Carbon Reduction Kwinana Industrial Area (CRKIA) project. (Public version)
Phase Two, Stream One (KIC member workshop)

Details: 13 October 2021, Alcoa Social Club, 10.00am – 2.00pm.

Attendees (KIC members)	
BHP	Tronox
Kleenheat	WesCEF
AGIG / DBGP	Good Water Energy
Coburn Cement	Synergy
bp	Coogee
BHP	Fremantle Ports
Tronox	Synergy
Water Corporation	Cockburn Cement
KIC – Director, Chris Oughton	WesCEF
Apologies	
Avertas	Summit
Covalent	BOC
Guests	
Karin Wittwer (City of Mandurah - Perth & Peel Hydrogen Cluster Lead	
Adrian Parker (Peel Development Commission - Director Regional Development	
Katie McKenzie (Climate – KIC https://climate-kic.org.au/	
Helen Riordan, Bill Barker, Maysar Adams, Stella Elkington (Advisian) - Presenters	
Dr Biji Kurup (Environmental Engineers International)	

- Chris Oughton chaired the workshop.
- Welcome, workshop outline, round table introductions.
- Thanks to guests Advisian.

Agenda Item 1: Introductions and statements about individual company GHG targets
Theme: Gathering a collective understanding within the KIC membership of what practical technologies are being considered to aid with carbon neutrality goals.

CO provided the background to the CRKIA project and gave a status update.

- KIC embarked on a first phase when the Board approved the three-phase project in 2020.
- The KIC's Environment and Planning Committee will continue to manage the project via its CRKIA Project Working Group.
- Phase 1: Inventory of publicly available emissions data collected via a desktop study and some respondent member interviews. The baseline of the inventory was the data reported in 2018-19 NGERS reporting year. The formal minimum reporting threshold is 100,000 Greenhouse Gas Equivalent tonnage per annum (CO_2-e). Also included were members that emit under the reporting threshold. The data collected indicated KIC members' emissions were 8.2 million tonnes (7.2 Scope 1 and 1.0 Scope 2) of CO_2-e, which represents the task presented to the KIC Board.
- The Phase One report was adopted by the Board in April 2021.
- KIC and members acknowledge the emissions profile will change as new members join KIC, or an existing member carries out business expansion work. All reported and (under threshold) changes will be tracked into the future.
- The adopted report also records the GHG emission targets and aspirations for each member as per their annual sustainability reporting.

- It is important to note that the CRKIA project, with its collegiate approach to identifying GHG reduction pathways has not been done in Australia, and is rare throughout the world.
- Phase Two of the CRKIA project moves into the exploration of what are the current practical technologies that are available and what are coming. We are looking at this through the lens of five separate lines of enquiry, broadly through a workshopping process.
    - Stream 1: KIC members; what practical technologies are the members looking at individually, and what technologies might work more effectively if progressed collectively by a number of members together.
    - Stream 2: The Innovators; what are they planning to bring to market?
    - Stream 3: The academics; what are they telling us around practical technologies in the future Emerging technology providers?
    - Stream 4: The Collaborators; what are the organisers of the associations, hubs, and regional representative groups seeing?
    - Stream 5: Governance; what are the federal, state and local governments thinking about, what are their policy and regulatory plans, and what they can offer in terms of broad support.
- Phase Two will culminate in a further report to the Board setting out a technology roadmap to support individual and collegiate GHG reduction goals.
- Phase Three is the implementation phase. Any Phase Two recommendations are purely for members to consider within their own private business environment. KIC's role will be to coordinate discussion and facilitate collaborations, but it cannot require action. It will also periodically gather reported NGERS data to report overall changes and review sustainability reports for published member GHG reduction goals and progress.
- It is anticipated that the Phase Two process will be presented to the KIC Board around Q3-2022.

Around the grounds – members present to the group:

Agenda Item 2:

CO facilitated a broad discussion across a series of subject areas – a 'quick fire' issue discussion

- **Agree 'rules of engagement' – how to deal with confidential information yet be able to talk about the subject matter**
    - After some discussion it was agreed that there is no need for considering confidentiality during this Phase 2 process as it is only a gathering of general information.
    - There was, understandably, an unwillingness to discuss commercial aspects of technologies under consideration by individual companies, s with agreement that this was proper and should be respected.
    - The group was comfortable about participating in general discussion about the relative merits of technologies, and their concerns or opportunities etc. Several members were going to seek clarification from their senior managers.
    - Agreed that in Phase Three, normal 'in confidence' requirements would apply as appropriate.

