Australian Academy of Technology & Engineering

SOUTH AUSTRALIA DIVISION

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2022 South Australian Election

Technology and policy-based initiatives to support innovation and economic growth in South Australia

The future prosperity of South Australia will rely on technology and innovation. This is particularly true as South Australia (along with the rest of the world) recovers from the effects of the worst global pandemic in a century.

Addressing climate change and other issues through development of emerging technologies offers major opportunities for South Australian business and society. The 2022 South Australian election requires inspirational vision to ensure the State remains a leading society and economy.

The Academy of Technology and Engineering (ATSE) has identified key initiatives across the sectors of energy, industry and innovation, mineral resources, digital transformation, agriculture, water resources, health and STEM education. If pursued these would enable South Australia to boost its economic growth and enhance its reputation as an international leader in technological innovation.

These initiatives are discussed in more detail below.

1. ENERGY

Initiatives

- Undertake a comprehensive techno-economic review of large-scale, base-load electricity storage and backup options as South Australia's demand for electricity inevitably increases over the next decade. The work should focus on activities compatible with increasing intermittent wind and solar power supply.
- Establish a South Australian Centre for Sustainable Energy Generation and Storage Technology with funding from the Clean Energy Finance Corporation, private sector capital, and the State Government. One initial focus should be developing technology for cost-effective recovery and recycling of valuable components from end-of-life solar panels and batteries.
- Provide an incentive for large-scale electrification and hydrogen-fuelled domestic and commercial transport through the establishment of an effective state-wide roadside network of fast, renewables-powered charging and refuelling stations for electric and hydrogen vehicles.
- Commence a new techno-economic, safety and environmental analysis of the proposal for nuclear waste storage in remote SA. This analysis should take advantage of technology for the handling, treatment and disposal of mining and processing waste in existing uranium and heavy mineral sands operations, and the experience and technology developed over many years at ANSTO and The Australian Radiation Protection and Nuclear Safety Agency (ARPANSA).
- Establish a South Australian Centre of Materials and Technology for Nuclear Power to develop the local skills and capabilities required for the construction, maintenance and decommissioning of Australia's new fleet of nuclear-powered submarines.

Supporting Information

Global evidence makes a strong case for emission reductions and security of supply at minimum cost. South Australia has specific strengths, weaknesses, and opportunities in the energy sector, which provide the context for policy decisions made in the State for any responses that it might make. These are summarised in the following table.

