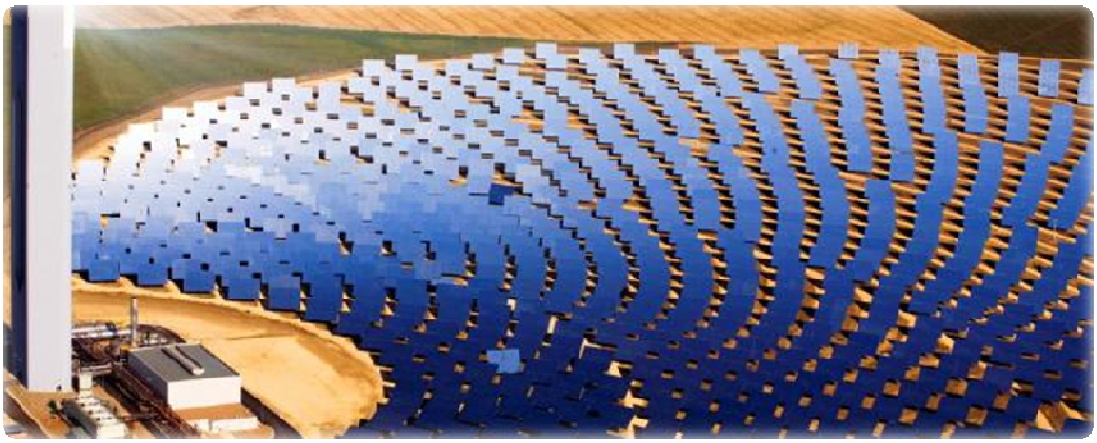
A Sustainable Energy Future for the Northern Territory

Submission to the
Northern Territory Committee on Energy Futures

22 November 2013



Environment Centre NT
protecting nature | living sustainably | creating a climate for change

Thank you for the opportunity to comment on the Northern Territory Committee on Energy Futures Inquiry into key challenges and opportunities. We welcome this inquiry and the scope of the committee. It is critical that a long term strategic vision is developed for the Northern Territory's energy future that considers the complex economic, environmental, social and cultural factors involved.

The Environment Centre NT is the Northern Territory's peak non-government environmental organisation that has advocated for 30 years on the area of energy policy. A sustainable energy future for the Northern Territory is of great importance for addressing all three aspects of our organisations mission objectives:

1. Cut greenhouse gas emissions and build renewable energy capacity.
2. Foster sustainable living and development, and
3. Protect and restore biodiversity, ecosystems and ecological processes

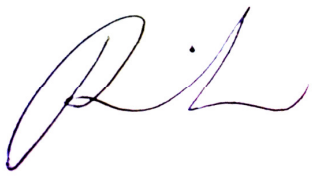
In summary we ask the committee to:

- Recognise the enormous potential for large scale solar in the Northern Territory and develop a policy framework that allows this industry to grow
- Recognise the critical need to reduce greenhouse gas emissions and this as a key driver in designing a future energy policy framework
- The increased uptake of solar photovoltaic systems on households and businesses and continuing support for this
- The value of continuing and expanding energy efficiency programs
- The potential for the Northern Territory to be a major exporter of renewable energy to Asia
- Recognise the environmental and social risks of shale gas and oil developments
- Recognise the environmental and social risks of nuclear power

Please consider our following comments. We would be very happy to meet with the Committee over time and discuss these ideas further.

Thank you,

Regards,



Rob Law,

Policy Officer, Environment Centre NT

LEGISLATIVE ASSEMBLY OF THE NORTHERN TERRITORY

12th Assembly

Committee on the Northern Territory's Energy Future

Inquiry into Key Challenges and Opportunities

Terms of Reference

In accordance with its resolution of 19 September 2013, the Committee on the Northern Territory's Energy Future adopted the following terms of reference for an inquiry into Key Challenges and Opportunities:

The Committee inquire into and report on key challenges and opportunities associated with meeting the Northern Territory's future energy needs including:

1. Impact of cultural, economic, environmental, geographic, regulatory or other factors on:

- **the exploration, development, and production of energy producing resources; and**
- **availability of developed resources for the domestic energy market.**

2. Demand and supply-side management strategies and incentive initiatives to improve productivity, cost effectiveness, energy efficiency, consumer and supplier participation in the energy market.

3. Off-grid power generation alternatives for commercial and remote applications, including funding and investment options for the development of emergent and enabling technologies, infrastructure, and commercial scale demonstration projects.

1 Introduction

1.1 The Environment Centre NT considers the fundamental role of the Committee as being to plot a course to rapidly transition the Territory from a reliance on risky fuels to an energy system and export economy based on a renewable energy future.

1.2 The high risk nature of our major stationery energy sources and energy exports renders them a liability to Territorians and others who suffer the consequences from their use: rising global temperatures caused by our dirty gas exports, increasing power bills due to diesel- and gas-price escalation, health impacts from burning fossil fuels on workers and communities living nearby, and the tens of thousands of radiation refugees who formerly lived near the Fukushima Daiichi nuclear power plant when it melted down, releasing radiation caused partly by uranium mined at Ranger Mine.

1.3 Conversely, the Territory has an enormous natural advantage in renewable energy sources that await exploration, R&D, deployment and potentially export.

1.4 Our deserts and savanna regions are global hotspots for solar irradiance with annual totals exceeding 2500 kWh/m2, more than double the levels in European nations that have well developed solar industries.[1] Yet we waste >99.99% of it in terms of energy generation.

1.5 Tidal power potential is very substantial in the Clarence Straits north of Darwin and other Top End near shore marine locations. Similarly, we waste it all presently in terms of energy generation.

