Submission to WA Government Climate Change Policy Development Process

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Section headings

List of Acronyms					
CCS	Carbon Capture & Storage	F&D	Fee & Dividend	NET	Negative Emission Technology
CCUS	Carbon Capture Utilisation & Storage	GGR	Greenhouse Gas Removal	PM	Particulate Matter
CE	Circular Economy	GHG	Green House Gas	ppm	parts per million
CS	Carbon Storage	GST	Goods & Services Tax	RE	Renewable Energy
DAC	Direct Air Capture	LE	Linear Economy	UFPM	Ultra Fine Particulate Matter
ETS	Emissions Trading Scheme	NE	Negative Emission	WACCP	WA Climate Change Policy

1. Introduction

It is appreciated to have this timely opportunity to submit our thoughts on the government's climate change policy. This submission is more than a wish list of points to be implemented. It also deals with the broad picture of concepts, ethics and philosophy that should form the foundation of the framework for the *WA Climate Change Policy (WACCP)*. The WACCP should not focus just only some technical issues related to WA, it should be a response to the worldwide Climate Emergency. Technical and scientific

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issues are the basis for any WACCP, but equally important are the socio-economic components of this policy. Namely what is the impact on the population if we do or do not act on climate change [2] (Creutzig, et al., 2017). Since these measures are likely to incur a cost, then raises the question "who and why do we have to pay for them"? Some of the issues raised in this submission may seem trivial or not to belong in a policy paper. That is correct, however they are used as examples of the diverse issues to be considered, as analogies why there needs to be a change of the mindset, how topics are interrelated and not in silos. The political neutrality of science in this debate is essential to provide the relevant policy pathways (Beck, & Mahony, 2018). In addition the WACCP should not only focus on "fixes" of climate change, it should also highlight areas of concern like climate refugees.

A quote that sets out the scene of the climate crisis severity, "*A 2°C world might be insurable*," warned Henri de Castries, former Chairman and CEO of insurance giant AXA, "*A 4°C world certainly would not be*." (Marcacci, 2019; Tooze, 2019). The natural catastrophes will have very costly financial consequences (Campanharo, et al, 2019; Gebert, 2007; IAG, 2019; IBC, 2012). Articulating this central issue of climate change action differently in a recent address Swedish climate activist Greta Thunberg (Thunberg, 2019), said very succinctly "**You do not have to listen to us children, but listen to the scientists**". The essence of this simple message should be made very clear to politicians. Many may feel uncomfortable hearing these true facts, but employing ostrich strategies and shrugging it off instead of accepting responsibility for our actions, is not an option.

As has been well documented and summarized by the IPCC (2018) the fact is that we have to stay below 1.5C warming in relation to the pre-industrial time in order to stabilize the climate (Gütschow, et al., 2018; Kuramochi, et al., 2018). The effects of CO2 emissions have been known for more than 40 years (NRC, 1979). At a minimum anthropogenic *Green House Gases (GHG)* emissions must be brought down to the concentrations experienced at the beginning of industrialisation; to stabilise the climate more needs to be done and there are two phases. The first phase starting now is to facilitate the shift to zero emissions by 2050 or earlier. The second phase should begin during the first phase well before 2030 and continues to 2100 and beyond is to take out the historic legacy emissions from the atmosphere. The latter process is called *Negative Emissions (NE).*

An extract from foreword of the latest UN Environment Programme's "Emissions Gap Report 2019"(UN, 2019) : *"… **Our collective failure to act strongly and early means that we must now implement deep and urgent cuts**. This report tells us that to get in line with the Paris Agreement, emissions must drop 7.6 per cent per year from 2020 to 2030 for the 1.5°C goal and 2.7 per cent per year for the 2°C goal. The size of these annual cuts may seem shocking, particularly for 1.5°C. They may also seem impossible, at least for next year. But we have to try. … We have to learn from our procrastination. Any further delay brings the need for larger, more expensive and unlikely cuts. We need quick*

2 When "climate change" is used in this submission it means "anthropogenic climate change".

wins, or the 1.5°C goal of the Paris Agreement will slip out of reach. The Intergovernmental Panel on Climate Change (IPCC) has warned us that going beyond 1.5°C will increase the frequency and intensity of climate impacts, such as the heatwaves and storms witnessed across the globe in the last few years. ***We cannot afford to fail****. …" (our highlights).* These passages and the rest of the report are alarming and show clearly that action needs to be taken now.

The current increase in CO2 emissions is not only directly from anthropogenic sources, but also indirectly due to warming of the earth, like the permafrost that is under threat. The areas of permafrost are very large, e.g. northern Siberia, and if they thaw out the amount of GHGs emitted will be enormous. In particular the methane released will have a near immediate impact on the climate (Keller, et al., 2018). The long duration and large aerial extent of the unusual bushfires in the arctic during the summer of 2019 are also a result of increased temperatures in these regions. Acidification of the oceans will be a side effect of increasing uptake of CO2 (Fuss, et al., 2016), which will cause bleaching on the coral reefs and also affects all the creatures in the ocean that have their skeleton made of calcium carbonate (CaCO3), this is serious issue is under reported.

Evidence of the workings of CO2, CH4 or NOx as a GHG will not be discussed here, since they are scientifically well established. The amount and rate of rising CO2 levels cannot be explained by the argument that of climate change is a common occurrence during geological history; actually geological evidence points to the anthropogenic causes of the current climate changes (DePaolo, 2015). GHG emissions which include CO2 [3], have been rising rapidly since the start of the 1st Industrial Revolution.

