Questions and Answers from Capricorn Power's Birchal Expression of Interest launch event on 8 June 2021

What is the anticipated cost of a kWh?

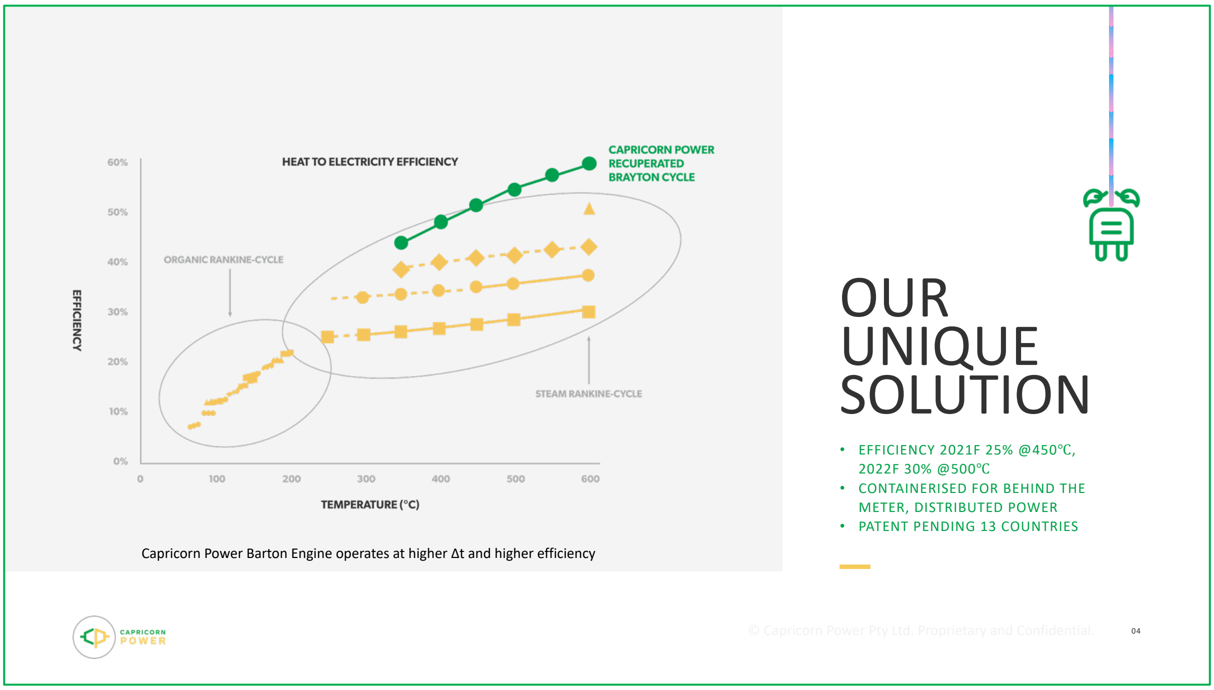
- Capricorn Power has a pathway to <$1/W which due to uptime as high as potentially 95% is <$10/MWh, however this will take years of product development (the Ultima program would boost this greatly) and volume production.
- Cost should not be confused with price, however
- In the short term Capricorn Power will focus on high priced retail ('behind the meter') markets where customers are paying as much as $300/MWh, and where significant numbers are still paying $200/MWh of more. These prices are much higher than the current (but highly variable) ~$50/MWh wholesale price for various reasons but mainly to do with network charges and losses which the Barton Heat Engine's small footprint enables us to avoid.

My understanding is that the container contains the inverter for generating the power. What is the rated electrical output of the containerised system?

- The current demonstration is located in a 20' container and the 100 kVA inverter is in a separate container.
- There are advantages to having a separate electrical and controls room ('modular approach') potentially in a separate 10' container, which needs to be kept cooler than the heat engine, which can potentially be used for multiple heat engines.

How efficient is Brayton cycle in converting waste heat to Electrical energy?

- See diagram below: theoretically at 600 degrees C the recuperated Brayton cycle is 60% efficient.
- The current heat engine is forecast to be 25% efficient at 450 degrees C and we expect the next build to be over 30% at 500 degrees C.
- We have a pathway to over 40% efficiency, but this will take years of product development to achieve (the Ultima program would boost this greatly).



Are the Barton Heat Engine power units purchased outright by your customers or are they leased or owned by Capricorn Power?

- Financing will be a customer decision – outright purchase, lease or paying for electricity only. Capricorn Power will offer all three options.

Who will operate these units, and can they be monitored and controlled remotely?