1.6 Modelling of potential geothermal resources indicates the Territory may have some of the largest deep geothermal reserves of any jurisdiction in Australia, according to Geoscience Australia's mapping of interpreted temperatures at 5km depth.2

1.7 Lots of countries have large reserves of fossil fuels, few have such abundant renewable energy supplies.

2 Climate change and reducing greenhouse gas emissions

2.1 Gas is a dirty fossil fuel that is contributing to global climate change, not clean and green as sometimes espoused. Rather than comparing greenhouse gas emissions from gas with those of dirtier coal, the more relevant benchmark should be the future towards which our energy mix must transition, which means renewables.

2.2 Accordingly, gas is dirty compared to solar, tidal, geothermal, wind, waste-to-energy, and second- and third-generation biofuels.

[1] For example, see http://www.creativhandz.co.za/images/solar_radiation.jpg

[2] Geoscience Australia, Geothermal Energy Project, see map 'OzTemp – Interpreted Temperature at 5km Depth', viewed 22 November 2013, available for viewing at http://www.ga.gov.au/energy/projects/geothermal-energy.html

2.3 Energy and climate are the flip side of the same coin. The climate change implications of diverse energy options should be central to the Committee's considerations.

2.4 Territorians have the highest per capita carbon emissions in Australia, and Australians have amongst the very highest per capita emissions on Earth.

2.5 Greenhouse gas emissions from stationery energy contributed one quarter of the Territory's greenhouse accounts in 2010/11 (or almost 4 $MtCO_2$-e p.a. of a total 14.7 $MtCO_2$-e p.a.), the most recent year for which annual accounts are available through the National Greenhouse Emissions Reporting System. With an additional 5 $MtCO_2$-e p.a. to be produced (av.) by the Ichthys LNG project within a few years, the Territory's greenhouse emissions are – literally- going to jump. Accordingly, the Territory needs to rapidly cut carbon pollution produced from electricity, such as gas and diesel fired generators.

2.6 A price on greenhouse gas emissions remains the best mechanism for driving economy-wide transformation from a high-carbon to a low-carbon future. An emissions trading scheme would reward early adopters and proactive industries which invest in energy efficiency and renewable energy, while requiring high-carbon businesses and industries to fund this transition.

2.7 Recommendations

2.7.1 Consideration of the greenhouse gas emissions released during exploration, production and use of energy sources should be prominent in the Committee's deliberations.

2.7.2 In the absence of any meaningful climate change policy by the NT Government, and substantial uncertainty regarding the likely effectiveness and costs of the Australian Government's proposed Direct Action climate policy, the Committee should propose mechanisms, legislative frameworks, incentives and targets to ensure future NT energy policy substantially cuts greenhouse gas emissions to ensure the Territory plays its part in stopping dangerous climate change.

2.7.3 The Territory support retention, and strengthening, of a national emissions trading system to drive investment in energy efficiency and renewable energy.

3 Renewable energy

3.1 A key goal of the Committee should be to identify steps to enable the rapid transition from fossil fuels to renewable energy resources to cumulatively provide reliable, dispatchable, cost effective electricity for grid and off-grid electricity.

3.2 Approximately 1% of the Territory's stationery energy is generated using renewable energy. In an era of escalating gas and diesel prices and associated electricity costs, falling costs of solar power, and the need to rapidly reduce carbon pollution to play our part to stop dangerous climate change, this is woefully inadequate.

3.3 In relation to Reference 1, a significant cultural barrier to the rapid deployment of renewable energy is the incorrect view that gas is clean and green. It's not.

3.4 Solar photovoltaic and wind power competes on price with coal fired electricity in southern states. On present trends the Territory will fail to generate from local sources the c. 300 GWh of electricity required to be produced from renewable energy sources under the federal Renewable Energy Target legislation.

3.5 Darwin, rather than just Alice Springs, has the potential to be a solar city. Significant opportunities exist to facilitate the construction and operation of utility scale solar PV power plants within the next few years to supply electricity to the Darwin-Katherine Integrated System (DKIS), the electricity grid stretching from Darwin to Katherine.

3.6 Locating an array of small to medium sized solar power plants (each 5-30MW) in the southern half of the DKIS (Hays Creek to Katherine) would reduce risks of cyclone damage, lessen intermittency issues from cloud cover by geographically spreading solar inputs, and mitigate grid stability risks. It would also create employment and business opportunities outside Darwin.

3.7 Rather than investing the $10-$20M p.a. mandated by the RET law in renewable energy generated in the Territory, Power and Water Corporation instead creates jobs and builds a renewable energy industry in other states – mainly South Australian wind generators – by buying large-scale generation certificates[3] elsewhere.

3.8 Territorians lose out because the Territory Government fails to require Power and Water Corporation to purchase the large-scale generation certificates locally. To illustrate the opportunity cost of this policy, Territory renewable energy generation businesses will forgo investment by an NT Government corporation of an estimated $100M-$200M between 2010 and 2020; sufficient funds to construct and operate several utility scale solar PV power plants in the Territory.

3.9 Other major opportunities include compelling and facilitating off-grid mines to generate significant renewable energy for both their operations as well as nearby remote communities which could be connected with mini-grids. The most significant opportunities to achieve such change would be during approvals process (initial construction, expansion, or seeking new energy supplies) and towards end of mine life where the company, government and local communities are focused on legacy, post-mine employment, future energy supply, and corporate social responsibility.

3.10 Compelling opportunities include iron ore mines in the Roper/Limmen region, Vista Gold's Mt Todd gold mine, Ranger Uranium Mine, Minemakers' Wonarah phosphate mine, and potentially RTA Gove's bauxite operation.

3.11 Significant advances have been made in remote communities and outstations to hep Indigenous communities transition from diesel generation to solar power in recent years. The

- [3] http://ret.cleanenergyregulator.gov.au/Certificates/Large-scale-Generation-Certificates/about-lgcs

first report of the Green Energy Taskforce provides useful information and recomemndations. Such a transition makes sense in terms of energy independence for remote communities, cutting carbon pollution, reducing noise and particulate pollution, reducing power costs by reducing the use of diesel, and saving the Territory Government from paying large subsidies under the uniform pricing tariff policy via Indigenous Essential Services.

