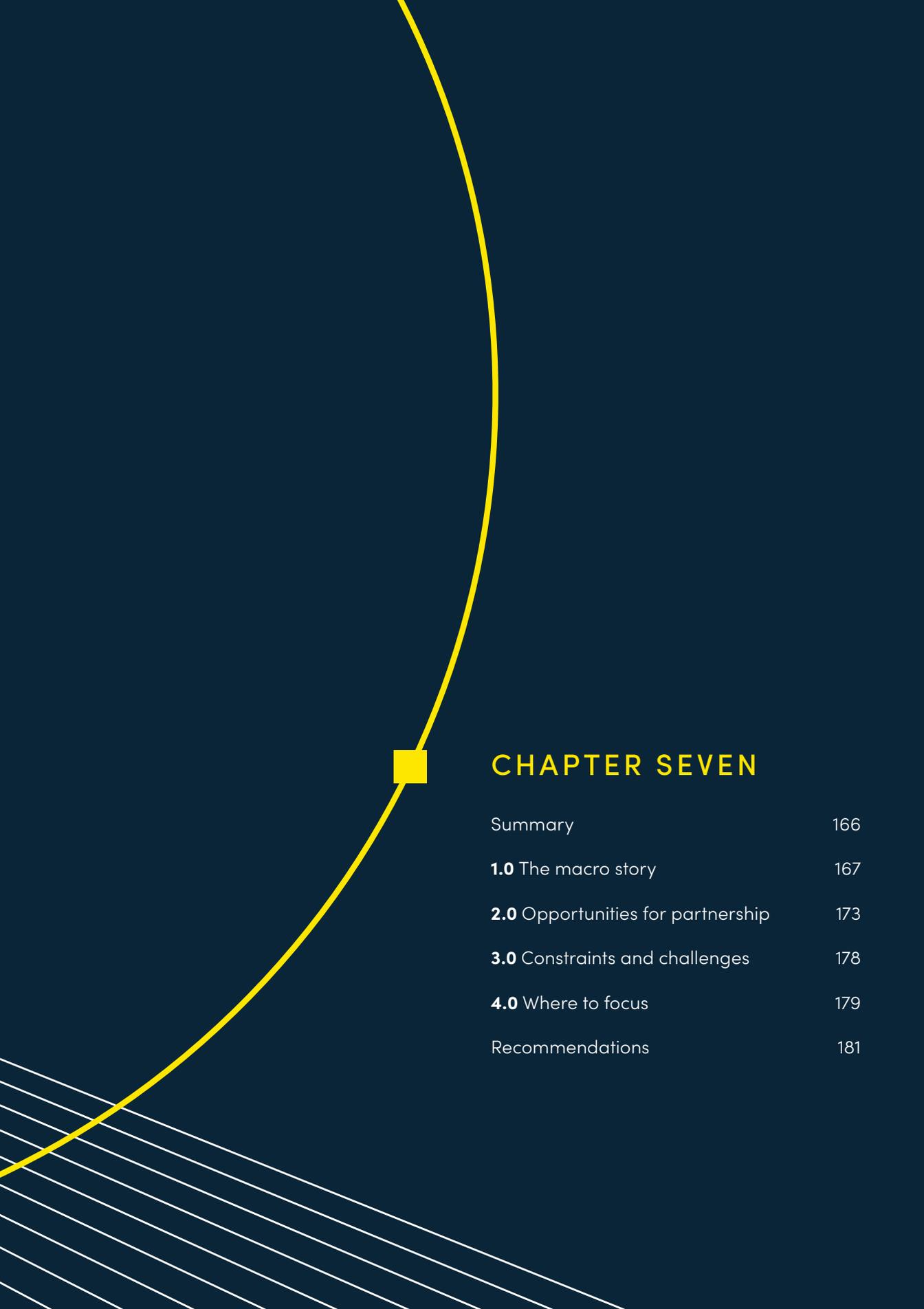


ENERGY SECTOR



CHAPTER SEVEN

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SUMMARY

- India's demand for energy is set to outpace domestic supply, providing the largest contribution (30 per cent) to global energy demand growth to 2035.
- Energy is central to achieving India's development ambitions: bringing electricity to those who do not have it; and developing infrastructure.
- India will remain reliant on energy imports, particularly for fossil fuels. It will also provide a market for services and technologies that improve energy efficiency and the uptake of renewables.
- In terms of commodities, India will be heavily dependent on imports of oil and gas.
- India will be largely self-reliant in thermal coal in the longer term, but will need to import thermal coal well into the medium term.
- India will present a significant market for uranium out to 2035, though opportunities for Australia will not be more than moderate.
- There are emerging prospects in hydrogen, including through partnerships with Japan, if Australia is able to stay ahead of the technological curve.
- How all these opportunities play out will depend on India's reform path. India's aspirations to simultaneously and rapidly: change its energy mix; be energy self-sufficient; ensure energy security; and meet its climate change goals, will be difficult to achieve but show India's energy policy sentiment. The political compulsion to provide affordable 'power to all' will shape other reforms in this sector.
- India's energy sector is characterised by myriad, often highly inefficient policy interventions. Controls on supply and the lack of transparent price signals reduce incentives to invest. Distribution is a bottleneck and a bigger problem than capacity. While political constraints will make any change incremental rather than wholesale, India is seeking to tackle these challenges.
- India's integration into global energy markets will be a key shift in the global economy out to 2035, with India having a greater stake in their efficiency.
- To support greater economic partnership with India in the energy sector, Australia should encourage India's deepening ties with the international energy policy regime, engage on regulatory barriers and foster a deeper bilateral knowledge partnership. We should also seek to build on our bilateral investment relationship in this sector, particularly Indian investment in Australian renewable energy sources.

