



Australian Sugar Milling Council submission to the ARENA Bioenergy Roadmap

An analysis of the potential and constraints to bioenergy diversification of the Australian sugar industry

June 2020

WHO WE ARE

AUSTRALIAN SUGAR MILLING COUNCIL

The Australian Sugar Milling Council (ASMC) is the peak representative body for the sugar manufacturing sector, representing the five companies that collectively produce approximately 90% of Australia's raw sugar at 17 sugar mills across Queensland.

These milling companies also own and operate large sugarcane farms.

Sugar manufacturing generates around \$1.8 billion in revenue annually – 75% of which comes from global raw sugar sales.

The Australian sugar industry – including millers and growers – is responsible for \$4 billion in annual economic activity and underpinning 23,000 jobs in regional Queensland.

Disclaimer

To the maximum extent permitted by law, the information contained in this document is given without any liability to the Australian Sugar Milling Council or any of their related bodies corporate or their respective directors, officers, partners, employees, advisers and agents (Relevant Parties). No representation or warranty, express or implied, is made by any Relevant Party about the accuracy, completeness or fairness of the information, statements or opinions in this document. No responsibility or liability is accepted by any of them for that information or those opinions or for any errors, omissions, misstatements (negligent or otherwise) or for any communication written or otherwise, contained or referred to in this document.

Contents

Executive Summary	5
1. The significance of the Queensland sugar industry	8
2. The potential of sugar bioenergy	8
2.1 Bagasse for cogeneration	9
2.2 Ethanol derived from molasses	9
3. The competitiveness of sugar bioenergy	12
3.1 Bagasse co-generation	12
3.2 Ethanol derived from molasses	14
4. The barriers to sugar bioenergy investment	15
4.1 Bagasse co-generation	15
4.2 Ethanol derived from molasses	16
5. The benefits of sugar bioenergy	18
5.1 Bagasse co-generation	18
5.2 Ethanol derived from molasses	18
6. International comparisons	19
6.1 Thailand	19
6.2 Brazil	20
6.3 Other country policies	21
7. Recommendations	22
7.1 Bagasse co-generation	22
7.2 Ethanol derived from molasses	22

List of Charts, Figures and Tables

Chart 1: Raw # 11 sugar price actual and real (\$A) 1970-2020

Chart 2: Positive impact of RET and LGC revenues on co-generation investment

Chart 3: Australian energy generation costs (real 2019-20 \$/kW installed)

Chart 4: Calculated Levelised Cost of Energy (LCOE) by technology and category for 2020 (MWh)

Chart 5: Australian, Thai and Brazilian milling revenues product mix (2018)

Chart 6: Forecast Australian petrol consumption under various electric car penetration scenarios (ML)

Chart 7: Forecast Australian ethanol requirement under various electric car penetration scenarios (5% national mandate) (ML)

Chart 8: Forecast QLD petrol consumption under various electric car penetration scenarios (ML)

Chart 9: Forecast QLD ethanol requirement under various electric car penetration scenarios (4% mandate) (ML)

Figure 1: Value add and diversification opportunities in the sugar industry value chain

Table 1: Australian sugar industry mass balance and revenues (2019)

Table 2: Australian sugar industry co-generation potential

Table 3: Australian sugar industry ethanol potential

Table 4: Estimated Australian molasses derived ethanol and unleaded pump costs (\$/l)

Table 5: Potential co-generation greenhouse gas savings

Table 6: Potential E10 greenhouse gas savings

Executive Summary

The Australian sugar milling sector has been a leading producer of bioenergy in Australia for decades and in the pursuit of further efficiencies, innovation and diversification, it can make a significant contribution to Australia's ongoing energy transition and regional development objectives.

Already, Queensland sugar mills:

- Generate 0.9 million MWh of renewable energy from bagasse (of which 0.425 million MWh is excess to internal requirement and is exported to the national grid as baseload and, synchronous energy);
- Produce 60 million litres (ML) of bioethanol from molasses for motor fuel and industrial uses; and
- Are establishing and developing bio precincts through the north of Australia with domestic and export potential.

Australian sugar mills have significant latent feedstock and capability to increase their current production of ethanol and electricity bioenergy, as well as broaden the kinds of bioenergy produced. ASMC analysis demonstrates that under the right commercial and policy settings, total ethanol production could increase from 60 ML to 216.25 ML per annum and total electricity production from 0.9 million MWh to 2.86 million MWh per annum. Relative to current consumption patterns and fuel uses, the annual estimated greenhouse gas savings under both scenarios would be 348,000 and 1,948,702 tonnes CO₂-e respectively.

ASMC urges development of a National Bioenergy Roadmap that provides a clear vision and objectives; senior Ministerial, Federal and State government cooperation; stable and consistent policy and legislation; and strong incentives to unlock the infrastructure, technology and people to deliver commercially sustainable outcomes.

Unfortunately without stronger and more positive government action, the economics at this time are not favourable for further investment in sugar bioenergy.

To leverage the significant latent potential of sugar mills and avoid 'new build' greenfield risks, Government should remove regulatory barriers that create risk for investors, and adopt policies that generate the appropriate and attractive long-term economic returns on investments.

Achieving an increase in production and installed capacity from 1.1 million MWh to 2.8 million MWh of bagasse co-generated electricity would require the following changes in industry practice and Government policy:

- A sugar industry specific renewable auction process where lowest cost (sugar industry projects) get guaranteed power prices for 20 to 30 years to underpin the investment required;
- Additional bagasse becoming available through changes in factory 'steam on cane' process changes (i.e. current inefficient practices are stopped) and storage facilities built for year round generation;
- Considerable investment in generation asset replacement and new generation capacity to utilise the additional bagasse;

- Upgrading of network interconnections to sugar mills (there is currently strong competition for network capacity in regional Queensland, especially in areas where solar farms have been established);
- Per AEMO classifications, bagasse co-generation remains a non-market, non-scheduled form of generation meaning mills do not participate in the central dispatch process;
- Pricing agreements that meet the long term requirements for both generator and retailer;
- Long term stabilisation of marginal loss factors;
- Less onerous AEMO generator performance standards;
- The ability to reticulate power back to local growers or the community more generally through innovative 'behind the grid' options (either physically or virtually);
- Allowing renewable projects to sell ACCU's in lieu of receiving LGC's; and
- Cogent and stable State and Federal government energy and climate policies.