As said at the start socio-economic impacts have to be incorporated in project assessments and policy formulation. For this reason the re-establishment of Social Impact Unit in the government is essential, as described by Prof Carmen Lawrence (2018) "*… Western Australia once had a Social Impact Unit to ensure that the social impacts of development proposals were systematically included as part of the environmental impact assessment procedures of the EPA. Although it did not have any powers based in legislation, the SIU established a close working relationship with the EPA and before its abolition by the Court government was judged to "have considerable success in persuading proponents to commit to social impact management measures as part of their EISs …*". The government should be asked to reinstate in legislation the SIU, in order to get environmental and societal issues properly weighted in the decision making process.

There are voices in the private sector that will be opposed to any measure that incurs a cost for climate action. Especially if the policy "surprises" them; illustrated with the following. The so called captains of industry have a halo of forward thinking and knowledge about them. But that appears to be just an illusion, many preferring just the status quo. Real captains of industry would have at the time of the Kyoto agreement in

3 Any mention in this paper of emissions or CO2 is referring to all GHGs unless stated otherwise.

1996, which was not signed by the Howard government, surmised that one day there would be a government after PM Howard that would want to implement a '*Price on Carbon (PoC)*'. So instead of crying foul and being "surprised" when PM Rudd wanted to implement and PM Gillard implemented a PoC, they should already had a decade the time to put systems in place to deal with it, and used the money saved by the Howard non-implementation of Kyoto over that period to fund R&D methods to bring down GHGs. The message from this is that business' often only view a narrow short-term self-interest, even if there are possible negative consequences for the community at large.

Businesses often mention that they have "robust processes in place" based on the "world's best practices". Are these statements independently verified? Are their statements feasible in reality? What are the risk assessments, not just financial but also social and environmental? Klein (2019) writes "*… BP's Gulf of Mexico Regional Oil Spill Response Plan specifically instructs officials not to make 'promises that property, ecology, or anything else will be restored to normal' – which is no doubt why its officials consistently favor folksy terms like 'make it right' … ... Apparently, it 'seemed inconceivable' that the blowout preventer would ever fail, so why prepare? ...*". Analysing these quotes does not give much confidence in "robust processes" and the "world best practices" statements. Concluding from this is that arguments by business, including in submissions, to do or not to do something should not carry the same weight as arguments presented by scientists, including medical doctors and other health professionals, and the presented reviewed papers.

The GHGs are to be classified as pollutants and therefore the polluter has to stop polluting or pay a fine. A climate policy is more than focusing on GHGs, but they form a large part of the problem of pollution. Littering is a form of pollution and can be dealt with like in Singapore first-time offenders who litter items such as cigarette butts incorrectly get a fine of $300, if it were larger pieces like plastic bags, fines can go up to $1,000 and for repeat offenders fine can be increased to $5,000. May be there should be a sliding scale for repeat GHG polluters. A price on carbon is in essence a fine on pollution.

2. The Challenges

The goals set by the IPCC to stay below 1.5C, are not easily achieved, especially if governments are misusing the system's framework to weaken the measures needed. The Australian federal government is a master in pretending that they are doing enough by legally distorting reality. The first example is the carrying over the Kyoto credits for accounting purposes, even though the Kyoto Agreement was only signed more than 10 years later. Second, the 2015 Paris Agreement targets are based Nationally Determined Contributions (NDCs) a process where countries select their own methods and levels of reducing GHGs (Gütschow, et al., 2018; Hare, 2019; Kuramochi, et al., 2018). In the developed countries of Europe 1990 is used as a base year while Australia uses 2005, a year with higher level of emissions than in 1990. Australian emissions in 1990 were 15.5

t CO2 per capita and 17.2 t CO2 per capita in 2005. That is to start from a 11% higher base. A 26% reduction by 2030 brings it down to 12.7 t CO2, which is only a 18% reduction compared to 1990 levels. Australia chose 26% from 2005 levels while European countries used 45% from 1990 levels in 2030. A 45% reduction on 1990 levels would mean 10.2 t CO2 per capita. To reach that same level using 2005 as base year would mean a 59% reduction. So, when the federal government brags about that it can reach the Paris targets while some European countries will not, that is comparing apples with pears. To the letter they do not say anything wrong, but they leave the qualifiers out that would show Australia is doing very poorly in real terms, and are not presenting an honest transparent picture. As also can be read in the Emissions Gap report 2019 (UN, 2019) Australia is not doing very well in combating climate change and Western Australia is a laggard within Australia (Reputex, 2018). That means in the West much work has to be done to catch up to reach real targets. Premier Mark McGowan said in February 2019 *"The science of anthropogenic climate change has effectively been settled for two decades, and no serious government can ignore the policy implications."* Therefore there is no excuse for the WA Government not to implement a science based climate policy.

In WA major contributors to the GHGs is the natural gas industry (CCWA, 2019). The amount is large, due to flaring, not-sequestering CO2 and the amount of fugitive methane emissions. The impact of fugitive emissions are mostly under estimated (Boothroyd, et al., 2016; Howarth, 2014). This month research from Canada and The Netherlands was released about using satellites to detect methane pollution (Varon, et al., 2019). The advantage of using satellites is that the data collection is uniform all over the globe and so data can be compared.