1.0 THE MACRO STORY

KEY JUDGEMENT

Out to 2035, India will keep depending on imports to meet its large and varied energy demand profile. Prospects for Australian energy commodity exports to India are not as strong as for non-energy resource commodities (such as coking coal) due to price dynamics (liquefied natural gas [LNG]) and India's own endowments (thermal coal). India seeks greater energy efficiency and there is a growing market for technology and services that can help deliver it. Energy is one of India's most dynamic sectors and opportunities will evolve rapidly in renewables, energy technologies and power infrastructure. Political sensitivity around the provision of affordable electricity drives government intervention.

1.1 The scale and key structural drivers of the sector

INDIAN DEMAND

India's demand for energy will increase significantly out to 2035, driven by economic growth, urbanisation, rising incomes and industrial activity

- energy consumption is forecast to grow at around 4.5 per cent annually to 2035 (up from 3.5 per cent from 2000–2017)¹²
- India starts from a low base for relative per capita energy consumption and has considerable scope for growth
 - per capita electricity consumption in India is 1,010 kilowatt hours (kWh), against a world average of 3,200 kWh¹⁰
 - India is a relatively inefficient user of energy indicating significant improvement potential^{xxii, 12}
- all four major energy-consuming sectors – industry, household, transport, and agriculture – will see a rise in demand

- electricity constitutes 15 per cent of final energy consumption in India and demand is set to keep growing at 5.8 per cent per annum^{12, 74}
- India's largest sources of energy (coal and biomass) have traditionally been domestically procured, allowing India a fairly autarkic approach to energy policy
 - but India is becoming a major global energy player with a strategic interest in well-functioning energy markets.

The nature of Indian power demand is evolving. India's uptake of renewables is driven by:

- the advent of new and cheaper energy technologies
- the need to reduce air pollution which results in more than one million premature deaths in India each year.

Indian demand for energy is, and will remain, extremely price sensitive.

Energy demand in India varies geographically

- urban population growth is outpacing rural areas, driving demand in new sectors such as buildings, air conditioning and transportation.

^{xxii} With an overall energy intensity at 0.56 kg of oil equivalent per USD.

The scale of demand and technological changes have made energy one of India's most dynamic sectors

- as well as energy resources, India is looking for solutions to address storage, grid and baseline capacity requirements
- a nascent shift from long term contracts to diverse sources, taking advantage of lower spot market prices and hedging via forward contracts, indicates a that more dynamic approach to energy trade could emerge.

INDIAN SUPPLY

India will remain dependent on imports of traditional energy sources

- its share of the world population is 18 per cent but its share of world gas and oil reserves are only 0.6 and 0.4 per cent respectively⁷⁵
- on a per capita basis, India's domestic production of fossil fuels is the lowest among major emerging markets⁷⁶ but India relies on fossil fuels for around 75 per cent of its energy demands
- India relies on imports of crude oil but is also a significant net exporter of refined products, including to Australia (\$1.1 billion in 2016–17) – our largest import from India; this reflects the sheer scale of its refining capacity
- rapid technological change makes India's future energy mix difficult to predict but even taking account of enhanced domestic energy supply and greater energy efficiency, India's energy import dependence could still rise from the current 36 per cent to as high as 55 per cent by 2040.⁷⁵

One implication of India's dependence on key energy imports is a growing strategic engagement with trusted suppliers, including to fill India's strategic reserves

- for example, India is buying stakes in oilfields in Gulf States and India's National Infrastructure and Investments Fund has partnered with Dubai Ports to invest in India's logistics infrastructure.

India is richly endowed with clean sources of energy

- there is high potential for generation of renewable energy from various sources particularly wind and solar, as well as biomass and small hydro
- the Government of India has put increasing emphasis on renewable energy, including grid-connected and off-grid systems.

India is a long way from meeting its supply and energy security objectives

- some 300 million Indians lack access to electricity, and about 500 million people are still dependent on solid biomass for cooking⁷⁵
- the large majority of those without access live in rural areas.

India has ambitious targets for energy production growth

- for this to occur capital, labour and infrastructure availability will require appropriate policy and financial support.

India's power challenges are more to do with reliability and distribution than capacity

- India has experienced overcapacity in thermal energy
 - for example, several states reneged on power purchase agreements in 2017
- given poor transmission and distribution grids, power access will remain challenging though a move to distributed networks could help
- as the energy mix evolves, the type of infrastructure India requires will change (including storage solutions and the integration of distributed and renewable resources).

