I object to the approval of this project and all ancillary projects of the CWO REZ build out.

I have a read a considerable amount of the 8000 pages of the EIS and find very little of it credible. Much of it relates to desk top produced reports. I cannot imagine the Minister for Energy reading much of the EIS and note the protocol that the Minister will make a decision based on a process of advisement. Given the advice to the Minister will be coming from the proponent and other institutions (like the Department of Planning) who have made it clear in past years that they support the development of renewables projects, it is imperative that *the advice to Minister documents be transparent and publicly available at the same time as publication of the Minister's decision.*

Since 2009 I have made many submissions relating to "wind and solar" power, but I was only able to do that because someone else typed them and organised them and set out references and so on using modern computer and research skills. I, essentially have none of the technical skills needed to be able to respond to this extraordinary process of bombarding interested or potentially impacted people and businesses with thousands of pages of EIS documents, not just for this project but all the ancillary projects - all within 28 days. *I know many people who feel strongly about objecting to this proposal but do not have the necessary skills either* - most are farmers and business people who are considerably skilled at what they do for a living and do not have the luxury of being paid to even try to object.

Regardless of the above I have struggled to type this response and set out below some of the basic reasons for my objection.

The EIS asserts that the build out of the CWO REZ with renewables (wind, solar, batteries, pumped hydro and transmission infrastructure) is **cheap, reliable, affordable and sustainable.** None of these bland assertions are substantiated by the document and they do not become more truthful just because they are endlessly repeated.

<u>Cheap and Affordable</u>

The NSW Electricity Strategy (DPIE 2019a) states that the electricity industry has four main levels, two of which are generation and transmission. Any assertion that renewables are cheap and affordable must include costings associated with all aspects of transmission as well as generation. In relation to cost and affordability, the proponent has not provided costing details **of its own project** which is transmission and ancillary infrastructure. The purpose of the transmission is to enable the proposed wind and solar generation of the CWO REZ area, combined with any firming pumped hydro projects and battery storage and infrastructure. The proponent must provide **full costings** for **all categories** of the scheme as they are part of the one system. The proponent cannot sustain the truth of its assertions as to cost and affordability without these details and it is impossible for the Minister (or anyone else) to justify this project without them.

There is no attempt to compare the cost of the project with the cost of alternative approaches to "energy transformation."

There is no attempt to calculate and compare the benefits with the losses resulting from the project and its associated generation. The EIS is full of studies and reports and lists. The EIS purports to set out the dollars of benefits to the community and the dollars of losses to farmers - where are the lists showing those calculations and how they were done. We need to see those lists and so do local councils. There is no attempt to cost the loss to the State of abandoning its strategic advantage of being able to generate plentiful electricity from its abundant coal reserves. There is no attempt to cost the losses to the State's manufacturing base or the losses flowing from the loss to business of the competitive edge previously provided by coal fired power stations.

Sustainability

Protection of the environment is an integral part of sustainability. Building out the CWO REZ with transmission and generation projects coupled with all of the associated infrastructure involves environmental destruction on a large scale. It is ironic that the project is concerned with the preservation of aboriginal culture and heritage when environmental damage on the scale and of the nature proposed would be abhorrent to its first custodians.

To be specific about sustainability, both wind and solar require extensive land masses for generation. That land is cleared, losing the benefit of its biodiversity. The manufacture of both wind turbines and solar panels requires significant natural resources and highly toxic rare earth elements. Each require aluminium and steel for structural components the processing of which requires large amounts of electricity. It is estimated that it takes about 220 tonnes of coal to produce a single wind turbine. Similarly, solar pv production is based on burning large quantities of coal, coke, charcoal and woodchips. Australia manufactures neither wind turbines nor solar PV panels. These come now almost exclusively from China and must be shipped then transported overland on arrival. During the relatively short lifespan of the wind and solar projects, there are micro-climate changes which are now well-documented. The proponent has made no attempt to assess these impacts on the sustainability of the impacted lands and local areas. Finally, neither wind turbines nor solar panels are readily recycled or disposed of at the end of their life cycles. There is extensive toxic waste.

As to **green house gas emissions**, there has been no assessment to substantiate that this project (and its associated generation projects) would meaningfully reduce green house gas emissions compared with the generation which it replaces. The EIS asserts repeatedly that this project must be completed in order to achieve legislated targets but it fails to provide any proper and comprehensive data which would justify this assertion.

The EIS asserts that the State needs this project to assist the nation in meeting its international obligations in relation to emissions. But this fails to take account of trends and behaviours in the largest emitting economies.

Reliable

Clearly, neither wind nor solar energy is reliable. They are ancient and discarded technologies. It is trite that they are intermittent and unreliable, and that firming back up is required in substantial amounts. The requisite firming back up proposed is pumped hydro and batteries. These do not exist in requisite amounts and there is no real likelihood at this point that they will in the foreseeable future. On no realistic basis is this energy transformation a "reliable" one.

