ENVIRONMENTAL CLEAN TECHNOLOGIES LIMITED

# ECT commences full feasibility for its headline project

**15 November 2021:** Environmental Clean Technologies Limited (ASX:ECT) ("**ECT**" or "**Company**") is pleased to provide the following update on the progress of the planning and development for its proposed commercial-scale project in Victoria's Latrobe Valley, aimed at delivering a net-zero emission hydrogen refinery.

## Highlights

- Net Zero Emission Hydrogen Refinery feasibility underway
- Refinery targeting material production of hydrogen-rich syngas and char
- Significant government funding initiatives available to support low emission energy technologies

## Net Zero Emission Hydrogen Refinery Hub Project

ECT is developing a ground-breaking new project for deployment in the Latrobe Valley, which will deliver clean hydrogen, agricultural char, and other valuable products with a net-zero emission footprint.

ECT's Coldry technology will form the core of the raw material processing system, acting as the gateway enabler for an integrated operating plant. Coldry provides low-cost, zero-emission dewatering and drying of incoming lignite and biomass streams, which will then be fed into a thermochemical decarbonisation process (partial pyrolysis), creating two major product streams:

1) A hydrogen-rich synthesis gas (syngas), also containing other valuable industrial gases for downstream use, and;
2) A char product containing most of the incoming carbon (in solid form)

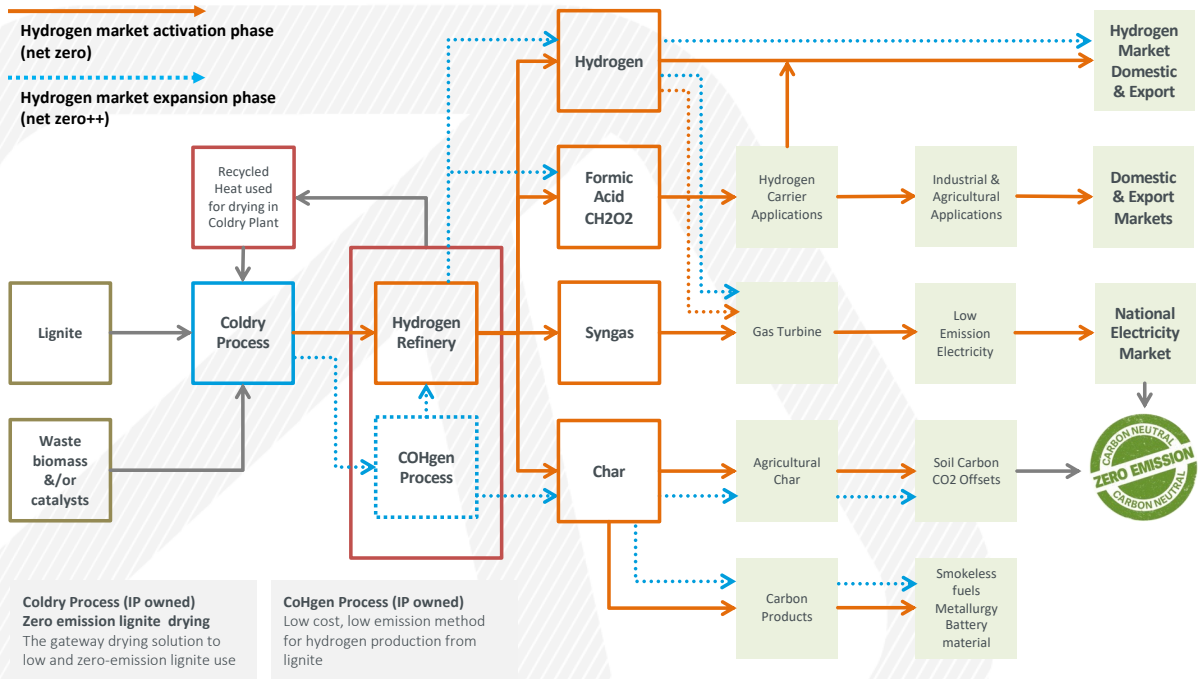


**Diagram (above):** the project involves two phases; Phase 1 entails hydrogen industry activation via an integrated utilisation pathway at scale enabling the manufacture of hydrogen and formic acid. Building upon this foundation, Phase 2 entails hydrogen industry expansion, developing and deploying our proprietary COHgen technology, which represents a significant advancement on conventional hydrogen production methods, featuring 70% lower $CO_2$ emissions.

The hydrogen-rich syngas is then utilised by integrated downstream applications within the project to produce hydrogen, formic acid and generate electricity.

Formic acid is a valuable industrial chemical and serves a range of uses. In particular, it is a form of hydrogen-carrier generated through consumption of $CO_2$ and $H_2$, utilising some of the process $CO_2$ emissions while producing a valuable product. In addition to being a hydrogen carrier, its primary application is as a preservative and antibacterial agent for livestock feed, with Asia being the largest, fastest-growing market.

