ENVIRONMENTAL CLEAN TECHNOLOGIES LIMITED

All Energy Conference 2011

Delivering least cost CO2 abatement for Victoria

Adam Giles| Wednesday 12th October 2011 | All-Energy Conference

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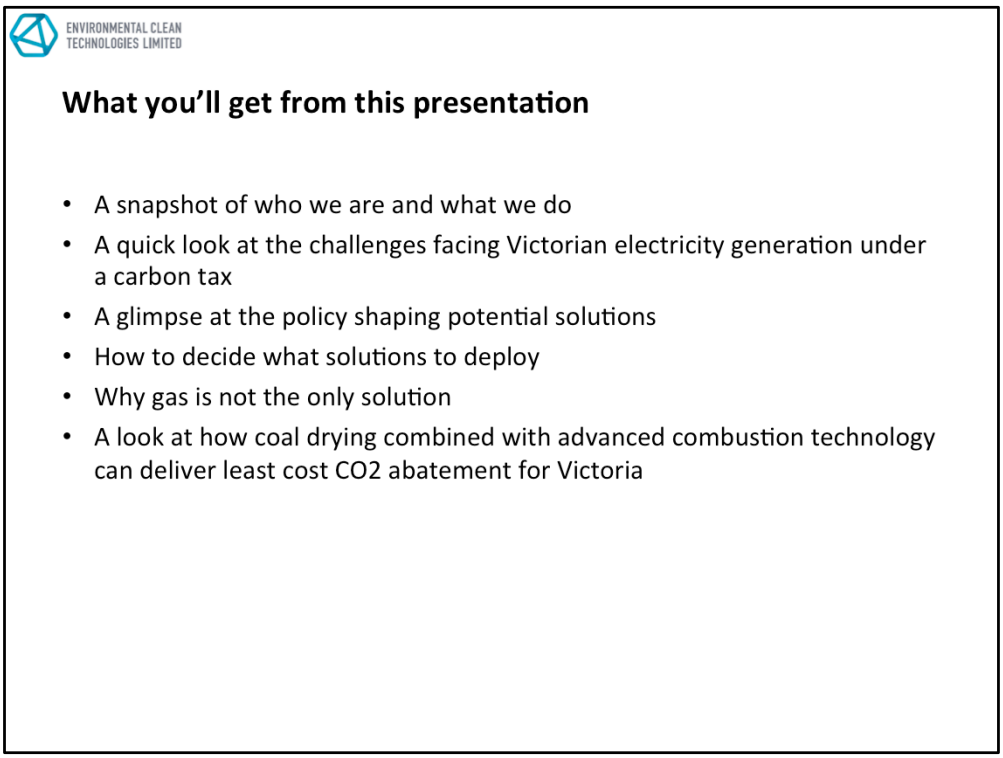
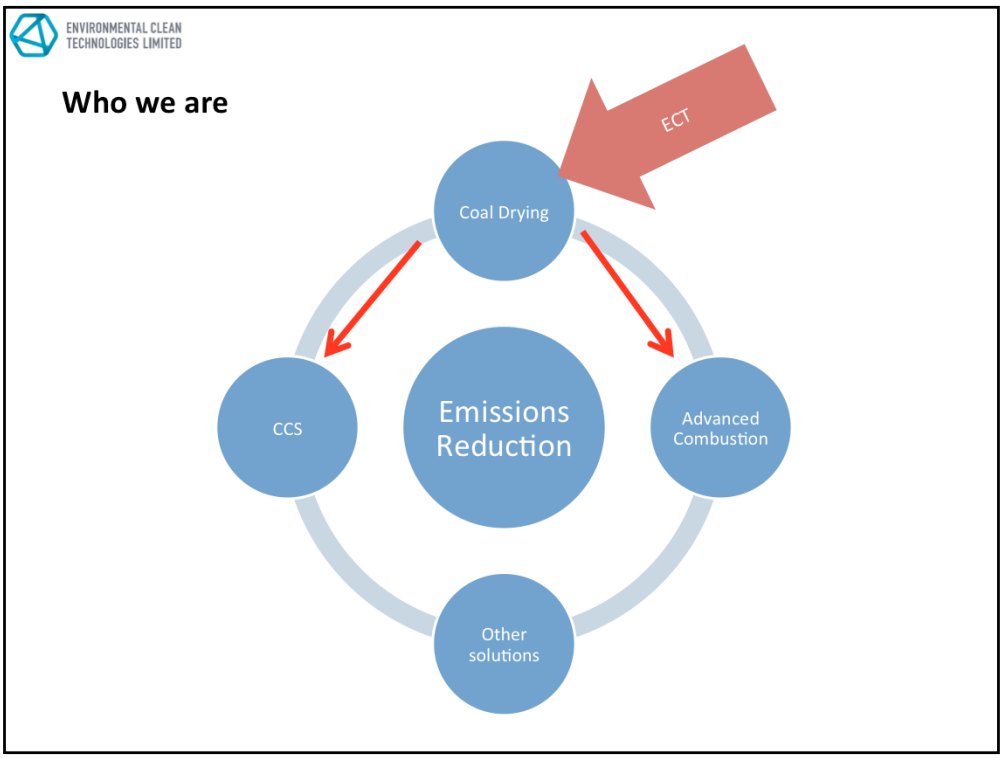


