 the Go8 invested \$6.1 billion dollars in R&D with half (\$3.0 billion) sourced from non-research specific General University Funds.

The loss of \$3.7 billion through the repurposing of the EIF will cripple the sector.

#### **ATTACHMENTS**

- A. KEY OUTCOMES – GO8-LED EDUCATION INVESTMENT FUND (EIF) INVESTMENTS**
- B. SOME SUPPORTIVE COMMENTS FROM END-USERS OF RESEARCH INFRASTRUCTURE**
- C. SOME KEY FACTS ABOUT THE EIF**

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<sup>12</sup> <http://www.anff.org.au/case-studies/nanopatch.html>

## Attachment A

## KEY OUTCOMES – GO8-LED EDUCATION INVESTMENT FUND (EIF) INVESTMENTS

**\$1.273 billion has been allocated to or through Go8 institutions in relation to 31 infrastructure projects, from a total of \$4.207 billion disbursed from EIF.**

### 1. EIF ROUND ONE / HIGHER EDUCATION ENDOWMENT FUND

*A TOTAL of \$580 million was allocated for 11 successful projects announced in December 2008<sup>13</sup>, assessed and approved pursuant to the Higher Education Endowment Fund (HEEF). These were selected from 55 eligible applications received through the 2009 funding round of the HEEF.*

*Go8 institutions attracted a total of **\$425.9 million** (73 per cent of funding) across six of the 11 projects.*

	<b>University of Sydney</b>	Centre for Obesity, Diabetes and Cardiovascular Disease	\$95 million <b>Student focus</b>
Health and medical	<p>The \$385 million Centre for Obesity, Diabetes and Cardiovascular Disease (Charles Perkins Centre Research and Education Hub) brings together researchers, clinicians and students from all 16 of the University of Sydney's faculties to find solutions to obesity, diabetes, cardiovascular disease and related conditions, enabling them to maximise research potential and creating Australia's single largest clinical trials capacity. The centre looks for integrated solutions across disciplines and at their junctions - clinicians, nutritionists and health scientists work with philosophers, marketers, agriculturalists, architects, economists and many others.</p> <p><u>Key outcomes (examples):</u></p> <ul style="list-style-type: none"> <li>• Research on the typical Australian's dietary behaviours and added-sugar consumption showed a decline in consumption of sugary beverages but that intake of confectionary rose significantly over the last 30 years.</li> <li>• Research found that sitting is not linked to incident diabetes.</li> <li>• Research is leading to a breakthrough in insulin dosage, with the potential to make it easier for people with type 1 diabetes to adjust their insulin levels after a fatty meal.</li> <li>• Creation of a game based app to prevent heart attacks among people who have suffered a cardiac arrest.</li> </ul>		
	<b>University of Melbourne</b>	Peter Doherty Institute for Infection and Immunity	\$90 million
Health and medical	<p>A partnership between the University of Melbourne and the Royal Melbourne Hospital, the Doherty Institute has more than 700 staff who work on infection and immunity through a broad spectrum of activities. This includes discovery research; diagnosis, surveillance and investigation of infectious disease outbreaks; and the development of ways to prevent, treat and eliminate infectious diseases.</p> <p><u>Key outcomes:</u></p> <ul style="list-style-type: none"> <li>• 'Killer' T cells revealed as best protection against novel influenza strain</li> <li>• Drug resistant Klebsiella pneumoniae(KP) decoded</li> <li>• Global movement of seasonal influenza viruses uncovered</li> </ul>		

<sup>13</sup> <https://ministers.employment.gov.au/gillard/580-million-fast-tracked-australian-universities>

	<b>University of Adelaide</b>	Institute for Photonics and Advanced Sensing	\$28.8 million
<b>Supports Health and medical</b>	<p>The Institute for Photonics and Advanced Sensing (IPAS) fosters excellence in research in materials science, chemistry, biology and physics and develops disruptive new tools for measurement. IPAS was created to bring together experimental physicists, chemists, material scientists, biologists, experimentally driven theoretical scientists and medical researchers to create new sensing and measurement technologies. IPAS is built on a strong ongoing partnership with DSTO and their support of numerous research projects and positions, and targets five key market areas: Defence and national security; Environmental monitoring; Preventative health; Food and wine; Mining.</p> <p><u>Key outcomes:</u></p> <ul style="list-style-type: none"> <li>• IPAS works closely with Adelaide Enterprise and Research Contracts and Partnerships, the commercialisation arms of the University of Adelaide, and has patented a number of technologies including: <ul style="list-style-type: none"> <li>○ Microstructured fibres and nanowires</li> <li>○ A sensor and a method for characterising a dielectric material (VESPR)</li> <li>○ Gastric cancer biomarkers</li> <li>○ Q-switched laser</li> <li>○ A new class of antibiotic</li> <li>○ Waveguide chip laser</li> <li>○ Whispering gallery mode sensor</li> <li>○ Autoantibody biomarker candidates for early ovarian cancer</li> <li>○ Optical fibre radiation sensor</li> <li>○ Device and method for sensing a chromatic property of foodstuff (browning sensor)</li> </ul> </li> <li>• New orthopedic implant designs that allow wrist fracture plate systems to be more securely attached and for faster healing to occur are being taken to market by the South Australian company Austofix following collaboration with IPAS and the Australian National Fabrication Facility's Optofab advanced manufacturing team, both located at the University of Adelaide. The VRP 2.0 plate system is expected to be suitable for treating 90 per cent of all wrist fractures and was expected to be available by the end of 2016.</li> </ul>		
	<b>University of Queensland</b>	World-class veterinary science facilities	\$47.2 million <b>Student focus</b>
<b>Supports agriculture</b>	<p>This project enabled UQ to build three state-of-the-art new buildings – the Veterinary Science building, the UQ Veterinary Hospital and the Veterinary Teaching and Research Facility on UQ's Gatton campus – as well as completely renovate an existing building to house modern pre-clinical teaching laboratories. It provides state-of-the-art teaching facilities for the School's veterinary science students and a vitality and economic boost to the Lockyer Valley. The arrival of the School at Gatton was forecast as an opportunity for greater industry collaboration, particularly with dairy and beef cattle, swine production and equine operations.</p> <p><u>Key outcomes (examples):</u></p> <ul style="list-style-type: none"> <li>• Collaboration with Meat &amp; Livestock Australia (MLA) is resulting in research aimed at reducing foetal and calf loss in beef cattle breeding herds across northern Australia. It builds on the findings from the \$2.47 million MLA-funded CashCow project recently completed by researchers from the School of Veterinary Science, the Queensland and Northern Territory governments, Outcross Performance Pty Ltd, Ausvet, and cattle veterinarians and commercial beef cattle producers. The main thrust was to identify major factors affecting the likelihood of cows becoming pregnant, and why some pregnant cows successfully weaned their calves while others failed to do so.</li> <li>• Research is also examining the causes for the increase of human cases not associated with livestock of Q fever, an infectious disease transmitted to humans from goats, sheep, cattle and other animals.</li> </ul>		

