US offers lessons for local coal future

By Philip Hopkins
1 Mar 2018, midnight

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The American state of North Dakota has vast brown coal (lignite) reserves that produce all its energy, and is "kicking goals" as it cuts carbon dioxide levels and produces new products from the coal.

That was the message from visiting American expert Mike Holmes to the brown coal products seminar at Federation University recently.

Mr Holmes is vice president of research and development at the Lignite Energy Council, a trade association of more than 250 members, including all major users of lignite in the northern half of the USA and Canada.

North Dakota, which is about three-quarters the size of Victoria, has 750,000 residents.

The state contains about 350 billion tonnes of lignite, the single largest deposit of lignite in the world, including about 25 billion tonnes of economically mineable coal – enough to last for more than 800 years at the present consumption rate of about 32 million tonnes per year.

Seven plants, including one that produces heat and power, generate about 4000 megawatts of electricity.

Mr Holmes said priorities were to work with industry to develop a research and development roadmap and 'new' lignite technology for clean, efficient, low-cost reliable power with a reduced carbon footprint.

"That means enhanced performance of existing assets, carbon capture on those units, invest in next generation transformational technology - carbon and capture for the next generation power, and focus on the complete cycle of carbon capture, storage and utilisation," he said.

Past successes included cutting pollutants by 70 per cent between 1970 and 2014 in a period when US gross domestic product went up by 250 per cent and energy use by 150 per cent.

"Coal-fired power did more than their share of that, more than transport," he said.

Mr Holmes said the main focus in the past decade had been on carbon management.

North Dakota had a huge CO2 carbon capture storage capacity of 23-78 billion tonnes, three-to-four kilometres deep, in geological formations and old oil reservoirs.

"That's far more than the CO2 we need to be stored," he said.

Mr Holmes said a feasibility study was under way for Project Tundra which combined carbon capture from a 500 MW plant.

The CO_2 would be used as a commodity with added value – "a stepping stone to help the economics of carbon capture and storage".

There was a suite of different projects, including "Next Generation Power", where carbon capture would be part of the project where coal would be used in a direct-fired super critical power station with much higher thermal efficiency.

Mr Holmes said polygeneration – an inter-related energy complex – integrated baseload power with upstream gasification and solid feed stock. This made the chemical building blocks from which it was possible to produce methanol, gasoline, jet fuel and natural gas.

The Great Plains Synfuels Plant had been successfully producing natural gas from coal since 1984.

By-products included two million tonnes of CO_2 a year that was piped more than 320 kilometres to Saskatchewan in Canada and used in enhanced oil recovery.

"A new system will take advantage of technology advancements and separate out hydrogen," he said.

Mr Holmes said with low natural gas prices, the synfuels plant had added to the revenue stream with other co-products. These included fertilisers such as ammonia and ammonia sulphate, liquid nitrogen, phenol – used in household cleaners and disinfectant – and carbon dioxide.

"There is a big market in the sale of CO_2. Over half of the annual revenue for the past two years has been from the co-products," he said, with the latest addition a urea plant.

Urea could be stored for two months and was easy to transport by rail and truck.

Mr Holmes said other value-added carbon-based products were char for barbecuing – "a small community in North Dakota may install an activated carbon facility"; carbon black, used in tyre production, was being researched in North Dakota; and carbon fibre - a low weight, high strength material with many applications.

There was also hydrocarbon production from direct coal liquefaction, but technology improvements were needed.

"I think liquefaction is going to come back," he said.

Mr Holmes said a North Dakota Geological Survey had concluded that rare earth elements – often termed "chemical vitamins" – could be easily extracted from local lignite.

Several funded projects were investigating recovering these high-value materials that could be used in batteries, magnets, computers, electronics, automobiles – "a suite of different things we have come to rely on".

The US imported all its rare elements from China whose supply was declining.

This was likely to push up prices and opportunities from getting the elements from ND lignite, he said.

Mr Holmes said agriculture was already benefiting from lignite.