3.12 The amount of diesel used off grid in both Aboriginal Communities and also remote mines is not clearly understood from a policy perspective.

3.13 The amount of diesel being trucked has a direct cost to the NT in terms of deteriorating condition of the roads and also the need for increased maintenance of the roads. This cost that is not reflected in the cost of transporting diesel energy. Tragically, the trucking and transporting of diesel and the resultant wear and detrimental impact to the condition of remote roads has a contributed to the increased number of traffic accidents, injuries and fatalities.

3.14 Moves towards community solar and wind projects in Australia and globally highlight the desire to achieve energy independence, cut rising energy costs associated with fossil fuel generation by large utilities, and cut carbon pollution. Examples include the Community Power Agency,[4] Hepburn Wind,[5] Embark[6] and Community Power Network (USA).[7]

3.15 Support for solar leasing would assist householders and businesses wishing to generate solar power but who do not have sufficient roof space or land to partner with organisations and businesses that do have suitable places for installing solar panels. Support could involve assisting solar companies to meet with potential lessees and assist them in negotiating power purchase agreements with Power and Water Corporation, as well as providing lessees with adequate legal protections. Various companies offer solar leasing, such as Ingenero[8] and Solar Watch.[9]

3.16 In Greater Darwin, Alice Springs and Tennant Creek, urban and peri-urban dwellers should be enabled to invest in community owned solar power plants.

3.17 A significant gap in the Territory is well funded research into renewable energy. The Centre for Renewable Energy at Charles Darwin University receives only a couple hundred thousand dollars in funding from the Territory Government each year. This is insufficient support to enable CDU to attract the range of senior researchers required to partner with the private sector, PowerWater, NGOs (eg CAT Projects, Bushlight), and community groups interested in developing their own community solar power plants.

3.18 Recommendation

[4] http://www.cpagency.org.au/

[5] http://hepburnwind.com.au/

[6] http://www.embark.com.au/display/WebsiteContent/Home

[7] http://communitypowernetwork.com/

[8] http://www.ingenero.com.au/residential/energy-access-solar-lease/

[9] http://www.solarchoice.net.au/blog/free-solar-panels-pay-as-you-go-solar-systems-australia/

3.19 The NT Government commit to generating at least 20% of its stationery energy needs by 2020 from renewable energy supplies harnessed in the Territory. Requiring the NT Government owned Power and Water Corporation to purchase its large-scale generation certificates from renewable energy generators based in the Territory would generate regional development and create jobs for Indigenous communities and landowners.

3.20 The NT Government undertake a study similar to modelling of 100% renewable energy supply by the Australian Energy Market Operator for the National Electricity Market on the east coast of Australia,[10] and by Beyond Zero Emissions for eastern, southern and southwestern Australia.[11]

3.21 The NT Government including Power and Water Corporation construct, support, or facilitate the construction by third parties, of utility scale renewable energy power plants – with a focus on solar PV and then solar thermal – to supply at least 300 GWh of electricity to the Darwin-Katherine Integrated System by 2020. This would require approximately 200MW of installed solar power plants to be constructed in the DKIS within the next six years. Co-investment by the federal Australian Renewable Energy Agency should be sought.

3.22 Mining companies operating in the Territory be required to invest in significant generating renewable energy for their operations that would also benefit nearby communities during approvals processes, expansions, when seeking new energy supplies, or at closure.

3.23 Support development of community owned solar power plants for urban and peri-urban areas, such as through funding a community solar facilitator.

3.24 Put in place support mechanisms for solar leasing.

3.25 Significantly enhance funding support for research into renewable energy by expanding the Centre for Renewable Energy at Charles Darwin University.

4 Export electricity generated from renewable energy

4.1 The Environment Centre NT and Research Institute of Environment and Livelihoods at Charles Darwin University co-hosted a workshop from 29-30 July 2013 on "Scoping Workshop on Australia-South East Asia grid connection to catalyse regional generation and distribution of renewable energy".

[10] Department of the Environment, report on 100% renewable electricity scenarios, available for download at http://www.climatechange.gov.au/reducing-carbon/aemo-report-100-renewable-electricity-scenarios, viewed 22 November 2013.

[11] Beyond Zero Emissions, 2010. *The Zero Carbon Australia Stationary Energy Plan*, available for download at http://bze.org.au/zero-carbon-australia/stationary-energy-plan, viewed 12 November 2013.

4.2 The report[12] from the workshop will be released in late November 2013. The Conclusions and Executive Summary are provided below to appraise the Committee of the workshop's findings:

Executive Summary

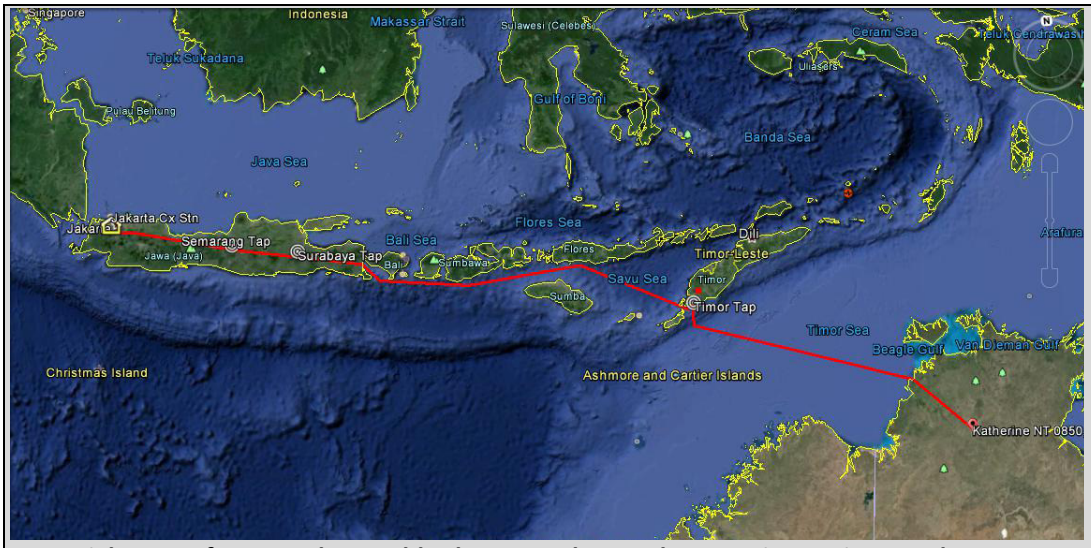
The Workshop on "Interconnection of Electricity Grids between Northern Australia and Southeast Asia" was held at Charles Darwin University, Darwin, on 29 – 30 July 2013. The two-day Workshop scoped possibilities and challenges in integrating electricity grids in Northern Australia and Southeast Asia to enhance opportunities for the generation and distribution of renewable energy, improve energy security and cut energy poverty in the region.