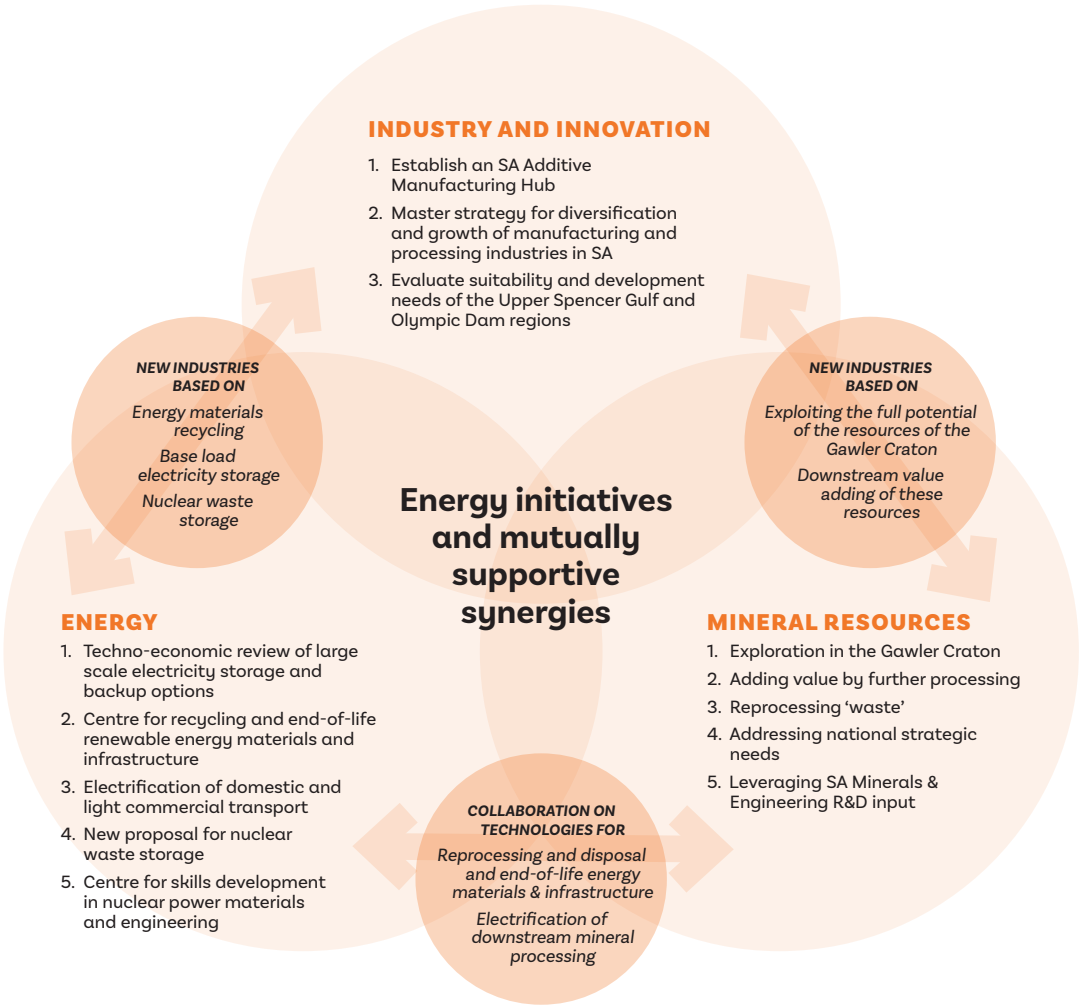
SA STRENGTHS	SA WEAKNESSES	SA OPPORTUNITIES
World's highest share (60%) of wind and rooftop solar in the local grid Target of reaching net 100 per cent renewables on the grid by 2030 A State population that has demonstrated its commitment to clean energy The Cooper Basin - Australia's largest onshore oil and gas province 80% of Australia's and 33% of the world's uranium resources World class, synergistic R&D across energy, engineering, manufacturing, minerals, and defence sectors	No cost-effective technologies for large-scale recycling of end-of-life clean energy materials and infrastructure Vulnerable to intermittency of supply due to high dependence on sun and wind Risk of prolonged and deep drought, with its associated impact on energy demand No large-scale energy storage, except for short-term regulation of voltage and outages via Lithium batteries Heavy reliance on gas and coal-fired interstate power for grid backup Need for increased electrification will require massive new, reliable clean energy sources and storage for public transport and industry energy needs Lapsed leadership position on local nuclear waste disposal as a potential precursor to a new debate on civil nuclear power for Australia	Technology for cost effective recycling of end-of-life renewable energy materials and infrastructure Technology for large-scale storage using chemical batteries, hydrogen from solar water electrolysis and off-river (pumped) hydro Establishment of a Centre for Sustainable Energy Generation and Storage Technology, with partners from across Australia and overseas Technology for enhanced abatement of emissions from backup gas-fired generators, including fit-for-purpose carbon capture and storage Widespread electrification and/or hydrogen-fueling of domestic and commercial transport, including a broadly distributed roadside charging network Reinvigorated push for the establishment of a local nuclear waste repository Establishment of local skills and capability for the construction, maintenance and decommissioning of Australia's new fleet of nuclear-powered submarines, and to underpin a potential future civil nuclear power industry

Australia's recent initiatives in nuclear-powered submarine procurement, together with a significant upward shift in public support for a civil nuclear power industry (or at least for the opening of debate on the subject), indicate that Australia may be at an inflection point in its long-standing opposition to nuclear technology. The main stimulus for this change is that nuclear power and heat is starting to be recognised as an integral part of the energy mix required to achieve net zero emissions by 2050.

South Australia has existing world-class expertise in energy materials and engineering at the University of Adelaide, the University of South Australia, Flinders University and the CSIRO. This provides a springboard for the rapid development and deployment of technology, infrastructure, skills and capabilities to address all of the initiatives outlined in this submission.

In respect of the proposal for a nuclear waste repository in remote South Australia, and for the maintenance and deployment of nuclear-powered submarines to be located in Adelaide, South Australia has a unique opportunity to play a leading role in facilitating a shift towards nuclear technology in Australia. Working with ANSTO and The Australian Radiation Protection and Nuclear Safety Agency, it can take advantage of its world class research institutions to create the necessary skills and capability development in nuclear materials and technology and thereby create a major new business and net zero emissions opportunity for the State.