CASE STUDY: ENTURA: APPLYING ITS EXPERTISE TO GENERATE CLEAN POWER IN INDIA

India's large population and fast-growing economy has led to a huge demand for electricity, including for clean, renewable hydropower. By some estimates, India has developed less than a third of its hydropower potential.

A decade ago, Entura established an office near Delhi to offer India its expertise in planning, building, managing and maintaining hydropower systems.

Entura has since worked as a consultant on large and small hydropower projects throughout India. For example it collaborated with the developer of the major Chanju-I hydropower project in the north Indian state of Himachal Pradesh, which opened in 2016.

Entura uses the skills of local engineers, geologists and other staff and its Indian office is used as a base to coordinate projects in other countries in the region, including in Nepal and Laos.



AUSTRALIA'S COMPETITIVE ADVANTAGE

Australia has considerable conventional energy resources (LNG, thermal coal, uranium) and largely untapped unconventional resources (shale gas, coal seam gas)

- Australia's major commodity traders are generally well placed to navigate the Indian market for commodity sales
- our energy resource fields are relatively close to Indian markets
- the sector is established and has a global mindset.

These competitive advantages are complemented by other, globally comparative, strengths. Australia has:

- world class research and development facilities and knowledge
- recognised expertise in: renewable innovation, remote electrification, smart grids, dispatchable renewable energy, innovative finance models, low carbon emissions technologies and battery storage
- strong regulatory and legal frameworks that protect intellectual property
- access to high quality renewable energy resources, which could translate to Australia becoming a leading exporter of renewable hydrogen and low carbon mineral resources
- highly skilled workforces in energy sectors including mining, technology and innovation.

1.2 How the sector will likely evolve out to 2035

Carbon constraints will shape global supply and demand

- policy attention to air quality is rising across the globe with energy generation assessed against air, water and environmental damage
- government regulations, subsidies, and rapid cost reductions of renewables are all pointing to continued decarbonisation of the energy sector

- the Paris Agreement set goals to remain within two degrees and achieve net zero emissions by second half of the century.

Supply and demand will be affected by new technologies

- in extraction
 - enabling new resources to be unlocked cost-effectively (shale gas and tight oil)
- in generation
 - rapidly falling costs of clean energy technologies
 - ultra distributed generation systems
 - new generation technologies (making hydrogen a viable fuel)
 - » LNG as fuel has the potential to increase LNG demand
- in delivery
 - smart grid and metering technologies, better monitoring and prevention of fraud will increase efficient use of resources
 - battery storage technologies will support renewables and electrification (more electric cars and solar and wind micro tanks)
 - cost reductions in utility scale storage, pumped hydro and concentrated solar thermal will enable use of renewable energy at night
- in demand management
 - network management technologies
 - virtual power plants which group together battery power from consumer premises.

Technologies unlikely to be commercially viable before 2035 could still draw investment

- superfracking could enable oil to be low cost for decades
- new superconducting materials could enable interconnecting electric super grids or 'global grids'

- India could receive 18 hours of solar power, including consuming solar power from the Sahara.

Increased transparency in international markets for fossil fuels, especially LNG

- several countries are seeking to create more transparent and reliable price discovery benchmarks – including spot market auction platforms
 - this is likely to result in more flexible short term contracts.

INDIA HAS POLICY AMBITIONS TO IMPROVE ITS ENERGY SECTOR

Achieving all of its targets and policies will be hugely challenging, but the scale and nature of India's ambitions indicate electrification rates, power consumption and use of renewables will increase.

NITI Aayog's National Energy Policy aims to chart the course for energy and power use in India. The plan it outlines includes:

- electrification of all census villages by 2018, followed by the universal electrification of households, with 24 hours, seven days a week power for all by 2022
- reduction of cross-subsidies in the power sector to ensure the competitive supply of electricity
- clean cooking access through efficient and affordable fuel.

The Government of India is seeking to rapidly increase the share of renewable power generation

- its Nationally Determined Contribution under the Paris Agreement includes targets to reduce emissions intensity of GDP by 33–35 per cent by 2030 from 2005 levels
- it has set a target of 175 gigawatt (GW) of renewable installed capacity by 2022
 - 100 GW from solar (60 GW from plants and 40 GW from rooftop), 60 GW by wind and the rest from hydro and geothermal power.¹²

The Government of India recognises the need to improve downstream delivery and is aiming to:

- rationalise tariffs and introduce peak pricing to increase power uptake
- improve transmission and distribution infrastructure and the financial status of distribution companies.

AUSTRALIA'S ENERGY SECTOR WILL NEED TO IMPROVE TO KEEP PACE WITH CHANGES OUT TO 2035

Australia must find a path to a lower emissions economy whilst also securing energy reliability and affordability as well as international competitiveness by:

- reducing extraction processing and conversion costs
- improving productivity and efficiency
- commercialising investments in research and knowledge.

The changes the Australian energy sector needs to make to remain globally competitive out to 2035 will be conducive to increasing trade and investment in India.