The Workshop was organised by the Environment Centre NT and the Centre for Renewable Energy - Charles Darwin University and brought together over 25 experts and practitioners in the areas of renewable energy and energy markets, High Voltage Direct Current (HVDC) cables, policy makers and government officials from the Northern Territory, Indonesia and Timor Leste.

If constructed, the Australia-Asia Interconnector would be the longest and deepest subsea HVDC cable in the world, and the first to connect electrical grids between different continents (though other projects are underway). The Workshop identified the following key issues that could be considered as important drivers for this ambitious but not unrealistic concept:

- Reducing emissions and tackling climate change
- Meeting rising energy demand in SE Asia
- Developing Northern Australia
- Addressing the inevitable depletion of non-renewable fossil fuel sources
- Realising the untapped world class renewable resources in the region
- Reducing the health and environmental impacts of coal, diesel and nuclear power
- Alleviating energy poverty
- Increasing energy security and reducing energy conflict risks
- Promoting energy cooperation for reduced energy conflicts
- Building regional partnerships
- Reducing the budgetary costs in Indonesia of major subsidies for diesel and electricity
- Falling costs of solar power and rising costs of fossil fuels

[12] Blanch, S. Campbell, A. Law, R. Halawa, E. & Eiritz, C. (2013) *Scoping Workshop on Australia-South East Asia grid connection to catalyse regional generation and distribution of renewable energy*, 29-30 July 2013, Environment Centre NT & Centre for Renewable Energy, Charles Darwin University, Darwin.



Potential route of HVDC subsea cables between the Northern territory, Timor and Java.

The Workshop also identified several key constraints that pose significant challenges to the realisation of the concept, split in to technical, financial, geopolitical and regulatory issues.

Subsea HVDC cables technology is well developed and has been deployed throughout the world. The critical technical challenge to Australia - Asia grid interconnection is the depth of the ocean in the Timor Sea and distance between main areas of energy generation and energy demand. Different route options were discussed, with the most probable being from Darwin across to Timor, a distance of approximately 700 km depending upon the exact route chosen. However, this would still require crossing the Timor Trench, which is a significant depth (around 2-3 km). It was noted that although it was not impossible to lay cables at such depths, it has not been done before. Laying a very long and heavy cable would place demands on existing submarine cable manufacturing facilities, be dependent on metals pricing such as copper and aluminium, and require very large cable laying vessels of which only 10 currently exist globally.

The region is also seismically active. The impacts on reliability of electrical supply due to a broken, or damaged, cable due to underwater earthquakes or mudslides, strong currents or anchor strikes would need to be assessed, including how a cable could be repaired. Significant concerns were identified for regional electrical grid stability that would arise from a failed cable.

Large infrastructure costs due to long distance transmission lines and associated technical challenges were also identified as a serious constraint. On the other hand, domestic energy markets in the region are characterised by mismatch between the demand and resource sites, making grid interconnection - which could promote renewable energy deployment an attractive option.

The Workshop pointed to an option of investing in domestic renewable energy in ASEAN nations which might make more economic sense than grid interconnection. It was noted that distributed photo-voltaic (PV) systems are growing in Indonesia in the domestic market and will be an important part of the energy mix in the future. However, an integrated grid could embrace the diversity of renewable energy resources along the route and provide an integrated regional energy hub. The solar resource, and land available for utility scale solar power plants, was identified as being of higher quality in the savanna and semi-desert regions of northern Australia than in equatorial Indonesia.

Furthermore, a HVDC cable was just one of various options of delivering renewable energy to Asia into the future. Other technologies such as solar fuels may develop further that could deliver better options from technical and economic standpoints. The region may also benefit from many renewable energy technologies which could deliver large scale energy supply in the region, most likely in the way of solar PV, concentrated solar thermal, geothermal and tidal.

The Workshop also raised concerns regarding the capacity of the electricity grid in Indonesia and Timor Leste to cope with new supply coming from a HVDC cable. The most feasible option to overcome this would be to connect to the higher load centre of Jakarta where AC networks are likely to be more robust. The likelihood of a multi-terminal interconnector delivering loads at different nodes was considered unlikely from a technical and economical point of view. However, provisions for a three terminal interconnector could provide electricity into Timor and Jakarta. Further work would need to be undertaken to consider AC network system capacity and system stability etc.

One of the greatest challenges from an economic perspective is finding finance to cover the potentially large CAPEX involved in the cable installation. A very rough estimate for an Australia-Asia Interconnector and associated renewable energy generation was considered to be $8-10 billion, including 2000 km of HVDC subsea cable ($1-2 million per km), 1000Megawatt of solar PV and solar thermal ($2-3 million per MW), $18 million for Indonesian geothermal, and $18 million to upgrade or duplicate existing land AC transmission networks and $18 million for AC-DC converters and contingencies.