The Energy Initiatives outlined above have significant, mutually supportive synergies with the Initiatives in the Mineral Resources and in the Industry and Innovation submissions of this document. All three sectors can draw technical and commercial expertise and experience from the others to produce economic/industrial, regional development, and environmental outcomes that would be much more difficult to achieve in isolation. Some of these synergies are illustrated in the following schematic.



2. INDUSTRY AND INNOVATION

Initiatives

- Establish a South Australian Additive Manufacturing (AM) (3D printing) Hub to facilitate South Australian businesses especially small to medium enterprises (SMEs) taking up AM technologies best suited to their individual needs
- Establish a high-level Taskforce from government, industry and academia to develop a long-term strategy for diversification and growth of manufacturing and processing industries in South Australia. Opportunities could include the conversion of minerals and end of life renewable energy products to high value materials
- Establish a sub-group of this Taskforce to evaluate the suitability and development needs of the Upper Spencer Gulf (USG) and Olympic Dam region as a manufacturing and process hub.

Supporting Information

To regenerate a significant manufacturing and processing sector in South Australia, businesses must employ leading edge applicable technologies including automation, robotics, and digitisation. Additional comparative advantage accrues for products derived from or directed towards Australia's existing and emerging markets e.g., mining and minerals and sectors of agriculture, food, wine, defence, aerospace and space.

South Australian Additive Manufacturing Hub

The SA Additive Manufacturing Hub would be a co-operative enterprise of South Australian industry, academia and government, needing only a small and experienced staff group for its establishment and operations, and would be funded by the industry users of its services. AM research and training facilities exist elsewhere in Australia and successful models of what is proposed in this initiative exist overseas. The SA Hub could learn from and partner with some of these organisations.

AM is an essential and rapidly developing technology for manufacture of high value-added products in many industries particularly defence and space. It is energy and resource efficient, eliminating the waste from traditional manufacturing and often reusing such waste in powder form as its feedstock. The range of AM equipment and processes is already very broad. Manufacturers need access to, but many SMEs cannot afford, a range of AM machines and processes on which to perfect the best manufacturing processes for their products.

The Hub's role would be to advise business how to access the already established facilities available to them in South Australia including advice on their specific needs. The Hub would facilitate co-operative industry/academia research, training, and product and market development using these facilities. It would also recommend and facilitate investment in new equipment and processes to broaden the State's AM technology base.

High level Taskforce to develop a long-term strategy and plan for diversification and growth of manufacturing and processing industries

South Australia has competitive advantages in minerals and renewable energy. The rich mineral deposits are currently processed and exported as ore and mineral concentrates. These processes, which require low-cost renewable energy, are similar to the process needed to deal with renewable energy products at the end of their life, like solar panels. Combining SA's advantage in both the processes and the energy availability would result in a unique economic opportunity not available to other states. It also builds Australia sovereign capabilities in the production of strategic materials.

The Task Force would determine the best processing opportunities and technologies for South Australia including for example the processing of mineral ores, tailings, mine waste rock, minerals sands, light metals including lithium, graphite and green steel manufacture.

Upper Spencer Gulf and Olympic Dam regional hub for manufacturing and processing
The social and economic importance of the sustainability and growth of this region is very great. Significantly increasing its size and economic importance as a population centre would decentralise and transform South Australia's economy. Other States are embarking on such major regional developments e.g., in the Hunter region of NSW, Gladstone in Queensland and the Asian Energy Hub in the Pilbara, WA.

The region has many competitive advantages for the purpose of manufacturing and processing. With the existing operations at Whyalla, Port Bonython, Port Pirie and Olympic Dam this region already has industry, infrastructure, culture, and community support for such processing and is under consideration as a hydrogen energy centre and exporter. Major varied minerals deposits, notably the Gawler Graton and magnetite deposits, are nearby. Essential for such processing, the region has outstanding potential for very low-cost renewable energy, and for energy storage including pumped hydro using salt water on the north coast of Upper Spencer Gulf. It is at the crossroads of Australia's transcontinental railway lines, has potential for a deepwater port, and Adelaide is relatively accessible as a centre for economic and financial services, health care, education, and cultural and leisure pursuits.

3. MINERAL RESOURCES

Initiatives

- Support exploration of the Gawler Craton using remote sensing techniques.
- Expand research into in-situ leaching and treatment of low grade and complex ores and waste rock for higher extraction rates, more environmentally benign tailings, and easier disposal.
- Deliver priority training to personnel in the required technological disciplines to support the minerals and mining industry.

