

LEGISLATIVE COUNCIL
Question Without Notice

Wednesday, 12 June 2019

C634. Hon Robin Scott to the Minister for Regional Development

Following the Minister's answer to Question C612 on 11 June 2019 stating that hydrogen can be produced using wind or solar PV for \$11 per kilogram, I ask the Minister to confirm that at current prices not including excise or GST:

1. The cost of 100 megajoules of energy in hydrogen is approximately \$9.17?
2. The cost of 100 megajoules of energy in diesel is approximately \$2.52?
3. The cost of 100 megajoules of energy in petrol is approximately \$2.01?
4. The cost of 100 megajoules of energy in coal is approximately \$0.34?

Answer

(1)-(4)

Typically the energy cost of fuels is compared on a \$/Gigajoule basis. The Department of Primary Industries and Regional Development advises that the costs you have quoted are roughly correct - except for petrol which is approximately \$31/GJ before excise and GST (or \$3.10 by your measure).

A more important metric for transport fuels is the cost per km. For example, the COAG Energy Council's 2018 briefing paper, Hydrogen for Australia's future states:

A petrol car using 8 litres per 100 km at A\$1.40 per litre costs 11.2 cents per km. A hydrogen car using 1 kg hydrogen per 100 km at A\$11 per kg costs 11 cents per km

This is because a hydrogen fuel cell car has a significantly higher energy efficiency than a car with an internal combustion engine.

In any event, while renewable hydrogen is currently generally more expensive than fossil fuel, those costs are coming down rapidly and the real benefits are the reduction in greenhouse gases and this is what our trading partners are chasing.

OR

Hydrogen and Mines

The opportunities and applications for mining

June 18, Westin Perth

Organized by Energy and Mines

Co-located with Energy and Mines Australia Summit, June 19-20

Commercialization of hydrogen technologies and hydrogen infrastructure development initiatives are rapidly gaining momentum in Australia. Hydrogen offers the mining sector a range of solutions to address energy and carbon goals including as a zero-emissions fuel for heavy haulage equipment and machinery; as a means of firming renewable electricity and providing back-up power generation, and as a source of high-grade heat for mineral processing.

Beyond direct energy applications, hydrogen derivatives, such as ammonia can be used to localize supply chains for explosives and chemicals used in mining operations and mineral processing, further strengthening the value chain for mineral extraction and processing. Adoption of these technologies for the mining sector requires a co-ordinated approach to address challenges such as infrastructure, costs, safety standards, and pilot projects.

Hydrogen and Mines will provide a timely opportunity for senior mining leaders to meet, explore and understand the opportunities and challenges for the introduction of hydrogen across mining's value chain. Organized by Energy and Mines, the global leader in content and events on renewables for mines, the event will address key questions for the mining sector around the timescale, commercialization, economics and real-world applications of hydrogen for mines, and runs as part of the 3rd annual Energy and Mines Australia Summit, June 19-20. Key topics include:

- Mining applications including fuel substitution, renewables integration and power supply
- Technology updates, pilot projects and commercialization outlook
- The economics and business fundamentals of hydrogen for mines
- Insight on codes, standards, safety, training and capacity-building
- Exploring the value-added benefits: hydrogen for processing applications
- Plus the official launch of a new International Energy Agency program - "Hydrogen Applications in the Mining and Resources Sector"

8:20 Welcome

Adrienne Baker, Director, Energy and Mines

8:25 Chair's Opening Remarks

8:30 Opening Keynote:

Hon. Alannah MacTiernan MLC, Minister for Regional Development; Agriculture and Food; Government of Western Australia

8:50 Unlocking Australia's Hydrogen Potential

- **Fortescue Metals Group (FMG)** is investing \$19.1 million to partner with CSIRO to unlock hydrogen's potential as a fuel-source and export industry in Australia

Bethwyn Cowcher, Legal Manager for Energy and Power, Fortescue Metals Group

11:10: Panel: Decarbonizing Mine Transport: Key Developments in Hydrogen for Heavy-Duty Fleets

- What are the main barriers for hydrogen for heavy-duty fleet applications - infrastructure, economics, safety standards, vehicle conversion?
- How are mines currently testing or assessing hydrogen to power transport and equipment?
- How are fuel and equipment suppliers approaching hydrogen for mining vehicles and trains?
- How does hydrogen fit (or not) with current OEM business and contract models?
- What lessons have been learned in testing hydrogen to power heavy haulage trucks and trains?
- What solutions are being considered to ensure safe and economical delivery of hydrogen for underground vehicles?
- What factors need to be present to support the business case for hydrogen-fueled mobile fleets?
- Experts views on the timescale for commercializing hydrogen-powered mine vehicles and trains?