This challenge should be helped by reduced subsidies to fossil fuels and introduction of price on carbon in region. However, coal fired electricity in western Indonesia currently retails for 6c/kWh (approx) while Australian solar power exported to Java is unlikely to retail for under 30c/kWh at current infrastructure prices.[13] Accordingly, no business case exists in the short to medium term, and without significant government subsidies.

[13] This is very approximate and conservative, and other estimates have been lower (see presentation from workshop delivered by Andrew Blakers for a solar PV/pumped hydro plant).

The Workshop also noted the geopolitical and regulatory issues the grid interconnection could bring about. Indonesia's Electricity Law (Law # 30 - 2009) essentially prohibits importing electricity if local demand has not been filled (Article 39 'Cross-border Electricity Trade'). In addition to this will be the importance of engaging with state owned electricity generators, such as Power and Water Corporation in the Northern Territory and Perusahaan Listrik Negara (PLN) in Indonesia.

The Workshop agreed that further discussions and research projects are required to explore in more detail on the feasibility of such a concept. ASEAN-Australia Comprehensive Partnership Agreement (2014-19 phase) and the Science and Technology Cooperation Agreement were noted as two key institutional arrangements warranting investigating for government to government and technical discussions.

Conclusions

Why connect electricity grids from Northern Australia to South East Asia?

An intercontinental grid interconnector will help to secure energy supplies for the region, reduce energy conflicts, address climate change and low carbon futures, maximise the regions' natural advantage of renewable resources, build regional partnerships and go some way to reducing energy poverty in the region.

Is grid interconnection between Northern Australia to South East Asia technically feasible?

Yes. It is possible to connect between Northern Australia and Indonesia/Timor Leste via High Voltage Direct Current (HVDC) subsea cable using existing technologies. However, there are significant challenges of ocean depth and distance, energy storage, existing network capacity and grid stability issues that will require further investigation.

Are there enough renewable energy resources in the region to make this idea feasible?

There are significant world class, largely untapped, renewable energy resources in the region. Northern Australia has one of the largest solar resources in the world, whilst Indonesia and Timor have significant geothermal and tidal energy resources. A spatial regional renewable energy resource assessment should be undertaken to understand this resource better.

Is there a strong business case for grid interconnection?

It is unlikely that there is a strong business case for grid interconnection at this stage. There are numerous financial challenges relating to the costs of renewable energy and HVDC and network cabling. However, the costs of renewable energy are rapidly falling and as subsidies from fossil fuel energy sources are reduced such a project is likely to become more cost competitive.

How much would regional grid interconnection cost?

A very rough back of the envelope estimate of the CAPEX of grid interconnection is $US8 billion. This is based on the current costs of HVDC cabling, network connections and 1000MW of solar power in

northern Australia. Further economic analyses would need to be undertaken to determine a more realistic CAPEX .

What are the most likely routes and scale for grid interconnection?

The most economically and technically feasible route is likely to be between Darwin and West Timor and then across to eastern Java via HVDC cable and then a land cable across to Jakarta. This would connect to the energy load centre of Jakarta, with the capacity to deliver energy to Timor Leste also.

Why invest in renewable energy when oil and gas are being extensively developed in the region?

Addressing climate change requires moving away from fossil fuel based energy sources such as oil, gas and coal. It is important that energy futures for the region invest more in renewable energy in order to reduce greenhouse gas emissions.

Would South-East Asian nations want to import renewable energy from Australia?

This is unknown. There remain geopolitical issues around energy sovereignty that the project will need to investigate further, and partnerships between countries are critical. However, Indonesia and nine other ASEAN countries are already working towards an ambitious ASEAN power grid action plan to interconnect electricity grids between the 10 countries by 2020.

Are there grid stability risks that could occur from the intermittent power provided by renewable energy?

Yes, renewable energy has challenges with providing power 24 hours, 365 days of the year, but these are not unsolvable. Solutions would need to consider storage and or hybrid systems. Large scale grid interconnectivity also makes it easier to manage intermittency issues in a scenario where there are distributed renewable energy sources.

What would happen in the event of cable failure?

This is a risk that would need to be managed and how cables would be repaired should be properly investigated. A single HVDC cable is faced with risks of damage and failure such as from underwater earthquakes or mudslides, strong currents or anchor strikes.

Should the grid interconnection project be investigated further?

Yes. The general consensus from the workshop was that there were significant strategic imperatives for realising electricity grid interconnection between Northern Australia and South East Asia that should promote further research and investigation.

4.3 Recommendations

4.4 The Territory Government investigate the feasibility of an Australia-Asia Interconnector to enable export of electricity generated by NT renewable energy, in partnership with the Australian Government, Indonesian authorities, and energy and construction businesses.

4.5 The Territory Government and business develop a plan to transition off exporting risky fuels (gas, uranium, oil) to safe and increasingly cost effective energy sources (renewable energy),

with a view to grid interconnection (or alternative means of export) with the major and growing Asian economies and energy loads to our north.

5 Demand management and energy efficiency

5.1 Reducing energy consumption is a smart approach to a sustainable energy future. Implementation of an effective energy efficiency strategy within the Northern Territory should:

- Support struggling families and businesses to financially cope with rising power prices.
- Reduce greenhouse gas emissions.
- Reduce energy wastage.
- Reduce costs to Power and Water Corporation of maintaining and extending its distribution system (poles and wires).

5.2 It is very important that appropriate incentives are administered by the Northern Territory Government to promote energy conservation and the wide spreading cost benefits are strongly publicised to Territorians. Investment in community programs to assist people (residents, business owners and institutions such as schools and hospitals) to reduce energy consumption is an investment in a more secure energy future.

5.3 Support for successful energy efficiency community engagement initiatives should continue. Recent budget cuts have effectively abolished the Top End COOmob and the Desert Smart COOLmob projects. These programs have been reduced to a one staff wage until June 2014, requiring them to try to establish fee for service projects – a very challenging prospect.