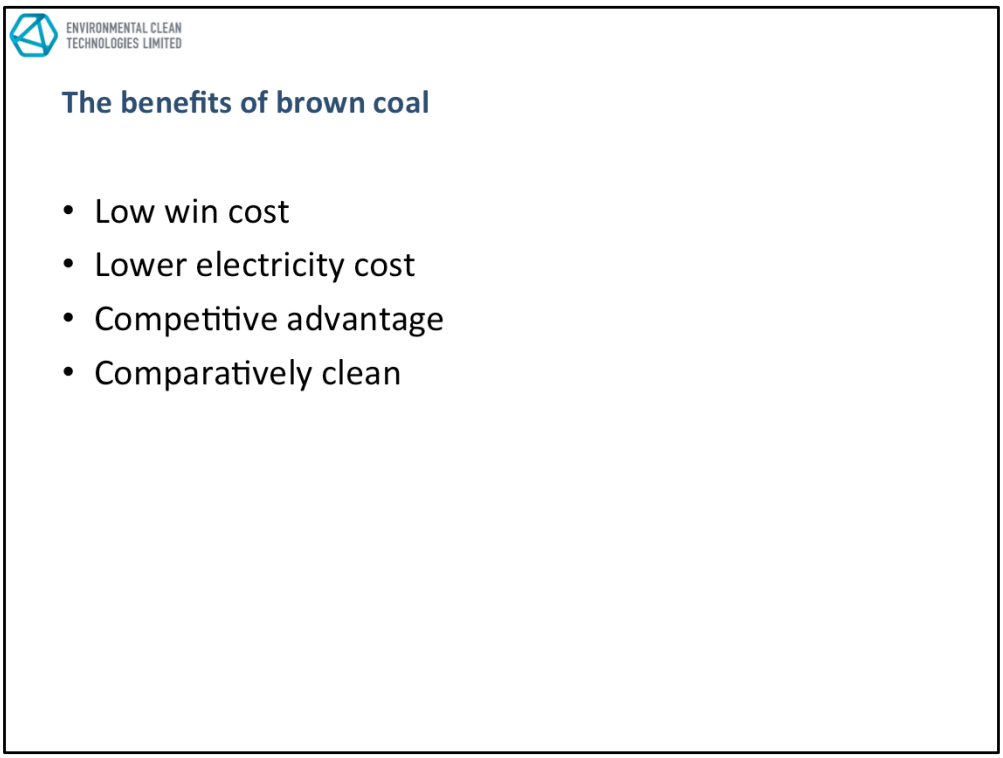
I'm presenting under the conference headline of 'embracing clean energy in government'. But I have to say I think government has done a pretty good job of identifying the challenges in this space. There's been a lot of investment. A lot of activity. And in the context of years of uncertainty around a carbon price, government have nonetheless made considerable advances.

Notably the state target around reducing emissions by 20% by 2020. That's a fair embrace of cleaner energy in our humble opinion.

So I'm not here to tell government they need to embrace cleaner energy. They know it. They're doing it. They're planning for more of it. We are here to shine a light on governments promise, both at State and Federal levels, to deliver least cost abatement in achieving emissions reduction targets to ensure the state, and its people arent unnecessarily burdened by the cost of acting to reduce emissions.

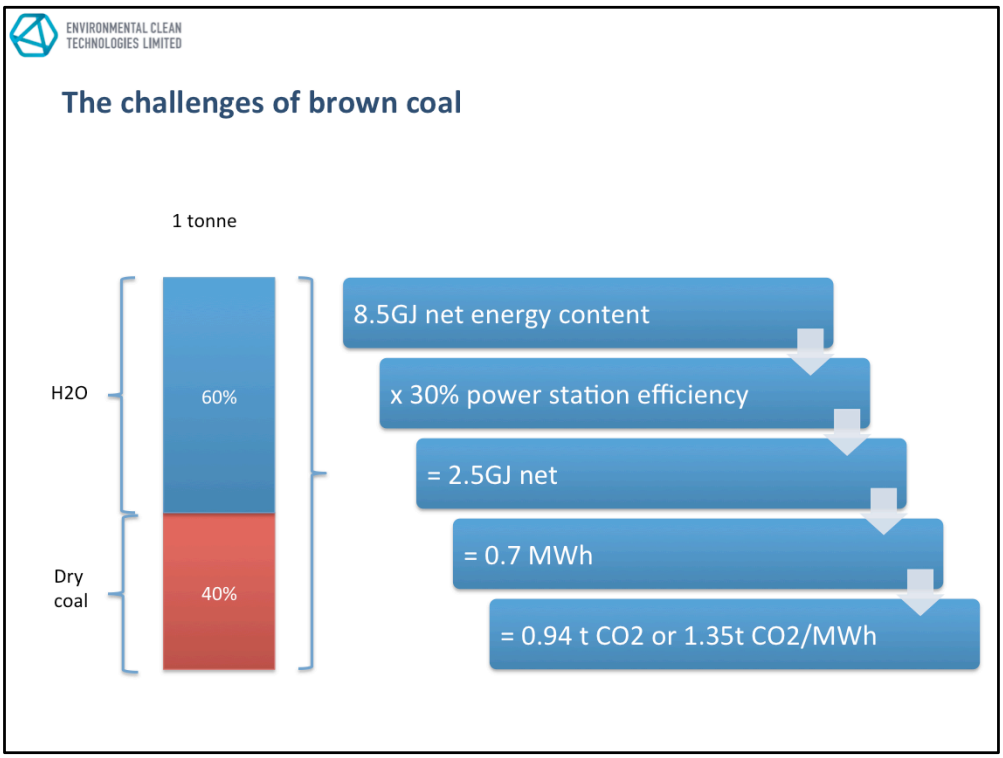


- ECT is a technology commercialisation company. We, along with many other companies, seek to develop solutions that contribute to a fuller emissions reduction strategy.
- Our focus is on the coal drying piece of the puzzle, but our technology also enables advanced combustion solutions and provides a complimentary pre-combustion strategy to CCS technology. Basically making CCS cheaper.
- I'll touch more on our coal drying technology shortly. But lets first take a brief look at the benefits and challenges facing Victoria's power generation sector.

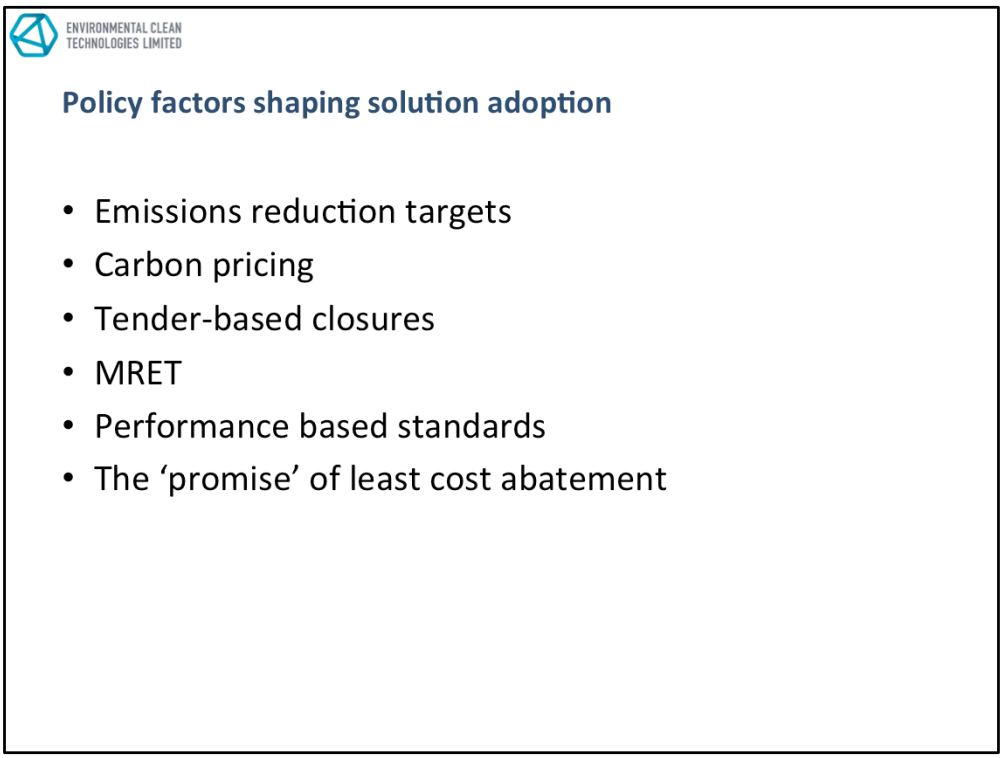


These have been done to death so I'll be quick:

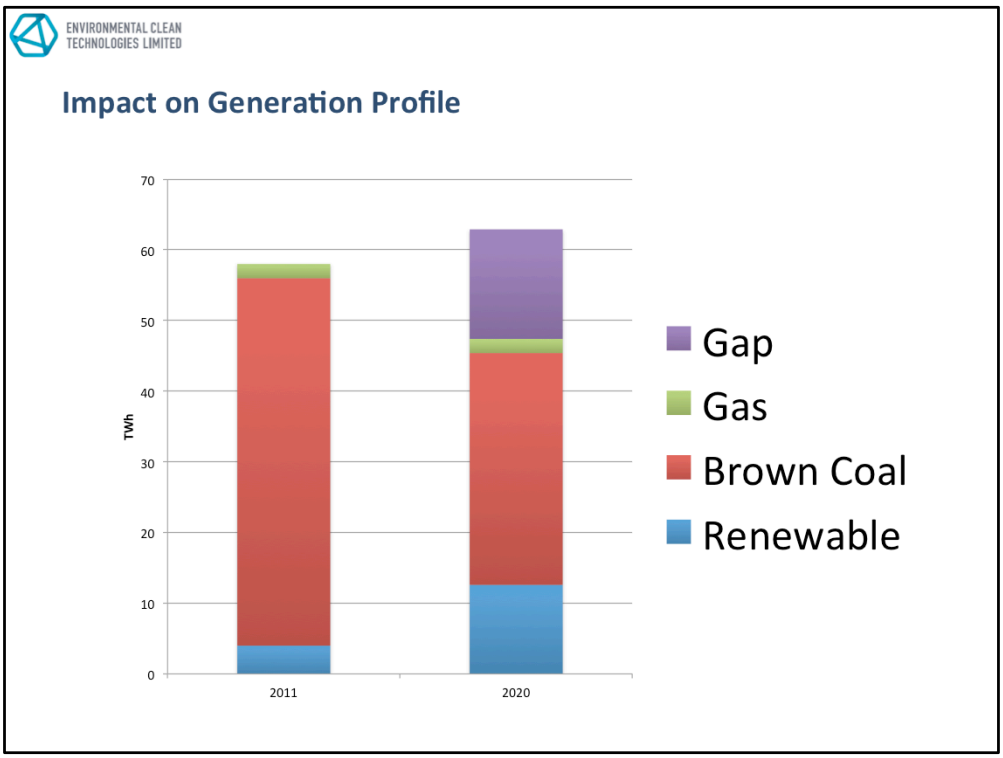
- Low win cost - Cheap due to open cut mining and abundance
- Lower electricity cost - Historically cheaper electricity prices than other states
- Competitive advantage - Cheaper electricity attracts energy intensive industries and creates jobs
- Comparatively clean – compared to other coals, Victorian lignite is Very low in trace elements making it one of the cleanest coals in the world – low SOx, NOx and mercury to name a few



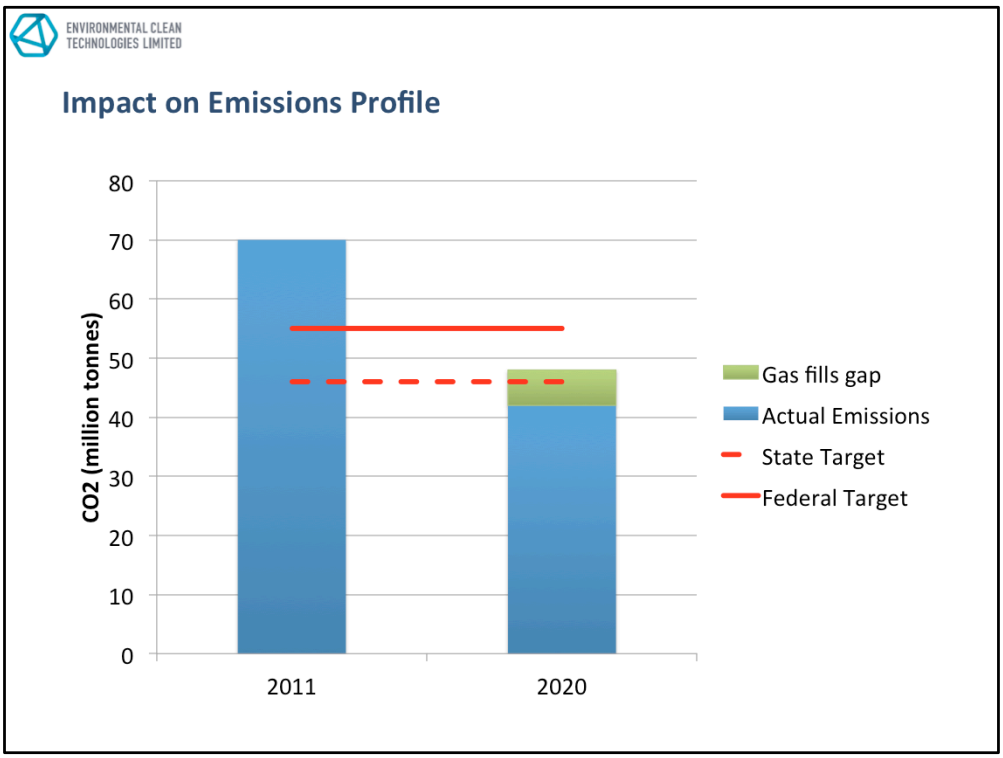
- However the single biggest challenge facing brown coal use, in a carbon constrained world, is its water content.
- I think it's important to understand why this is the single largest issue:
    - Brown coal is 60% water. This water draws energy away from the coal as it combusts, causing it to evaporate.
    - Of the remaining energy, around 2//3 of that is lost through power station inefficiencies, leaving only a fraction of the original energy in the coal to actually produce electrons.
    - The ratio of coal in versus MW out is inefficient, leading to a CO2 intensity of around 1.35 tonnes per MWh.
    - Most people understand the concept around assessment of losses; pareto analysis dictates we should focus on the area of most potential improvement to get bang for buck.
    - With this in mind lets take a look at how policy factors shape the type of solutions we need.