As ethanol cannot compete with Mogas at realistic oil prices under the current market structure of excessive capacity, excise differential, product positioning as a discounted substitute for ULP and a lack of mandate enforcement¹, achieving an increase in production from 60 ML to 216.25 ML of ethanol derived from molasses would require the following strong government intervention:

- Model legislation that enacts a national minimum biofuels mandate of at least 5% with States and Territories given discretion to impose legislative and policy frameworks that exceed this (with periodic review). This reflects the fact that the current QLD and NSW mandates will not encourage expansion as the mandate volumes still leave significant overcapacity which will also serve to keep prices depressed. Mandated volumes need to increase or broadened to PULP to ensure that current domestic over capacity is eliminated so that ethanol can generate a sensible price;
- Facilitation of an ethanol market price that is independent of the Mogas 95 price and provides a sustainable and profitable return for existing and new projects and that reflects the positive regional development, greenhouse gas and other health and safety benefits of consumption;
- Consideration should be given to a requirement that that every litre of ULP or PULP sold needs to have a minimum amount of ethanol in it and the price for that ethanol becomes a 'below the line' cost component of the fuel;
- State and Territory Governments should enforce the biofuel mandate under the following framework:
 - Government incentives provided to ensure E10 is available at every site in Queensland where regular unleaded petrol is sold to give motorists choice.
 - Government incentives provided to ensure separate ethanol storage facilities are installed or provided at all major fuel terminals in Queensland (to ensure blended E10 fuel can be supplied at most retail sites serviced by the terminal).
 - E10 based on 91 RON ULP sold in Queensland should have a minimum 95 Octane rating and be labelled accordingly at the bowser (labelled as '95 E10' not as 'Premium').

¹ However, the increased costs of ethanol vis-à-vis unleaded petrol is not overly relevant as the increase in E10 fuel would only increase 3.2% from \$1.51/l to \$1.56/l. As such, at an E5 or E10 level, paying a bit more for ethanol will not materially increase the retail cost of gasoline. The key principle is that any government mandate must all ethanol to trade at a price that is independent of Mogas (i.e. higher than Mogas parity).

- Where fuel sellers (whether retailers, wholesalers or site owners) fail to meet mandated obligations, penalties should apply to any shortfall volume such that there is incentive to comply.
- Mandate obligations should apply to the entity (or entities) determined by the Minister's delegate to be responsible for deciding the availability and accessibility of E10 at a retail site (whether it be the operator, owner or wholesaler).
- Exemptions should be available to fuel sellers, but only in exceptional circumstances and where there are insurmountable obstacles.
- The Government should consider extending the mandate to require a bio-based percentage of all grades of petrol sold in Queensland to take account of the inevitable and already evident transition of the market from low grade regular unleaded to cleaner, higher-octane fuels.
- The Government 'E10 OK' campaign should be revived, refreshed and re-launched to facilitate a more appropriate market position for E10 fuels recognising their fuel quality (Octane), environmental and social/fuel security benefits.
- The Government should actively seek the co-operation of motoring organisations such as the RACQ, NRMA, and motor industry organisations such as Motor Traders Association of Queensland in promoting the value and benefits of E10 to motorists, media, the motor trade and motor repairers.

Furthermore, a major barrier to the milling sector considering or investing in bioenergy expansion or diversification projects is the uncertainty created by mandatory pre-contract arbitration provisions contained in both the *Sugar Industry (Real Choice in Marketing) Amendment Act 2015* (Qld) and the *Competition and Consumer (Industry Code – Sugar) Regulations 2017* (Cwth) (commonly known as the Sugar Industry Code of Conduct). The pre-contract arbitration laws discourage investment in diversification such as cogeneration of electricity and ethanol production because of the risk that post-investment revenue will be expropriated through cane supply agreements.

1. The significance of the Queensland sugar industry

In 2017/18, the Queensland sugar industry injected \$4.05 billion in Gross State Product and supported almost 23,000 jobs in the Queensland economy². Local Government regions like Hinchinbrook, Burdekin, Mackay and the Cassowary Coast are highly dependent on a prosperous sugar industry.

The industry has a number of strong advantages that put it in a sound position to take advantage of improved commercial, policy and market conditions for sugar and bioenergy investment, including:

- Intense global competition has spurred world-leading innovation and efficiencies in farming and milling practices.
- Energy self-sufficiency through installation of co-generation plants at many mills.
- Injection of up to \$40 million per annum from milling companies, growers and government into research and development through Sugar Research Australia.
- Significant foreign ownership in milling assets that has delivered capital injection and asset renewal.

2. The potential of sugar bioenergy

The potential value add and diversification opportunities of the sugar industry (**Figure 1**) depend on the resources available (**Table 1**). Sufficient quantities of feedstock are required to meet the economies of scale needed in order to be competitive in their respective markets.

Figure 1 shows that there are many energy, food, alcohol and chemical products that can be manufactured from the sugar industry value chain. Specifically in relation to bioenergy, the immediate focus of ASMC members is with relation to:

- (1) Steam and electricity from the bagasse (or alternative crops) that is burnt in boilers
- (2) Ethanol from the distillation of molasses...

while monitoring commercial and technology developments in other areas such as densified biomass and bio chemicals. It should be stressed that the primary focus of ASMC members is maintaining maximum cane throughput at mills, hence diversification policies should not divert cane from sugar manufacturing but instead promote value-added products from the bagasse and molasses as milling co-products.

² <https://asmc.com.au/policy-advocacy/sugar-industry-overview/economic-contribution-sugar/>

[illegible]

Table 1 shows the industry's available resources, and **Tables 2 and 3** show the latent electricity and ethanol capacities of the industry. In relation to **Table 1**, the industry in 2019 generated \$1.584 billion in raw sugar sales, \$187 million in molasses (and related products) sales and \$74 million in electricity (not all of which was sold into the National Electricity Market).

Table 2 shows that there are currently 1,235,445 tonnes of bagasse that is stored and not utilised for steam and energy production. If this was utilised in high efficiency boilers an additional 602,025 MWh could be generated and sold (or an equivalent of steam). Further, the average efficiency of mill boilers is 0.2 MWh/t of bagasse. If the average efficiency is lifted to 0.4, a further 2,258,853 MWh could be generated. Combining the latent supply with the inefficient consumption, total generation could increase to 2,860,878 MWh with revenues of \$186 million per annum (currently 1,132,937 MWh of generation with \$74 million in revenues per **Table 1**).

Table 1 shows that there is currently 0.88 million tonnes³ (Mt) of molasses produced generating \$187 million in total molasses and by-product revenues (i.e. ethanol and rum). **Table 3** demonstrates that another 156.3 ML in ethanol could be manufactured from the 0.625 Mt of

9

molasses currently sold for export and feedstock⁴ lifting total potential ethanol revenues to \$216 million per annum.

Table 1: Australian sugar industry mass balance and revenues (2019)

Commodity	Unit	Quantity	Revenue (\$m)	
<i>On farm</i>				
Cane trash	Mt	4.56		
Cane billets	Mt	32.21		
SUB TOTAL		36.77		
<i>At mill</i>				
Raw sugar	Mt	4.28	\$	1,584
Molasses	Mt	0.88	\$	187
<i>Export</i>		0.175	\$	21
<i>Ethanol</i>		0.24	\$	60
<i>Other (feedstock etc)</i>		0.45	\$	54
<i>Rum distillery</i>		0.015	\$	52
Mud & boiler ash	Mt	2.02		
Waste water	Kl	1,586,862		
Bagasse	t	8,340,065		
Energy	MWh	1,132,937	\$	74
TOTAL REVENUES (\$M)			\$	1,844

Source: ASMC members

⁴ That is, at a ratio of 1t molasses produces 250l of ethanol, 0.94 Mt in molasses produces 2.35 Ml of ethanol.