5.4 Our Top End hot humid environment and increasing power prices place a lot of pressure on householders who want affordable climate comfort in their home. The Northern Territory currently has the highest household energy consumption in Australia (approx 25kWh per day compared to southern states with around 18kWh).

5.5 The building boom in Greater Darwin is leading to the construction of hundreds of 'hot box' houses that are poorly designed for the hot humid tropics. They are designed to be airconditioned for most of the year, have poor passive airflow, and will require owners and renters to pay ever increasing power bills.

5.6 A key reason for poor building design is the failure of previous NT Governments to mandate very energy efficient building designs that are also appropriate to tropical living. A key failing has been the absence of mandated stringent and tropically appropriate energy efficiency standards for all building types under the NT building law in line with Section J of the Building Code of Australia.

5.7 One means of promoting energy efficiency is through transparent price signals with respect to the true cost of electricity. Other Australian State and Territory Governments have been proactive in improving energy productivity by introducing a combination of both a price signal

for energy efficiency and also a target for the amount of energy efficiency technologies rolled out.

5.8 The elegance of these measures is that it also manages and reduces the cost of energy and addresses the conflict of a commodity market by enabling the retailers to also make money on energy efficiency.

5.9 The larger states of NSW, VIC and ACT have achieved this through a market based mechanism. SA is a more direct action model. All states have been motivated by the direct energy security and the compelling economic productivity benefits.

5.10 The Northern Territory electricity market is too small to justify the cost of establishing such as scheme. However, it would be plausible and in the NT's economic benefit to join an established energy efficiency market for example either NSW / ACT, the VIC or SA schemes.

5.11 The effective outcome would be for electricity consumers of these other states would be assisting to pay for the roll out of energy efficiency technologies across the NT and the resultant reduced cost of electricity in the NT.

5.12 Recommendations

5.13 Reinstate and significantly expand the NT energy smart rebates program to significantly boost installation of energy efficient appliances, as well as solar hotwater systems and household rooftop solar PV arrays.

5.14 Fund the COOLmob community energy efficiency programs in the Top End and Central Australia to support households to save energy and cut power bills.

5.15 Mandate energy efficient buildings through 'turning on' and / or requiring higher energy efficiency standards for all types of dwellings (residential, commercial, office, industrial) under the Building Act, as provided by the Building Code of Australia (see section J). This approach must ensure perverse outcomes are not achieved by ensuring higher standards do not increase construction of 'hot box' houses that are designed to be airconditioned most of the year and have poor passive airflow.

6 Shale gas and oil

6.1 In contrast to the massive potential renewable energy offers the NT, the development of an onshore shale oil and gas industry is a step in the wrong direction, for a number of reasons. The Territory has an estimated 200 trillion cubic feet (tcf) of onshore shale gas reserves, according to industry commentators. The Territory can either develop those reserves, or it can act responsibly towards the climate and future generations and not develop them. It cannot do both.

6.2 The Territory must play its part in stopping global climate change and transitioning to renewable energy resources, and not exploit these enormous reserves.

6.3 Just as east coast states with massive coal reserves should not mine them, neither should the Territory develop its shale gas reserves. Developing an onshore gas industry lock the NT into reliance on a non-renewable fossil fuel source for at least three decades. The Environment Centre NT has serious doubts about the wisdom that sees gas as a "transition fuel" away from coal. These doubts only increase when it comes to unconventional gas sources, such as the massive shale deposits in the NT.

6.4 Technological lock-in would occur if the massive shale gas and oil reserves were developed, meaning future governments and industry would not agree to transition rapidly from them on to renewable energy because their investments in these old energy assets would be stranded and lose value.

6.5 Encouraging major onshore production of gas would make sense in the Territory if it were to hasten a transition from coal to renewables. However this is not the case. The Territory does not generate electricity from burning coal. Hence the transition required to cut greenhouse gas emissions needs to be from the existing predominant energy mix – gas, diesel, bunker fuel and fuel oil to renewables.

6.6 In the case of transitioning from diesel, bunker fuel and fuel oil towards gas to cut generation costs and greenhouse gas emissions, such as at RTA Gove's bauxite refinery, the transition could only last a decade before further transitioning to renewables if the Territory is to implement energy policies consistent with the advice of authoritative global and national organisations regarding climate change. Ref to IEA, IPCC, CCA, etc

6.7 Exploration for oil and gas in coastal waters poses substantial risks to marine wildlife, habitats, fishing and Indigenous sea Country use. The *Petroleum Act* (NT) and *Petroleum (Submerged Lands) Act* (NT) provide for coastal waters to be protected from such exploration and production through the reservation of blocks, as exists for Darwin and Bynoe Harbours and Greater Darwin, and as has occurred for mineral exploration around some islands and bays under mining legislation (eg Maria Island, Crocodile Islands, Darwin and Bynoe Harbours).

6.8 Methane gas is an extremely powerful greenhouse gas. Over 20 years, its global warming potential has been estimated as being 72 times stronger than carbon dioxide. Therefore, fugitive emissions (induced through fracking and released during shale gas production, from leaking pipes etc) pose a serious climate risk. US studies have shown that operators with good practice will typically lose 2-3% of the methane they extract through fugitive emissions. At a time when the science tells us we must drastically reduce our emissions, this is of serious concern.

6.9 Estimates of water use suggest that during the process of horizontal hydraulic fracturing (fracking), used to extract shale gas, around 20 million litres of water is used per frack. This is of particular concern given a) the arid nature of much of the NT environment, b) the reliance on bore water by many NT communities, and c) the expected stress on scarce water supplies as climate change intensifies.

6.10 The development of an onshore gas industry will require a significant expansion in the Territory's road network, and significant increase in truck traffic to cart large amounts of water, chemicals and equipment to potentially thousands of gas wells. This in itself will contribute to an increase in carbon emissions through a major increase in truck traffic.