- Capricorn Power will operate the units
- We successfully provided remote control and monitoring of the Mk 1 engine in 2018 and all the present control system design builds on this

Practically where is the Barton Heat Engine at. Where is it practically up and running?

- We demonstrated the Mk 1 heat engine at Austeng in Geelong and at a customer site in Geelong in 2018
- The Mk 2 will begin commissioning next week at Austeng in Geelong

How many products is Capricorn Power producing currently from the biomass collected and what is your strategy to collect the biomass in a particular locality?

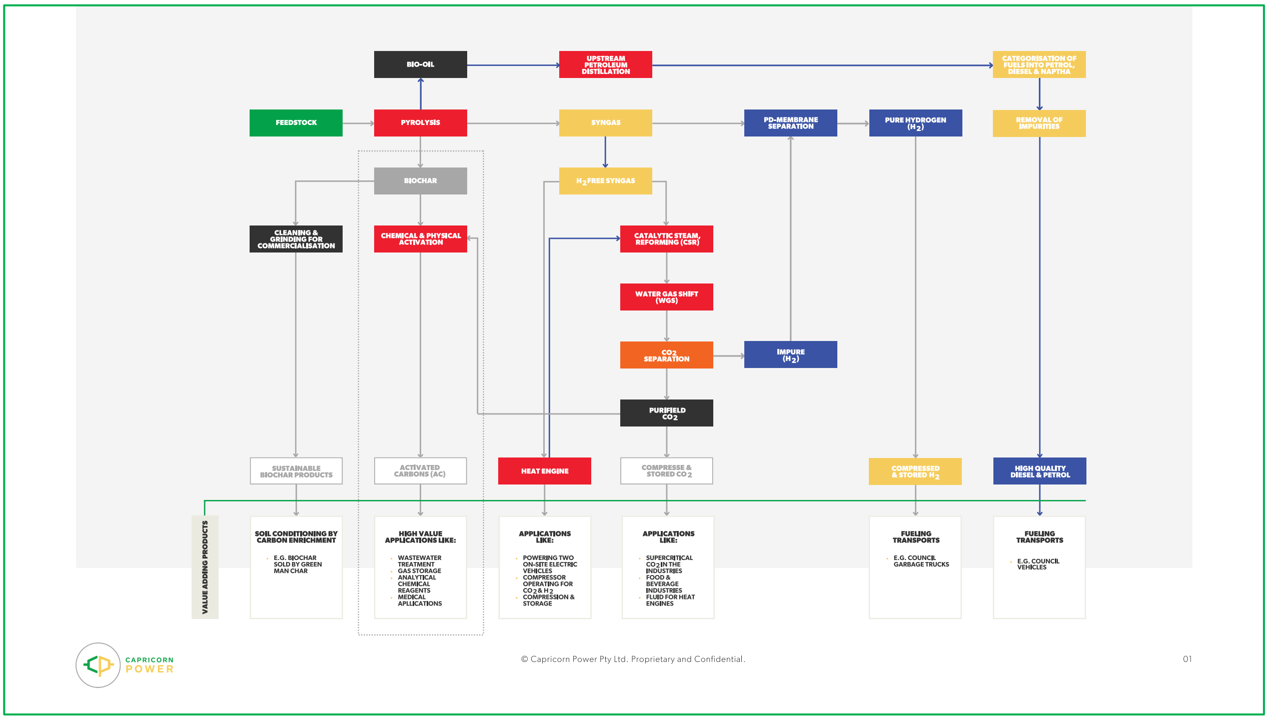
- The small-scale pyrolysis unit that Capricorn Power uses is a mature technology with over ten units operating around the world. We have tested the City of Greater Geelong feedstock with it successfully
- Feedstock is typically already collected at or produced at a site e.g., at City of Greater Geelong's green waste processing centre or at an Agribusinesses processing centre.
- Being able to locate our small-scale system at or right next to the waste stockpile is a key advantage of our system.

Hydrogen production from waste biomass is also a most promising technology to produce clean and renewable energy. So how efficient is the Brayton Cycle over Hydrogen fuel cells in producing energy?

- Whilst most discussion about renewable hydrogen assumes production using electrolysis, we have identified an alternative route, using the hydrogen bound in green waste. This does not require electrolysis, and so saves high value electricity for other uses. Our investigation is at an early stage, and includes potential feedstocks, strategic partners for gas production and hydrogen off-take agreements.
- Hydrogen has many applications that complement our other potential revenue streams. The highest value application is transport, where the benchmark value of hydrogen is $5 - $7 /kg. There is also strong interest in hydrogen for decarbonising steel production and ammonia.