- **Gain an understanding of the broad reasons for GHG reduction targets, and to get a sense of how closely aligned they are collectively**
    - There was clearly a substantial degree of understanding about reduction targets within the group.
    - Many found they had a common understanding of carbon reduction and renewable technologies, and several were considering solutions that had a common alignment.
    - It became quite apparent that working together made a good deal of sense through the sharing of resources and knowledge, and possible future GHG reduction alliances looked likely.

- **Understand approaches and technologies being pursued and being considered**
    - Many examples of technologies being considered were identified and discussed. See Appendix (Advisian notes).
    - Also discussed in this section was the extent to which land use constraints are an important factor if pursuing a carbon farming sequestration pathway.

- **Develop a list of proponents to be approached to present their technologies**

It was decided that rather than identify actual technology proponents, it was better to compile a list based on the technologies available and emerging.

- Renewable energy sources
    - Locally-produced geothermal energy
    - Remotely-generated solar energy
    - Locally and remotely-generated wind energy and green hydrogen
    - Green electrical energy generation and distribution

- Associated opportunities
    - H_2 doesn't make sense for power generation, whereas Geothermal produces green energy
    - Waste heat and steam pipeline connectivity
    - Converting CO_2 to graphite (Hazer project)
    - Pyrolysis
    - Direct Air Capture not commercial yet, depends on carbon price and regulatory
    - CO_2 geo-sequestration, carbon sequestration (trees, bush, seagrass)
    - Carbon Farming Initiative
    - CO_2 recycling by methanation for producing H2 and also using CO2 and H2 to make CH4 methane.
    - Carbon scrubbing (before emitting to atmosphere), and capture
    - Bio methanation
    - Fuel cell technology development

- Enabling infrastructure / programs
    - Pipeline connectivity within the industrial area
    - Climate Action Fund
    - Industrial scale microgrid clusters
    - H_2 pipeline in DBGP corrido with insertion/extraction points along the way, with excess for export.
    - CO_2 pipeline in the DBGP corridor receiving gas at Kwinana and geo-sequestering in a northern depleted gas basin.

- Political support
    - State-supported workshop process to make achievement through government processes easier
    - Climate Action Fund
    - Land use planning to assist carbon storage, farming, offsetting, geo sequestering etc
    - 'Sea bed tenement' allocation processes for seagrass planting.

- **Identify and discuss actual or perceived organisational or economic roadblocks**
    - The transition through from a carbon-based economy to a net zero economy will be difficult from the perspective of comparative pricing. While there is a cost penalty to transition to net zero carbon content in products, companies trying to make the transition are likely to be

in an un-competitive phase of production when compared to those not transitioning. This will remain challenging because consumers usually go for the lowest price.
- The economic rate of return for inserting renewables into the production side can be a roadblock to achieving board support for projects.
- There is a company reputational risk to factor in to the analysis, and boards are becoming more cognisant of this.
- On this basis producers need to be incentivised to make the transition. This can be in the form of taxes, tariffs etc to discourage the status quo. In other words, the price of carbon needs to go up, and this is occurring in several parts of the consuming world.
- Clearly as the use of renewable inputs and supply chains increases, the cost of 'net zero' transitional costa will reduce. It is possible for grey hydrogen to achieve a positive return over time, but green?
- Mandated transitions (policies, laws etc) level the playing field.
- Shareholder pressure for company boards to make the transition also add to the actual case for transition. Shareholder pressure comes from the consumer need-credentialled for green products.
- A decarbonisation plan could focus on a hierarchy of effort for reduction.

- **General Discussion-Facilitated**

A general discussion was held to brain storm potential collegiate strategies and what the role expectations of KIC were from members, and how to proceed.

Working lunch and presentation by Advisian

Advisian provided a formal showcasing of some international case studies illuminating the following aspects of transitionary pathways being undertaken in the USA (Princeton 2020 report) and Scotland, covering;

- International trends and expectations
- likely future GHG reduction technologies
- most commonly observed industry carbon reduction pathways
- practical pathways for Kwinana.

A series of common themes emerged as a means to assist in achieving net zero targets:

- There should be a fundamental and visible pathway to reach renewable goals.
- The use of every technology, not relying on one, is necessary.
- Collaboration and trust is important.
- Strengthening human capacity is integral, as is investing in foresight.
- Common-user infrastructure provision, or facilitation of its installation by governments.
- Carefully manage community displacement.
- Design one build many.
- Communication and collaboration, policies and governance have important roles.
- Enabling digital access is key.
- There is a need to move beyond the mindset of IP, to enable people to bring what is already available to the table and work together to achieve a collective outcome.
- The USA and UK examples support the carrot and stick approaches, as they are working well together to encourage the transition.
- Government vision and commitment in terms of policy, legislation, and access is absolutely needed for buy-in. The planned pathway needs to be visible. Finding the right people at the right time to find the right answers needs the focus a good business case can deliver.
- Academia can play an important role.