6.11 In other jurisdictions, in response to sustained community pressure and mounting scientific evidence about the risks of fracking, moratoriums and tighter regulations are being introduced: Victoria has a moratorium on fracking; NSW has recently introduced a moratorium on coal seam gas mining and exploration in Sydney water catchment "special areas"; fracking is banned in France and a number of other countries.

6.12 The shale gas industry is still at the very early exploratory stages in the Territory, and the Environment Centre NT recommends that a moratorium be placed on horizontal hydraulic fracturing. Now, before mistakes have been made and aquifers contaminated, is the ideal time to halt this industry and allow for a thorough, independent inquiry into the impacts such an industry would have on the NT environment, economy, and other water-dependent industries such as agriculture.

6.13 Onshore shale gas and oil reserves in the Territory may not be financially viable to exploit due to rising production and a gas glut in the USA – which will see US gas companies compete in Asian markets with Australian LNG, as well as massive reserves in Mozambique, Tanzania and Russia.

6.14 These nations have generally lower labor and infrastructure costs, making Territory-based shale gas and oil projects less competitive. The Territory's remoteness and poorly developed infrastructure similarly mean many onshore gas reserves in the Territory may never be developed, and not because of environmental or land access regulations.

6.15 Further, connecting the Territory's gas pipeline network to the east coast gas pipeline network would add entrench gas as for many decades as the focus for energy production when the Territory should be focusing on reducing emissions from stationery energy and investing in renewables.

6.16 Contrary to statements by the NT Department of Mines and Energy, and Minister for Mines and Energy Willem Westra van Holthe, the Territory's regulatory frameworks for petroleum and environmental assessment/protection are the weakest in Australia. To illustrate, Victoria has a moratorium on coal seam gas but the Territory does not for shale gas. Private landholders in NSW are legally allowed to literally 'lock the gate' on CSG companies to prevent them from entering their lands, while Territory leaseholders are not allowed to prevent shale gas companies entering their pastoral leases. That state has relatively strong protections over access by CSG companies to high grade cropping lands but the Territory does not for shale gas. Similarly exploration for oil and gas is prohibited on National Parks, while Imperial Oil & Gas was recently approved to explore on Limmen National Park.

6.17 Recommendations

6.18 The Territory Government establishes a moratorium on exploration for shale gas and oil, including fracking, until legislative frameworks are substantially strengthened, landholders and sea Country managers are given the right of veto, information exists to accurately assess risks (to water, food production, human health, climate, landscapes, seascapes, and communities), and communities and landholders have been appropriately consulted.

6.19 Reservations be declared over all Top End coastal waters under the *Petroleum Act* (NT) and *Petroleum (Submerged Lands) Act* (NT) to prohibit exploration and production of oil and gas.

6.20 The Territory Government and industry commit to transitioning out of fossil fuels, including gas, to renewables, as the primary energy source within a timeframe consistent with the scientific consensus amongst climate scientists regarding the need for rapid global action to stop dangerous climate change.

6.21 The Territory Government reform petroleum laws to make them the strongest of any Australian jurisdiction regarding environmental protection, buffers and no-go areas, interaction with other laws (environmental assessment, pollution control, water and land clearing), public participation and third party enforcement, and risk assessment and management.

7 Nuclear Power, Uranium Mining, Nuclear Waste and Water Use

7.1 Nuclear power has received significant promotion in Australia by industry advocates such as the Uranium Association of Australia, with proponents attempting to exploit concern about climate change to reverse the industry's ongoing decline.

7.2 However, nuclear power cannot be divorced from the cycle of deleterious health, environmental, social and security issues posed by the industry from uranium mining to energy production, waste management and weapons proliferation. The Australian uranium industries contribution to the ongoing Fukushima nuclear disaster serves to highlight the unacceptably high risks of nuclear power and further entrench public mistrust in an industry that has never enjoyed public support for its introduction in Australia.

7.3 There is also growing recognition that the urgency of the climate change crisis means there is simply no time to choose nuclear power. The average construction time for a new nuclear power reactor is close to 10 years with construction costs for a new reactor estimated at approximately $15 billion. A 2003 Massachusetts Institute of Technology study[14] concluded that more than two new reactors would have to start operating somewhere in the world every month over the next 50 years to displace a significant amount of carbon-emitting fossil-fuel generation.

[14] Massachusetts Institute of Technology, 2003, The Future of Nuclear Power accessed at http://web.mit.edu/nuclearpower/

7.4 Claims that nuclear power is 'greenhouse free' are incorrect as substantial greenhouse gas emissions are generated across the nuclear fuel cycle. Fossil-fuel generated electricity is more greenhouse intensive than nuclear power, but this comparative benefit will be eroded as higher-grade uranium ores are depleted.

7.5 Most of the earth's uranium is found in very poor grade ores, and recovery of uranium from these ores is likely to be considerably more greenhouse intensive.[15] Nuclear power emits more greenhouse gases per unit energy than most renewable energy sources, and that comparative deficit will widen as uranium ore grades decline.

7.6 High-grade, low-cost uranium ores are limited and will be exhausted in about 50 years at the current rate of consumption and the estimated total of all conventional uranium reserves would only be sufficient for about 200 years.[16] But in a scenario of nuclear expansion, these reserves will be depleted more rapidly.

7.7 The most recent independent assessment of the Australian uranium industry, a Senate inquiry in October 2003 found the sector was characterised by underperformance and non-compliance, an absence of reliable data to measure contamination or its impact on the environment and an operational culture focused on short term considerations.

7.8 The World Nuclear Association (WNA), the trade body for companies that make up 90% of the industry, admits that in "emerging uranium producing countries" there is frequently no adequate environmental health and safety legislation, let alone monitoring.