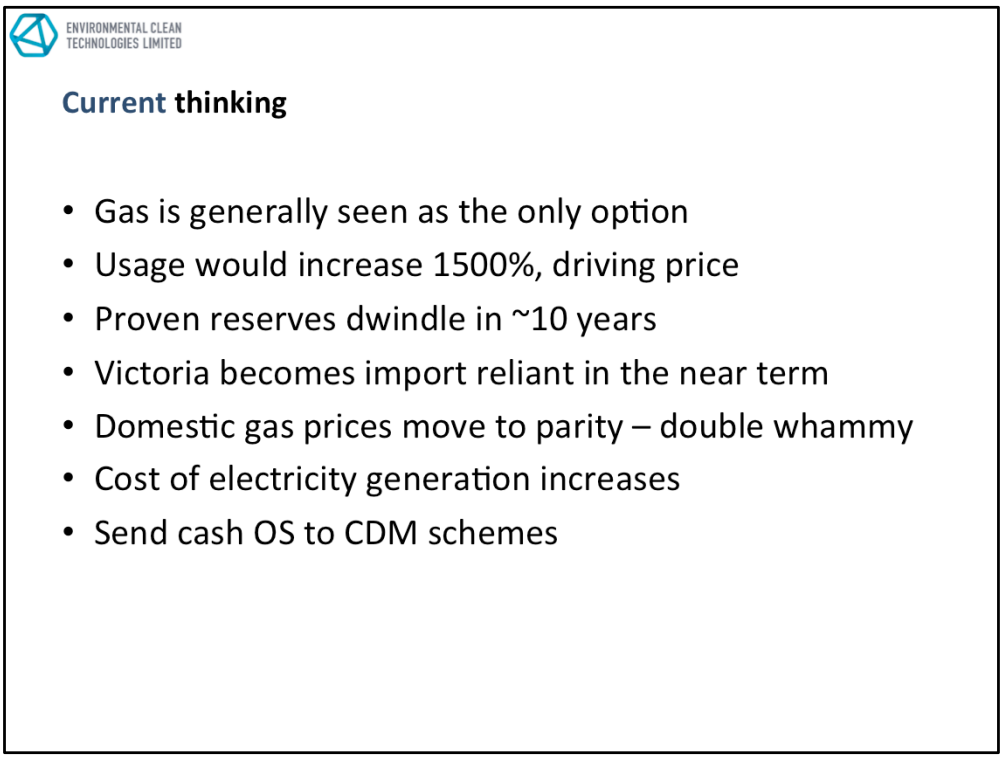
- Emissions reductions targets, including the 5% Federal target and 20% State target, draw the line in the sand.
- Carbon pricing, at $23 a tonne, sends a price signal, but apparently not a strong enough signal to make generators switch, so there's also a tender based process as part of the Federal Governments package to force the closure of 2000MW of the most CO2 intensive generators. While this may allow a degree of orderliness and predictability, it also creates a supply gap for Victoria. We need to make up around 1800MW, which by 2020 will account for about 21% of our generation needs…. Around 13 to 14 TWh.
- To fill that void we look first at the RET. The RET requires 20% of our electricity to come from renewables by 2020. It just so happens that's around 13TWh. So clearly, most of the void created by forced closures is filled by renewables under the ret scheme. Mostly wind. Some solar. Whatever the mix, at its current contribution of 4TWh, renewables will need to triple their output by 2020.
- That closure of 1800MW will leave a gap to be filled, considering our consumption is projected to grow by around another 4TWh a year, requiring an additional 550MW of capacity or there abouts.
- If we're looking to deploy new power generation assets there are performance based standards that must be met, with the key being any new coal based stations must emit less than 0.8t CO2 per MWh.
- Further guiding these policies is the 'promise' of least cost abatement.



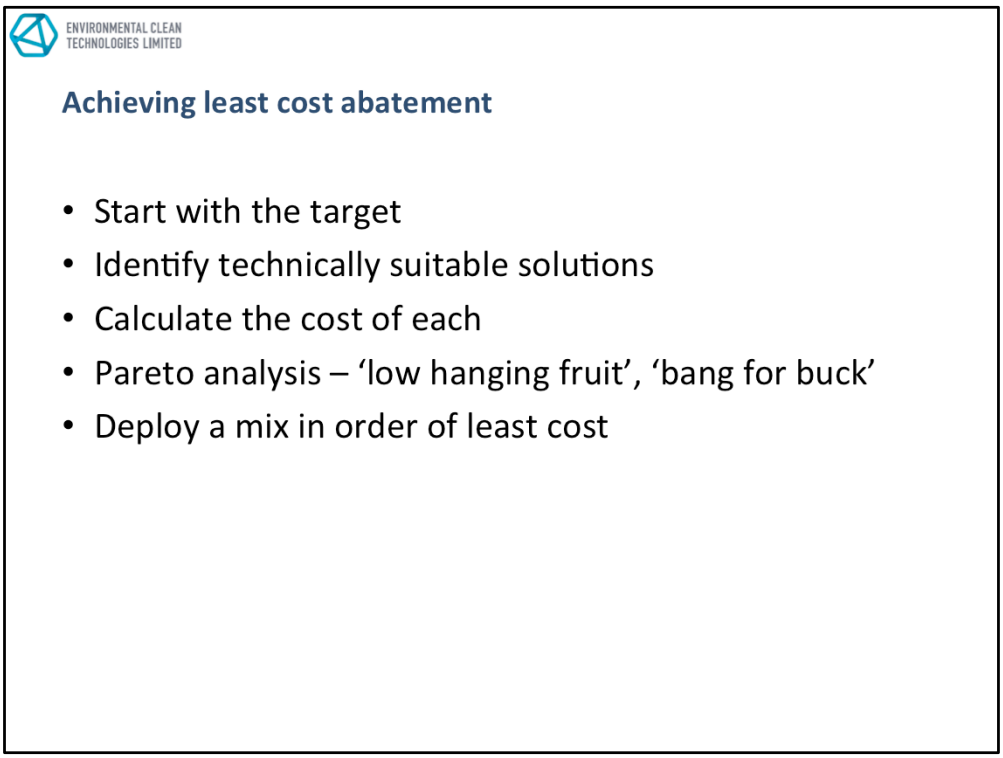
- The generation mix in the first column is todays profile
- If we close 1800MW of brown coal and meet RET of 20% by 2020, then the generation mix will look something like the right column
- In the right column we've kept gas the same to highlight the gap in generation capacity that needs to be filled (purple)