To reach international consensus and action on how to combat climate change are very difficult. However, a success story is the Montreal Protocol of 1984 regarding Chlorofluorocarbons (CFCs) phase-out management plan. At the time the hole in the Ozone layer was getting larger and larger and recently it was recorded that the hole was shrinking as a result of action taken following the ratification of the protocol.

Climate Change is in general abstract and complex, and therefore more difficult to apprehend with time frames long into the future. The politicization of this issue makes it also harder for people wanting to do something about it. Quoting Markowitz, & Shariff (2012) "*… Unlike financial fraud or terrorist attacks, climate change does not register, emotionally, as a wrong that demands to be righted. ...*". When discussing climate change people often focus on small items that are difficult to achieve, or sit on the fence because some actions in the past may have had negative side effects and forget the broader picture. No doubt mistakes will be made when combating climate change, but that is not a reason not to take action. There is a moral dimension to the action on climate change, since we are, if we want to or not, passing on the environment to the next generations. The ethical question is what type of environment we want our children to inherit?

The Australian Financial Review wrote "*… According to experts, it's also a sobering preview of how climate change, accelerated by human behaviour (and exacerbated by political corruption), will not just complicate Venetian's unique and fragile life but wash it away entirely. ...*" (Bellware, 2019). These fleeing Venetians are basically climate refugees. With increasing severity of natural disasters, like floods and droughts and rising sea levels we have to be prepared for an influx of "climate refugees". Even though it is a federal responsibility climate refugees will also have their impact on WA. Unfortunately Australia's latest white paper on foreign policy only scantly refers to this, while it was made aware of the importance of this major issue by at least one submission (FP, 2017). In WACCP should acknowledge the potential problem of climate refugees and it should be used as another reason to combat climate change.

2.1 Removing past emissions

The discussion paper does not mention it and it may not be part of the government's agenda, but just bringing down the emissions to zero is not sufficient to reach the 1.5C target. To achieve this reduction from 400ppm CO2 down to 280ppm of the pre-industrial times, GHGs have to be drawn down from the atmosphere, this *GHG Removal (GGR)* is called *negative emissions (NEs)* and there are many different ways to achieve it. Some of these methods falling under the umbrella term "geo-engineering" are such that they cannot be reversed if something goes wrong (De Richter, et al., 2019). Taylor, et al., (2016) state "*Large-scale geo-engineering is ethically fraught and poses dangers of both foreseeable and unforeseen consequences*." A general overview of negative emission concepts and technologies can be found in Boogaerdt (2019a).

Whatever technology is used to carry out GGR, they all can and should be powered by RE. In WA this is certainly possible with abundant solar and wind resources. So a good reason for the WA government to facilitate *Direct Air Capture (DAC)* projects, benefiting regional communities as well with employment opportunities. DAC is a generic term for technologies that remove CO2 from the atmosphere, not the separation of CO2 from industrial flue stacks or from natural gas production.

2.2 Carbon Capture Storage and Utilisation

As stated before zero emission by 2050 is not enough so *Carbon Capture & Storage (CCS)* should be implemented as a standard practice by 2030. A "common" location of *carbon storage (CS)* is in or near oil and gas wells, because that are places of likely good traps, like originally for oil and gas. This also creates business opportunities for the oil & gas industry.

Cement production is very high in CO2 emissions, ½ t CO2 for each ton of cement, should be required to carry out CCS in their production processes by 2030 at the latest. The extra cost for cement would encourage the use of alternative building materials. If

plantation wood is used this is still a form of carbon storage for the length of the existence of it as a building material. Concrete footpath repairs are another example where the use of cement can be reduced. In recent underground power projects, holes were cut in the existing concrete footpaths. Under the likely requirement to restore footpaths to their original status sections, 10 times larger than the original hole were removed and replaced by fresh concrete, instead of repairing the footpaths. Resulting in extra CO2 emissions from the extra concrete and machinery used. In addition there are the extra costs of waste and labour. Even though CCS may not be permanent in geological time frame, it is a good temporary (10,000 years?) solution until better technologies are available. The chemical and steel industries are as well very large emitters of CO2.

The use of CO2 as a feedstock for input to production processes. The CO2 could come from captured gasses from the atmosphere, industrial processes or landfills. This is the utilisation part of CCUS.

Scientists also look at sequestering CO2 into basaltic rocks where it will create carbon containing minerals; tests are done in Iceland, and are looking at peridotite rocks in Oman (Krupp, et al., 2019; Matter, et al., 2016). Work is also done in Australia to sequester CO2 in old minesite tailings (Harrison, et al., 2011; Oskiersky, et al., 2013).

2.3 Biomass

Biomass has been noted to be useful in creating biofuels or electricity. In general growing biomass for energy generation should be discouraged since the externalities are very large, as shown in table 1 (Amaroux, 2014) and other modelling supports this (Séférian, et al., 2018). Nevertheless in certain cases "growing" biofuel can be an overall benefit and particularly because the water input is low. A scheme, like the one in WA for Mallee (an *Eucalyptus*) growing where only the new the shoots are harvested helps the CO2 emissions as well as stop/reverse land degradation due to salination problems (McGrath, et al., 2015). There is a need for R&D in to mini-distillers, so this biofuel can be produced and used locally by regional communities. This would also have socio-economic benefits to the regional economy, and the externalities of transport of this biofuel are near zero.