7.9 The Northern Territory's experience of uranium mining has been plagued by environmental contamination incidents, ongoing failed rehabilitation of former mines, transport accidents and security and water management problems and the sector is long overdue for an independent assessment of its regulation and operations.

7.10 Ranger uranium mine situated within the boundaries of the World Heritage Listed Kakadu National Park and the longest running uranium mine in Australia has recorded over 200 spills, leaks, breaches and incidents in its operational lifetime.

7.11 The significant problems and risks regarding water management for an open-cut uranium mine in the Wet/Dry tropics have consistently plagued Ranger's operations. A 2009 report by the federal government's Supervising Scientist Division (SSD) indicated that Ranger's Tailing Storage Facility is seeping contaminated water at a rate of around 100,000 litres per day.

7.12 Ranger's operators, Energy Resources of Australia, are currently undergoing an approval process to expand the mine underground to extract uranium from a deposit called Ranger 3 Deeps holding an estimated 34,000 tonnes of uranium. If the project proceeds it would see

[15] Nuclear Energy Agency and International Atomic Energy Agency, 2004.
[16] 'Water-Smart Power: strengthening the U.S. electricity system in a warming world'. Accessed at www.ucsusa.org

the creation of 21,990 tonnes of depleted uranium waste, 3850 tonnes of high level nuclear waste and enough plutonium to build 3900 nuclear weapons.

7.13 The critical issue of water scarcity is already impacting on the power industry in Australia, largely due to the high water supply needs of coal-fired power plants. An expansion of uranium mining or the introduction of nuclear power, the most water-intensive of all electricity sources, would significantly exacerbate these problems.

7.14 A 2013 report by the Union of Concerned Scientists noted that the non-renewable power sector is built for a water-rich world and that at every stage of the nuclear fuel cycle the industry contributes to unsustainable water consumption and pollution. The nuclear power cycle uses water in three major ways: extracting and processing uranium fuel, producing electricity, and controlling wastes and risks. Compared to coal-fired plants nuclear power plants consume between 20-83% more water, with water consumption for nuclear reactors typically 13-24 billion litres per year, or 35-65 million litres per day.[17] Conversely, the water consumption of renewable energy sources and energy efficiency/conservation measures is negligible or zero.[18]

7.15 Regulation of the uranium industry to prevent contamination is inadequate and, in the case of existing Australian mines, finite water supplies are used by companies free of charge despite proven adverse impacts on biodiversity and environmental flow rates.

7.16 Operator of the Beverley uranium mine in South Australia, Heathgate Resources, pollutes the underground aquifer with heavy metals, acid and radionuclides as a routine aspect of its operations, and is under no obligation to rehabilitate the aquifer.

7.17 BHP Billiton, operator of the Olympic Dam uranium, copper, gold and silver mine in South Australia does not pay a cent for water it extracts from the Great Artesian Basin and is licensed to extract 42 million litres daily for the mine, making it the largest single-site industrial user of ground water in the Southern Hemisphere. Since GAB water extraction for the Roxby Downs mine began in the 1980s, many connected Mound Springs have experienced reduced flows and some have ceased flowing altogether.

7.18 In 1994, former Olympic Dam operation WMC admitted that some 5-6 billion litres of waste had leaked from the tailings dams at Roxby Downs and into the groundwater and soil below. The leak had occurred unchecked for at least two years.

7.19 Jillian Marsh, Adnyamathanha Traditional Owner, noted in her submission to the 2002-03 Senate References and Legislation Committee that: "The government chose not to demand that the groundwater be rehabilitated, an unacceptable situation for the Australian public at

[17] Guy Woods (Department of Parliamentary Services), December 4, 2006, "Water requirements of nuclear power stations", Research Note no. 12, 2006–07, ISSN 1449-8456. www.aph.gov.au/library/pubs/rn/2006-07/07rn12.pdf
[18] L. Pentz Gunter and K Kamps, Nov 7 2013, Don't trade global warming for nuclear meltdowns, CNN accessed at http://edition.cnn.com/2013/11/07/opinion/pandora-nuclear-gunter-kamps/index.html

large given our increasing reliance on groundwater and the increasing salinity of land surfaces and water systems."

7.20 As the potential host of Australia's first national radioactive waste dump, the Northern Territory government is well placed to consider the social, environmental and political costs of the six year community and legal campaign to resist the imposition of the waste facility on Muckaty Traditional Owners and the wider NT community.

7.21 Over its operational lifetime every nuclear reactor produces hundreds of tonnes of highly dangerous and long-lived radioactive waste. There is currently estimated to be over 300,000 tonnes of high-level nuclear waste around the world today in addition to over one billion tonnes of low-level radioactive waste. This waste includes some of the most toxic materials known to humankind, such as plutonium, which pose a threat of cancers and genetic disorders to future generations for hundreds of thousands of years (6).

7.22 After nearly 50 years of the nuclear power experiment, to date, internationally no government has been able to solve the intractable problem of storing radioactive wastes. In the absence of a viable solution, expanding the rate of waste production is deeply irresponsible.

7.23 On a national scale the introduction of nuclear power in Australia would exacerbate water problems caused by fossil-fuel intensive energy production, increase electricity prices and blackouts and increase competition for access to scarce water resources. Coastal nuclear plants face the added impediment of rising sea levels and predicted increases in extreme weather events such as tornados, cyclones and tsunamis.

7.24 At a time when the uranium commodity price is at historic lows reflecting a lack of confidence from governments and investors worldwide, it makes little sense for the Northern Territory government to consider subsidies to prop up failing ventures or establish additional uranium mines.

7.25 Recommendations

7.26 A cost/benefit analysis of the nuclear industry in the Northern Territory be undertaken to examine the environmental, health, security and social risks posed by uranium mining and the nuclear fuel cycle.

7.27 All public subsidies for uranium mining or nuclear projects in the Northern Territory be removed.

7.28 No new or expanded nuclear/uranium projects be approved in the Northern Territory .

Ends