	<b>Monash University</b>	New Horizons Centre, Clayton Centre	\$89.9 million <b>Student focus</b>
<b>Supports Health and medical</b>	<p>The New Horizons Research Centre co-locates and integrates around 500 staff from Monash University and CSIRO. The New Horizons Research Centre provides platforms for global research and teaching collaboration through state-of-the-art information technology and research equipment that facilitates greater linkages with business and the community. The New Horizons Centre is home to the Monash Institute of Medical Engineering (MIME) and the Monash Immersive Visualisation Platform: CAVE2.</p> <p><u>Key outcomes:</u></p> <ul style="list-style-type: none"> <li>• Examples include</li> <li>• * Ground breaking x-ray imaging to examine in real-time changes in the lungs in response to treatment for cystic fibrosis</li> <li>• * 3D printing of complex jet engine components cutting down significantly on time needed to manufacture from 6-24 months to 1-2 weeks</li> <li>• * Building crystalline material into 3D structures that can help with water filtration, with potential for commercial portable filtration devices for remote locations, aviation and other purposes.</li> </ul>		
	<b>University of NSW</b>	Energy Technologies Building	\$75 million <b>Student focus</b>
<b>Supports Energy research</b>	<p>The Tyree Energy Technologies Building supports UNSW's world-leading work in photovoltaics as well as research into carbon capture and storage, reservoir characterisation, nanomaterials and policy and market analysis.</p> <p><u>Key outcomes:</u></p> <ul style="list-style-type: none"> <li>• The Tyree Energy Technologies Building was completed on 11 January 2012. The building received a 6 Star Green Star Design rating, awarded by the Green Building Council of Australia, making it the fourth 6 Star education facility in Australia and a first for UNSW. The accreditation represents world leadership in environmentally sustainable building practices.</li> <li>• The facility incorporates administrative spaces, teaching and learning spaces, collaborative engineering workshop laboratories, engineering display spaces, a cafe, and research areas including laboratories. The rooftop incorporates photovoltaic cells for the testing of research and development work as well as contributing to the energy input requirements of the facility. It is home to the Australian Energy Research Institute (AERI), the School of Photovoltaic and Renewable Energy and the School of Petroleum Engineering, providing a space where research, education and industry can collaborate in the development and implementation of sustainable energy technologies.</li> </ul>		

## 2. EIF ROUND TWO

A TOTAL of \$934.2 million was allocated for 31 of 32 projects deemed to satisfy the evaluation criteria, announced in the 2009-10 Budget, from a total of 154 projects. Go8 institutions directly attracted **\$221.8 million** (23.4 per cent) of this across five projects. Two Go8 universities participated in a further \$19.5 million project for the Sydney Institute of Marine Science.

	<b>University of Melbourne</b>	Centre for Neural Engineering	\$17.5 million
Health and medical	<p>The Centre for Neural Engineering (CfNE) is an interdisciplinary centre, established to undertake research in neuroscience and neural diseases. The CfNE draws together leading neuroscientists, neurologists, psychiatrists, cell biologists, geneticists, electrophysicists, chemists, physicists and engineers from the University of Melbourne and partner institutions.</p> <p><u>Key outcomes:</u></p> <ul style="list-style-type: none"> <li>Capabilities in bionics, computational biology, computational neurobiology, integrative biological psychiatry, sensors and imaging, and stem cells and disease models help researchers undertake a range of research including on neurons, genomics, brain function, psychiatric disorders, and brain disease. A recent example is the use of state of the art neurobiological and neural engineering techniques to help identify the underlying causes of autism spectrum disorder (ASD), with an emphasis on the contribution of inflammation and the glutamate signalling system within the brain.</li> </ul>		
	<b>University of Queensland</b>	Advanced Engineering Building	\$50 million <b>Student focus</b>
	<p>The Advanced Engineering Building (AEB) enhances The University of Queensland's (UQ) ability to deliver practical active-learning styles for engineering students, and maximise global research opportunities enabling UQ to respond to major shifts in the world economy and global marketplace for innovative engineering solutions.</p> <p><u>Key outcomes:</u></p> <p>The AEB houses the state-of-the-art GHD Auditorium – a 500 seat lecture theatre – as well as active learning laboratories and student spaces, and contemporary research facilities to support global engineering research centres.</p>		
	<b>University of Melbourne</b>	Transformed Graduate Learning Spaces	\$16.3 million <b>Student focus</b>
	<p>The grant supported the \$33.2 million transformation of traditional teaching and learning facilities into Melbourne Model professional graduate learning spaces, providing high-quality teaching environments to assist the development of a strong cohort experience in eight of the new Graduate Schools.</p> <p><u>Key outcomes:</u></p> <ul style="list-style-type: none"> <li>Construction was completed for Arts, Design, and Engineering in 2010, with construction for Education, Law, Science, and Environments due for completion in 2011.</li> </ul>		