Table 2: Australian sugar industry co-generation potential

<i>Current supply</i>		
Bagasse currently produced	8,340,065	t
Bagasse that is currently used to generate energy	7,104,620	t
Energy that is currently produced	1,132,937	MWh
Revenue (\$m)*	\$	74
<i>Latent supply</i>		
Bagasse currently produced	8,340,065	t
Bagasse that is currently produced but stored	1,235,445	t
Additional energy that could be produced from this incremental supply at max. MWh/t efficiency	602,025	MWh
Additional possible revenue (\$m)	\$	39
<i>Inefficient consumption</i>		
Bagasse that is currently used to generate energy	7,104,620	t
Additional energy that could be produced if all of this bagasse is burnt in boilers at their max. MWh/t efficiency	2,258,853	MWh
Additional possible revenue (\$m)	\$	147
TOTAL POSSIBLE SUPPLY	2,860,878	MWh
TOTAL POSSIBLE REVENUES (\$M)	\$	186

Source: ASMC members

* Assumes a NEM price of \$65 MW/h

** Current efficiency is 0.2 (MWh/ t of bagasse) and this increases to approximately 0.4 (with variances according to each boilers configuration)

Table 3: Australian sugar industry ethanol potential

<i>Current supply</i>		
Molasses currently produced	0.88	Mt
Molasses used for ethanol production	0.24	Mt
Ethanol currently produced	60,000,000	l
Revenue (\$m)	\$	60
<i>Molasses substitution</i>		
Supply that could be diverted to ethanol production	0.625	Mt
Potential additional ethanol production	156,250,000	l
Additional possible revenue (\$m)	\$	156
TOTAL POSSIBLE SUPPLY	216,250,000	l
TOTAL POSSIBLE REVENUES (\$M)	\$	216

Source: ASMC members

3. The competitiveness of sugar bioenergy

3.1 Bagasse co-generation

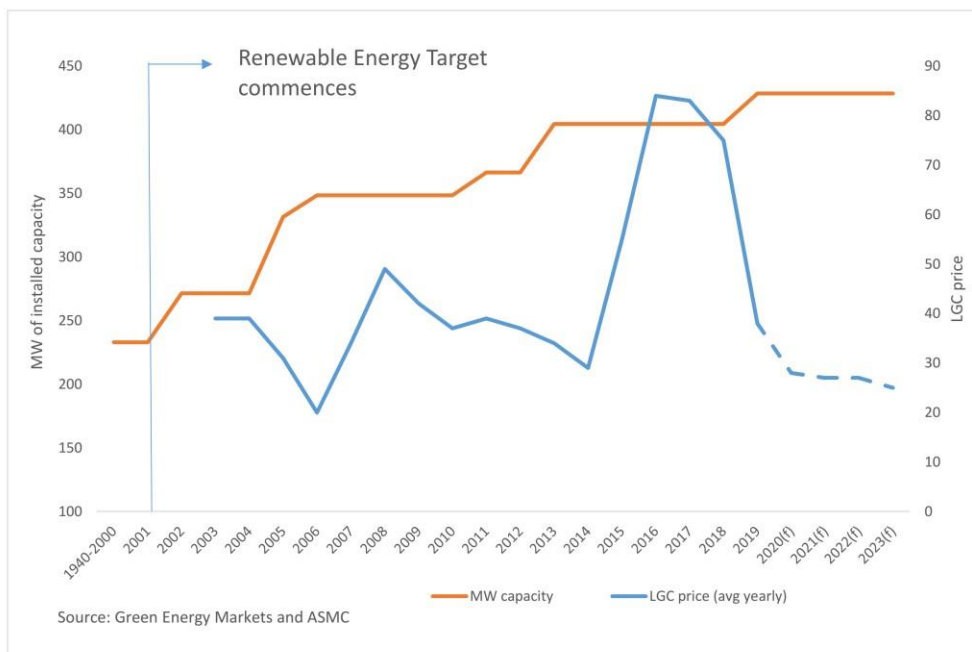
Sugar mill co-generation plants utilise the by-product cane fibre (bagasse) to generate steam that is used to:

- (1) Power internal processes (e.g. drive turbines on shredders); and
- (2) For electricity generation (i.e. to drive powerhouse turbines of a generator).

This electricity is then used internally or externally (sold into the grid). The competitiveness of cogeneration as a supply into the NEM is the focus of this section.

The industry currently has 429 MW of installed co-generation capacity in the 24 Australian sugar mills. The Renewable Energy Target (RET) and generation of Large-Scale Generation Certificate (LGC) revenues has seen co-generation capacity increase from 233 MW prior to 2001 to 429 MW today (see **Chart 2**).

Chart 2: Positive impact of RET and LGC revenues on co-generation investment



Significant change is underway in Australia's energy systems. Climate policies have led to a record investment in decentralised large-scale variable renewable generation and rapidly decreasing renewable technology costs. This transition has however been costly and policy uncertainty and a number of other complex factors has led to electricity prices doubling over the past 10 years - albeit softening more recently – and other issues emerging. According to the latest Energy Security Board *Health of the National Electricity Market 2019* report, the four critical priorities for the NEM are:

- (1) CRITICAL - The security of the electricity and gas system (maintaining frequency, voltage, inertia and system strength within parameters);