One of the biggest opportunities for CO2 sequestration is by increasing the carbon content of the in general poor soils in WA. This can be done in the form of changing agricultural practices to "regenerative farming" (Massy, 2019). Resulting in an increase of carbon content in soils and so storing carbon and improving yields (FAO, 2005; Hepburn, et al., 2019). If biochar [4] generated from CO2 by DAC methods is added to the

4 Biochar is the charred product of biomass heated without oxygen in a process known as pyrolysis; it is expected to be stable for thousands of years not weathering quickly. A high proportion of carbon from the biomass remains within the newly created biochar. It can be added to soils without breaking down. In South

soil there will be an improvement in soil quality and the carbon will be stored for some thousands of years.

Energy production Type	Water requirement (liter/MW h)
Oil extraction	10 – 40
Oil refining	80 – 150
Coal integrated gasification combined cycle	950
Natural gas combined cycle power plant	200 – 3,000
Nuclear plant closed loop cooling	950
Geothermal power plant in close loop tower	1,900 – 4,200
Enhanced oil recovery	7,600
Nuclear power plant open loop cooling	94,000 – 27,700
Ethanol from corn (irrigation volume)	2,270,000 – 3,670,000
Soybean biodiesel (irrigation volume)	13,900,000 – 27,900,000

Table 1. Energy production water usage adapted from Amaroux (2014).

2.4 Enhanced Weathering

Enhanced weathering is a way to speed up the natural weathering process of rocks. The application of finely ground alkaline rocks like basalt to depleted soils could increase the nutrient availability in acidic soils and capture of CO2 (Taylor, et al., 2016). In addition enhanced weathering could be a tool used at minesites to help rehabilitation of waste dumps and pitfaces. Starting with trials of enhanced weathering at minesites, especially abandoned ones, easy to monitor and does not disturb new areas should be great research projects. This could be done in conjunction with the in section 2.2 mentioned use of CCS in tailings at minesites.

3. Current emissions

Besides CO2, GHGs as methane (CH4) and nitrogen (NOx) are also very important factor in the global warming (Sanchez-Pérez, et al., 2016; Sutton, 2011). The importance of reducing the amount of methane now is because it's near immediate effect on tropospheric ozone while CO2 takes up to 30 years be most effective GHG. Nitrogen, a very potent GHG, has a beneficial effect on the growth of plants, however for plants thriving on nutrient poor soils this excess of nitrogen will get them replaced by non-local species. Nitrogen is produced in agriculture as ammonia or nitrous oxide and is also

America more than 2000 years ago biochar was used to improve soils ("Terra Preta") which have much higher yields than the surrounding areas without biochar (Boogaerdt, 2019a).

produced by internal combustion engines. With lot of vehicles and nitrogen producing farms near environmental sensitive areas the potential problem arises with excess nitrogen. Processes have to be put in place to avoid a situation as currently in The Netherlands where residential developments are put on hold in order to reduce amount of nitrogen emissions. The Dutch national broadcaster just relayed an announcement (10 November 2019) that their government has lowered the speed limit on the freeways from 130 km/h (a signature policy for the liberals in government) to 100 km/h which would save enough NOx start up the building projects again.

Fugitive methane emissions from the large LNG industry in WA are a major problem (Boothroyd, et al., 2016; CCWA, 2019; Howarth, 2014). Near these facilities DAC should be installed to capture the fugitive methane. These emissions can now be monitored by satellite (Varon, et al., 2019) as noted in section 2 of this submission.

4. Policy

Each jurisdiction should be responsible for its own legacy emissions, in Australia this should ideally be approached on a national basis. WA should do its share regardless of whether other states', territories' or federal governments are doing their share. This is an issue of moral obligation (Kelleher, 2015; Lenzi, et al., 2018; Lenzi, 2019; Mittler, 2014). It is to be noted that the USA on a historic per capita basis has emitted 10 times more CO2 than China and in relation to India it is 25 times (Hansen, et al., 2019). For Australia these figures would likely be similar.

Now it is time to pay the debt created by past generations, since we have the technology to create negative emissions. It comes down to according Ruscio (2014) *"… the value-laden question, which is what do we owe to future generations? The verb is important. 'Owe' implies an obligation, a duty, which further implies an ethical question, which further implies an ethical answer or at least an ethical analysis ...".* Morally we cannot leave it for the next generations, who will pay in part for it anyway and already have to deal with the effects of climate change. The motivations of right and wrong are powerful forces in behaviour, but climate change it is not clear cut because the complex and abstract notion of climate change. In addition to the abstract nature of climate change these financial incentives play a role. Rau & Oberhuber (2017) write that "... *Knowledge is no incentive for change. Financial incentives are that. No one turns around their business plan because they think their grandchildren will be better off ...*". In a way this is at odds what parents often do, namely they make sacrifices for the betterment of their children's future of better lives and opportunities. With this in mind the hardest part will be persuading politicians to create legislation and regulations that make it happen. Besides relying on regulations from governments of not polluting there is also a need for financial incentives, which would spur innovation (Boogaerdt, 2018). It is important to point that business invests when they see a market opportunity and as a way to grow. If these opportunities do not exist, government stimuli like tax relief will not be effective (Boogaerdt, 2019a).

Scenario modelling has to be carried out to ascertain where it will not be possible to live any more in the future, due to rising sealevels, and how to adapt to a drying climate especially in the southwest of WA. It will be too complex to do it in a flow chart or mindmap, cognitive mapping tools are needed to handle multiple nested ideas (Eden & Ackerman, 1992). This could also highlight the intersections of WACCP with requirements of other departments.