	<b>University of NSW</b>	Gateway @ College of Fine Arts	\$48 million <b>Student focus</b>
	<p>The project aimed to build teaching capacity with new flexible, digitally-equipped facilities, along with a new installation gallery facing Oxford Street.</p> <p><u>Key outcomes:</u></p> <ul style="list-style-type: none"> <li>Gateway@ College of Fine Arts (COFA), completed in 2013, is a multi-million dollar upgrade of the COFA campus through the creation of new galleries and art spaces. It re-oriented the campus to Oxford Street to create an arts and cultural precinct where the public can attend exhibitions, lectures and short courses.</li> </ul>		
	<b>Australian National University</b>	Stage Two of the Chemical Sciences Hub	\$90 million <b>Student focus</b>
	<p>The funds provided for the construction of chemistry buildings C1 and C2 and a teaching laboratory at the ANU.</p> <p><u>Key outcomes:</u></p> <ul style="list-style-type: none"> <li>Advanced teaching and learning capacity for students.</li> </ul>		

This round also funded the Sydney Institute of Marine Science, which includes Go8 partners.

	<b>Sydney Institute of Marine Science (Go8 partners University of Sydney; UNSW)</b>	Sydney Institute for Marine Science (SIMS)	\$19.5 million <b>Student focus</b>
	<p>The grant enables SIMS to establish the first protected marine aquarium and associated research laboratories in southern Australia, along with pumps, research vessels, mobile radar equipment and sophisticated communications equipment. SIMS is a partnership between University of NSW, University of Sydney, University of Technology Sydney and Macquarie University.</p> <p><u>Key outcomes:</u></p> <ul style="list-style-type: none"> <li>The infrastructure contributes to the capacity of SIMS and its researchers to conduct multidisciplinary marine research across five core research themes – Urbanisation, Biodiversity, Climate Change, Ocean Resources and Marine Management. SIMS also facilitates the research of PhD students and post doctoral fellows, and through undergraduate and postgraduate teaching at the Institute, as well as the SIMS Master of Marine Science and Management and SIMS Doctoral Fellowships</li> </ul>		



### 3. EIF ROUND THREE AND SUSTAINABILITY ROUND

A TOTAL of \$550 million was allocated for 19 of 22 projects from 192 applications announced from May to July 2010. Go8 institutions directly attracted **\$166.4 million** (30.25 per cent) of this across **five projects**.

	<b>University of Melbourne</b>	Australian Geophysical Observing System	\$23 million
<b>NCRIS facility</b>	<p>The Australian Geophysical Observing System (AGOS), which builds on the NCRIS Auscope, creates specific capability for enhanced data acquisition and simulation capabilities for the geophysics of the shallow crust of the Australian continent. It delivers a new geophysical observing capability designed to characterise and monitor the physical state and behavior of the accessible crust. AGOS makes available new seismometers, borehole strain meters, GPS stations, and a host of other scientific instruments to provide new capability exploring new realms of the continent; from the ocean fringe to the deepest levels of the crust accessible by drilling. In addition to University of Melbourne, AGOS partners include ANU, University of Adelaide, University of Queensland, Curtin University, Macquarie University, and Geoscience Australia.</p> <p><u>Key outcomes:</u></p> <ul style="list-style-type: none"> <li>The integrated infrastructure facilitated maximum scientific return from the massive geo-engineering projects that are now being considered, such as deep geothermal drilling; in effect building the platform for treating these as mega geophysical science experiments. AGOS enables collection of new baseline data including surface geospatial and subsurface imaging and monitoring data, thereby providing for better long-term management of crustal services, particularly in Australia's energy-rich sedimentary basins.</li> </ul>		
	<b>University of Queensland</b>	National Imaging Facility	\$40.2 million
<b>NCRIS facility Supports Health and medical</b>	<p>The grant enabled the expansion of the National Imaging Facility established in 2007 under NCRIS with a \$7.25 million grant to provide state-of-the-art imaging capability of animals, plants, and materials. Specifically, the funding allowed a major enhancement of imaging capabilities at NIF's UQ node with the construction of a new 5-story facility, the Centre for Advanced Imaging (CAI), that houses a cyclotron, radiochemistry and ultra-high field human MRI instrumentation. Radiotracer development and in-house production supports world-class molecular imaging research programs utilising the PET-CT and MR-PET facilities.</p> <p><u>Key outcomes:</u></p> <ul style="list-style-type: none"> <li>NIF provides users with access to 12 new 'flagship' instruments, improved bio-informatics capability and existing instruments and capabilities across 10 nodes in NSW, Queensland, South Australia, Victoria and WA. The facility will aid medical research and the development of pharmaceuticals. Brain imaging, imaging of white matter and nanomedicine are only three of the areas of research facilitated by the Centre for Advanced Imaging at UQ.</li> </ul>		