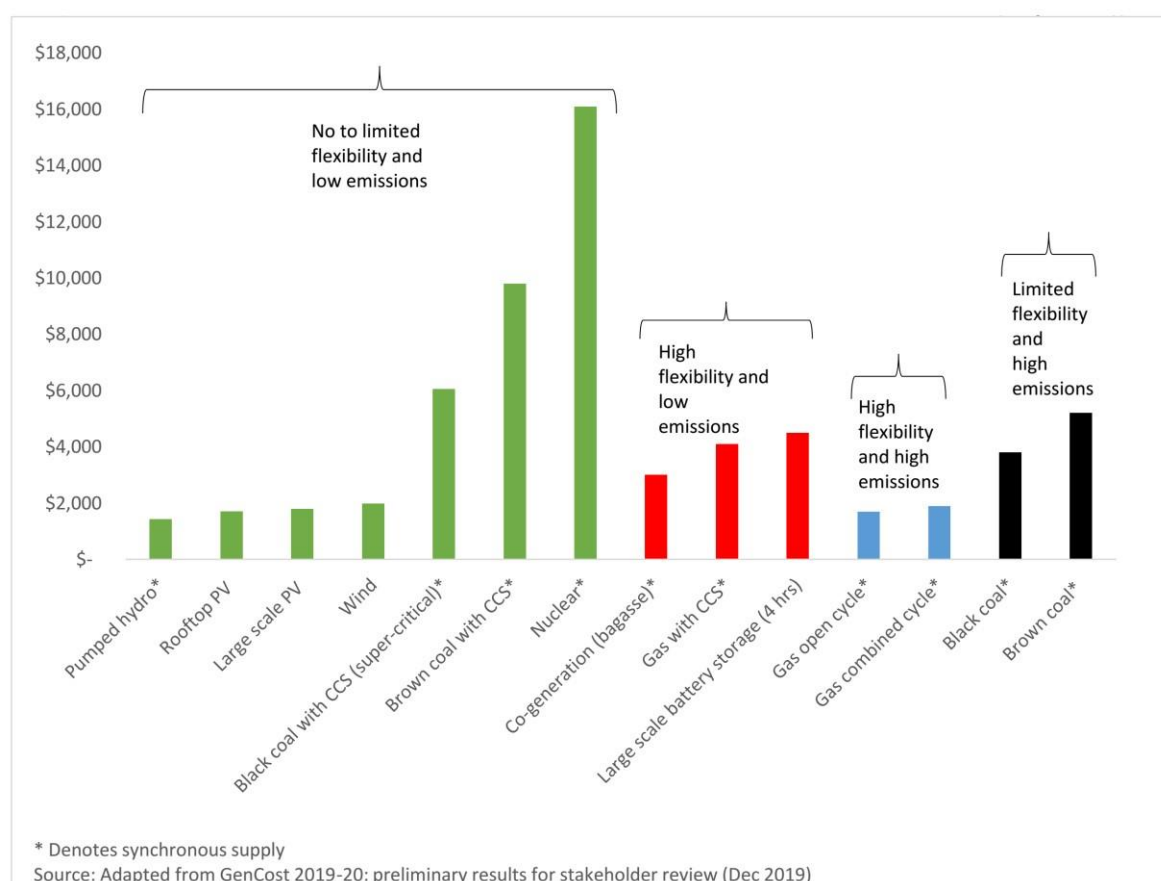
- (2) CRITICAL – Reliable and low emissions electricity and gas supply (sufficient supply when wind and solar is not available);
- (3) MODERATE-CRITICAL – Affordable energy and satisfied customers; and
- (4) MODERATE-CRITICAL – Efficient and timely investments in networks.

Charts 3 and 4 show the capital costs (per kW installed) and levelised costs of electricity (LCOE) (low and high estimates⁵) of Australia's current generation technology mix. These technologies are also categorised into three categories:

- (1) Their flexibility (can electricity be despatched quickly to meet demand requirements);
- (2) Their emissions (are they low or high contributors to greenhouse gas emissions); and
- (3) Their synchronous qualities (whether rotation is synchronised with the frequency of the system thereby contributing to system strength).

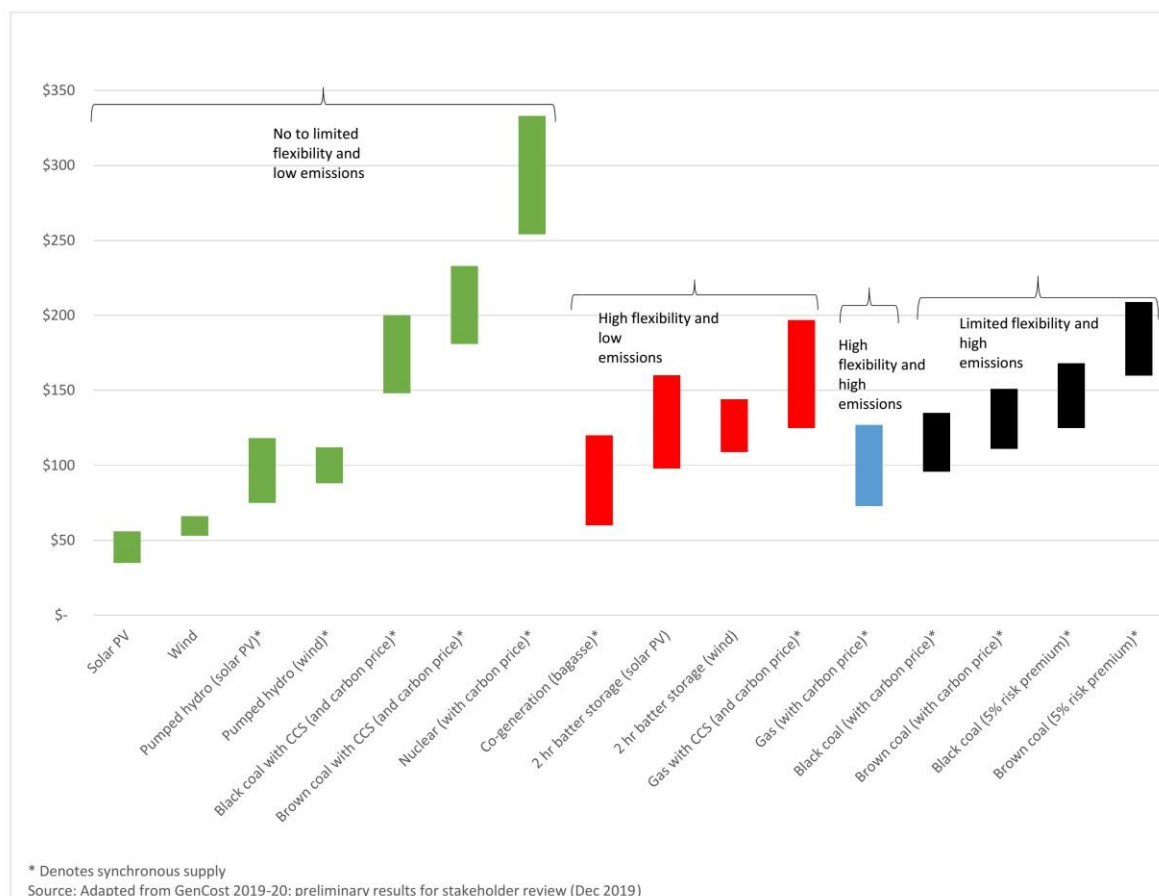
Bagasse co-generation is unique in that it can meet all four of the ESB's current critical objectives. That is, it is synchronous, it is competitive in terms of capital costs (**Chart 3** – at \$3,000 KW installed) and LCOE (**Chart 4** – at \$60-\$120 MWh) relative to other highly-flexible and low emissions energy sources, and there is sufficient latent supply that can be brought on relatively quickly.

Chart 3: Australian energy generation costs (real 2019-20 \$/kW installed)



⁵ The variance in co-gen LCOE of between \$60-\$120 MWh is primarily a result of the estimated costs of bagasse storage.

Chart 4: Calculated Levelised Cost of Energy (LCOE) by technology and category for 2020 (MWh)



3.2 Ethanol derived from molasses

Whilst under a plausible oil price scenario⁶, ethanol produced from molasses is not cost competitive with unleaded petrol at the bowser, when sold as E5 or E10 fuel the difference in costs becomes insignificant. **Table 4** shows that a new 55 ML per annum capacity ethanol plant, costing \$120 million and with operating costs of 90c/l would need revenues of \$1.35/l over 20 years to return an IRR of 15%. At \$1.35/l wholesale ethanol revenues and total molasses-based ethanol costs of \$1.989/l – ethanol is not competitive against regular unleaded of \$1.510/l total costs at a Brent price of USD 64 barrel and USD:AUD 72c exchange rate. However, the increased costs of ethanol vis-à-vis unleaded petrol of \$0.479c/l (i.e. 32%) in this example is not overly relevant as the increase in E10 fuel costs would be 3.2% from \$1.51/l to \$1.56/l. As such, at an E5 or E10 level, paying a bit more for ethanol will not materially increase the retail cost of gasoline. The key principle is that any government mandate must all ethanol to trade at a price that is independent of Mogas (i.e. higher than Mogas parity).