The session concluded with discussion on the applicability to Kwinana, and it was generally agreed that the processes outlined in the presentation had good applicability to Kwinana.

Workshop in Groups: - Envision the KIA as a whole, as well as a collection of individuals

Objectives

- Create a list of practical actual technologies being considered or implemented
- Are these individual or can they be collegiate
- Sort into pathways that can be individually pursued, and those that can be collectively
- Create a list of likely potentials
- Brainstorm 'what could be' scenarios
- Report

The feedback was consolidated and summarised as follows:

Group 1:

Practical technologies	**Collective (C) Individual (I)**
Methanol production from green hydrogen and CO2	C
Renewable electrical energy availability & distribution network with in the KIA	I
Blue hydrogen transition to green hydrogen • Reticulated carbon dioxide capture network for bulk treatment (further processing/sequestration) (AGIG idea) • Leads to green hydrogen as an energy source and fuel feedstock	 I I
Green hydrogen from • Geothermal (base load) energy • Wind – offshore and onshore and battery • Solar PV and battery	 I I I
What is the availability of each technology?	
How do they reach into and enhance the existing symbiosis exchanges and opportunities?	

Group 2:

Practical technologies	**Collective (C) Individual (I)**
Methanol production from green hydrogen and CO2	C
NOx reduction technologies	I
Release of emissions during use of fertilizer	I
Fuel cell technology for heavy transport (diesel displacement)	C
Access to green hydrogen	C
Alternative battery technologies eg Redox battery	I
Combustion of natural gas (all forms) plus CO2 utilisation CCU/CCS	C
Reticulated carbon dioxide capture network for bulk treatment (further processing/sequestration), CO2 pipeline network	C
Hydrogen supply via pipeline network	C
Waste heat recovery (co-location opportunities)	C
Hydrogen fueling for power at compressors (aggregated Hydrogen)	C
Ammonia export	I

Group 3:

Practical technologies	**Collective (C) Individual (I)**

Understand how CO2 is generated in the KIA, how much and by what processes (electricity generation, chemical processes?) There then needs to be CO2 categorisation, identification, prioritisation and a reduction roadmap.	C
Data collection and storage – KIC agreed as the likely repository. There may be confidentiality issues and requirements, and KIC can manage this.	
Advocating to government(s) about; What is the public strategy for hydrogen production/supply Extent of support for CO2 sequestration What supporting common user infrastructure will be supported/provided What is DWER's approach to these, so we don't waste our time identifying opportunities only to find they will not support industry's proposals	C

Where to from here – how do we manage progress toward the decarbonisation goal in the years to come? Formalise commitments and process going forward

- Federal information from DISER is available.
- Workshops being circulated for Friday could be utilised.
- Joint submission could be ideal.
- Work through funding application in collaboration.
- Better opportunity is currently available and willing to provide all the support (DBNP, Advisian, BHPNW, Climate KIC). Getting a letter of support from all industry members would be ideal.

Impromptu discussion: Hydrogen Hub Funding (DISER)

Noted that a grant round which may be able to assist in some research was tabled and discussed. The workshop participants identified that there was support for;

- identifying, quantifying and categorising CO_2 by source (and use), how easily it was to be captured and cleaned, and how that source could be substituted with a clean alternative (green hydrogen), or sequestered, and
- doing the same for energy.

A grant could be worked up for a study to help us better understand needs, options, and locations for hydrogen production / CO_2 sequestration, and transmission infrastructure (the AGIG pipeline corridor option was regarded quite favourably.

It was agreed there was merit in undertaking this work regardless of whether a HHF grant were to be pursued.