	<b>University of Western Australia</b>	Indian Ocean Marine Research Centre	\$34 million <b>Student focus</b>
	<p>The Indian Ocean Marine Research Centre, a purpose built facility at UWA's Crawley campus (\$62 million), brings together four leading research organisations working in and around the Indian Ocean: UWA's Oceans Institute; Department of Fisheries WA; CSIRO and the Australian Institute of Marine Science. The development includes an upgrade to the Department of Fisheries WA Watermans Bay Marine Centre (\$11 million).</p> <p><u>Key outcomes:</u></p> <ul style="list-style-type: none"> <li>The Centre undertakes research in climate change, the sustainable use of marine resources, conserving marine biodiversity, coastal zone management, and security and safety. New multi-disciplinary research teams are being developed by the collaborating partners to create a graduate training environment to significantly advance the profile and capabilities of marine science in Australia.</li> </ul>		
	<b>Monash University</b>	Green Chemicals Futures	\$29.1 million <b>Student focus</b>
	<p>The Green Chemicals Futures (GCF) building, opened in March 2015, provides opportunities for collaboration and innovation in Australian research and manufacturing. It is a key piece of infrastructure at Monash's Clayton Chemicals and Plastics Manufacturing Innovation Network, which aims to act as a catalyst for new opportunities in global investment, innovation, productivity, job creation and economic growth.</p> <p><u>Key outcomes:</u></p> <ul style="list-style-type: none"> <li>The GCF supports academic and industrial research within the chemicals and plastics sector in Australia and provides world-class research to expand Australia's 'green workforce'. houses over 100 chemists and engineers and allows the growth of basic science research to targeted industry-driven research. It has 17 specialist sectors, training programmes for industry practitioners and laboratory spaces available for over 1000 students and 100 industry partners.</li> <li>The Chemicals and Plastics Manufacturing Innovation Network and Training Program (C&amp;P GRIP) has 17 partner driven PhD projects where in addition to multidisciplinary capabilities, the projects offer the PhD research an internship within the industry partner's company. C&amp;P GRIP is led by Monash University and Chemistry Australia and involves 20 industry members including multinationals and SMEs.</li> </ul>		

	<b>University of Sydney</b>	Australian Institute of Nanoscience	\$40 million
Partners with <i>NCRIS facility</i> <i>The Australian Nano Fabrication Facility</i>	<p>The grant enabled the University of Sydney to establish the new Australian Institute of Nanoscience, now called the Sydney Nanoscience Hub, located in a major research precinct at the University spanning medical and physical science and hosting a range of nationally accessible research infrastructure. The grant was used for a new building and new laboratories purpose built to enable breakthrough science in nanoscale technology.</p> <p><u>Key outcomes (examples):</u></p> <ul style="list-style-type: none"> <li>• As part of University of Sydney’s multi-year quantum computing partnership with Microsoft in July 2017, the Sydney Nanoscience Hub houses Microsoft’s Station Q, which aims to bring quantum computing out of the laboratory and into the real world.</li> <li>• Among other research, the Nanoscience Hub – opened in April 2016 – is using trapped atomic ions to harness and exploit quantum mechanical phenomena as resources to power a new generation of quantum technologies; enabling the quantum-limited measurement and manipulation of nanoscale systems, and the harnessing of interactions between light waves, sound waves, and matter at the nanoscale.</li> </ul>		

#### 4. SUPER SCIENCE

Of the 22 projects totalling \$901 million under Super Science<sup>14</sup> funded by EIF to support a range of national research infrastructure projects, 11 were collaborations led by Go8 universities totalling **\$295.6 million**. An additional allocation of up to **\$88.4 million** was announced from EIF on 20 July 2009 for the Giant Magellan Telescope project.

Total Go8 was **\$384.03 million**.

	<b>University of Queensland</b>	Terrestrial Ecosystem Research Network	\$25.63 million (original \$35 million minus \$9.37 million)
<i>NCRIS facility</i>	<p>The Terrestrial Ecosystem Research Network (TERN) connects ecosystem scientists and enables them to collect, contribute, store, share and integrate data across disciplines. Collectively, this increases the capacity of the Australian ecosystem science community to advance science and contribute to effective management and sustainable use of Australia's ecosystems.</p> <p><u>Key outcomes:</u></p> <ul style="list-style-type: none"> <li>TERN expands observation and monitoring programs into unrepresented ecosystems, and builds digital infrastructure to store and publish this information in a form that can be searched and accessed freely under licenses that acknowledge the data providers and build collaborative research. Twelve TERN Facilities, each which works in one or more ecosystem science domains, currently have over 1100 monitoring sites around Australia, a figure which is expected to grow to over 10,000.</li> </ul>		
	<b>University of Melbourne, University of NSW, Australian National University (with Griffith University)</b>	Built environment	\$20 million
<i>NCRIS facility</i>	<p>The Super Science Built Environment project culminated in the Australian Urban Research Infrastructure Network (AURIN), a national collaboration delivering eResearch infrastructure to enable better understanding of the current state of Australia's cities and towns. AURIN is delivering access to diverse data from multiple sources, and is facilitating data integration and data interrogation using open source e-research tools.</p> <p><u>Key outcomes:</u></p> <ul style="list-style-type: none"> <li>Built environment and urban researchers, designers and planners are provided with electronic infrastructure that helps them access a distributed network of aggregated datasets and information services essential to understand patterns of urban development, and to inform and provide direction to urban growth for a sustainable future. This will assist improved design and management of Australian cities, by linking the physical and social aspects of the built environment.</li> </ul>		

<sup>14</sup> Details largely taken from Department of Education and Training NCRIS website and factsheets.