⁶ At USD:AUD 0.72c and USD 64 per barrel (Brent), the corresponding Mogas 95 value is 69c/l. This compares to the current International Energy Agency forecast of USD 80 per barrel (Brent) in 2025 and rising each year thereafter.

Table 4: Estimated Australian molasses derived ethanol and unleaded pump costs (\$/l)

Ethanol	
Ethanol revenues*	\$ 1.350 l
Wholesale costs and margins	\$ 0.170 l
Retail costs	\$ 0.150 l
Excise	\$ 0.139 l
GST	\$ 0.181 l
TOTAL	\$ 1.989 l
Unleaded **	
Mogas 95	\$ 0.690 l
Wholesale costs and margins	\$ 0.110 l
Retail costs	\$ 0.150 l
Excise	\$ 0.423 l
GST	\$ 0.137 l
TOTAL	\$ 1.510 l

* Reflects the revenue needed to achieve a 15% IRR on a 55 ML distillery costing \$120 million with operating costs of \$0.90c/l and selling on average 41.74 ML of ethanol per annum over the 20 years

** Assuming USD 64 barrel (brent) and US 72 cents AUD-USD exchange rate

Source: ASMC and ACCC Report on the Australian petroleum market, Dec 2019

4. The barriers to sugar bioenergy investment

4.1 Bagasse co-generation

Changes to the Renewable Energy Target (RET) and energy and carbon pricing policies, volatile NEM wholesale market prices, increasing marginal loss factors and onerous AEMO generator performance standards have all contributed to investment uncertainty (both in investing in new generation and updating the efficiency of current generation).

Inconsistent and varying carbon policies and targets

Consecutive Australian Government's through various global agreements including the Kyoto Protocol and Paris Agreement have supported national emission targets as Australia's contribution to global action. These targets are however contentious with Australian political parties adopting different policies. Furthermore, with electricity and stationary energy related emissions contributing to the majority of Australia's emissions profile⁷, consecutive Australian parliaments and state governments have found it important but unable to agree to cogent and nationally-consistent renewable energy and climate change policy frameworks. Where alignment has been agreed, such as the RET, it itself has been subject to continual adjustment.

Volatile NEM wholesale market prices

⁷ Quarterly Update of Australia's National Greenhouse Gas Inventory, December 2018

With manufacturing in Australia declining and reducing demand, coupled with new solar and wind electricity production, the gaps in the day time NEM demand versus supply profiles for the Queensland and New South Wales Pools are too high to allow commercial medium term prices. Extending to Victoria also, the inherent and increasing capacity surpluses of these two states will continue to suppress long term power prices until there is a significant change in either or both supply and demand profiles. Regrettably, the limits on transmission links into South Australia and Tasmania limit the flow into these two transmission regions.

Domestic demand is expected to keep rising, but net NEM demand is likely to decline as rooftop solar PV systems continue to permeate throughout the country.

Marginal loss factors

Whilst location dependent, reductions in marginal loss factors as a result of changing power flows is resulting in significant reductions in generation earnings at certain mills.

AEMO generator performance standards and constraints

AEMO are imposing increased performance standards on generators (both generator and load) which is increasing compliance costs of connecting to the grid. Furthermore, Ergon Networks are requesting that when Connection & Access Agreements (CAs) expire compliance to tougher standards (even with old machines) will be required.

Furthermore, AEMO is now constraining co-generators when the grid is overloaded. An example of this is when new solar farms become connected to the nearby grid. AEMO applies the generator constraint to all semi and scheduled generators irrespective of whether they are distribution or transmission connected. The key is for cogeneration sites to remain non-scheduled.

Current Government programs

The Australian Government has a number of programs that ASMC members continue to assess re usefulness for new investment, including:

- The Emissions Reduction Fund (ERF);
- The Underwriting New Generation Investments Program (UNGIP); and
- The Regional and Remote Communities Reliability Fund Microgrids 2019-20 program.

Because the industry has established renewable generators, then there is minimal if any benefit from struggling existing plant from any of these funds.

4.2 Ethanol derived from molasses

Consumer demand is weak

There are three major producers of bioethanol in Australia. All produce both fuel and industrial grade ethanol – including Wilmar’s Sarina distillery which manufactures 60 ML of ethanol annually. Total Australian ethanol production capacity is currently estimated at 440 ML.

The Queensland biofuel mandate requires that a minimum of 4 per cent of the total volume of regular unleaded petrol sales and ethanol blended petrol sales (such as E10) by liable fuel retailers be sustainable biobased petrol (of which 775 ML of regular and premium unleaded and E10 was

sold between the October and December 2019 quarters⁸). Reported ethanol volume sales in the same quarter were 3.0 per cent⁹ (equating to approximately 16.3 ML in quarter ethanol sales or 65.2 ML annualised). If the 4 per cent was met, annual ethanol sales would be approximately 91 ML per annum.

The New South Wales ethanol mandate requires that a minimum of 6 per cent of the total volume of petrol sales by liable fuel retailers (approximately 4,500 ML¹⁰) be sustainable biobased petrol (ethanol). Reported ethanol volume sales in 2017/18 were 2.7 per cent¹¹ (equating to approximately 122 ML in ethanol sales). If the 6 per cent was met, annual ethanol sales would be approximately 270 ML.

In effect, total fuel ethanol sales of approximately 187.2 ML (65.2 ML + 122 ML) in QLD and NSW is 43% of the 440 ML in capacity of the Australian ethanol industry and 52% of the 361 ML of ethanol demand that would exist if the NSW and QLD's mandates were met. This leads to plant under-utilisation, higher costs of production and reduced return on investment as ethanol cannot receive a remunerative price for suppliers (that is, ethanol trades at a discount to Mogas when it needs to have price set independently of Mogas and based on ethanol cost of production and economic returns). The fact that there is considerable more ethanol capacity (440 ML) than mandated demand (361 ML) is a significant issue.

The Queensland Government in its report, *Discussion paper, Review of the Queensland Biofuels Mandates, May 2019*, states that the reasons for low consumer demand may include access/availability of E10, consumer aversion to E10, vehicle compatibility, perceptions around the quality of E10 and the price differential between E10 and other fuels.

Another consideration is the increased penetration of electric vehicles in the Australian vehicle fleet and what impact this may have on fuel and ethanol. Given challenges in relation to range and recharging, technology and cost relativities, the likely adoption of these vehicles remains unclear with estimates varying from 8 to 27 percent of the market¹².