WHAT AUSTRALIA WOULD LIKE THE ENERGY RELATIONSHIP IN 2035 TO LOOK LIKE

To have captured a greater share of Indian energy commodity imports, while the size of India's imports has grown

- to be a reliable source of baseline energy inputs
- through efficient market mechanisms, long term contracts and the spot market.

To supplement sales in traditional commodities with new markets, new customers and by providing new services to improve efficiency

- through new or unconventional commodities (coal seam gas, hydrogen)

- providing energy related services, for example grid management, energy systems optimisation, distributed energy resources, smart grid technologies, metering, and training and development.

To be a centre of innovation across the lifecycle of energy resources

- having developed and commercialised technologies for export, including in collaboration with India
- for example in low carbon emission technologies, hybrid power generation,

battery storage, smaller scale concentrated solar thermal systems, carbon capture and storage (potentially geosequestration where Australia's geology provides a strong competitive advantage).

To be a top ranked jurisdiction for energy resource investment, including from India

- with a possible Australian investment presence in India.

To be cooperating closely with India in regional and global forums on energy security and efficiency.

CASE STUDY: ITP RENEWABLES: RENEWABLE ENERGY CONSULTANTS ADVISE INDIA ON EXPANDING SOLAR POWER

The potential for solar power in India is immense as the country races to meet its growing energy needs and as solar technology and storage becomes more cost effective.

Consultancy group ITP Renewables, part of the ITP Energised group of companies, specialises in consulting and implementation of renewable energy projects and has run successful collaborations in India.

ITP Renewables produced a major report on concentrated solar power, which uses reflectors to concentrate sunlight and create steam which can be used in industrial processes or to drive a turbine for electricity generation. The in-depth study, commissioned by the Australian Government, reviewed the Indian market, the barriers to uptake of concentrated solar power and approaches to increasing capability.

ITP Renewables presented the Indian Ministry of New and Renewable Energy with 13 recommendations for improving their ambitious National Solar Mission policies for concentrated solar power (CSP). The report was welcomed by the Indian government. Subsequently three large scale CSP plants have been completed in India.

Collaboration between ITP Renewables offices in Australia and India has been key. Producing the studies involved multiple site visits to India, consulting Indian stakeholders and presenting at renewable energy conferences in India and Australia. Having ITP Renewables staff on the ground in India was essential to completing the work effectively.

2.0 OPPORTUNITIES FOR PARTNERSHIP

KEY JUDGEMENT

There is growth potential for Australian commodity exports, subject to a range of variables, notably price. Opportunities will emerge through diversifying into new products. There will be a growing market for services and technologies in areas where Australia is competitive, including to support the development of a resilient, low emissions energy sector in India. India is looking to invest offshore, including for energy security and price-hedging reasons.

2.1 Export opportunities

Table 4 provides the spread of opportunities out to 2035.

TABLE 4: ENERGY EXPORT OPPORTUNITIES OUT TO 2035

| | | Near term | Medium/Long term |
|------------------------|-----------------------------------|---|---|
| Goods | Conventional Commodities | Export conventional commodities Import refined oil products Export of specialty minerals and metals required for renewable energy sources | Export conventional and non-conventional commodities Invest in different links in the supply chain |
| Services and solutions | Renewable technologies | Export of technologies Joint research and development | Export of technologies Joint research and development Manufacturing of Australian technologies in India |
| | Training | Partner with Indian institutions to deliver training | Partner with Indian institutions to deliver training |
| | Grid management | Knowledge sharing on distributed systems, integration of renewables and remote electrification | Smart grids Smart metering Joint venture with Indian manufacturers |
| | Fossil fuel generation efficiency | Joint research and development and technology exchange, for example beneficiation and efficient coal use technologies | Collaboration on new technologies |
| | Energy Efficiency | Export of technologies Systems engineering | Collaboration on new technologies |

LIQUEFIED NATURAL GAS

India's appetite for gas is expected to grow out to 2035 and domestic production is not projected to meet demand – sustaining significant import reliance

- the Government of India aspires to double the share of gas to 15 per cent by 2030⁷⁵
- the International Energy Agency (IEA) expects India's natural gas consumption to increase from 50 billion cubic metres (BCM) in 2014 to 159 BCM by 2035 while Indian gas production rises from 33 BCM to 75 BCM in 2035
- if international pipeline projects do not materialise, India will require 84 BCM of LNG imports in 2035.⁷⁴

Australia's capacity to build LNG trade with India will depend on:

- price economics
 - gas does not compete with low-priced coal in power generation
 - large demand segments (for example fertilisers) are highly regulated and dependent on subsidies, preferring domestic gas at administered prices over imported LNG
 - oil prices, which influence industrial use gas or liquid fuels
 - the landed cost of Australian LNG in India compared to competitors
 - spot market auction platforms and more flexible contracts, which should see prices drop in an oversupplied market
- the pace of infrastructure installation
 - India's gas pipeline infrastructure is relatively underdeveloped, with the northern and eastern regions of the country gas-deficient and the existing infrastructure at full carrying capacity
 - city gas demand (mostly limited to urban areas as a transport fuel) will depend on the speed at which city gas distribution infrastructure is extended

- there are a number of greenfield and brownfield LNG projects at different stages of conceptualisation and development on the eastern and western coasts of India

- India's desire to diversify supply
 - currently, India has most of its long term contracts with Qatar, followed by the United States
 - Australia is the world's second largest LNG exporter
 - » if India sought to diversify supply for energy security reasons, it could be to Australia's benefit including through Indian investment in LNG projects in Australia.