Supporting Information

The minerals and petroleum sectors have been, and will continue to be, critical to the South Australian economy. Burra and Moonta, Olympic Dam, Prominent Hill and Carrapateena, are principally copper deposits, but with significant, key entrained elements such as uranium and gold. Important deposits, such as Four Mile uranium, Jacinth-Ambrosia zircon, Dry Creek halite, Eyre Peninsular iron ore and graphite also demonstrate the diversity of mineral potential in South Australia. The Cooper Basin remains a nationally important producer of petroleum products.

Resources such as Whyalla steelworks have underwritten regional development. These value adding operations, can now encourage the building of new manufacturing activities, linked to energy availability and strategic national needs, including for critical metals. To achieve this future potential, innovative exploration and mining technologies will be necessary to identify and utilise these underlying resources.

South Australian Governments have encouraged mineral and petroleum exploration, largely on a bipartisan basis and the state possesses a very competent Geological Survey, which has implemented many leading initiatives, including sophisticated airborne surveys, support for deep drilling and state-of-the-art core archiving and analysis. These are needed in particular to "see" through the deep cover over the highly prospective Gawler Craton, which hosts the world class Olympic Dam type mineralisation. Remote sensing exploration techniques are noninvasive and facilitate land access. These initiatives should receive increased broad support from government, agencies and industry.

Much of South Australian mining currently, and in the future will be conducted deep underground and will require improved extraction and milling techniques to be economic. Research should be expanded into in-situ leaching and treatment of low grade and complex ores and waste rock for higher extraction rates and more environmentally benign tailings and easier disposal.

South Australia has credibility in the exploration, extraction and processing of mineral and petroleum resources, but the State Government is financially limited in what it alone can achieve. Catalysing greater funding from the Federal Government (through Geoscience Australia, ARC Centres of Excellence, etc.), universities, CSIRO and the mining industry to meet recognised needs for expanding the sector, is a powerful lever.

Greater support for technological initiatives through new and established collaborative bodies is necessary, noting that the demonstration of state commitment often catalyses larger contributions from other stakeholders. This collective approach should also be applied in giving higher priority to training personnel in the required technological disciplines to support this important industry.

4. DIGITAL TRANSFORMATION

Initiatives

- Provide support and leadership to help transform businesses and government sectors in adopting digital transformation technologies to super-charge economic recovery from the COVID-19 pandemic and to create new jobs. This should include providing support for businesses to partner with government on pilot projects for AI-based solutions to regional problems.
- Take advantage of initiatives emerging from the national government's Artificial Intelligence (AI) Action Plan by working closely with the Federal Government to ensure South Australia is considered as a prime location of one of the four proposed AI Capability Centres.
- Establish a cross-sectoral taskforce to oversee development for local industry and government of minimum trust standards to ensure best practice in data security and cyber resilience.
- Undertake a critical assessment of the digital skills required for the transition to a digitally enabled economy and drive initiatives for digital skills development from Vocational Education and Training to graduate-degree level.

Supporting Information

Digital Transformation of Local Industry and Government Activities

To ensure South Australia can take advantage of the opportunities arising from Digital Transformation technologies, government should promote their integration into businesses and government sector work. This will necessitate promotion of growth in the most significant emerging digital transformation technologies which offer key advantages for South Australia.

This includes focusing on the following technologies:

Data, particularly big data, is a critical input to all emerging digital technologies. The foundational nature of data, and the workforce skills required to create value from the data, underpin the success of emerging digital technologies.

Artificial intelligence (AI) and machine learning have made immense progress, particularly in recognition, tracking, video and image analysis, and speech-to-text systems.

Cyber Security of digital systems continues to be a high priority for government and business, but many South Australian organisations remain inadequately prepared to prevent, detect, and respond to cyber threats.

Internet of Things (IoT) platforms, where a large number of objects can be accessed, monitored or controlled via a network connection, are expected to deliver a two per cent increase in productivity per year and create jobs in network design, cybersecurity, data monitoring, management, and analysis.

Quantum Computing is an emerging technology that will allow exponentially faster computation to enhance capabilities across a range of sectors, including cyber security, banking and financial modelling, and artificial intelligence.