The findings of modelling conducted by the ASMC of the impacts of 0.5%, 5% and 20% electric vehicle penetration by 2030 on petrol and ethanol demand at the Australian and Queensland level is provided at **Attachment 1**. Under all scenarios petrol demand falls meaning ethanol targets must be incrementally increased to ensure current investors realise a return on investment and new investment is encouraged. Given that there is an additional 710 ML of ethanol capacity proposed¹³ (on top of the current 440 ML) (total 1,150 ML) a national mandate of 5% by 2030 under a 20% electric vehicle penetration scenario would be required for demand to meet supply.

⁸ <https://www.business.qld.gov.au/industries/manufacturing-retail/retail-wholesale/selling-fuel-qld/qld-biofuels-mandates/fuel-seller-statistics>

⁹ <https://www.business.qld.gov.au/industries/manufacturing-retail/retail-wholesale/selling-fuel-qld/qld-biofuels-mandates/fuel-seller-statistics>

¹⁰ ABS Catalogue 9208.0, Motor Vehicle Use as at 30 June 2018

¹¹ <https://www.ipart.nsw.gov.au/files/sharedassets/website/shared-files/investigation-compliance-monitoring-transport-publications-ethanol-market-monitoring-2018-19/final-report-monitoring-of-wholesale-and-retail-markets-for-fuel-ethanol-in-2017-18.pdf>

¹² International Energy Agency and IPART NSW

¹³ Renewable Developments Australia (350 ML), Dongmun Greentac (115 ML), Austcane (100 ML), Nth QLD Bioenergy (90 ML) and MSF Sugar Biorefinery (55 ML).

5. The benefits of sugar bioenergy

5.1 Bagasse co-generation

Co-generation from bagasse delivers various benefits, including:

- A clean and renewable energy source with a 0.01t CO₂-e/MWh greenhouse gas (GHG) signature (compared to 0.81 CO₂-e/MWh¹⁴);
- Considerable supply and GHG abatement potential. Assuming the industry's current potential of 2,860,878 MWh is reached (**Table 2**) and the balance beyond the industry's internal requirements of approximately 425,000 MWh is exported to the NEM, this 2,435,878 MWh would power approximately 348,000¹⁵ dwellings for 12 months;
- Furthermore, GHG emissions at a 0.01t CO₂-e/MWh intensity would be 24,359 tonnes compared to 1,973,061 tonnes at a 0.81 CO₂-e/MWh intensity – effectively a saving of 1.95 million GHG tonnes per annum (**Table 5**);

Table 5: Potential co-generation greenhouse gas savings

Fuel type	Supply (MWh)	Avg electricity emissions (CO ₂ -e/MWh)	Bagasse co-gen emissions (CO ₂ -e/MWh)	Total CO ₂ -e emissions (t)
Avg electricity	2,435,878	0.81		1,973,061
Co-gen from bagasse	2,435,878		0.01	24,359
TOTAL GHG SAVINGS PER ANNUM (t)				1,948,702

- If the industry's electricity can be reticulated back to local growers or the community more generally through innovative 'behind the grid' options (either physically or virtually), further regional development could occur through utilisation of more affordable energy;
- Unlike wind and solar the electricity can be supplied consistently and can help to improve the reliability and security of the grid; and
- The revenue is essential in offsetting real price decreases in raw sugar and improving the profitability of sugar milling (and preserving the associated socio-economic benefits).

5.2 Ethanol derived from molasses

Ethanol derived from molasses delivers various benefits, including:

- Investment and jobs in regional Queensland (for example, the Wilmar bioethanol distillery in Sarina directly employs 80 people in the bioethanol production process and a further 80 people in the distribution and sales of bio-fertiliser dunder, which is a by-product of the molasses ethanol production process);
- Additional income for farmers if the amount of cane grown and sugar (and molasses produced) increases to meet additional demand;
- Improved vehicle performance as the higher the octane number of a fuel, the more compression that the air fuel mixture in an engine can withstand reducing the potential for "knocking" – an effect caused by the premature detonation of the mixture of air and fuel during combustion;

¹⁴ Being the current NGERS all electricity emission intensity default value from Australian Government Department of Environment and Energy. National Greenhouse Accounts Factors – July 2017

¹⁵ While various estimates of average household energy consumption exist, for these purposes 1 house = 7MWh

- Reduced emissions and improved health. Assuming the industry's current potential of 216.25 ML of ethanol derived from molasses is reached, the estimated GHG emission savings per annum are 348,811 tonnes (**Table 6**);

Table 6: Potential E10 greenhouse gas savings

Fuel type	Consumption (l)	Energy content (GJ)	Avg CO2-e emissions (kg of CO2-e/GJ)*	Total CO2-e emissions (t)
Gasoline	216,250,000	7,352,500	67.4	495,559
Ethanol	216,250,000	5,060,250	29	146,747
TOTAL GHG SAVINGS (t)				348,811

Source: *Australian Government Department of Environment and Energy. National Greenhouse Accounts Factors – 2019.

** Australian Government Department of Environment and Energy. National Greenhouse Accounts Factors – 2019 says ethanol emissions are 0. As fossil fuels are used at Wilmar's distillery an alternate 29kg of CO2-e/GJ is assumed.

- Improved balance of trade. Assuming the industry's current potential of 216.25 ML of molasses derived from ethanol is reached, Australia's terms of trade would be improved by A\$149 million per annum¹⁶; and
- Improved energy security. The production of biofuels in Australia can help diversify the sources of transportation fuels and decrease Australia's reliance on petroleum imports.

6. International comparisons

Australia's sugar milling sector derives 87 percent of its \$1.8 billion in annual revenues from raw sugar sales where it is a price taker. This global market is intensely competitive with supply and demand balancing the main determinant of global prices. Good seasonal conditions combined with generous government subsidies in competing countries often leads to oversupply and 'long and deep' price cycles such as the one occurring now. The remaining 13 percent of sector revenue is derived from molasses and molasses derived products (ethanol and rum) and cogenerated electricity sales (**Table 1**).

A review of the Brazilian and Thailand sugar industries - Australia's main competitors - reveals these countries are developing effective commercial and government policies and strategies to diversify and mitigate the risks associated with relying on raw sugar revenues (**Chart 5**).

6.1 Thailand

Chart 5 shows that the Thailand sugar industry generated AUD\$8.9 billion in diversified revenues and whilst largely reliant on sugar, it has significantly larger ethanol and power industries than Australia.

In relation to ethanol, Thailand's consumption is around 1,465 ML (Australia's is 187.2 ML) with various E10, E20 and E85 mandates in place. The Thai government has also introduced tax breaks for ethanol producers and for oil companies that provide ethanol blending and selling facilities, tax

¹⁶ At USD:AUD 0.72c and US 64 per barrel (Brent), the corresponding Mogas 95 value is 69c/l. Calculated on 156.25 ML of incremental supply over and above the current 60ML already supplied by Wilmar.

reductions on E20 passenger cars, investment incentives, government procurement of E85 vehicles, media and communication strategies and ongoing industry and academic R&D collaboration initiatives.

In relation to co-generated electricity, Thailand supply is around 7 million MWh (Australia's is 1.1 MWh).

6.2 Brazil

Chart 5 shows that the Brazilian sugar industry generated AUD\$37 billion in diversified revenues and developed its industry such that it can arbitrage between ethanol and sugar production based on prevailing export and domestic prices.