Is Capricorn Power concentrating on producing biodiesels or biohydrogen from the biomass collected?

- We are aware of the potential of bio-hydrogen (see previous question). Capricorn Power has made a grant application for the below concept, a truly circular economy project which uses waste biomass to create biochar, activated carbon (with the right feedstock), heat, power, cooling (using the heat energy for a chiller), biofuel, CO_2 (‘sustainable CO_2 for industry e.g., PH control for local swimming pools’) and hydrogen. Our priority is to generate revenue from the products which are commercial now (biochar, activated carbon, electricity and heat) and use this to support the products which require more technical and commercial development (biodiesel and bio-hydrogen).
- This project requires a grant to proceed as whilst the components exist that are promising for commercialisation, they require development and commercial scale trial. However, we believe that there are multiple substantial commercial advantages in these types of ‘de-centralised integrated circular economy factories’, and we would welcome the opportunity to conduct this type of commercial trial.



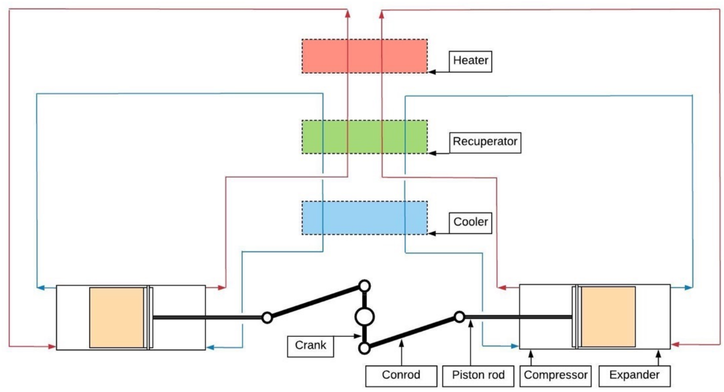
In case of heat engines generally only some part of the input heat is converted to energy and the rest has to be left into environment, so how is Capricorn Power managing that heat and emissions from the Brayton cycle, are you using a simple Brayton cycle or is your Brayton cycle equipped with reheat and regeneration cycles?

- Yes, every thermodynamic cycle needs to shed excess heat at the end of the process. We tackle this problem in several ways:
    - we are using the Brayton cycle rather than the steam Rankine cycle. The steam cycle relies on condensing steam from the turbine exhaust, into water, so it can be pumped back to the boiler. This process alone loses about half the heat supplied by the boiler in creating the steam (about 2.2 MJ/kg), which is the 'latent heat' of the phase change from liquid water to steam. In many thermal power stations, you will see large cooling towers, which reject this heat to the atmosphere. The Brayton cycle does not have this phase change. We have a pathway to use this advantage, and other innovations, to achieve an efficiency of in time potentially over 50%, which of course reduces the heat which is rejected.
    - we are targeting 'behind the meter' installations, which in addition to providing electricity direct to customers (avoiding network charges), allows us to sell the low grade heat rejected by the heat engine to our customers. This can improve the overall energy efficiency (fuel to electricity plus useful heat) to over 85%, increase revenue, further cut greenhouse gas emissions, and create certificates for green heating.
- A little-known fact is that it is the shedding of the heat at the end of the process through the cooling towers of large steam Rankine cycle power plants wastes enormous amounts of water (this is often seen as vapour plumes above the cooling towers). In Victoria this accounts for about 20% of the state's drinkable water consumption). At Capricorn Power we believe that the water used by Steam Rankine Cycle power stations is unsustainable, and we are surprised that this does not feature more prominently in the public arena.

- Please see the below diagram and explanation of the process.
- We use a 'recuperated' Brayton cycle, so yes there is a regeneration cycle which helps with the high efficiency.

HOW IT WORKS

Closed loop, piston-cylinder recuperated Brayton-cycle



The Barton Engine is a heat engine; it converts heat (thermal energy) into mechanical energy, which can then be used to do mechanical work. Principally this will be to drive an electric generator, but it could instead, for example, drive an air compressor.

The process is known as a closed-loop recuperated piston-cylinder Brayton-cycle. It is circular, but starting with the external heat source, a heat exchanger brings the air (the working gas) contained inside the Barton Engine to a high-temperature state. This air then generates work by expanding in the Expander, which drives the piston-cylinder which then drives a generator. As the piston moves back in the exhaust stroke, hot air is pushed through the recuperator, which reclaims most of the heat energy, before being cooled to a low-temperature state and compressed. The process then resumes.