THERMAL COAL

India's demand for thermal coal will increase in absolute terms although the share of thermal coal in India's power mix is projected to drop from nearly three-quarters in 2016 to about half by 2035

- while there are a range of projections⁷⁶, Indian thermal coal demand is expected to grow at 3.5–4 per cent per annum out to 2030¹²
- falling costs of renewable energy and storage could mean India gets cheaper baseload power from renewables before 2035
- however, existing and under-construction coal-fired power stations point to sustained demand for thermal coal.

Demand for India's thermal coal is driven by the power and cement sectors:

- thermal coal use in the power sector is expected to almost double by 2030, from around 600 million tonnes (MT) in 2016 to 1,000–1,100 MT by 2030
- the housing and infrastructure sector is expected to drive cement demand with 6 per cent growth per annum with thermal coal a key input.¹²

However, India's domestic supplies are projected to increase at a comparable scale

- Coal India production is expected to grow at a steady rate of 6 per cent per annum

to 2030 with domestic supply reaching 1200 MT by 2030¹²

- if this happens, India's coal imports could fall significantly in the longer term, declining from 156 MT in 2016 to 40–50 MT by 2030.

There are a range of factors which will determine the quantum of overall Indian thermal coal imports and Australia's prospects to capture a share

- to increase domestic production, Coal India will need to expand capacity by raising environment/forest clearance limits, utilising excess available capacity and clear bottlenecks in rail infrastructure across main and connecting lines
- where it has sought thermal coal imports, India has purchased thermal coal from Indonesia and South Africa, which offer coal that matches India's coal specifications at a lower price point than other international suppliers
- due to high transport costs, it is likely that the only coal plants that utilise imported coal in the near future will be those on the coast
- there could be a significant increase in Australia's thermal coal exports to India if Adani's Carmichael coal project commences production and exports
- India will roll out new High Efficiency, Low Emissions (HELE) power plants over the next 10 years
 - in principle, India's high ash, low energy domestic thermal coal is less suited to these plants than Australian thermal coal
 - but it is unlikely this would offset domestic coal consumption with imports due to India's price sensitivity and the potential to use technologies (including from Australia) to wash/upgrade India's domestic thermal coal supplies
 - while small quantities of higher quality thermal coal may be imported to blend with domestic mixes, HELE should not be relied on to create large-scale opportunities for Australian exporters.

URANIUM

Given rising demand, India is likely to become a key uranium market by 2035

- India currently has about 6 GW of nuclear power capacity spread across more than 20 nuclear power plants
- by 2032, India wants to increase nuclear power capacity to 63 GW⁷⁵
 - this goal appears unlikely but there should still be significant expansion in India's nuclear generation capacity over the period
 - current projects under construction add up to 10 GW of additional capacity by 2027
 - India has a longer term target for nuclear power to supply 25 per cent of the nation's electricity by 2050⁷⁶
- India has limited domestic uranium reserves and the growth in demand for uranium will be met through imports
 - along with China, India is a rare growth spot for global uranium markets
 - the most realistic option for scaling up nuclear energy in India lies with their indigenous pressurised heavy-water reactors (PHWR)
 - » most nuclear energy generated in India is by PHWRs.

India's growing demand offers some long term opportunities to Australian exporters

- Australia has the world's largest known reserves of uranium and is the third biggest producer
- Australia and India signed the Civil Nuclear Cooperation Agreement in 2016, opening the prospect of uranium trade
- India's goal appears to be to accumulate significant stockpiles of uranium.

The size of the opportunity for Australia will be influenced by:

- the number and proportion of nuclear power plants that are subject to International Atomic Energy Agency safeguards

- several reactors are being set up in technical cooperation with Russia, these contracts include supply of fuel by Russia
- other third party reactor and fuel supply arrangements may present opportunity
- how other countries respond to India's increase in uranium demand
 - Kazakhstan and Canada each exported over 900 metric tonnes of uranium ore concentrate to India in 2017⁷⁷
- India's desire to develop its indigenous reactor fleet appears to be delaying the roll-out of foreign reactors and may temper its ability to meet nuclear energy target goals.

India is pursuing the development of domestically designed advanced heavy-water reactors, fuelled by thorium

- given the lengthy process required to produce certain key materials and deploy such reactors, this scenario is beyond the term of this report.³⁸

HYDROGEN

Out to 2035, innovations in energy storage and transport technologies could see hydrogen become a more common energy source

- with few changes to equipment, clean burning hydrogen can be directly used in combustion including stationary power generation, as well as used directly in fuel cells for power and transport
- this could present an option to diversify our export base and lower emissions intensity of fertiliser production.