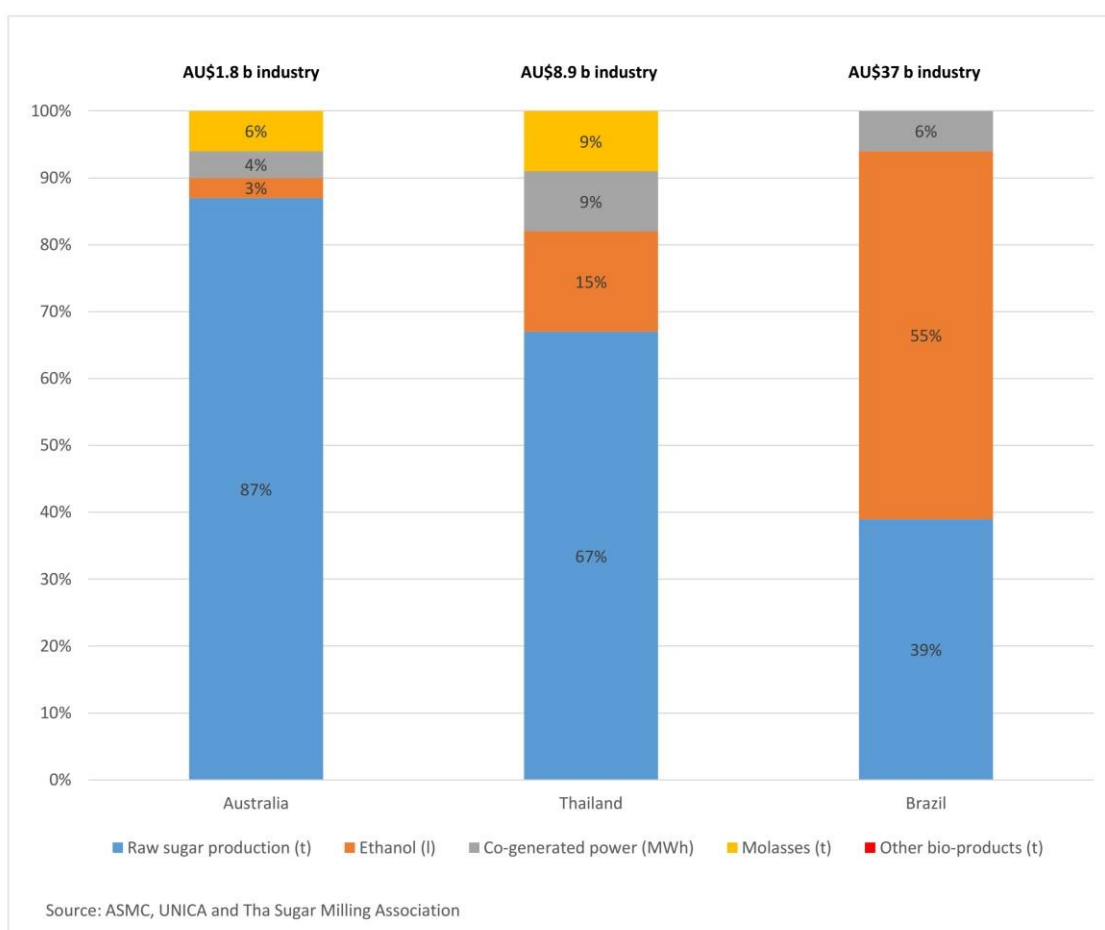
In relation to ethanol, Brazil's consumption can vary significantly but in 2018 was around 32,000 ML (Australia's is 220 ML) with various supporting policies in place including:

- RenovoBio which mandates fuel distributors to gradually increase the amount of biofuels (Brazil's Ministry of Mines and Energy expects RenovoBio to generate demand of 47,000 ML by 2028);
- Mandatory ethanol blend into the petrol (27% in the whole Brazilian territory);
- Tax differentiation between petrol and ethanol;
- Mandatory contracts between ethanol distilleries and fuel distributors in advance of the harvest season (in the order of 90% of previous year), and minimum ethanol stocks to be carried over by the distilleries and distributors at the end of the harvest season (both measures to ensure energy security); and
- The introduction of flex-fuel cars (that run on pure ethanol or a petrol-ethanol blend).

In relation to co-generated power, Brazil's supply is around 21.5 million MWh (Australia's is 1.1 million MWh) with various supporting policies in place:

- Regular renewable energy public auctions: Every year, there is the scheduling of auctions for new projects. These auctions contract only renewables generation projects (bioelectricity, wind, small hydro-electrical plants and solar projects), and the winner secures power purchase agreements (PPA) with a 30-year term for hydropower, and a 20-year term for wind, solar and biomass sources; and
- Incentivized Energy: There are discounts granted to certain projects and applicable to Tariffs for the Use of the Electric Transmission and Distribution Systems. Current legislation provides that projects based on solar, wind, small hydro-electrical plants, biomass, and qualified cogeneration sources, according to the electricity injected into the power grid, are entitled to a discount of at least 50% on these tariffs. The discount is extended to consumers who purchase energy from these generation sources (called incentivized energy). The incentivized energy can be acquired by Free Consumers (in the Free Energy Market) and by Special Consumers (those with demand equal or higher than 0.5 MW).

Chart 5: Australian, Thai and Brazilian milling revenues product mix (2018)



6.3 Other country policies

Around the world, government policies have been implemented to:

- Support and secure feedstock supply, infrastructure and logistics;
- Promote access to technology and early-stage investment support; and
- Improve demand (e.g. through blending mandates, taxation measures and consumer education).

Biofuel blending mandates of between 2% and 27% are in effect in more than 64 countries around the world, including the US, Canada, Europe, India, China, the Philippines, and Thailand¹⁷. Many of these countries have benefited greatly from the development and growth of biofuels and, in particular, the bioethanol industry. One effect of a biofuels policy is to build a foundation for a bioeconomy. Infrastructure that supports the production and up-take of biofuels will promote cost reductions through the supply chain that enable further value-adding to produce bio-based chemicals, plastics and biomaterials.

¹⁷ <http://www.manildra.com.au/ebooks/biofuels/#p=1>

7. Recommendations

7.1 Bagasse co-generation

Achieving an increase in production and installed capacity from 1.1 million MWh to 2.8 million MWh of bagasse co-generated electricity would require the following:

- A sugar industry specific renewable auction process where lowest cost (sugar industry projects) get guaranteed power prices for 20 to 30 years to underpin the investment required;
- Additional bagasse becoming available through changes in factory 'steam on cane' process changes (i.e. current inefficient practices are stopped) and storage facilities built for year round generation;
- Considerable investment in generation asset replacement and new generation capacity to utilise the additional bagasse;
- Upgrading of network interconnections to sugar mills (there is currently strong competition for network capacity in regional Queensland, especially in areas where solar farms have been established);
- Per AEMO classifications, bagasse co-generation remains a non-market, non-scheduled form of generation meaning mills do not participate in the central dispatch process;
- Long term price agreements that meet the long term requirements for both generator and retailer;
- Long term stabilisation of marginal loss factors;
- Less onerous AEMO generator performance standards;
- The ability to reticulate power back to local growers or the community more generally through innovative 'behind the grid' options (either physically or virtually);
- Allowing renewable projects to sell ACCU's in lieu of receiving LGC's; and
- Cogent and stable State and Federal government energy and climate policies.