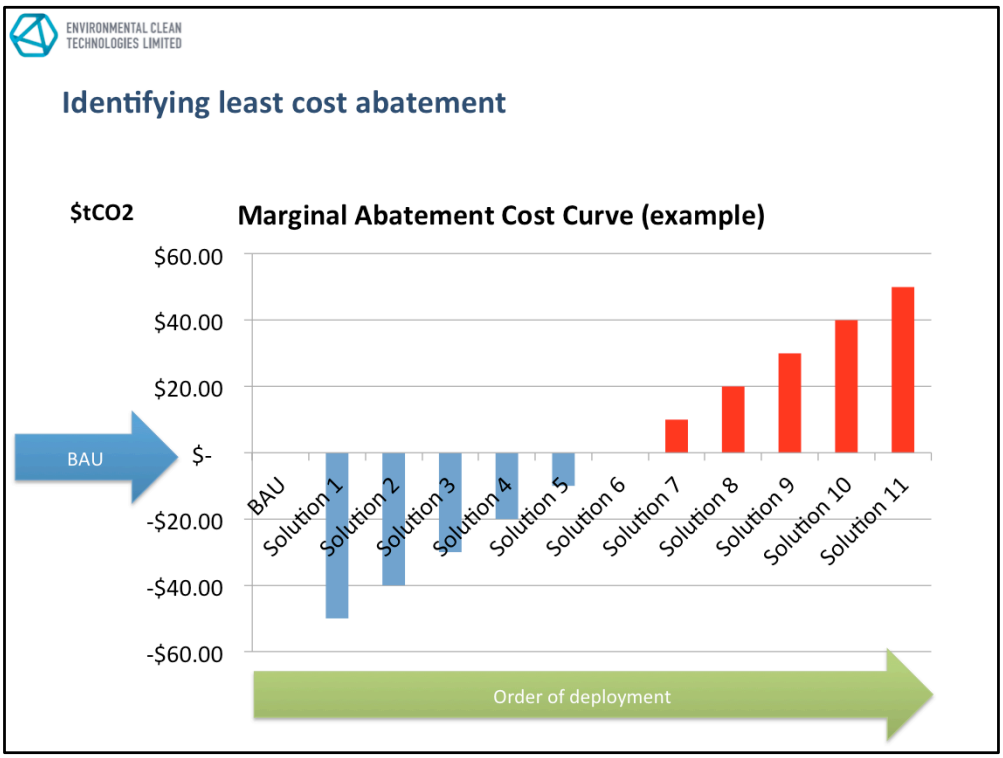
- The emissions total in the first column is todays profile, around 70 million tonnes a year
- If we close 1800MW of brown coal and meet the renewable energy target (RET) of 20% by 2020, then the emissions will drop to around 42Mtpa. However we need to fill the electricity generation gap identified on the previous slide
- If we fill the gap with increased gas capacity, emissions will total around 48mtpa. Well within the federal target of 55mtpa (representing the 5% reduction on 2000 emissions)
- However the state target of reducing emissions to 46mtpa is not achieved
- Now, these few slides have shown what policy can do to drive action. It shows that technically, we can achieve the federal target, and with a bit more action we can achieve the state target
- But this leads us to the current thinking on how best to fill the gap left by forced closure and growing consumption… and still achieve the promise of least cost abatement



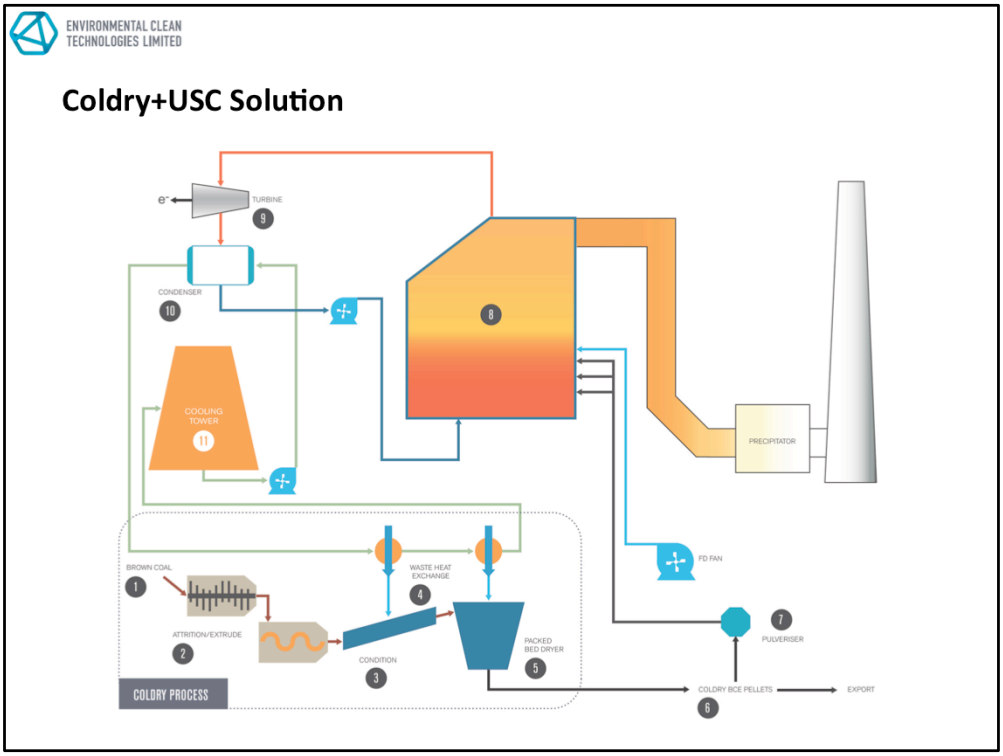
- Gas is generally seen as the only viable option to fill the gap between the 20% RET and the void left by shutting down enough brown coal to meet targets?
- The implication is that this results in a significant increase in demand, with resulting flow on to available supply, infrastructure and cost for competing demand points (i.e. domestic consumption, industrial consumption)
- What will the projected 1500% increase in demand mean to Victoria's gas reserves and domestic gas prices? Our reserves are projected to last 30 to 50 years at current consumption. Under a gas-led scenario our domestic gas dwindles in around a decade.
- What impact will parity pricing have on cost per MWh? If Victoria pays the same as every other State to generate it's electricity, what becomes of our historic competitive advantage and ability to keep energy intensive manufacturers in our State?
- And then there is the choice to meet targets by sending cash overseas to CDM (Clean Development Mechanism) schemes. The idea being this makes meeting our targets cheaper. Federal Treasury modeling says $3Bn a year will be sent overseas to such schemes. We think real, cost effective reductions can be achieved in our own back yard. Would it be more productive spent here?
- By drying the coal effectively and efficiently, were solving the single biggest driver of emissions intensity. And if we replace existing brown coal power stations with advanced coal fired technology such as USC or IGCC, that emit less than .8t per MWH and are CCS ready, we can keep the solution cost effective and local
- Victoria is lucky in that it can choose to meet its targets as either a gas importer, or it can better utilise its world-class lignite resource
- But how do you decide whether gas or advanced coal is the way to go?