Recent Australian and Japanese technology breakthroughs have solved technological issues and pilot projects for export are already underway

- these projects will only be economically viable once affordable conversion technologies are commercialised to support the point-of-use hydrogen applications
- there will be opportunities if Australia stays ahead of the curve and establishes itself as supplier of hydrogen fuel to India, possibly through partnerships with Japan.

Exporting 'green' hydrogen (hydrogen produced using solar or wind) in the form of ammonia could save the Indian Government millions of dollars in subsidies for the fertiliser industry.

RENEWABLES

India has a large and growing demand for renewable energy and it will be a strong growth segment out to 2035

- the share of renewables in India's energy mix is expected to increase from 19 per cent in 2016 to approximately 39 per cent in 2030¹²
- India views energy independence and sustainability as mutually reinforcing because fossil fuel requirements are currently met mostly by imports
- the falling cost of solar photovoltaic (near parity with coal) will ensure its competitiveness with fossil fuels
- India's pumped hydro sector is emerging
- India is already the fourth largest generator globally of wind energy.

The uptake of renewable technology brings with it the need for support services, investment, market reforms and regulatory support.

India's financial support will be aimed at promoting generation and infrastructure creation, and not just capacity creation

- for example, India is seeking to develop residential off-grid capacity through a regulatory policy framework including a remunerative net metering policy.

The rapid uptake of renewables in India will have positive knock-on effects

- the scale of India's demand (especially in solar) will drive down prices of technology imports for Australia, supporting our long term energy transition.

Minerals and metals that are inputs to renewables are all produced in Australia and could also provide a trading opportunity as much as the technology itself

- inputs to solar panels include bauxite, silica, tellurium and cadmium.

2.2 Collaboration

The current challenges Australia faces in its energy policy and price structure should not crowd out the quality of Australian expertise in many parts of the energy sector. In addition to energy commodities, India needs support services, consulting, systems engineering and technologies in areas where Australia has expertise. This offers opportunities for partnership beyond commodity exports.

For example, the International Solar Alliance (ISA), launched by India and France in 2015, presents opportunities to collaborate on finance and technology in its pursuit of increasing the uptake of solar power

- the ISA is the first international inter-governmental organisation headquartered in India and marks a foray by India into global energy engagement which should be strongly supported
- the ISA's vision is to enable the deployment of solar at scale by aggregating demand across member countries for finance and technology, de-risking investments, collaborating on financing mechanisms and best practice.

Examples of where Indian demand and Australian capabilities converge include:

- improvement of transmission and distribution, including efficient management of renewable generation
 - installing and managing distributed solar systems
 - smart grid technologies (including advanced analytics)
 - energy curve balancing strategies
- pumped hydro design and management
- scalable concentrated solar thermal systems
- delivering training on renewable energy skills, engineering, science
- collaborating on policy frameworks, performance standards and regulatory environments

- pursuing joint research, development and commercialisation of new renewable technologies
 - for example battery storage technologies
- integrating variable and dispatchable generation, including remote electrification
- market mechanisms including demand response initiatives
- combining Australia's expertise with India's manufacturing capacity will help produce technologies and equipment at a lower cost.

Given the sustained predominance of coal in the Indian energy sector, India will offer opportunities to companies with expertise in

- coal washing
- reducing methane emissions during the coal mining process
- next generation coal combustion technology
- carbon capture, usage and storage where Australia has made significant investments and built expertise (though this technology is currently too expensive for the Indian market).

Australia and India could also strengthen climate cooperation in international fora, and link climate and energy engagement to support the emergence of lowest-cost energy investment options

- including information sharing and collaboration on research and development.

2.3 Investment

The current regulatory environment in India presents limited opportunities for investments.

However, over the timeframe of this report, investment in India's power infrastructure could become more appealing

- Indian policy-makers are making large efforts to remove obstacles to investment in energy supply
- the transmission segment is seeing some deregulation and private participation

- as the renewable energy generation segment matures it could offer more investment opportunities.

Indian investment in Australia

- nearly two-thirds of Indian FDI in Australia between 2003 and 2017 was in alternative or renewable energy, reflecting the growth and global outreach of Indian companies in this sector
- more broadly, Indian outbound investment is increasingly driven by energy security considerations
 - India seeks overseas assets to deliver energy resources in times of crisis and as a hedge against price volatility
- this is an extension of India building strong bilateral relationships with major energy suppliers
- Australia's vast resources base requires foreign capital, technology and markets for further development and Indian investment could play an important role
- projects such as Adani's Carmichael mine are viewed as a 'test case' for potential future investments
 - there is a view that this experience may lead Indian investors to put Australia in the 'too hard basket'.

3.0 CONSTRAINTS AND CHALLENGES

KEY JUDGEMENT

Despite the immense opportunities in India's growing demand, the energy sector in India is characterised by monopoly players, state-run corporations, controlled pricing and high barriers to market entry. Controls on supply and the lack of transparent price signals reduce incentives to invest, improve efficiency or rationalise supply. Distribution is a bottleneck, impeding the effectiveness of reforms and innovation.