Blockchain is a digital platform used to record, verify and store transactions through a network of computers. It can improve business processes and create efficiencies across sectors considered 'data intensive', including financial services, trade, energy, resources, and healthcare.

Gaining Benefits from the National Government's AI Action Plan
South Australia should also position itself to take advantage of initiatives emerging from the national government's Artificial Intelligence Action Plan. This plan announced in May 2021 as part of the Federal Budget, will boost Australia's capability in Artificial Intelligence by $124.1 million in new initiatives, including a National AI Centre led by CSIRO, supported by a network of AI and Digital Capability Centres to drive adoption of AI across the country.
See https://www.pm.gov.au/media/modern-digital-economy-secure-australias-future.

The SA Government should take urgent steps to ensure that at least one of the proposed AI and Digital Capability Centres is located in this State.

Minimum Trust Standards for Data Security and Cyber Resilience
The South Australian Government should establish a cross-sectoral taskforce to oversee development of minimum trust standards for local industry and government to ensure best practice in data security and cyber resilience.

An agreed framework for generating, sharing and using data in a way that it accessible, secure and trusted will be critical to support implementation of modern transformational technologies. Likewise, it will be increasingly important to ensure that local industry and government agencies are made aware of the most recent developments in cyber security standards and systems necessary to protect their organisations from criminal interference.

Education and Training for a Digitally Enabled Economy
The South Australian Government should undertake a critical assessment of the digital skills required for the transition to a digitally enabled economy and drive initiatives for digital skills development from Vocational Education and Training to graduate-degree level. Inclusive digital skills development at all levels is critical to ensure industry growth and create new businesses and job opportunities.

There is a growing shortage of digitally skilled workers and international border closures due to COVID-19 have exacerbated this shortage. The future of this State's digital industry sector requires the establishment of a robust talent pipeline for ensuring, sustaining and growing our industry capabilities.

5. AGRICULTURE

Initiatives

- Support research to develop sustainable, low-energy and low-chemical input primary production systems that will facilitate their adaptation to a low-carbon future, matched to land management systems, that effectively sequester greenhouse gases.
- Support the development of diagnostic imaging for natural and agricultural ecosystems to assess and manage nutritional status, crop yield, biodiversity, fire hazards, quarantine incursions, and outbreaks of pests, weeds and disease.
- Ensure that regulations addressing quantifiable risks or hazards of new primary production technologies including those that derive from crop genetics and improved animal welfare, are congruent with other jurisdictions and are science based.
- Seed-fund a collaborative government-industry-academia approach to developing a plant-based protein food manufacturing industry in South Australia, based around the dry fractionation of South Australian low-cost dryland crop products.

SA STRENGTHS	OPPORTUNITIES	RECOMMENDATIONS
New skills and technologies recognising climate change		
1. South Australian farmers and pastoralists have unique skills in dryland cropping, intensive horticulture, livestock management and biodiversity conservation, supported by world class R&D expertise within SARDI, CSIRO, UniSA, Flinders University and the University of Adelaide.	New technologies can be adopted to rapidly respond to threats and expectations in a world increasingly demanding sustainable and ethical production and processing systems, using safe, low input systems that are both labour and energy efficient. Depending on evolution of carbon markets, pastoral and rangeland areas have potential for carbon sequestration.	Further invest in collaboration and coordination to develop profitable low-energy and low-chemical input agriculture, fisheries, and forestry production systems, including land management systems, that sequester greenhouse gases including CO2 and methane. Link outputs with the objectives of the SA Drought Resilience Adoption and Innovation Hub and its regional centres.
The potential of digital imagery		
2. The newly established $10 M per annum Australian Space Agency, the SA Space Industry Centre, Australian Institute for Machine Learning and the Institute for Photonics and Advanced Sensing are headquartered in Adelaide. They should provide, among others, services to primary production including weather forecasting, emergency management and the monitoring of ecosystem and crop health and productivity.	Being able to judge how the season is developing, both in SA and internationally, is crucial to successful farm and environment management. Satellite imagery and associated digital technologies can provide crucial information for farming adaptation in the face of changing climates and world markets and for supporting environment conservation and protection.	Integrate an agricultural satellite imaging and interpretation capability into the existing SA Lot 14 satellite and artificial intelligence activities. The facility will be crucial for monitoring natural ecosystems, pastoral land and crop yields within Australia and internationally.
Adapting new plant and animal genetic opportunities		
3. South Australia has a world class track record in the development of innovative genetics and breeding technologies, built on crop genomics, plant and animal physiology and phenomics.	If we are to meet the targets for sustainable food production under increased climate stress, access to the best and safest technologies in breeding, agronomy, plant nutrition, animal welfare and protection of both plants and animals against pathogens and pests are essential. We should develop sufficient flexibility to adapt in response to new information on risks.	Review the genetic and breeding regulations to ensure they are consistent and flexible enough for the adoption of new technologies.
Be first mover in dry fractionation protein food manufacturing		
4. Plant based proteins are forecast to become a $6 B market in Australia by 2030 and are an important contributor to the Food, Wine and Agribusiness SA Government Growth Plan. SA is uniquely placed, compared to other states, to develop sustainable plant protein manufacturing, which can occur in or near cities uniquely located close to reliable raw material production (pulses and cereals) with established and efficient distribution channels (e.g., ports) and a competitive cost structure (land, labour, and energy).	SA can be a first mover in the creation of a plant-based protein manufacturing industry, using dry fractionation. In contrast to traditional wet fractionation, dry fractionation has much of the native functionality of the raw material, and hence nutritive value. Supporting R&D will be focused on increasing protein concentrations in crops, removing undesirable flavours and anti-nutritional factors, improved fractionation efficiency and the design of novel high value food products, using breeding, genomics and novel processing methods.	Establish a sustainable plant-based protein industry around dry fractionation, using targeted high-quality R&D, engineering and industry service. Product delivery from agronomy, raw material processing (fractionation), through to ingredient and end product manufacturing should be supported by existing R&D capabilities.