Equally importantly, and in relation to the CWO REZ build out in particular, the following applies:

- The generation is too far inland from the areas which require the electricity;
- The suitability of the wind resource has never been properly evaluated other than by proponents who are paid by averages and receive the benefits of significant subsidies. The suitability for a grid which requires 5 minute dispatch intervals has never been demonstrated;
- The known technical problems for such an array of renewables projects to be able to deliver rational electricity supply to the east coast from the central west are being ignored (e.g. inertia and stability). Pretending these can be fixed is irresponsible.

Strategic Purpose

Chapters 2 and 23 are self-serving content designed to overstate the importance of the project in terms of global action to reduce greenhouse gases and to supply emissions free electricity to the National Electricity Market.

There is no strategic justification for this project. It is a strategic disaster. The State gives up its long term advantage of abundant and cheap power. It replaces this advantage with a dependence on Chinese imports to build out the REZ, a dwindling manufacturing base, the loss of business advantage and high electricity prices for consumers.

At the same time it totally underestimates the destruction of one of its oldest and most productive regional areas. The citizens of the CWO REZ are tossed away and alienated by the imposition of these changes. The project ignores the basic fact that "the rural landscape" is not an empty factory space but a living and breathing and biodiverse area of land where every new project extends its effect onto every living thing around it. The aboriginal concept that the country around us is our "mother" is correct and not understood in the corridors of power where it is just seen as "space." Every renewable energy project with its back up systems and transmission infrastructure is a new wound to our "mother" which, when you add up the individually small percentage of her body ripped off each time leaves her pock marked, disfigured and debilitated.

Not Fit for Purpose

Reliability, stability and no interruption to service are considered **must haves** for a grid. The world is watching Australia as a "unique" experiment – no grid has ever been run by wind and solar farms because of technical issues.

There are numerous technical problems in attempting to power the NEM with wind and solar as primary generating sources of electricity. The major issues relate to the fundamental character of these non-synchronous generators as working only intermittently in a random and chaotic manner producing, maybe, 30% and 20% of nameplate capacity on an average basis unrelated to demand.

By way of background, at a simplistic level, electricity received by consumers has two main components – current and voltage. The Australian current is AC - an alternating current system. The voltage is a measure of the pressure of the current. It needs to be strong and stable. Current and voltage move in a wave form which should be smooth and regular, not too big or too small. When the voltage wave form is strong and stable, we have high system strength. If we don't have high system strength, we have blackouts. As the AEMC states, ***"Historically, system strength was supplied as a free by-product of synchronous generators which are typically coal and gas fired generators, as well as hydro generators. As the power system transitions to an increasingly non-synchronous generation mix - which are typically wind and solar generators - we need new ways to provide system strength."***

Synchronous generators like coal and gas stabilized the voltage wave form. Not only was output of energy able to be controlled, the turbine (aka *condenser* or *generator*) which actually produced electricity was located as part of the power station with the coal or gas driving synchronous condensers which are/were physically coupled to the grid. Intermittent wind and solar generators have no such capacity and require Inverter Based Resources (IBR) which are nonsynchronous to couple with the grid.

As stated above, there are numerous technical problems in attempting to power the NEM with wind and solar as primary generating sources of electricity. These problems, which beset the CWOREZ and which are ignored by the EIS, include the following:

1. It is a given that at this time, the grid requires some synchronous capacity. There must be voltage forming generators in the system to support asynchronous generation. As the Australian Energy Security Board has advised, a "capacity market" must exist.

   It has been argued that with sufficient numbers of asynchronous generators spread over sufficient areas of the continent, synchronous capacity becomes redundant because somewhere, the wind will be blowing or the sun will be shining. Even a cursory examination of wind output across the continent establishes that this is not an argument that can be sustained. There is ample evidence now, regularly collated, which demonstrates that system strength cannot and will not be maintained at all times by asynchronous generators. The battery technology usually trotted out in support of this argument does not exist and in any event, does not provide synchronous generation.

   As it is, the existing and proposed penetration of wind and solar generators into the NEM means synchronous generators must not only be available but will have

to vary their output constantly in support of the grid. This means that effectively gas generators are the only alternative available. As a result of the policies of the states and the federal government, there is no reasonable likelihood of modern gas fired generators providing the necessary synchronised generation to support the wind and solar generators which will comprise the grid. There is little reasonable likelihood of Snowy 2 fulfilling any meaningful role in the foreseeable future.