Gerard de Fleurieu, Vice-President Zero-Emission Mobility, Michelin

Mikio Kizaki, Chief Professional Engineer, Toyota Motor Corporation

Victor López, Innovation Manager, Codelco

Daniel Chen Wang, Vice Director of Business Development, Weichai Power Co

11:50 Audience Q&A

12:00 Networking Lunch

Session 2: Integrating Hydrogen into Mining Power Systems

Affordable hydrogen could address the primary barrier to sustainable energy for mining by delivering an emissions-free alternative to diesel or gas back-up. With this in mind, mines and other heavy industrial sectors are exploring hydrogen integration with wind and solar energy. This session will offer critical insight on the latest developments, test sites, business models, hurdles and milestones for hydrogen integration into remote mining power systems.

1:00 Case Study: Hydrogen for a Mining Microgrid in Canada's North

Glencore's Raglan mine is the world's first mining microgrid to incorporate hydrogen storage

- Performance results from hydrogen alongside wind and lithium ion and flywheel storage
- Lessons learned from implementing and operating hydrogen in an extreme climate
- Benefits and drawbacks from hydrogen versus other storage options in a mining microgrid

Jean-Francois Veret, Director, Capital Projects and Exploration, Glencore

1:20 Case Study: Opportunities and Challenges of Integrating Hydrogen into a Mining Hybrid

- Key attributes including energy costs and mine life that support hydrogen's business case
- Insight on the financial modelling: what is the expected value of converting excess renewable energy into hydrogen fuel?
- What are the main challenges - economic, technical, cultural - that need to be overcome?

1:40 Panel Discussion: Integrating Hydrogen into Mining Power Systems

- What are the main considerations for mines when assessing on-site hydrogen production?
- How much energy spillage from renewables is needed to make hydrogen production economic?
- How can hydrogen work with other storage technologies to meet mining's energy demands?
- What are the main barriers to integrating this technology for mining power systems?

Hydrogen derivatives, such as ammonia can be used to localize supply chains for explosives and chemicals used in mining operations and mineral processing, further strengthening the value chain for mineral extraction and processing. This discussion will examine the value-added benefits of hydrogen derivatives in mining operations and mineral processing.

- How can hydrogen address processing challenges for mines?
- What are the key benefits of introducing hydrogen, ammonia, and derivatives for processing application (heat processing, leaching, etc.)?
- What are the current challenges of integrating these hydrogen derivatives into minerals processing applications?
- What examples are there of pilot projects in operation and under development for mining companies?
- What lessons can be learned from this application for other industrial sectors?
- What are the next steps for integrating hydrogen into mining and mineral processing?

Chair: **Miranda Taylor**, CEO, National Energy and Resources Australia (NERA)

Gus Nathan, Director, Centre for Energy Technology, University of Adelaide

Kevin Eggers, Partner, AP Ventures

4:30 Audience Q&A

4:40 Session 4: Interactive Discussion: Industry Response and Next Steps for Hydrogen and Mines

Following a full-day of expert insights, this interactive discussion will ask audience members for their perspectives and observations on hydrogen applications for the local resource sector and next steps.

- How can the domestic resource sector maximize this opportunity for integrating hydrogen into energy, transport and processing applications?
- What is preventing mines from testing hydrogen applications today?
- What are the deployment timelines for operational projects and business models for mines to draw from?
- What needs to happen to drive uptake for mining applications in Australia?
- Hydrogen and decarbonizing mining: what are the advantages and disadvantages of hydrogen as a means of decarbonizing mine transport and power systems?
- What will mines be watching for in terms of key milestones for mining applications?
- How can mines position themselves to benefit from the current enthusiasm for building Australia's hydrogen economy?
- What are the key takeaways for mining and energy leaders on the next steps for integrating hydrogen for mines?

5:10 Networking Drinks and Welcome Drinks for Energy and Mines Australia Summit