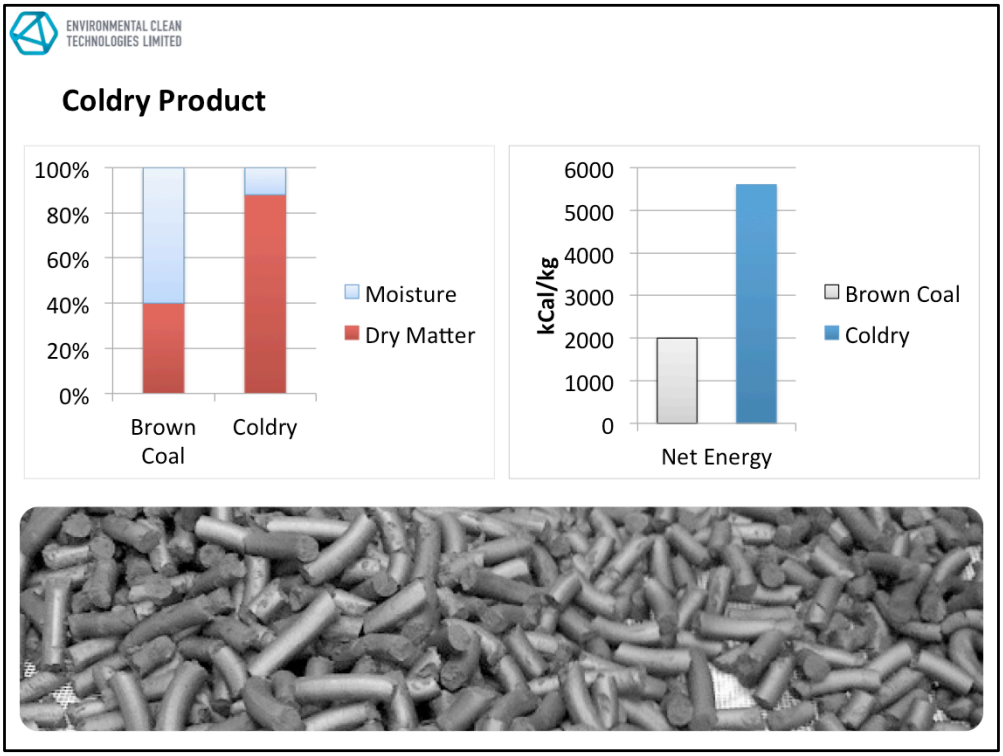
- How do we begin to achieve least cost abatement given the policy environment?
- Simply, we start with the target - the desired end result - and work back from there
- Firstly, we carve out 20% for the RET quota – set that chunk of emissions aside, because it's taken care of… locked in regardless of what other solutions we deploy
- Then we identify how much CO2 we need to eliminate from the power generation sector by 2020, 2025 to meet our targets
- Next we identify the suite of solutions that can technically deliver on the target whilst meeting the performance-based criteria of <0.8t Co2/MWh
- Then we identify the marginal abatement cost of the technologies versus business-as-usual (BAU),
- Using various analysis tools, we identify least cost solutions that also deliver significant reductions
- Finally, the market should implement the solutions in order of least cost abatement to ensure unnecessarily expensive measures dont disadvantage the state and households



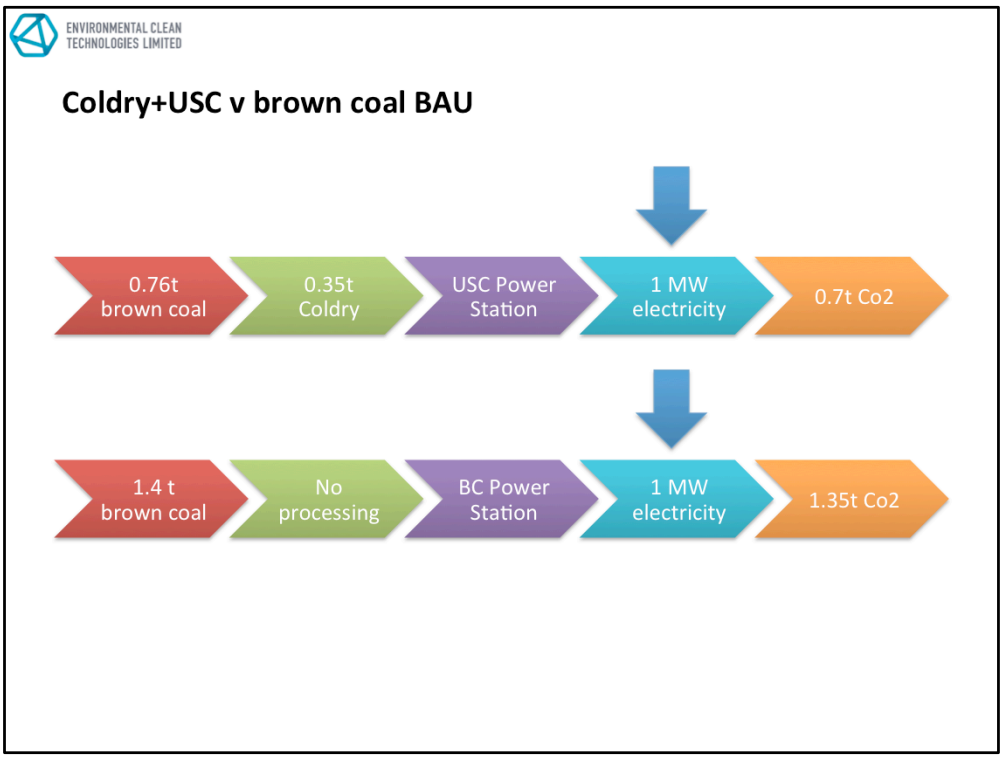
- This sample chart illustrates what a marginal abatement cost curve could look like.
- By calibrating the marginal cost against BAU - in this case brown coal power generation with a carbon price - we identify least cost options
- Which brings me to a look at how our own Coldry+USC (ultra supercritical) solution may work…