4.1 Minimising emissions

The WA government needs to take a lead in implementation in house of the climate change policies to avoid GHGs in all their departments and prefer suppliers that have strong environmental credentials; this should be consistent with the policies while it creates a substantial market for sustainable products and services. Part of the government policy has to include the removal of subsidies to the fossil fuel industry, even if the federal government does not come on board the WA government should implement their part.

The introduction of a Price on Carbon is essential to combat GHGs and is supported by many economists (Rhodes, et al., 2014), the best form would be Fee & Dividend system (CCL, 2019; Holden & Dixon, 2018)

Two simple steps the government can do with immediate effect are :

- The hierarchy of **avoidance**, **minimisation** and **offsets** (as established in the EPA GHG emissions guidelines discussion paper being adopted to assess new development proposals);
  - Avoidance in the form of not granting exploration and extraction licenses for coal, gas and oil in their jurisdiction;
  - Minimisation : by implementing Price on Carbon and Royalties on fugitive emissions;
  - Offsets : Carbon Capture, Storage & Utilisation to be implemented;
- Immediate action to reduce fugitive methane emissions and the extraction of methane from the atmosphere to begin urgently on the basis that it may have a significant immediate effect that will outweigh the warming effect of CO2 in the short term thus buying the world some time to establish CO2 removal technologies at the scale required to impact on the temperature increases.

4.2 Regulation

Regulations in relation to the resource industry appear currently to be a voluntary opt-in process because penalties for compliance are too low. In other words a company's cost

benefit analysis suggest it is cheaper to pay a fine than to comply [5] . If an organisation cannot fulfil its obligations under the regulations it should be shut down until it fixed the problem. An analogy is if someone with a personal loan does not fulfil their financial obligations their assets will be repossessed. So similarly, if a mining company does not carry out its annual rehabilitation obligations it should be shut down until they are rectified. The same for GHG emitters, but the oil & gas industry appears to skip regularly their social responsibility regarding GHG emissions while at the same time receiving substantial fossil fuel subsidies (IMF, 2019). Tooze (2019) writes "*... that is precisely what the fossil fuel interests have been lobbying hard to prevent. This resistance may make sense from the industry's narrow point of view, but by blocking proactive decarbonisation and clinging to a vision of fossil fuelled future, it also maximises the risk of a large-scale build-up of stranded assets. It is the old dilemma of conservative politics: By resisting progressive adjustment, they are courting a revolution. For the financial system that is bad news. …*". Part of ensuring compliance is enforcement of the regulation. With self-regulation or outsourcing of compliance services and a reduction of money available for this, problems have been created. A current example of this is outsourced building inspections in the highrise building sector in regards to structural defects and flammable cladding; and the certification issues around the Boeing 737 Max[6].

We ask the government to start to have discussions with industry immediately to discuss the steps that should be taken, to find solutions in a cooperative manner and how technological barriers can be overcome and to provide a way for transition to a low carbon economy. It has to be now, because there is no time to waste for all policies to be approved by parliament. Industry should be called on to endorse the objectives and then to begin the process of reaching the target. Part of the problem is as is raised by Rau & Oberhuber (2017) namely "*... power and responsibility are too far apart. The producer has the power, but not the responsibility for the consequences of his actions. He passes it on to the consumer. Where power and responsibility come together, things are going well ...*". It is part of the social license that companies need to operate. In a Circular Economy (see Sector 5) the gap between power and responsibility will be narrowed.

The fact that the federal government does not have a good climate policy should make the WA government to have a good climate policy. We are bound by the international treaties or agreements, like the Paris Agreement, signed by the federal government. With the need to diversify the economy tackling climate change and moving towards renewable energy is an opportunity to widen the economic base. This feeds in to the recent Harvard Growth Labs report (Harvard, 2019) which states Australian economy has become dumber because of less complexity and diversity. Tackling climate change is an opportunity to diversify the economy. Governments do not mandate how it should be

5 Until now, post Royal Commission into Banking, the banking and finance industry showed the same attitude and were not fined heavily for breaches.

6 The Boeing 737 Max were grounded after investigation in two fatal crashes, the self-certification problems came to light.

achieved or become involved in setting prices – it sets the regulation and industry responds.

As stated before in order to incentivise climate policies all subsidies to fossil fuels should be abolished, as documented by the IMF (2019). In addition a Price on Carbon has to be implemented and preferably in the form of 'Fee & Dividend'. There is the cost of avoiding pollution, there is a cost associated with CO2 abatement, and CCUS is the cost of cleaning up pollution. What about the pollution's by the emitters of the past? The answer is the taxpayer, and that is nothing new because we already do that for recent pollution created by companies that went bankrupt or were not accounted for cleaning up their pollution. To achieve that there needs to be regulatory framework that ensures that the pollution is reduced, and including incentives to do this pollution abatement. Incentives come in the form of fines or Price on Carbon (Malischek, et al., 2019). ETS schemes work well, but have the negative side effect that a part of the money generated ends up in the hands of the financial institutions that are doing the trading. A Price on Carbon in the form of a Fee & Dividend scheme as promoted by Citizens' Climate Lobby (CCL, 2019) is a fairer option. A Fee is put on carbon emissions; the Fee is increased every year by a fixed amount, this makes it easy for companies to budget for. The money raised, the Fee, is distributed equally as a Dividend amongst the population (Tooze, 2019). This Dividend is likely to offset more than the cost increases of the products bought or services used. A version suitable for Australia which incorporates border adjustments was researched by the University of NSW (Holden & Dixon, 2018).