3.1 The policy and regulatory environment

The four key objectives of India's energy policies are: affordable prices; improved energy security and self-sufficiency; greater sustainability; and economic growth

- in pursuit of these objectives, India's energy sector is characterised by myriad, often inefficient, policy interventions.¹⁰

The following defining features of energy policy and regulation in India will likely endure in some form out to 2035, with change being incremental

- subsidies (especially for oil, gas, electricity) that are aimed at improving access for poor and rural communities
 - central and state governments also provide financial support for distribution companies, including occasional bailouts, to cover losses for supplying power at artificially low rates⁷⁸
- regulated energy prices
 - electricity tariffs to end-users are regulated by state utilities below the cost of supply in many states, making any pass-through of higher priced imports difficult
 - currently, there is no formal provision for different peak and off-peak tariffs making it harder for distribution companies to recover costs¹²

- difficult land acquisition laws
 - development of transnational pipelines has been limited because of strict land acquisition laws
 - environmental concerns
 - policy and investment decisions are influenced by the sensitivity of land and water use, as well as the worsening air quality in many of India's major cities.⁷⁶
 - the continued dominance of state-owned enterprises in the resources sector creating inefficiencies and raising transaction costs
 - severe water shortages
 - for example hydro and thermal power plants have gone idle for various periods due to water shortages.
- Constraints and limits on the Australian side include:

3.2 Skills, infrastructure and other constraints

For the foreseeable future, constraints and limits to trade and investment on the Indian side include:

- poor transmission and distribution systems
- price sensitivity and its prioritisation over product life-cycle costs
- government overriding the commercial viability of power purchase agreements
- corruption
 - independent reports have identified power and utilities to be some of the most vulnerable sectors for corruption in India⁴³
- complex processes to get certification and licences especially for renewables
- perceptions Australia has growing sovereign risk for capital investment due to regulatory burdens, 'lawfare' challenges in the courts, and changes in policy
- Australia's public debate on the flaws in our energy sector is detracting from our ability to convince India we have world-leading expertise
- challenges to the industry's social license to operate, including negative community perceptions of the social and environmental impacts of unconventional developments
- limited commercialisation of research activities
- relatively high operating costs due to high labour costs contributing to higher costs for our export commodities.

4.0 WHERE TO FOCUS

India's energy policy landscape is diverse, spread across several ministries and often divided at central and state levels. The prioritisation of energy issues varies across states. Australian efforts should focus on the Central Government and Public Sector Undertakings (PSUs) for bulk trade and progressive state governments for engagement on renewables and energy efficiency.

4.1 The Centre and the states

At the central level, energy is handled by different ministries that set their own sectoral agenda. The Central Government has responsibility for public sector generation companies.

But states alone have the power to set and collect tariffs. States are responsible for day to day operation and maintenance of their grids.

States are the only customers big enough to fully support the renewable energy industry.

State Governments run programs of clean energy deployment, and other interventions related to the energy sector (for example electric vehicle deployment, decentralised renewable energy solutions in villages).

4.2 Key states

Trade in energy resources: a state focus is not judged as critical as generation companies are not bound by states and major energy PSUs are owned by the Central Government.

Renewables and associated technology and services: the share of renewable energy is expected to be highest in eight states – Tamil Nadu, Andhra Pradesh, Telangana, Karnataka, Maharashtra, Gujarat, Rajasthan and Madhya Pradesh.⁷⁵

ANDHRA PRADESH

India's highest installed solar capacity and strong potential in wind power. A state focus on innovation and technology.

TAMIL NADU

A leading solar and wind energy producer with among the highest installed capacity in India and the world's largest solar plant. A well-developed manufacturing sector which could be tuned to renewable energy technologies. Plans for a high capacity transmission corridor.

TELANGANA

India's largest generator of solar energy, with plans for further expansion. Outperforms most states in terms of power supply.

RAJASTHAN

Recent oil and gas discoveries are expected to drive numerous upstream and downstream ventures. Strong solar prospects due to high solar irradiation and land for setting up solar parks.

WEST BENGAL

Not for its renewable sector, but as the coal industry hub West Bengal is a natural target for engagement on fossil fuel generation efficiency.

RECOMMENDATIONS

Australia should continue to position itself as a strong, stable supplier of commodities and services to help India meet its energy demands. As India looks to strengthen energy ties with strategic international partners, Australia should seek to be part of India's inner circle of reliable energy partners.

43. Promote Australia as a destination for Indian investment in the energy sector

Address regulatory and social license concerns to ensure Australia continues to be perceived as a politically stable and economically reliable destination for future capital investment

- building, for example, on Indian investments in Australia's renewable energy sector.

44. Build targeted relationships with decision makers and seek to align regulatory efforts

The Australian Government can support commercial activity through the pursuit of policy and regulatory convergence and efforts to address obstacles. This includes for large players and multinationals who will continue to dominate energy commodities trade with India and who are generally large enough to operate without recourse to or support from governments or industry bodies for access to the Indian market.

44.1 Continue to maintain regular ministerial engagement on energy issues, particularly on clean energy innovation

- ensure the Australia-India Energy Dialogue takes place annually and is effective in advancing policy engagement on energy (and non-energy resources)
 - support in India by Australian industry bodies, businesses and research organisations helps any advocacy on reforms and policies to be effective.