6. WATER RESOURCES

Initiatives

- Work with the Federal Government and the other state governments to develop a mechanism to ensure that all jurisdictions fully comply with the Murray Darling Basin Plan including the provision of an additional 450 GL of water per year for environmental purposes.
- Amend the Water Industry Act (2012) to make a single utility responsible for the planning, management and operation of urban stormwater infrastructure for Adelaide and all large cities in South Australia.
- Provide significantly increased support for water resources research in South Australia and ensure increased cost effectiveness of water and wastewater services for consumers by encouraging SA Water Corporation to invest further funds in research and development of new water technologies.

Supporting Information

The Murray Darling Basin Plan

The MDB Plan originally allowed for a volume of 2750 GL per year to be provided for environmental flows. That was subsequently increased to 3200 GL per year based on a study undertaken for the Murray Darling Basin Authority (see http://download.mdba.gov.au/altered-PBP/Hydrologic-modelling-relaxed-constraints-October-2012.pdf) that established that this higher annual flow together with relaxed constraints on river operation achieved a significantly improved environmental outcome for the river and its dependent ecosystems. It is vital for South Australia that this higher flow level be achieved in order to maintain the health of the Coorong, the Lower Lakes, wetlands and floodplains in the Murray Basin.

A Single Utility for Planning, Management and Operation of Stormwater Infrastructure

Setting up a single utility responsible for the planning, management and operation of stormwater infrastructure would provide for more efficient and coordinated service delivery. It would also ensure a suitable funding base for stormwater infrastructure and integrated planning of flood management, stormwater reuse and water sensitive urban design. This initiative is supported by a submission by the Stormwater Management Authority to the Review of the Water Industry Act (see https://www.environment.sa.gov.au/topics/water/water-industry) and, in part, by one of the recommendations of the Review

Increased Support for Water Resources Research

The Australian Government Productivity Commission Report on National Water Reform emphasises the importance of Governments funded water-related research (see https://www.pc.gov.au/inquiries/completed/water-reform-2020/report). In South Australia, this support can take many forms including significant additional financial support to the Goyder Institute for Water Research (or other dedicated water research institute), strongly supporting other initiatives like Water Sensitive SA, CRC bids and co-funding ARC Industry Linkage grants through the Department of Environment and Water and other state government departments.

Consistent with recommendations of the AGPC Report, the South Australian Government should also encourage SA Water Corporation to make significant investment in research and development of new water technologies so that consumers benefit from the most cost-effective water and wastewater services.

Evidence shows that investment in water research has resulted in an average benefit-cost ratio of around 13 over a large number of projects (see https://doi.org/10.21139/wej.2018.042). There are a number of areas in need of research support including the integration of centralised and decentralised water resources management systems, planning for extreme droughts, water recycling and water sensitive urban design.