Appendix (Advisian)

Comments from participants:

- Water utility needs to know when water demand is needed by the KIC, to manage water availability?
    - There will be a new water demand from the new companies in Kwinana, i.e. Covalent & Tianqi etc.
- Projects underway for two desalination plants in Kwinana & Alkimos. Expect to be operational by 2030.
- Second highest power user in WA and have PPA in place to decarbonise.
- Hydrogen requires high quality water – WC could provide high quality water through expansion or a new plant.
- Has assessed use of H2 in the existing infrastructure. There are challenges - Hydrogen (H2) into DBNGP gas pipeline is difficult. H2 is less dense and so pipeline operating pressure is reduced, leading to less capacity in the pipeline. There is also capacity reduction due to the metallurgy and the low energy content of H2. This will also lead to the need for additional pressure boosting stations along the length of an existing pipeline.
- Customers do not want 9% H2 in the gas. No incentive to change their equipment to support this amended composition of gas.
- Looking at a dedicated pipeline, with off takers along the pipeline. Initial study work has been completed. Potential location would be the DBP pipeline gas easements.
    - CO2 pipeline going North
    - H2 pipeline going South
- Hub connecting together, using a pipeline to connect markets for demand and supply
    - Mentioned UK Hubs and how well they have worked there.
- Believe there is no demand for green H2 in WA.
- Gas pipeline will be there when renewables are not available due to the climate / weather conditions.
- Steam Methane Reformer (SMR) is being used to produce process H2 needed. Also can be used to make Ammonia.
- Green H2 economics are poor (even if the project had received the ARENA grant) at this stage, but member is keen to progress in this direction.
- It makes more sense to use a PPA is in place for lower carbon intensive power.
- keen to collaborate with other companies to get the cost of renewable energy or green H2 down.
- Current Decarbonisation plan is based on electrification. Most power is required for heating and expected usage to increase tenfold. So planning to electrify their heating.
- Very large volume of CO2 produced from their cement manufacturing process.
- Currently looking into CO2 capture technology.
    - World leaders in Seagrass transplanting, but currently not getting any carbon offset benefits from this process.
- Still utilising coal within their process and current strategy is to convert to 100% gas, but they are not there yet.

- Electrification or H2 is main focus for use in steam generation (electric boilers) and haulage trucks (electric or H2 fuel cells).
- Still utilising coal within their process and currently looking for coal substitutes.
    - has state funding to conduct a feasibility study for green H2 (utilities and green energy).
- focusing on renewable fuels
    - the market for biodiesel is currently not there.

    - project feasibility stage will be in 2022, with plan to be online by 2024, if the market is there.
- focusing on land repurposing at the end of this year, so still thinking of a "Kwinana Energy Park".
- Demand is high for green energy. Currently cannot meet the demand.
- Currently have 60-70% renewables power (solar & wind) at midday, depending on the weather through the South West Interconnected Grid System (SWIS). (@ 2,200 MW) In the evening, renewable power is not available.
- 100MW battery at Kwinana Power station will be the only source of smoothing for the power grid.
- Grid not designed for wind fluctuations and currently has no black start facility.
- Preference for EV / PV batteries rather that H2, due to concerns with energy losses incurred in producing H2 or Ammonia.
- Have assessed electrification (changing gas turbines to electric) but the sub-station could not cope highlighting the challenge for infrastructure required to support the transition.
- producing a very pure CO2 from their Ammonia process. Looking at CCU technologies.
- Looking at green H2 production.
- Mentioned collaboration with Mitsui and the Japanese government to investigate the export of low-carbon ammonia from Western Australia that will need a $1 billion-plus processing plant and large-scale carbon storage, see article:

Technologies for KIC:

- Geothermal.
- Waste heat recovery and sharing through a steam / condensate network system.
    - New pipeline would be very heard to build at Kwinana, but utilising an existing pipeline circuit should be looked at. Issue will be the age of the pipeline network.
- Compressed air technology – Subsurface.
- Carbon material (graphene or graphite) produced from vehicle exhaust.
    - Pyrolysis & Hazar process.
- Direct capture of CO2 is being investigated in UK and USA, but not commercial yet.
- Offsets from tree planting etc.
    - Department of Primary Industries and Regional Development. Deputy Director General. $50million budget. Not sure what this funding covers?
- Methanation, pushed by Japan. Combining CO2 + green H2 = CH4.
    - Also Bio methanation for impure CO2.
- Diesel displacement, initially using renewable diesel and them moving on to H2 fuel cells or batteries.

What is impeding KIC Companies to decarbonise:

- Currently no economic sense or driver to decarbonise, so most Companies are not putting any large effort into this space.
- Companies understand that climate change is coming and change will need to happen, but there is no return on investment during this transition phase.
- Environmental, social and governance (ESG) regulations and cost penalties from Europe, are coming.
- Who covers the cost of being greener?
- Legislation is needed to guide / support Companies in this transition to becoming greener.
- Market demand for greener products is not there yet. So Customer will not accept the higher cost related to being greener.
- Net zero targets have been set by Companies, but due to the significant, diverse and increasing technology options, it is difficult to know how select decarbonization pathways.