Carbon Capture Utilisation and Storage (CCUS) may not be feasible everywhere. However the GHG pollutants are evenly distributed in the atmosphere. Therefore WA with its ample solar and wind resources (in more distant future tidal energy) is well placed to use DACs for GGR. Payment for these facilities could be done via DAC-Dividends. To offset their NE-obligations customers, be it companies or governments, could be paying to the facility with DAC-Dividends. The Fee & Dividend a price is put on carbon, paid by the polluter and the dividend is paid the citizens, where DAC-Dividends could work in the reverse. The organisation or individual get money (Dividend) for the captured CO2 and other pollutants. This Dividend is paid for by the taxpayer or in part by the polluters that have not captured these pollutants. Initially, that is from now, the Dividend is high. Over time when technology improves and the costs go down, the dividend will go down until one time in the future when the NEs are not any more required. This process would incentivise DAC technologies to be taken up. There will be opposition from other NETs because they will see the scheme biased towards DAC and CS. That criticism is fair but the reason for choosing DAC & CS is because the Carbon-Capture can easily be measured, which is important when having to out.

5. Accounting

It is important that when the WACCP is implemented, all items are accounted for by public and private organisations. Setting up environmental accounting standards are

beyond the scope of WACCP, but the policy framework should set a timeframe when environmental accounting of externalities is fully embedded in the reporting. The costings should be simple, based on how the GST works, including credits to avoid double payments and can easily be computerised.

5.1 Environmental Accounting

When talking about costs of pollution, NEs, global warming and so on, besides deciding who pays for them, there is the issue of how do we account for them and what are the values given all these expenses including GHGs (Nápoles, 2011). There are two points here, first how do we account for all the emissions and second how can they be incorporated in the "standard" financial accounting practices (Antheaume & Gibassier, 2019). The first point deals in a large part with the costs of externalities. Externalities can be defined as market failures that arise when there is an in-balance between social costs and private costs, or as unintentional and unbalanced losses or gains in the welfare of a party resulting from the activity of another party (Unerman et al., 2018).

Environmental costs are not often borne by the polluter; more formally said they are not internalised. Quoting Eidelwein et al. (2018) to explain this "... *Internalization of externalities refers to all measures (public or private) that guarantee that unpaid benefits or costs are taken into account in the composition of goods and services prices ...*" and even if externalities are a result of failing markets, they are an integral part of the market economy (Unerman, et al., 2018). In most cases markets continue to ignore externalities, because no penalties are enforced when externalities are not incorporated with them. This process is akin to most private car owners looking at the costs of driving only at the fuel expenses, ignoring the cost of services, insurance and write downs. After methods have been worked out how to account for GHGs, both positive- and negative-emissions, mechanisms can be designed how to incorporate them in to the current accounting methods. The same can be worked out for other types of externalities.

In environmental accounting another question is how to incorporate the economic and social costs of natural disasters. The worldwide costs of a changing climate are rising and so the socio-economic burden (Campanharo, et al., 2019), and insurers are noticing the financial impacts (IBC, 2012). With the increased risk of bushfires due to a drying climate the question has to be asked "What are the economic costs of bushfires?" (Campanharo, et al; Gebert, 2007; IBC, 2012). The externalities here include the social costs and lost opportunity costs to people directly affected. These costs are part of the externalities to be accounted for. Currently we are not looking at the cost of externalities of doing business. The cost of compliance has to be borne by the producer. This is a market incentive to create products without the cost of emissions and where waste is a saleable resource. The accountancy for this process becomes important.

From a policy perspective a 'Price on Carbon', independent of its form, is like mortgage cost, in this case a CO2-Debt repayment and paying for NEs is a CO2-Debt repayment from an accountant's viewpoint.

5.2 Who pays for it all and what are the costs?

The first criticism about a NET, any environmental issues for that matter, is "what will it cost" and "who is going to pay". Whatever we do in life has a cost associated with the action or the non-action. These costs may have been incurred in the past or currently or could be expected to occur in the future. Similarly we could argue about benefits reaped in the past, enjoying them now or in the future. An analogy is receiving a decent superannuation in the future when retiring, while paying for it now. To get a future monetary benefit there has to be a cost input now. In this field there are no miracles that produce a benefit without an input (costs). There are various permutations are laid out in Table 2.

	BENEFITS		**COSTS**
1	In the Past	a	In the Past
		b	Now
		c	In the Future
2	Now	a	In the Past
		b	Now
		c	In the Future
3	In the Future	a	In the Past
		b	Now
		c	In the Future

Table 2. Benefit and Cost matrix

Paying for current emissions as a concept is straight forward. As indicated above there is a need to remove CO2 from the atmosphere, but who bears the costs for these negative emissions? Now it has to be established who is and was responsible for them. As a society, at least in the developed world, we have benefited since the start of the 1st IR of the progress away from an agrarian society, to achieve this shift there has been an ever increasing amount of CO2 emitted, during this 200 years period. China is often quoted as the biggest emitter, but the USA has produced historically per capita 10 times more GHGs than China (Hansen, et al., 2019). So all generations pushed the problem of CO2 emissions forward, because they did not have the technology to avoid these emissions to deal with it, neither would they initially have anticipated it to be a problem. In other words they unknowingly borrowed time and money for abatement from future generations, and this continues today. In the meantime their actions have created enormous wealth and comfort, at least for the developed world. Now it is time to pay

the debt created by past generations, since we have the technology to create negative emissions.