Under the project's first phase, syngas can be diverted from formic acid production to electricity generation during peak demand periods, providing a low carbon transitional step away from conventional lignite power generation. Subsequent expansion of the project in line with industry activation will further transition from syngas-fired electricity to 100% hydrogen-based electricity.

Upon completion of the initial stage of the project, this will see ECT become Australia's largest producer of agricultural char for soil health and soil $CO_2$ sequestration, and a substantial manufacturer of hydrogen, formic acid and emission-free electricity.

ECT Managing Director Glenn Fozard commented:

> *"We initially commenced scoping for a commercial scale Coldry project back in 2017. At that time, we also started highlighting hydrogen technology development. Energy and climate policy has finally caught up to what we've been saying for several years, and the market is starting to recognise the true potential for our technology suite. The initial feasibility review indicates a strong commercial potential, and as a result, ECT will commence full feasibility for this project to ensure our submissions for Government funding are powerful, compelling and competitive."*

## Significant Government Support

Underpinned by the proposed commercial-scale hydrogen refinery, the Project aims to establish a new regional hydrogen hub, delivering substantial value to the region and significant jobs, training, and research opportunities.

Over recent months, significant funding initiatives have been established across federal and state governments in the form of grant or funding programs to help stimulate technology-driven climate transition and activate nation-wide hydrogen industry development. The proposed Project is aligned with several of these programs, for which ECT is currently preparing submissions, including:

1. **InvestVictoria** – ~$50 million Victorian State Government program providing low-interest R&D funding facilities from $250,000 to $4M secured against future R&D Tax Incentive rebates
2. **Clean Hydrogen Industrial Hubs program** – $462 million Australian Government program to help establish clean hydrogen industrial hub projects via implementation grants of up to $70M
3. **The Low Emissions Technology Commercialisation Fund** - $1 billion Australian Government fund targeting support for technology development via 1:1 investment matching

Regardless of the funding sources, the Project will feature the production and utilisation of hydrogen from waste biomass and Victoria's vast, world-class lignite resource. This Project is designed to support the transition of lignite use away from emissions-intensive electricity generation to a range of low and net-zero emission applications for domestic and export markets, featuring:

- Net-zero emission footprint for the end-to-end process
- Hydrogen for the in-situ production of formic acid
- Synthesis (syngas) gas to produce hydrogen and to power a gas turbine
- Formic acid production for supply to a range of markets

- Agricultural char for soil health, carbon farming and $CO_2$ soil sequestration
- Speciality char products for a range of niche, high-value markets
- Net-zero emission dispatchable electricity, to support peak demand periods via gas turbine and hydrogen fuel cells

## Solving key barriers facing hydrogen industry activation in Victoria

The Project is designed to address challenges and obstacles to hydrogen industry activation in Victoria and the broader establishment of a hydrogen economy, including:

1) **High renewable hydrogen cost**: Renewable hydrogen (made using electricity generated by wind and solar) is unlikely to meet price and volume requirements due to high cost, intermittency, and the demand from electricity consumers as further coal plants are retired
2) **Enabling infrastructure** is required to activate competitive hydrogen production and utilisation within and export from Victoria
3) **Legacy asset constraints:** The extent to which existing gas and other infrastructure can be adapted for future hydrogen use
4) **CCS Cost:** The conventional approach to producing clean hydrogen from lignite, while cheaper than renewable hydrogen, is reliant on costly and complex carbon capture and storage (CCS); and
5) **Biomass supply constraints**: Concerns exist around the total potential volume of clean hydrogen produced purely from biomass due to limited, seasonal supplies. Additionally, there is emerging evidence that questions the "green" status and sustainability of biomass combustion, which represents a potential future legislation risk to emissions standards for this feedstock.

A diversified approach is required to address the renewable hydrogen cost barrier, with 'clean' hydrogen extracted from the state's vast, world-class lignite resource blended with biomass proposed under the Project. This approach will enable the timely development of scalable, affordable hydrogen production capacity, helping activate the industry in Victoria by justifying the deployment of the required infrastructure while solutions to bring down the high cost of renewable hydrogen technology are allowed to develop.

However, conventional hydrogen production methods from lignite emit $CO_2$, requiring significant carbon capture and storage (CCS) to achieve the required low or zero-emission footprint.

The Company's proposed Hydrogen Refinery provides a hydrogen production solution utilising Victoria's vast lignite resource, blended with the available biomass, at a far lower cost than renewable hydrogen. In addition, unlike other methods for deriving clean hydrogen from lignite, the break-through net-zero approach being adopted by the Project does not require CCS and the associated costs.

Additionally, lignite will act as the reliable baseload of process feedstock, allowing for waste biomass utilisation without influencing primary biomass demand. Finally, due to maintaining the credentials of biomass recycling, biomass generated emissions from this Project will be future-proofed against possible legislation changes in this area, through soil $CO_2$ sequestration offsets.

## Eliminating Costly Carbon Capture and Storage (CCS)

Conventional CCS involves the separation of $CO_2$ from the process gas stream, followed by compression, liquefaction, transportation and storage in geologically suitable underground locations. While this conventional approach to CCS is technically well-understood, it is energy-intensive and expensive.