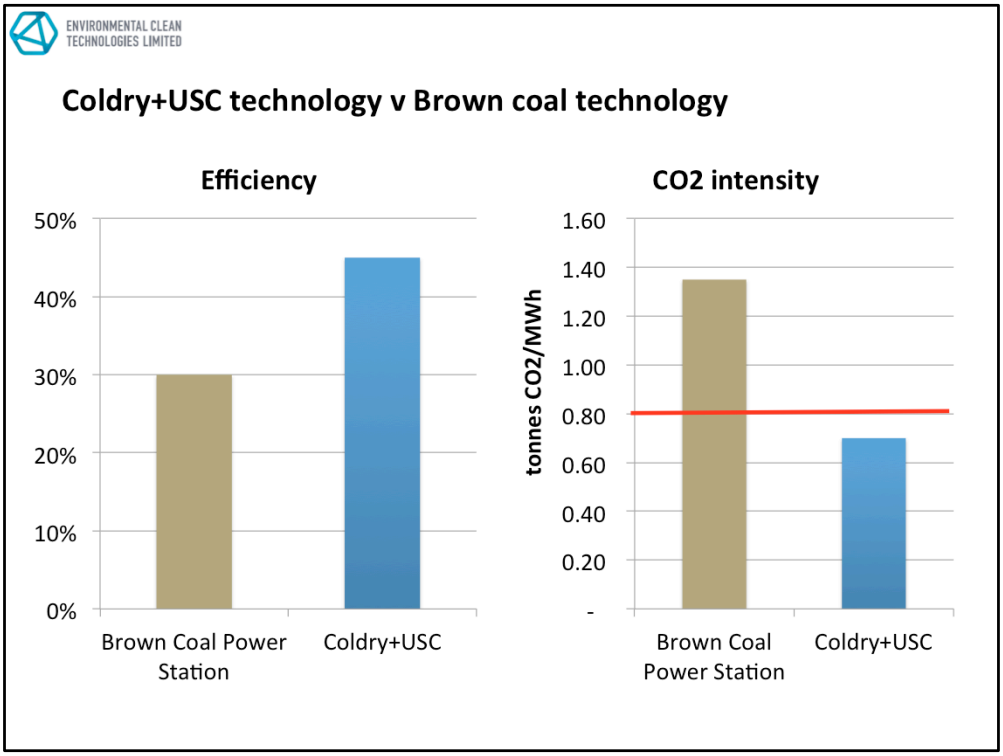
- We at ECT have developed a simple approach that targets the very heart of the issue identified at the beginning of this presentation – wet brown coal is inefficient, leading to high CO2 intensity
- We've developed a cost effective drying solution that is currently approaching commercial demonstration and large-scale deployment, with our design for tender about to kick off
- By drying the brown coal we allow it to be used in proven, high-efficency power stations such as ultra supercritical or USC and even higher efficiency IGCC plant achieving emissions of less than .8t CO2 per MWh



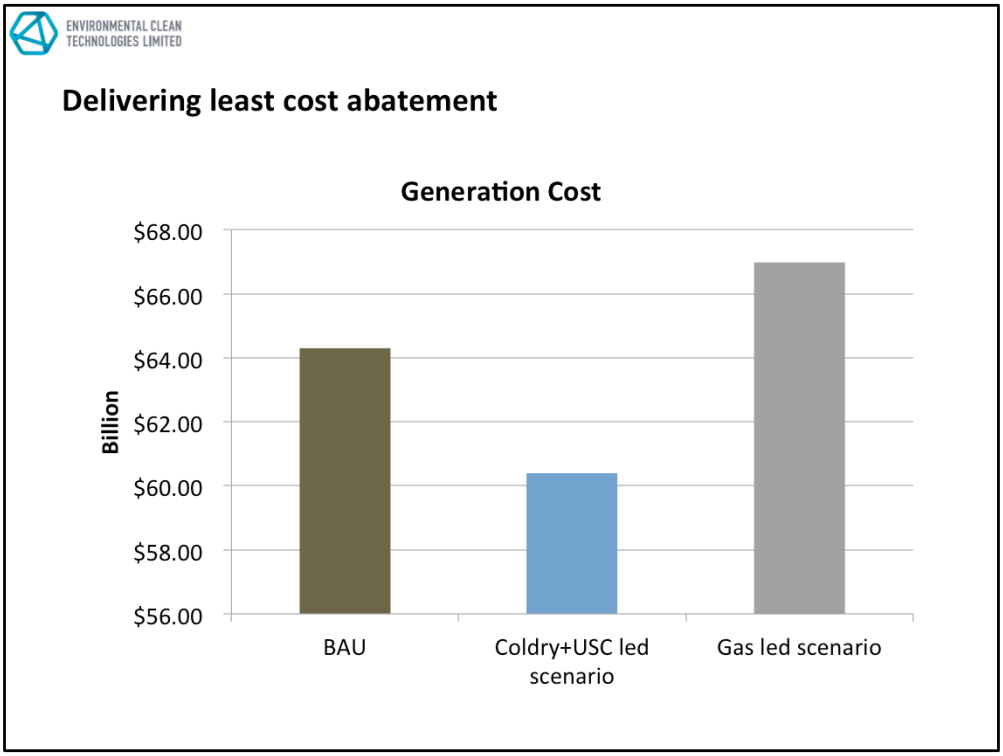
- How is this achieved?
- By drying the coal we solve the single biggest factor in our emissions intensity - water content. And we enable the solution to the second leading cause of emissions intensity – combustion efficiency - by opening the door to the deployment of advanced combustion generation (USC & IGCC).



- If we compare the difference between the Coldry+USC solution and business-as-usual, its clear how dry coal and high efficiency combustion drags down the CO2 intensity
- To produce 1MW of electricity BAU requires 1.4tonnes of coal and emits around 1.35 tonnes of CO2
- The Coldry-USC solution requires almost half as much brown coal and emits 0.7t of CO2