It comes down to according Ruscio (2014) "*… the value-laden question, which is what do we owe to future generations? The verb is important. 'Owe' implies an obligation, a duty, which further implies an ethical question, which further implies an ethical answer or at least an ethical analysis ...*". Ethically we cannot leave it all for the next generations, who will pay in part for it anyway and already have to deal with the many effects of climate change.

In the case of carbon emissions benefits we are dealing with in the past and now (scenarios 1 & 2), but for the costs now and in the future (scenarios b & c). It is like buying goods on credit with an interest free period. At the time when CO2 emissions started to increase there was no timeframe set for the repayments, there would not have been any notion for a need of payments at the time anyway. In the financial sector, when risks are high the costs are higher. Translated into the climate crisis scenario the longer action on CO2 reduction is postponed the higher the risks of higher temperature increases. In financial terms it means much higher costs for mitigation later on. However the financial crunch has come now and society has to start paying "interest and capital" back to nature. *The interest is being the costs of mitigating CO2 and the negative emissions strategy. The capital is removing the CO2 from the atmosphere to pre-industrial levels*.

Issues by Sector

The rest of the submission is a commentary on the issues raised by the government's discussion paper.

Sector 1. Transforming Energy Generation

The transformation of the energy generation is well documented by SEN (Sustainable Energy Now) in documents published on their website (SEN, 2019).

Sector 2. Industry Innovation

In the process of moving from a fossil fuel based economy to a renewable energy based economy and from a Linear Economy to a Circular Economy industry will innovate, the government can play a role with positive regulations.

See also the comments in Sector 5.

Sector 3. Future Mobility

Electric city buses are a start they can be implemented immediately. Some concerns have been raised regarding climatic conditions in Perth. Not a very believable argument since temperature range in other places are similar and already have electric buses. There are options for charging at bus stops, batteries for trolley buses to use outside the trolleybus overhead power network (VDL, 2019).

Australia does not have a car industry any more, therefore the government is free to select any brand for its governmental fleet, so it should purchase electric ones, or at least hybrid vehicles straight away.

The government can start campaigning to get drivers to check their tyres. Correct tyre pressure could save the driver $100 / year and will reduce tons of CO2 emissions [7].

See also Sector 9.

Sector 4. Regional Prosperity

The prosperity in the southwest of WA depends in a large part on tourism, both national and international. Many come to WA to see the wild flowers and its unique vegetation (WA Tourist, 2019). Climate change is threatening this biodiversity (Cox, 2019; Keith, et al., 2008). If this loss of diversity continues the number of tourists to WA will drop, resulting in a sizeable impact on the economy, especially in regional areas. The economies of regional areas around the Ningaloo reef and Shark Bay will also be affected (CA, 2019).

Water security is essential for regional centers to survive and therefore a ban on fracking should be implemented (Boogaerdt, 2017). The current government does not like to hear this, but allowing fracking has been ignoring independent science, while appeasing oil & gas industry's "scientific" evidence.

Most likely the regional areas have plenty of wind and/or solar resources that could be used to generate their own energy and could be in combination with NETs (Boogaerdt, 2019a).

7 Based on the information from the Urgenda environment group in the Netherlands, who released a simple 40-point plan to reduce CO2 emissions in order for The Netherlands to meet its 25% target in relation to 1990 of GHG reductions by 2020. https://www.urgenda.nl/themas/klimaat-en-energie/40-puntenplan/ . Note that the €100 was lowered to $100 because lower fuel prices in Australia.

Sector 5. Waste Reduction

To avoid future GHG emissions any produced GHG has to be treated as a resource, not just as a waste product. A resource has a value, both for the producer and the purchaser. This approach will necessitate a change in the current economic model to a Circular Economy.

The current economic system that we are part of is called the *Linear Economy (LE)* for the following reasons. It is linear, because raw materials get collected, manufactured into a product which get sold to a consumer who dumps it after use. A sequence by some called "take, make, dispose". In other words natural resources are used for just for temporary benefits in the meantime creating waste and depleting the resources. A *Circular Economy (CE)* is an economic system where the waste from production to the final consumption stages of disposal, is minimised and becomes a resource. This resource can then be used as input for the same or different products. So inherently the CE is more environmentally friendly; and has the ultimate goal of zero waste (EMF, 2019).

In the CE the producer takes more responsibility of the product. This is where part of the externalities get internalised. Fortunately some jurisdictions like China and the EU are regulating a move to more sustainable circular investment models (El País, 2019), even though it is not exactly CE, it is a step towards it. It is creating many business opportunities in CE. Business leaders have to start thinking more innovative and accepting that fossil fuels are never a part of the CE, because they are not a renewable resource.

Environmental pressure will make CE acceptable for economic and political reasons in order to survive as a society. At its core the CE is an economically and politically palatable response to aspirations for sustainable growth in the context of mounting pressures on global resources. According González Ordaz & Vargas-Hernández (2017) the CE has positive impacts on economic development and business while contributing in social responsible way.

Sector 6. Safe and Healthy Communities

Tackling climate change will reduce the heat impact on locations where people live and will help avoiding heat islands with associated health problems (Brown, 2014). Combined with this is a need to maintain at least and preferably increase the tree canopy cover (Beatley, 2017). Some councils like City of Stirling put a great effort in doing this. Also different town planning regimes like the 'Freo Alternative' are needed (Boogaerdt, 2019b; Freo, 2019).

Immediately install on all public schools PV-panels, and provide cheap loans for non-government schools to do the same. Schools will become nearly carbon neutral. This will save a lot of CO2 emissions, besides saving money for the schools **Error! Bookmark not defined.** and in the end saving the government money.