The Project steps outside the conventional CCS approach, adopting a carbon capture and utilisation route that delivers a net-zero emission, revenue-generating alternative via a combination of:

1) $CO_2$ utilisation to produce valuable industrial chemicals
2) In-process capture of solid carbon to manufacture valuable agricultural char
3) Char impacts on soil, enhancing atmospheric absorption of $CO_2$

The char product is ideal for a range of markets and applications, the principal being that of agricultural soil additive or AgChar. This sequesters much of the process carbon and creates improved chemistry and biology within agricultural land that enhances soil productivity and triggers additional absorption of atmospheric $CO_2$. This latter impact potentially takes the Project to a net-negative $CO_2$ footprint. In addition, char process parameters can be tuned to produce an ideal char feedstock for high-value markets, including specialty metals reductant, solid smokeless fuel and battery anodic material, through further downstream processes.

This combination circumvents the need for conventional CCS development and infrastructure, creating a circular outcome whereby 'waste' from syngas production (char) is used to create a secondary product of value for agricultural and other applications.

The Project entails an integrated set of applications that consume the bulk of the available waste energy outputs, recycling that energy back into the gateway Coldry process to create a highly efficient platform for net-zero hydrogen production from lignite and biomass.

## The Project Partners

ECT is currently in discussions with a range of parties to support the various aspects of the Project, including:

- Lignite supply
- Project site
- Power purchase agreement for electricity generated
- Technology partner for formic acid production (see below)
- Offtake partner for AgChar
- Engineering
- Planning & approvals
- Downstream plant
- Project financing
- Other parties will be engaged as the Project proceeds.

**Formic Acid Production Partner**

ECT will partner with GrapheneX to deliver the hydrogen utilisation element of the Project.

GrapheneX is an Australian pioneer in developing innovative manufacturing processes and material technologies capable of powering the fourth industrial revolution. The company is focused on developing technically feasible and commercially viable manufacturing processes for smart materials and digital platforms to enable Industry 4.0. GrapheneX Pty Ltd is also a founding industry partner of the Clayton Hydrogen cluster and plays a key role to test, trial and demonstrate new and emerging hydrogen technologies.

## Timeline

Initial activities around financial and commercial feasibility, site preparation and the commencement of engineering design and development is targeted to commence during H1 of CY2022, with financial investment decision (FID) to follow upon achieving successful feasibility results.

Regular updates will be provided on this Project as activities advance.

This announcement is authorised for release to the ASX by the Board.

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## About ECT

ECT has been developing net-zero emission and hydrogen technologies for over 15 years.

Our solutions aim to transition today's use of resources to tomorrow's zero-emission future, delivering immediate financial and environmental benefits.

We are focused on advancing a portfolio of technologies, which have significant market potential globally

ECT's business plan is currently focusing on two major projects:

1) Zero-Net Emission Coldry Commercial Demonstration at Bacchus Marsh, Victoria, Australia
2) Zero-Net Emission Hydrogen Refinery Project at the Latrobe Valley, Victoria, Australia

## About our Technology Suite

### Coldry

Coldry is the gateway enabler of higher-value applications for waste biomass and lignite.

These streams are a rich source of valuable hydrocarbons. However, they suffer from high moisture content that must be reduced to enable higher-value upgrading and conversion to solid fuels, liquid or gaseous hydrocarbons.

Drying is easy. However, drying efficiently, cost-effectively and with a low emissions footprint has been the challenge. Coldry meets this challenge through a combination of 'substrate densification' and waste heat utilisation, delivering the world's first low temperature, low pressure, low cost, zero $CO_2$ emissions drying process.

### HydroMOR

The HydroMOR process has the potential to revolutionise primary iron making.

HydroMOR is a simple, low cost, low emission, hydrogen-driven technology that enables 'low value' feedstocks to produce primary iron. HydroMOR is the transition solution to a "green steel" future.

### COHgen

The COHgen process has the potential to deliver a lower cost, lower emission method for hydrogen production from lignite and other waste biomass streams.

COHgen is currently advancing through fundamental laboratory development intended to form the basis for a patent application ahead of scale-up and commercialisation.

COHgen aims to decouple hydrogen production from CCS, accelerating the race towards <$2kg production costs, with little to no emissions.

**CDP-WTE**

The catalytic depolymerisation-based waste-to-energy process converts' low-value resources into higher-value diesel and other valuable by-products.

CDP-WTE can be deployed as a standalone solution or integrated with the Coldry process to deliver higher-value, lower-emission energy solutions to lignite resource owners.

**Forward-Looking Statements**

Statements contained in this release, particularly those regarding possible or assumed future performance, revenue, costs, dividends, production levels or rates, prices or potential growth of ECT, are or may be, forward-looking statements. Such statements relate to future events and expectations and, as such, involve known and unknown risks and uncertainties. Therefore, actual results and developments may differ materially from those expressed or implied by these forward-looking statements depending on a variety of factors.