7.2 Ethanol derived from molasses

As ethanol cannot compete with Mogas at realistic oil prices under the current market structure, which includes excise differential, product positioning as a discounted substitute for ULP, lack of mandate enforcement etc., achieving an increase in production from 60 ML to 216.25 ML of ethanol derived from molasses would require the following strong government intervention:

- An ambitious national biofuel and bio-based products strategy with clear objectives and legislative and policy frameworks;
- Model legislation that enacts a national minimum biofuels mandate of at least 5% with States and Territories given discretion to impose legislative and policy frameworks that exceed this;
- COAG Environment Ministers to review the 5% periodically to ensure ethanol demand increases;
- This mandate needs to facilitate the fuel ethanol market trading at a price that is independent of Mogas 95 price and provides a sustainable and profitable return for existing and new projects. Consideration should be given to a requirement that every litre of ULP or

PULP sold needs to have a minimum amount of ethanol in it and the price for that ethanol becomes a “below the line” cost component of the fuel;

- State and Territory Governments should enforce the biofuel mandate under the following framework:
 - Government incentives provided to ensure E10 is available at every site in Queensland where regular unleaded petrol is sold to give motorists choice.
 - Government incentives provided to ensure separate ethanol storage facilities are installed or provided at all major fuel terminals in Queensland (to ensure blended E10 fuel can be supplied at most retail sites serviced by the terminal).
 - E10 sold in Queensland should have a minimum 95 Octane rating and be labelled accordingly at the bowser (labelled as ‘95 E10’ not as ‘Premium’).
 - Where fuel sellers (whether retailers, wholesalers or site owners) fail to meet mandated obligations, penalties should apply to any shortfall volume such that there is incentive to comply.
 - Mandate obligations should apply to the entity (or entities) determined by the Minister’s delegate to be responsible for deciding the availability and accessibility of E10 at a retail site (whether the operator, owner or wholesaler).
 - Exemptions should be available to fuel sellers, but only in exceptional circumstances and where there are insurmountable obstacles.
 - The Government should consider extending the mandate to require a bio-based percentage of all grades of petrol sold in Queensland to take account of the inevitable and already evident transition of the market from low grade regular unleaded to cleaner, higher octane fuels.
 - The Queensland Government ‘E10 OK’ campaign should be revived, refreshed and re-launched to facilitate a more appropriate market position for E10 fuels that recognises their fuel quality (Octane), environmental and social/fuel security benefits.
 - The Government should actively seek the co-operation of motoring organisations such as the RACQ, NRMA, and motor industry organisations such as Motor Traders Association of Queensland in promoting the value and benefits of E10 to motorists, media, the motor trade and motor repairers.

End.

Attachment 1

Chart 6: Forecast Australian petrol consumption under various electric car penetration scenarios (ML)

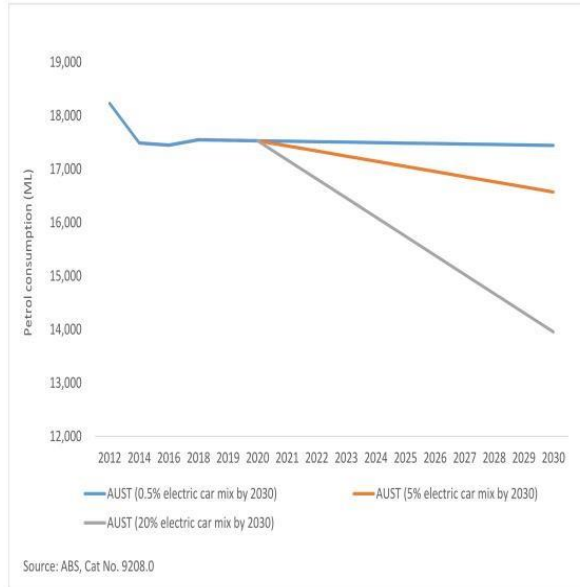


Chart 7: Forecast Australian ethanol requirement under various electric car penetration scenarios (5% national mandate) (ML)

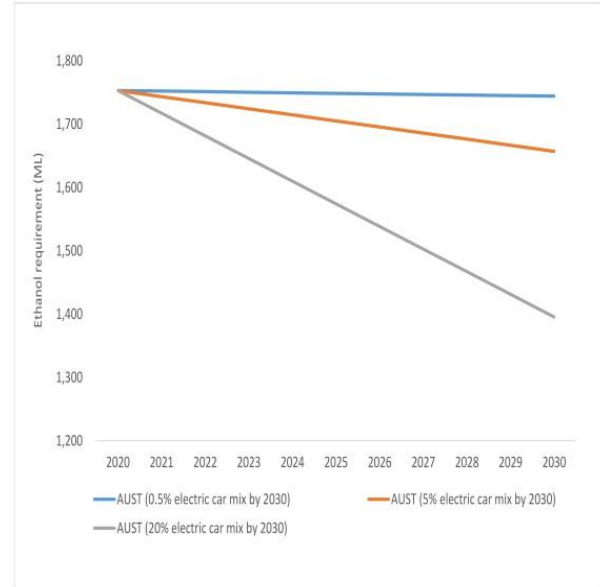


Chart 8: Forecast QLD petrol consumption under various electric car penetration scenarios (ML)

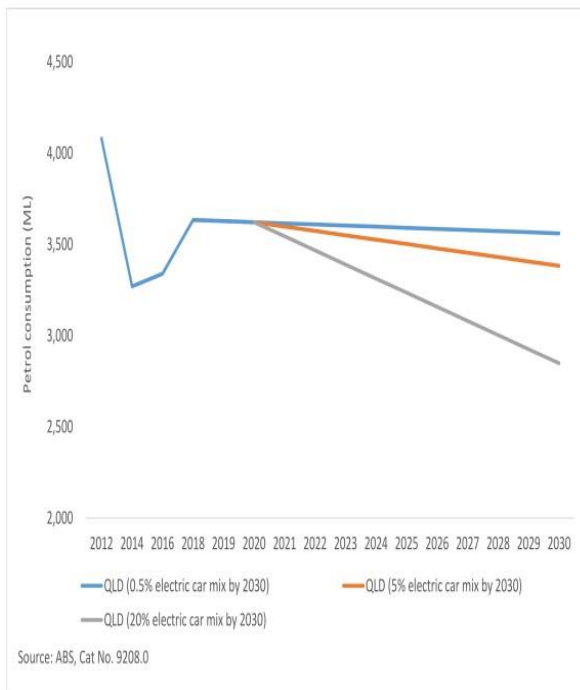


Chart 9: Forecast QLD ethanol requirement under various electric car penetration scenarios (ML) (4% mandate) (ML)