	<b>Australian National University</b>	Climate High Performance Computing	\$50 million
<b>NCRIS facility – Supports Health and Medical</b>	<p>The grant enabled a critical infrastructure upgrade of the National Computational Initiative (NCI) tier one supercomputer, with the installation of Raijin – the centre’s petascale computing infrastructure.</p> <p><u>Key outcomes (examples):</u></p> <ul style="list-style-type: none"> <li>• The Raijin system provides a peak performance of approximately 1.37 petaflops.</li> <li>• Researchers from the Bureau of Meteorology (BoM) are using NCI’s high performance computing facilities and expertise to research and develop the Australian Community Climate and Earth System Simulator model used in daily weather forecasts all over the country. Improvements in computing power make it possible to simulate the atmosphere, water and land much more reliably and accurately than ever before, dependent on improvement of the model’s code at NCI.</li> <li>• Researchers from ANU have discovered the oldest known star in the universe, with a little help from NCI. The star was discovered using the ANU SkyMapper telescope, and using Raijin to sort through a terabyte of raw images from the telescope.</li> <li>• NCI supports the Australian digital rock start-up company, Lithicon, sold for \$76 million to a US multi-national in 2014. The technology, which is at the forefront of the efficient recovery of oil and gas resources worldwide, is a fusion of a new generation of micro-CT scanner, and advanced analysis and simulations, using ANU/UNSW IP based on composite material theory, that require supercomputer performance.</li> </ul>		
	<b>Australian National University</b>	Upgrade of National Plasma Fusion Facility	\$10 million
<b>NCRIS facility Supports Energy research</b>	<p>The Australian Plasma Fusion Research Facility (APFRF) is a uniquely versatile plasma research facility. It consists of the H-1 heliac magnetic confinement device and the smaller MAGPIE prototype device (MAGnetised Plasma Interaction Experiment), for investigating the interaction of plasma with materials, especially those potentially suitable for fusion reactors.</p> <p><u>Key outcomes:</u></p> <ul style="list-style-type: none"> <li>• The facility will have ramifications for sustainable power generation and aims to ensure that Australia is intellectually and technologically equipped to benefit from a future fusion power industry. The APFRF enables researchers to perform research into the basic properties of magnetically-confined, high-temperature plasma as part of an international program, whose ultimate aim is ecologically sustainable power generation by the controlled fusion of hydrogen isotopes.</li> </ul>		
	<b>University of NSW</b>	Groundwater Infrastructure	\$15 million
<b>NCRIS facility</b>	<p>The Groundwater project has enabled the establishment of six long-term groundwater monitoring sites with multiple bores and installations at each site to allow Australian groundwater resources to be evaluated.</p> <p><u>Key outcomes:</u></p> <p>The infrastructure enables exploration of groundwater flow including in aquifers, and the observation of how groundwater systems interact with rivers, vegetation and climate. A groundwater database collates and distributes the data from the groundwater monitoring equipment.</p>		

	<b>Australian National University</b>	Australian Phenomics Network	\$15 million
<b>NCRIS facility Health and Medical</b>	<p>The APN provides Australian and international researchers with mouse models for the study of a range of diseases. The APN has reduced the cost to researchers of accessing mouse models of disease, and provides specialised equipment and expertise to undertake characterisation of these models to further scientific research.</p> <p><u>Key outcomes:</u></p> <ul style="list-style-type: none"> <li>By using mouse models, researchers aim to develop new insight into a variety of important human and animal diseases, including cancer, diabetes and immunological and blood disorders, and discover new prevention and treatment strategies for these.</li> </ul> <p>Recently, the team at The Australian Phenomics Facility – a node of the APN – employed a large-scale forward genetics discovery platform to screen thousands of genes and successfully find the gene, Gasdermin-D, that triggers the inflammatory condition that leads to sepsis. Sepsis is a severe, whole-body infection that kills an estimated one million people in the United States each year. It occurs as a complication to an existing infection, and if not treated quickly, it can lead to septic shock and multiple organ failure, with death rates as high as 50 per cent. The discovery will enable further developments in how to understand and treat sepsis and other diseases.</p>		
	<b>University of Adelaide</b>	Australian Plant Phenomics Facility	\$10 million
<b>NCRIS facility Supports agriculture</b>	<p>The APPF measures the phenotype (physical attributes) of plants leading to the development of new and improved crops, healthier food, more sustainable agricultural practices, improved maintenance and regeneration of biodiversity and the use of crops to develop pharmaceuticals. The project is a world-leading plant research facility, consisting of three separate facilities: a high throughput plant phenotyping facility, a deep phenotyping and field phenotyping facility, and a model plant phenotyping and high resolution glasshouse analysis facility.</p> <p><u>Key outcomes:</u></p> <ul style="list-style-type: none"> <li>Among its aims, the APPF addresses the impacts of climate change on crops in controlled environments and in the field. It provides access for Australian plant researchers and breeders to a world leading facility that provides a pipeline for the development of new plant lines from single plant pot-based studies to specialised field investigations.</li> </ul>		

	<b>University of UWA</b>	Population Health Research Network	\$10 million
<i>NCRIS facility Health and Medical</i>	<p>The Population Health Research Network (PHRN) created originally with a \$20 million NCRIS grant provides researchers with the ability to link de-identified population health data from a diverse and rich range of health data sets, across sectors and jurisdictions. This supports nationally and internationally significant population-level research that will improve health and wellbeing and enhance the effectiveness and efficiency of health services.</p> <p><u>Key outcomes:</u></p> <ul style="list-style-type: none"> <li>The infrastructure allows researchers to carry out nationally and internationally significant population-level research, to improve health and wellbeing and to enhance the effectiveness and efficiency of health services. This includes research into health determinants, organisation and delivery of health services, health status and health outcomes in the population and non-health fields that impact upon health and vice versa. PHRN also enhances collaboration across health systems, public and private health services and agencies that run health systems and provide mainstream health information.</li> </ul>		
	<b>University of Queensland</b>	Research Data Storage Infrastructure	\$50 million
<i>NCRIS facility – Supports Health and Medical</i>	<p>The project built the foundational national data storage infrastructure for research initially with a network of six primary and two additional nodes that include facility for easy access, analysis and re-use of research data. The project grew to support 50 organisations or collaborations, including 37 universities, CSIRO, Bureau of Meteorology, other Commonwealth and state agencies, other NCRIS facilities, and Ergon Energy. The facility (refunded under NCRIS) is now called Research Data Services (RDS).</p> <p><u>Key outcomes:</u></p> <ul style="list-style-type: none"> <li>The project allows researchers and institutions to more effectively preserve, manage, share and use much larger amounts of research data. It supports a national data environment at a scale that will enable new questions to be asked on topics and at scales not previously possible.</li> <li>The storage capacity provided to the research sector through this investment is expected to grow to 100 Petabytes. This is the equivalent of over 901,232.64 kilometres of books in shelves, stretching 23 times around the world.</li> <li>RDS currently supports the following data collections: 31 LifeSciences, 40 Earth Systems, 90 Medical and Health, 4 Astronomy, 49 Cultures and Community, 51 Terrestrial Systems, 54 Marine Science, 46 Geoscience, 1 Geophysics and 22 Imaging Characterisation Facilities</li> </ul>		