Make social housing carbon neutral and start with installing PV-panels with batteries followed by making the dwellings more sustainable amongst others by changing them fully electrical. This will improve the living conditions of the more vulnerable people in our society. This project should include remote indigenous communities. These measures will save CO2 emissions and also will save the tenants money **Error! Bookmark not defined.**.

See also Sector 8.

Sector 7. Water Security

In a drying and warming climate in WA water security becomes even more important. Water security was also one of the pillars of opposing fracking for oil and gas, the science of which was unfortunately ignored by the WA government. With a warming climate and a growing global population water is a precious resource and water security a major issue and that a large part of the world population, two-thirds, experience water scarcity of at least one month a year, according to Grafton (2017). There is a need to increase the carbon content in agricultural soil in order to hold more moisture. The changes in rain patterns are already having an impact on both vegetation and water resources (McFarlane, 2019; Ukkola, 2016).

With rising sealevels it becomes even more important that water extraction near the coast is reduced. For a start no more new residential bores can be installed in the coastal zone. The freshwater wedge under the coastal dune corridor is essential to keep the seawater from moving inland. If not the groundwater behind the dune corridor will become salty and all vegetation will die. This concept is not new, this was already taught in primary school in The Netherlands around 1960.

All water bores to be registered and metered, so they can be monitored and the data used for modeling. The trading in water licenses should not be allowed. The reason for this, look at the problems water trading in the Murray-Darling Basin has created. Waterbore licenses are to be site specific for a specific purpose. The concept of minimum usage, wasting large amounts of precious fresh water, should be abolished.

The idea of **greywater** is that it will be released subsurface for the benefit of plants and the rest will percolate downwards into the superficial aquifer. So why not install "greywater tanks (a septic tank for greywater only)" on each property, which will only collect "greywater", while the "blackwater" goes into the sewerage. This greywater then replenishes the superficial aquifer, which will benefit trees. There will be also a cost

saving for Watercorp because they have to treat only "blackwater". This cost saving should flow through to the householder. The greywater tanks are especially important on small blocks or apartment complexes where the greenspaces are too small to warrant a "standard" greywater irrigation system.

Sector 8. Liveable Towns and Cities

Electrification of public and private transport and in Perth at least the use of Trackless Trams will reduce the amount of Particulate Matter (PM) and Ultrafine Particulate Matter (UFPM), which are pollutants and a health risk (Cahill, et al., 2016; El Público, 2019; Jim & Chen, 2008; Varotsos, et al., 2012).

Scenario modelling has to be carried out where it will be possible to live in the future due to rising sealevels and how to adapt to a more desert-like climate. Also the likelihood of increased housing density, with its economic benefits, puts a strain on sustainability. A tool like 'cognitive mapping' can be used to address the complex issue of balancing the environment with health and economic activity to achieve a sustainable outcome (Fernandes, et al., 2018).

Encourage the establishment of green roofs with PV-panels. Start with all government occupied buildings. These green roofs will insulate the building more and will bring insect diversity back in to the built up areas. These insect were displaced in the first place by building development. All this will reduce CO2 emissions. Even bus shelters could be considered in having green roofs **Error! Bookmark not defined.**.

As well as the points raised in Sectors 3 & 6 above.

Sector 9. Infrastructure

To reach the 1.5C Paris target and fulfil the climate emergency declaration obligations, all energy has to come from renewable resources. Resulting in that a new development should be totally electric; for this reason a policy was introduced in The Netherlands that by 2020 no gas for new developments will be allowed and similarly policies are developed in the ACT. Since natural gas is **not** a renewable energy source, new gas infrastructure should not be allowed in new residential development sites. Natural gas is not as environmentally friendly has been promoted, due to fugitive emissions which actually makes it produce more potent greenhouse gasses than coal (Boothroyd, et al., 2016; CCWA, 2019; Howarth, 2014). To recap, to achieve zero emissions in the future gas cannot be used. New homes should have induction cooktops instead of gascookers and heatpumps instead of gashotwater systems [8]. The cost saving by not having to

8 The authors have no pecuniary interest in any of the technologies mentioned in this submission.

install a gas infrastructure and the lack of a monthly gas connection fee will easily offset the extra cost for installing an induction cooktop and heatpump hotwater systems.

Sector 10. Biodiversity

"Regenerative Farming" (Massy, 2019) in conjunction with the "Strip Cultivation" as researched in Wageningen University, The Netherlands (Wageningen, 2019) can be adapted to agriculture in WA. This will increase the carbon content in the poor soils of WA which improves yield, moisture retention and sequester carbon. It will have a positive impact of the viability of farming. These practices could also be adapted to forestry. This practice will maintain and promote diversity.

Will the very diverse range of Banksia species, for example, be able to adapt to a drying climate (Fitzpatrick et al., 2008)? If not, plant species and diversity will be lost (Cox, 2019; Huntly et al., 2010; Keith, et al., 2008; Pearson & Dawson, 2003).

A warming and drying climate will be a reason for more catastrophic bushfire as have been raging on Australia's east coast in 2019. They can happen in WA as well with amongst others resulting in a loss of biodiversity.

Biodiversity loss will also affect WA's iconic World Heritage sites such as the Ningaloo reef. The already occurring marine heatwaves cause damage and losses to seafloor vegetation and fish in Shark Bay area (CA, 2019).

See also comments under Sector 4.

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