7. HEALTH

Initiatives

- Improve 'Continuity of Care' across the 'Primary-Acute Care' Interface to address a major health system issue. Current digital health initiatives and health service reform could be leveraged to improve entry and exit from acute care and access to quality care in the community setting for benefit to all South Australians.
- Rebuild, from the grassroots, clinical and translational research in the public hospital system. Creating efficient and direct interaction between Local Health Networks (LHNs) and South Australian universities and medical research institutes to drive a culture of continuous improvement in the productivity and quality of care. Excellent clinical research leaders are essential to this regeneration.

Supporting Information

Continuity of Care Across the Primary-Acute Care Interface

The 'Primary-Acute Care Interface' was identified by Health Translation SA's (HTSA) Board of Partners as a strategic priority for SA. Better use can be made of the rich supply of primary, acute and sub-acute care data that is available in South Australia to inform planning, delivery and evaluation of health care services and improve patient outcomes. This fits into the philosophy of a Learning Health System approach. Continuity of care describes 'effective coordination and smooth progression of care over time as viewed from the perspective of the patient.

Continuity of care across the interface of primary and acute care — particularly on referral to and discharge from hospital, is critical. Discontinuity in continuity of care during transitions across this interface carries a higher risk of preventable adverse events, such as hospitalisations or death. https://healthtranslationsa.org.au/wp-content/uploads/2020/09/Background-Briefing-Paper.pdf

Rebuild clinical and translational research in the public hospital system

The quality and quantity of research undertaken in SA's public hospitals has been in serious decline over the last decades, and needs to be revitalised urgently. It is proposed that the distinction between clinical academic and clinician should be removed. All clinicians however defined should have research and teaching obligations regardless of their employing organisation and appropriate structures should be in place to ensure accountability for obligations associated with teaching, research and clinical practice. After all, clinical practice should be evidence based.

8. STEM EDUCATION

Initiatives

- Promote quality STEM education for all students throughout levels 1 to 12 of school education by appointing specialist teachers with industry experience and pay a salary premium to teachers with expertise in appropriate areas of STEM.
- Develop curriculum in STEM subjects that encourages participation from groups of students who are currently poorly represented in these areas including female students and Indigenous students
- In years 7 to 12 develop an approach to STEM education that integrates science, mathematics, engineering and technology through the increased use of inquiry- and problem-based pedagogies.
- Explicitly include the applied sciences, including engineering and computer programming, in the science and technologies learning areas at all year levels, to ensure the focus is on all STEM careers and learning, not just 'discovery' science.

Supporting Information

The future growth of the state economy relies on having a strong workforce qualified in science, technology and engineering. A shortage of suitably qualified teachers in these areas limits their attractiveness to students and hence limits the number of students with a suitable educational background to follow careers in engineering, computer science, science or technology.

The recruitment of teachers with industrial experience in STEM areas would help provide quality STEM education at all levels of schooling. Introducing salary premiums is one of the most effective ways to encourage this recruitment.

Poor representation of female and indigenous students studying STEM subjects at senior levels limits their possible career options in these areas and contributes to the "wage gap". If South Australia is to build its STEM qualified workforce, it needs to draw on students from all backgrounds.

The use of inquiry- and problem-based pedagogies in education encourages students to take an integrated approach to problem solving. It also reinforces the inter-relationship between the various STEM disciplines. Traditionally, science, mathematics and technology are taught as distinct subjects and not in an integrated fashion. Engineering is a profession that draws on science, mathematics, technology and a number of other diverse fields such as economics and human resource management to develop solutions to open ended technical problems.

While fundamental science and the scientific method are extremely important for research, the applied sciences, including engineering and computer programming are extremely important for careers in industry. Combining the teaching of the fundamental principles of science with suitable applications can stimulate student interest and make students aware of possible future career paths.

Programs like ATSE's STELR (Science and Technology Education Leveraging Relevance) and CS (Computer Science) in Schools are excellent examples of industry led and practical science, technology and engineering education. CS in Schools is a free, world-class computer science initiative that is already being implemented in some South Australian schools. STELR provides a hands on approach using classroom kits and teacher resources to support students to apply the science curriculum to real-world sustainable energy problems.

The Australian Academy of Technology and Engineering is a Learned Academy of independent experts helping Australians understand and use technology to solve complex problems.

Bringing together Australia's leading thinkers in applied science, technology and engineering, the Academy provides impartial, practical and evidence-based advice on how to achieve sustainable solutions and advance prosperity.

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