	<b>University of Melbourne</b>	Collaboration Infrastructure	\$47 million
<i>NCRIS facility - Supports Health and Medical</i>	<p>The funding provides \$47 million for the National eResearch Collaboration Tools and Research facility, which enhances the impact of Australian research by providing an online infrastructure that enables researchers to more easily collaborate and share ideas and research outcomes with colleagues and industry in Australia and around the world.</p> <p><u>Key outcomes:</u></p> <ul style="list-style-type: none"> <li>The facility includes 14 Virtual Laboratories – covering a range of research areas from the humanities to climate change, astronomy, genomics, marine research and geophysics – and the NeCTAR Cloud which provides users to store, access and run data remotely, rapidly and autonomously and collaborate with each other from their desktop.</li> <li>An example is the Endocrine Genomics Virtual Laboratory (endoVL). It allows endocrinologists to access large enough cohorts of endocrine disease cases to conduct studies with real statistical power on endocrine disorders that are rare enough to present challenges for researchers to gather sufficient patient data through clinical trials. For example, more than 8000 adrenal tumour cases are registered on endoVL, with cases being contributed by 78 centres internationally. EndoVL has also helped the Australasia Diabetes Data Network to develop a national database of childhood diabetes including existing and onset cases, aggregating data from the five major children's hospitals in Australia. A key advantage of the endoVL is the search and analysis function which enables researchers to query and learn from the data in real time, in ways they had not envisaged.</li> </ul>		
	<b>Australian National University / University of Melbourne</b>	National Ion Accelerators	\$10 million
<i>NCRIS facility</i>	<p>The grant upgrades the ANU's Heavy Ion Accelerator (HIA) facility which comprises of the 14UD pelletron accelerator and a superconducting 'booster' linear accelerator (LINAC), as well as University of Melbourne's ion accelerator. HIA supports Australia's only experimental nuclear physics program, a major accelerator mass spectrometry program and facilities for ion-beam modification and analysis of materials.</p> <p><u>Key outcomes:</u></p> <ul style="list-style-type: none"> <li>The infrastructure provides researchers with infrastructure, with ensuing applications ranging from capabilities from creating and characterising new and innovative materials, resource/energy exploration and waste management, research in environmental, biological and life sciences and investigating climate change, to archaeological and heritage studies, and critical investigations into nuclear science, including fundamental quantum science.</li> </ul>		



	<b>Monash University</b>	Australian Research Data Commons	\$48 million
<i>NCRIS facility – Supports Health and Medical</i>	<p>The funding provides \$48 million to support the Australian National Data Service, whose purpose is to make Australia’s research data assets more valuable for researchers, research institutions and the nation.</p> <p><u>Key outcomes:</u></p> <ul style="list-style-type: none"> <li>• ANDS’ flagship service, the Research Data Australia discovery portal enables users to find, access and reuse data for research from Australian research organisations, government agencies and cultural institutions. For example, scientific data from the Antarctic and Southern Ocean is expensive and difficult to collect. 2300 records from the Australian Antarctic Data Centre, established in 1996 as the primary facility to ensure data is adequately managed for long-term reuse as required under the 1959 Antarctic Treaty, are syndicated into Research Data Australia.</li> <li>• ANDS provides advice on all aspects of research data management across all disciplines and has so far worked with more than 50 Australian research institutions to improve their data management capabilities. For example, ANDS has partnered with the CRC for Mental Health on a project to increase the discoverability and reusability of two virtual biobanks: The Australian Parkinson’s Disease Registry and the Treatment-resistant Schizophrenia Cohort.</li> </ul>		
	<b>Australian National University</b>	Giant Magellan Telescope	\$88.4 million
	<p>The funding provides \$65 million for the \$1 billion optical telescope being built in Chile’s Atacama Desert, which will provide 30 times better resolution than current land-based telescopes, and \$23.4 million to upgrade Australian infrastructure, including the ANU’s Mount Stromlo Observatory. Astronomy Australia Limited (AAL) partners with the ANU on the project.</p> <p><u>Key outcomes:</u></p> <ul style="list-style-type: none"> <li>• The GMT began construction in 2015 and is expected to come online in 2020. Australia is also building substantial parts of the facility, including two of the four first-generation instruments. ANU is designing part of the adaptive optics system that corrects the blurring of the atmosphere, allowing the GMT to take images 10 times sharper than the Hubble Space Telescope.</li> </ul>		

## 5. EIF CLEAN ENERGY INITIATIVE (RESEARCH COMPONENT)

A TOTAL of \$300 million was committed from EIF to support the Clean Energy Initiative's Solar Flagships Program (\$200 million) and Carbon Capture and Storage Flagships Program (\$100 million). Of this \$140.9 million<sup>15</sup> was awarded for research infrastructure, with one Go8 institution (UQ) attracting **\$40.7 million**.