- 44.2 Ensure policy engagement under the frameworks described above, and through the Joint Working Group, promote regulatory convergence to support private sector engagement. Do this by focusing
- where Australia has distinct expertise
 - sharing experiences on accreditation of solar panels for quality checks
 - » for example the Australian Solar Council's Positive Quality Program
 - battery storage solutions
 - bioenergy systems (to help address air pollution)
 - smart grids and metering
 - new energy systems related to agriculture
 - » for example solar panels that either pump water or feed energy back into the grid
 - where Indian reform could catalyse greater trade and investment, for example
 - work with India to develop technical forecasting capabilities to underpin viable energy pricing models, particularly as more variable power sources come online
 - share experiences on tariff rationalisation and adoption of peak power prices in a federal system
 - fossil fuel energy generation technologies
 - improving industrial energy efficiency, including high voltage grid maintenance.
- 44.3 Build relationships and share expertise focused on regulating energy and grid management in a federated system
- offer internships or exchanges for India Administrative Service officers involved in energy or regulators in India's Central Electricity Regulatory Commission to the Australian Energy Market Operator and Australian Energy Market Commission.
- 44.4 Explore opportunities with third parties on energy technology
- seek accords with third country partners whereby we promote the use of their technology (where Australia is not itself a technology leader) that would open up new supply opportunities for Australian energy resources
 - for example hydrogen.

45. Support India's participation in global energy organisations and work with India in international institutions

Given India's dependence and influence on international energy markets will only grow, India shares our strategic interest that these markets function well. But India is not a member of most energy specific regional and global organisations. Aligning India's energy frameworks with regional approaches to reliability, affordability and sustainability can support conditions for trade, investment, technology cooperation as well as promote information sharing and collaboration on research and development.

45.1 Advocate in support of India's engagement with the IEA

- India's new status as an Association Member increases India's relevance in global energy governance and aligns with Australia's advocacy for the IEA to reflect evolving global energy market dynamics
- Australia should support ongoing affiliation, including cooperation in numerous fields such as forecasting and data
- India cannot currently become a full IEA member as membership is limited to member nations of the OECD, but this restriction should be reviewed.

45.2 Support development of a practicable ISA

- Australia, having joined as a founding member in late 2017, should:
 - facilitate engagement for Australian businesses in initiatives across the ISA's growing membership base
 - explore options for establishing regulators' forums under the ISA
 - use the ISA to share our solar expertise with India and ISA member countries and promote further research and development and capacity building collaboration with Australian institutions
 - leverage the ISA's work to reduce costs of equipment and finance and remove other barriers to increase the deployment of solar in Australia.

45.3 In the context of support for India's APEC membership, promote potential collaboration through APEC's Energy Working Group.

45.4 Continue to work with India through fora such as the United Nations Framework Convention on Climate Change, Mission Innovation, the Clean Energy Ministerial and the International Renewable Energy Agency.

46. Foster a knowledge partnership on technologies and systems

- 46.1 Promote research, development and commercialisation of energy efficiency technologies between Australia and India, or with a third party, for entry into the Indian market
- continue to foster deep collaboration between Australian research agencies (for example CSIRO) and Indian agencies
 - leverage existing funds directly relevant to India such as the AISRF
 - promote opportunities to collaborate with India through Living Labs
 - seek to draw on Indian venture capital or funding from large conglomerates.
- 46.2 Australian institutions and commercial providers should seek to establish partnerships with key Indian institutions to deliver skills training
- including on-the-job skills training this could be through ramping up engagement with the National Institute of Solar Energy on curriculum and assessment design and train-the-trainer modules on solar rooftop infrastructure development and maintenance (Australia is a recognised leader)
 - the ISA could prove a useful platform for this
 - Government could play a role in facilitating this effort.
- 46.3 Foster collaborative training and education services focused on clean energy technologies and energy efficiency, through sponsoring of:
- masters/PhD offerings in energy research, including through the Australia Awards
 - training, workshops and executive courses.

47. Consolidate private sector engagement mechanisms (state and business level) to help unify Australian branding, improve knowledge sharing and coordinate lobby efforts

Explore options to work under an existing body (such as the Australian Solar Council or Clean Energy Council) to package Australian renewable energy offerings specifically for India (for example, akin to Water Industry Alliance)

- an initiative to support public and private partnerships for sharing Australia's energy sector expertise with India, especially key states
- could link with the ministerial level Energy Dialogue
- could aggregate full set of Australia's expertise
- could open opportunities for Australia to learn from India's approaches
- could seek co-investment for collaborations.

48. Continue to improve Australian competitiveness

The Australian Government should continue to seek to optimise regulatory frameworks and also incentivise greater research and development in the energy sector

- for example, explore options for an industry-wide research program for the energy sector
 - emulating Australian Coal Industry’s Research Program whereby the Australian coal sector provides a small, voluntary but sector-wide levy to support research programs, including funding PhD scholarships
 - such an independent and focused scheme could build an industry wide and transparent research community
 - complementing the joint industry project model more traditionally employed by the sector.⁶³