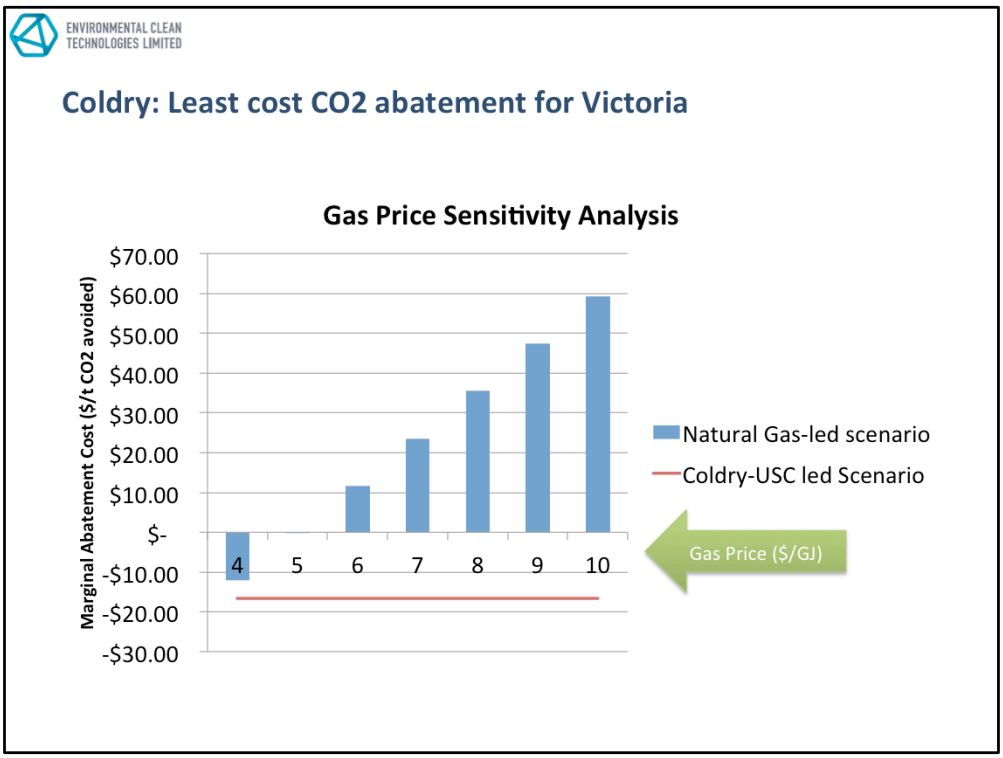


- Why is it lower emission?
- Because traditional brown coal power stations are around 30% efficient. USC is upwards of 45%.
- This translates to a significant emission reduction compared to BAU.
- But how does it fare in cost terms against gas? Lets take a look…

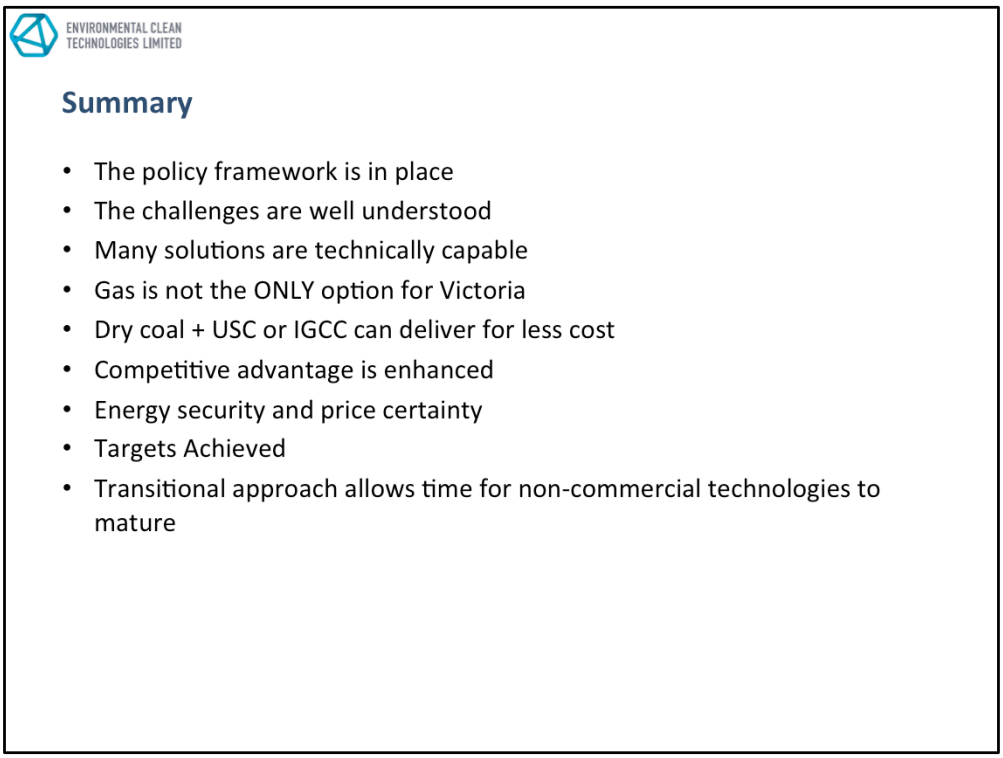


- After mapping out the three scenarios; business-as-usual, the Coldry+USC led scenario and the gas-led scenario, between now and 2025, we came up with a very interesting snapshot.
- This chart shows what could happen to the cost of generation if we do nothing, versus deploying gas or a dry coal plus advanced generation solution
- The two right columns deliver the targets locally. The left column, business-as-usual, just pays the carbon price, potentially sending cash overseas to import carbon credits.
- Note here that we've pegged the gas price at only $6 a GJ, increasing by inflation. We've used ACIL Tasman and Treasury modeling to pull together the costs. It gives a snap shot of total system generation cost out to 2025, including the carbon tax, capex and opex.
- A Coldry+USC scenario could save $4 to $6 billion out to 2025.
- The Coldry-USC led solution also has the added benefit over gas of not stranding our lignite asset (which I might add contains 4 and a half times the energy of the north west shelf). It doesnt drive domestic gas prices through the roof, doesn't risk energy security, or sending cash overseas to buy credits from schemes that may or may not deliver real reductions.

[Note: A more detailed paper will be released shortly showing the analysis behind the above snap shot]



- In the last slide I highlighted that gas was pegged at $6. We think this is very conservative as commentators are saying that deploying only gas to meet our targets exposes the state to parity pricing.
- This chart shows the abatement cost per tonne of CO2 for a Coldry+USC solution (red line) compared to BAU – zero line – and gas.
- The abatement cost is highly sensitive to increases in gas price. Roughly for every dollar increase in gas price, the cost per tonne of CO2 saved increases ten-fold, in a gas-led scenario.
- As we can see when the gas price exceeds $5 per GJ, its cheaper to keep burning brown coal and just pay the tax, than it is to switch.
- Whereas a dry coal plus advanced combustion approach is not impacted by gas price volatility.



- So, to summarise, the policy framework is in place both at State and Federal level.
- The challenges around Victorian lignite are well understood.
- There are a bunch of stakeholders surrounding the problem with innovative solutions
- While gas is part of the mix, it's by no means the only option
- DPI have flagged the potential key role dry coal and advanced combustion can play
- By using our coal better, we retain some competitive advantage, energy independence and security and price certainty
- We achieve targets and do so while meeting the promise to deliver least cost abatement
- Lastly, we create a transitional foundation which allows time for higher cost renewables and CCS to mature and organically merge with our existing energy mix

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Thank you

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