2. The large scale renewable energy generators have been located in areas remote from highest demand. In addition, the NEM is a huge grid with over 40,000 kilometres of transmission lines. This does not include the additional 10 – 28,000 kilometres of new build out currently stated as required. The net effect of long transmission lines distant from consumers is a weak network giving limited short circuit capacity. The technical term is “impedance.” Impedance is “the opposition to alternating current presented by the combined effect of resistance and reactance in a circuit.” The more transmission lines added to the grid, the more impedance increases and the more current capacity is required

3. Wind and solar do not have synchronous generators stabilizing the electricity wave form. To assist in overcoming the resulting instability, wind and solar engineers have decided to use synchronous condensers (called “syncrons”). Synchronous condensers basically do the same job as synchronous generators but they **consume power** rather than generate it and therefore only work in conjunction with synchronous generators. Synchronous condensers and synchronous generators do both provide inertia, voltage control and provide and absorb vars. (Vars occur when AC electric currents and voltage are not in phase.) But only synchronous generators generate power.
Synchronous condensers are merely a “trick” used to allow for less synchronous generators and pretend a grid is powered by wind and solar only.
South Australia is claimed to be a wholly renewable stand alone grid but it is simply a small part of the NEM grid and gets its support power from the existing Heywood interconnector which often relies entirely on coal fired generators. SA has replaced 4 synchronous generators with synchronous condensers powered by being online with other sources. These include now their own gas fired generator and diesel engine generators as well as the Heywood interconnector.

4. Voltage oscillation is a major problem. There is no current large scale solution and attempted fixes have failed. Voltage oscillation literally damages turbines of any sort.

5. Wind and solar generation connect to the grid via “inverter-based resources” (IBR). An IBR has been defined as “a source of electricity that is asynchronously connected to the grid via an electric power converter.” They require the presence of stable AC voltage wave form to operate properly and to synchronise their AC output. In so doing, they can actually “use up” system strength.
IBRs are “grid following” in Australia. Grid following inverters depend on the grid to provide a stable voltage and frequency reference, and cannot operate in islanded or off-grid mode. If there are no stable voltage forming generators in the electrical system, that system cannot work. Wind and solar are not stable voltage forming generators. Wind and solar are non synchronous inverter based

technologies. There are no major grids in existence that only have IBR providing power.
Batteries and synchronous condensers are mooted to solve the above problem. Batteries do not replace synchronous generators. There are currently no IBR in the world that can take the place of 100 MW and larger synchronous generators.

On a wing and a prayer, the AEMC states *"this may change in the future as new technologies, particularly "grid forming" inverters, become more widespread…. Australia is leading the world in operating a system with high levels of inverter-based resources and new technologies are being tested by AEMO, ARENA and industry trials and other demonstration projects."*

6. System strength is essential for it to be functional. System strength is the availability of constant voltage regardless of how much current is being drawn. When there are increases in power demand, synchronous generators can keep their voltage up whereas inverters are not able to do so to any useful extent. Synchronous generators are able to supply up to 600% of their rated current. Inverters typically supply only between 120% to 150% at best. Voltage collapse cannot be prevented by inverters when power demand goes up quickly which it frequently does.

7. AEMO acknowledges other significant technical issues relating to the following:-
   a) Reactive Power
   This becomes an even greater problem for proposed generation in "remote" places acknowledged to include "Central West of NSW."
   b) Frequency Control and Inertia.
   AEMO recognises synchronous units rather than renewables and batteries are needed to supply adequate frequency response. AEMO also recognises extremely expensive Frequency Control Ancillary Services (FCAS) are needed to deal with "short period dispatches" these now being 5 minutes, 60 seconds and 6 seconds and a proposed 1 second required in an attempt to make wind and solar work.
   c) Reserves
   Frequency control and inertia concerns do not resolve the imbalance between load (actual demand) and generation. In South Australia batteries are supposed to overcome this but in reality, they rely on thermal plant that renewables and batteries are supposed to replace.
   d) Load Shedding
   Grid capabilities must be able to cover its fundamental operating parameters such as frequency, voltage and reactive power, when things go wrong. This is when inertia is critical. AEMO has rules about this but nothing is currently in place to deal with it that does not include synchronous generation from fossil fuelled generators.
   e) System function during frequency excursions.
   On the 25.5.21 a number of Queensland coal stations "tripped" in a cascade. "Under frequency" load shedding occurred. Queensland was ultimately "islanded" for 15 seconds until things were stable and balanced enough to reconnect automatically. Queensland was saved by the high grid inertia. If renewables were powering the grid it would have been a collapse into complete blackness. AEMO is aware of this.

The build out of the CWOREZ as proposed will only make a bad situation worse. The solutions for the wind and solar grid are theoretical. The “just around the corner” industry changing innovations and breakthroughs have not worked out. Germany is now firing up old brown coal synchronous generators and still relies on neighbours for electricity. Australia is the only country in the world which insists on believing it has the solutions which basically translates to a manic build out of more wind and solar farms, more transmission lines, more batteries, more synchronous condensers, more pumped hydro stations and more expensive switchyards to attempt to deal with vars (i.e. issues with reactive power). Increasing the grid penetration with the above **“will only compound the problems and the cost and are not bold innovations but rather costly, makeshift, stop gap band aids”** (Chris Morris).

I reserve the right to make more objections.

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