	University of Queensland	Research infrastructure to support the AGL Energy Photovoltaic Solar Flagship	\$40.7 million
Supports Energy research	<p>The grant was awarded to UQ to build research infrastructure in NSW and Queensland to support the AGL Energy Photovoltaic Solar Flagship. UQ was set to partner with UNSW on the research infrastructure program.</p> <p><u>Key outcomes:</u></p> <ul style="list-style-type: none"> <li>The 3.275 megawatt Solar Research Facility at UQ's Gatton campus, comprising more than 37,000 thin-film photovoltaic panels, and estimated to produce enough clean energy to power more than 450 average Queensland homes and displace the equivalent of 5600 tonnes of carbon dioxide annually, was opened on 27 March 2015.</li> <li>UNSW aimed to develop new energy modelling techniques to assist in the design and integration of solar power stations into the electricity grid.</li> </ul>		

## 6. EIF REGIONAL PRIORITY ROUND

A TOTAL of \$312.6 million was allocated for 11 projects under the EIF Regional Priorities Round. One Go8 institution attracted **\$20 million** (6.4 per cent) from this round.

	University of NSW	Joint Health Education Facility at Port Macquarie	\$20 million <b>Student focus</b>
Health and Medical	<p>The facility, owned and operated by UNSW, brings together the teaching of three organisations: UNSW, the University of Newcastle and North Coast TAFE.</p> <p><u>Key outcomes:</u></p> <ul style="list-style-type: none"> <li>Completed in January 2015, the new facility will be the first campus in regional Australia where undergraduates can complete their full six-year medical degree. It will provide tertiary education to hundreds of students on the mid-north coast, where current participation rates are well below State and National averages, and will help improve the participation rates in medical studies of students from low socio-economic or regional backgrounds. The development includes specialised teaching facilities, tutorial and teaching spaces, computer laboratories, lecture theatres, office space and study rooms. The facility will encourage interaction between a range of medical fields.</li> </ul>		

<sup>15</sup> Of the remainder, \$51.6 million went to the CO2CRC to build research infrastructure to support the CarbonNet CCS Flagship in Victoria and other CCS projects such as the Collie-South West Hub CCS Flagship project, and \$48.4 million to CSIRO to build the National Geosequestration Laboratory in support of the Collie-South West Hub CCS Flagship in Western Australia (<https://www.education.gov.au/eif-support-clean-energy-research-infrastructure>). \$200,000 was also approved for research infrastructure components of Solar Dawn, involving UQ, but the project did not proceed (<http://solardawn.com.au/>)

ATTACHMENT B

SUPPORTIVE COMMENTS FROM END-USERS OF RESEARCH INFRASTRUCTURE

MTP Connect (the Medtech, biotechnology and pharmaceutical Industry Growth Centre) notes<sup>16</sup>

‘Australia can establish itself as a specialist provider with skills and expertise in certain areas such as adaptive trial design, efficient patient recruitment and complex trials that require access to **world class imaging, pathology and clinical practices**. The underlying service sub-sector and **research infrastructure that support clinical trials** ... can become a thriving MTP export in their own right. Within this context, clinical trials in Australia can become a valuable source of revenue, growth and innovation for the sector.’

Medicines Australia notes<sup>17</sup>

‘**ongoing support for national research infrastructure is crucial** in maintaining and expanding Australia’s innovation and research capabilities’

‘Australian and multinational pharmaceutical companies with Australian operations are key contributors to the research infrastructure in Australia, creating jobs and investing in supportive industries. The roadmap’s recognition of the role of some Medicines Australia members, such as CSL, highlights the importance of ensuring that the contributions that industry makes are not overlooked in future decisions on directions for development and investment into research infrastructure.’

‘nine focus areas that require ongoing support will help to continue to grow Australia’s research infrastructure. Of the nine areas, Medicines Australia believes that five of these require urgent attention to capture the growth opportunities within the pharmaceutical sector’

The Department of Industry, Innovation and Science notes in relation to the development of the 2016 National Research Infrastructure Roadmap<sup>18</sup>

‘One of the key objectives of the Industry Growth Centres Initiative is to increase collaboration between industry and research, and improve commercialisation outcomes. To reflect the Government’s focus on commercialisation of research by industry, the roadmap would benefit from discussion on how research infrastructure builds industrial competitiveness and improves linkages with industry. The roadmap could also identify how industry can access and benefit from improved NRI.’

‘The National Innovation and Science Agenda highlighted the important role of data as a driver for innovation. Research infrastructure to support data being findable, accessible, interoperable, and re-usable remains essential if Australian research is to take advantage of these new opportunities.’

Bureau of Meteorology notes<sup>19</sup>

Consideration of the atmosphere as ‘national in scale and .. critical for the environment including for air quality and composition. Indeed in the future, **these areas may grow to an extent that national**

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<sup>16</sup> MTP Connect 2016, *Medtech, Biotechnology and Pharmaceutical Sector Competitiveness Plan*

<sup>17</sup> Medicines Australia 2017, Submission to the Draft 2016 National Research Infrastructure Roadmap

<sup>18</sup> Department of Industry, Innovation and Science 2016, Submission to 2016 National Research Infrastructure Roadmap Capability Issues Paper

<sup>19</sup> Bureau of Meteorology 2017, Submission to the Draft 2016 National Research Infrastructure Roadmap

**research infrastructure needs consideration in the context of air quality and human health and for greenhouse gas budgets** following the Paris agreement.’

‘the Bureau strongly endorses a capability for environmental modelling for the research community’

‘The Bureau also strongly supports the prioritisation of high performance computing for the national benefit across all the key domains and that attention is given to the upgrade cycle to keep pace with the computational requirements of models, large data, collaborative efforts and end users.’

Department of Social Services (DSS) notes<sup>20</sup>

‘there is an opportunity for Australia’s future research data capability to build on existing investments, including data sharing initiatives undertaken by DSS’

‘With more than \$250 million invested by government in .. four studies [through DSS’s National Centre for Longitudinal Data (NCLD)<sup>21</sup>], they represent a significant national research asset that can be further leveraged as part of an effective [Humanities, Arts and Social Sciences] HASS data integration and sharing platform.’

‘Despite their value as national research infrastructure, Australian longitudinal study datasets are not delivered in Australia through a coordinated or harmonised platform. DSS recognises that a coordinated and harmonised HASS data integration and sharing platform is required to facilitate data integration and sharing for HASS longitudinal datasets on a national level.’

‘The establishment of a coordinated and harmonised longitudinal data integration and sharing platform ... would be an essential component in supporting a unified HASS platform in Australia.’

The National Archives of Australia notes<sup>22</sup>

‘The Archives supports a coordinated and integrated HASS platform to provide improved research infrastructure held by collecting institutions.’

The Department of Agriculture and Water Resources notes<sup>23</sup>

‘The Department of Agriculture and Water Resources recognises that the capital and running costs of research infrastructure can be high, and that a sustainable funding model is needed to provide assurance to researchers and industry that facilities will continue to be available for their use.’

‘While some research infrastructure may be used for commercial purposes, a commercial funding model will often be unviable as commercial returns from the investment may be limited or non-existent, or not realised in the short to medium-term.’

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<sup>20</sup> Department of Social Services 2017, Submission to the Draft 2016 National Research Infrastructure Roadmap

<sup>21</sup> The four studies include *The Household, Income and Labour Dynamics in Australia (HILDA) Survey* (from 2001), *The Longitudinal Study of Australian Children (LSAC)* (from 2004), *The Longitudinal Study of Indigenous Children (LSIC)* (from 2008), and *Building a New Life in Australia: The Longitudinal Study of Humanitarian Migrants (BNLA)* (from 2013)

<sup>22</sup> National Archives of Australia 2017, Submission to the Draft 2016 National Research Infrastructure Roadmap

<sup>23</sup> Department of Agriculture and Water Resources 2016, Submission to the Draft 2016 National Research Infrastructure Roadmap

‘Improving environmental and agricultural outcomes for farmers and the broader community will require better integration of people, networks and technologies to make best use of emerging technologies in sensors and sensor networks. These will need to be linked with data streams emerging from international satellite-based remote sensing, improved weather forecasting, local soil information and model-data fusion capabilities to build resilience to seasonal variability and increases in climate extremes. ... In addition to data capture, the capacity and capability to generate and manage complex data and models for water resource systems in ways that support better management decisions is becoming increasingly important’

‘Continued improvement in earth systems models, particularly the Australian Community Climate and Earth System Simulator (ACCESS), will obviously assist primary producers to make more informed decisions, increasing their profitability and thus the strength of rural communities. The department is conscious that research on such models requires extremely high performance computing capacity, currently provided by the National Computational Infrastructure’

The Office of Science, Western Australian Department of Premier and Cabinet<sup>24</sup>

‘The Office of Science agrees .. that new opportunities would be created by linking ‘omics data and linking health and non-health data sets, and considers that the suggested national networked approach could be achieved through the Population Health Research Network (PHRN).’

‘PHRN has [built] a nationwide data linkage infrastructure capable of securely and safely managing health and health-related data from around Australia to improve health and related research, whilst minimising privacy risks associated with use of personal data.’

‘A significant expansion of Australia’s data linkage infrastructure will be required over the next ten years to meet researcher demand for access to high quality linked data at the person level across the spectrum of health and human research in Australia, from ‘omics to clinical trials to health, medical and broader human services research.’

South Australian Department of Environment, Water and Natural Resources (DEWNR)<sup>25</sup>

Critical infrastructure needs to have longevity of support (...) Many partners invest in NCRIS infrastructure and the lack of long term security will reduce the effectiveness, uptake and co-investment of these systems.

The approach to funding national research infrastructure through the NCRIS programs has been effective in providing access and in attracting significant cash and in-kind co-investment from state and territory governments, government agencies, universities and research institutes. It has also reduced waste by enabling implementation of agreed infrastructure without costly duplication.

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<sup>24</sup> The Office of Science, Western Australian Department of Premier and Cabinet 2016, Submission to the Draft 2016 National Research Infrastructure Roadmap

<sup>25</sup> South Australian Department of Environment, Water and Natural Resources (DEWNR) Cabinet 2016, Submission to the Draft 2016 National Research Infrastructure Roadmap

## ATTACHMENT C

### SOME KEY FACTS ABOUT THE EIF

#### Key fact 1

Around half the \$4.207 billion investment from the EIF has funded research infrastructure.

#### Key fact 2

Nearly a quarter of the EIF investment has served **national** research infrastructure.

#### Key fact 3

The EIF has supported at least 22 National Collaborative Research Infrastructure Strategy (NCRIS) facilities.

#### Key fact 4

EIF investments in research infrastructure make up around a third of major government investments<sup>26</sup> in research infrastructure (2006-2016).

#### Key fact 5

Go8 EIF projects facilitate research and education ranging over and sometimes entailing collaborations involving, but not limited to, the following:

- health (obesity, diabetes, cardiovascular, infectious diseases such as flu viruses, preventative health, gastric and ovarian cancer, antibiotic development, cystic fibrosis, mental health, neural diseases, brain disorders and other research, immunological and blood diseases, population health, endocrine disorders, regional health education)
- materials science
- chemistry, biology and physics
- veterinary and agriculture, food and wine
- environmental including urban, terrestrial and marine
- food and wine
- mining
- geoscience
- nanoscience
- advanced engineering
- quantum science and computing
- climate and weather science
- energy – including plasma fusion and solar energy
- astronomy
- genomics
- Antarctic
- Humanities – including language

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<sup>26</sup> These include investments through the Research Infrastructure Block Grants, the Australian Research Council's Linkage, Infrastructure, Equipment and Facilities, and the National Collaborative Research Infrastructure Strategy (NCRIS)