11/11/2019

Mr John Pierce
Chair
Australian Energy Market Commission
PO Box A2449
SYDNEY SOUTH NSW 1235

Your Reference: EPR0073
Submitted online to www.aemc.gov.au

Dear Mr Pierce

LYON GROUP RESPONSE TO COGATI PROPOSED ACCESS MODEL DISCUSSION PAPER

Lyon welcomes the opportunity to provide the following to the Australian Energy Market Commission (AEMC) in response to its request for submissions in relation to its Coordination of generation and transmission (COGATI) review – proposed access model.

Lyon notes that there is a need for greater responsiveness to the fast changing dynamics in Australia's National Electricity Market (NEM) than has been evident to date.

In providing its comments, Lyon has not focused on the mechanics of the AEMC proposal. We consider there are more important and fundamental issues that need to be addressed.

The original NEM reforms were microeconomic reforms directed at increasing the economy's international competitiveness. The NEM reforms were not an engineering, technical, climate or political reform. While those factors have a role to play in the sector and how it operates, they should not replace or alter adherence to the NEM objectives.

When the NEM was first designed and implemented, the potential for multiple markets or a single market which accommodated bundled and unbundled services was not a practical option given the maturity of the industry. There was limited ability to unbundle services and create markets for those services, and it was accepted wisdom that energy could not be stored. This resulted in the current incentive structures which have not changed to accommodate the single most significant factor for the NEM design, that electricity can now be stored and released when needed.

If the NEM had been designed with the current knowledge of battery and other storage options, it would look different to what it does today. It would be more market based and take advantage of an ability for services to be unbundled and aligned with the needs of consumers and system stability.

A fundamental tool to drive economic efficiency in every sector that was subject to microeconomic reform in Australia was the extent to which the services required by the industry in delivering consumer needs could be provided now and in the future by unbundling the service requirements and where possible creating markets for their provision.

This economic principle was applied in the electricity sector but not to the extent that would have occurred if battery storage or other storage options were available then as they are now.

This stage of the NEM reforms must seek to apply the same microeconomic principles to the sector if consumers are not to bear the cost of entrenched inefficiency and higher costs.

Lyon considers that it is important to design and implement measures that:

1. do not deviate from the NEM objectives which are rooted in the microeconomic reforms of commenced in the early 1990s;
2. enhance or increase the use of markets to provide pricing and locational signals;
3. provide for an unbundling of services and efficient markets for these services to maximise innovation and technological development;
4. minimise transaction costs to market participants;
5. adequately remove barriers to entry;
6. do not introduce barriers to entry and unintended consequences;
7. do not arise from misguided policy in the pursuit of the wrong objectives;
8. do not support cross subsidies between sectors; and
9. do not allow technological preference or incumbent interest to divert adherence to the NEM objectives.

Put simply, the NEM should not be reformed to accommodate the limitations of particular forms of technology (e.g. generation with variable output). It must be reformed to produce optimum economic efficiency regardless of the technology or fuel source (taking full account externalities such as carbon emissions). This will be achieved more economically efficiently via the implementation of more markets for services in addition to the energy only market currently in place.

In providing its comments, Lyon is able to draw on the broad and deep experience of its team in the energy and infrastructure sectors, microeconomic and electricity sector reform, finance, and as project developers and principal investors. This includes:

- more than 30 years in developing electricity generation of most types including base load coal, gas peakers, biomass, wind, solar and now projects that fully integrate utility scale advanced battery storage with wind and solar;
- extensive involvement in electricity sector reform (and other microeconomic reforms) in Australia and a number of other countries including wholesale market design, network regulatory frameworks and the design of contestable retail markets; and
- Lyon's focus over the past six years on fully integrated behind the meter grid connected utility scale advanced battery storage with wind and solar projects, as a means of contributing one valuable solution to congestion and the other challenges associated with standalone solar and wind, so they can become primary energy sources.

Attachment A provides further information on Lyon.

Lyon also draws on its long-standing and close relationships/alliances with a number of the leading global energy utilities, equipment manufacturers and capital providers (debt and equity).

Most of the issues in the Australian market are not unique. Lyon's recently announced partnership with China Huadian Corporation (CHC) came about after CHC approached Lyon to assist it in addressing the same sort of issues in China that are evident in Australia, albeit at a much larger scale. CHC's generation portfolio alone is roughly three times the size of the whole NEM generation fleet.

CHC and Lyon's co-development partner JERA, the world's largest buyer of gas, consider Lyon to be the world's leader in the development and operation of utility scale grid connected integrated renewable generation and advanced battery systems.

General Comments

Lyon considers that to ensure the transition underway leads to economically efficient outcomes for consumers and enhances Australia's international competitiveness, generation and transmission investment needs to be optimised consistent with the NEM objectives.

We agree that substantial and timely transmission infrastructure will be required as the NEM transitions to renewable based generation and we agree with the proposition that the scale and pace of the changes in the market "mean that there is a need to have a better way of coordinating generation and transmission investment decisions in order to better facilitate the transition that is occurring."

While agreeing with the above statement, we consider that the options proposed by the AEMC may not lead to the most economically efficient outcomes and may result in a misallocation of capital.

Key among Lyon concerns regarding the AEMC's proposal is that we do not accept the proposition that generators can't take action to insulate themselves from or manage their exposure to congestion risk and changes in loss factors. This is simply not correct. **Attachment B** provides an overview of some of the ways in which Lyon's integrated projects (or any generator that fully integrates battery storage with solar or wind) can manage risk.

The fundamental problem that needs to be addressed in the NEM design is the limited use of markets to provide for services that are now available in a bundled and unbundled form and which can be taken advantage of in addition to the energy only market that exists now. This would extend the economic reform of the NEM to take advantage of the new technological developments and innovation occurring.

Lyon considers that the technological developments currently unfolding are yet to be fully understood by the industry, regulators and policy makers so it will be important to design these reforms so they do not provide unintended barriers to the development of the full range of technology and innovation that can assist the transition underway while staying consistent with the NEM objectives.

Further, based on Lyon's experience gained from its association with global utilities and leading global equipment manufacturers, we consider assessment of overseas experience and approaches implemented overseas should be treated with caution as the response in those markets was developed without the benefit of knowledge of technological developments and innovation that are rapidly taking place.

Lyon commends the Australian Energy Market Operator (AEMO) for its Integrated System Plan (ISP) but recognises that AEMO is developing its ISP at a point in time where there is significant technological change and innovation taking place so the IPS is necessarily limited in being able to foresee the effect of these on the sector.

Information now available to NEM market participants from AEMO, AER, AEMC and others will allow a more detailed consideration of how technology, such as advanced battery storage, can be utilised, not just as an adjunct to the network, but to enhance the quality of electricity being produced by renewable energy generators at the point the power they produce enters the grid.

The projects that Lyon develops are designed to manage the risks that the AEMC proposal is designed to address and provide multiple bundled or unbundled services across the sector.

Developers and owners of renewable generation now have a broader range of options to manage their risk exposure than previously available and these options will increase in the future.

Lyon does not see evidence that these risk mitigation mechanisms have been recognised by AEMC in the development of its proposals. To implement reform in the absence of a full understanding of these tools risks implementing policy with unintended consequences. How these reform measures are structured and introduced go to the very heart of whether:

1. the NEM stays true to its objectives and provides the optimal economic outcome; or
2. the reform measures entrench additional barriers to entry and reduce economic inefficiency.

Lyon is of the view that the proposed reforms will produce a number of detrimental unintended consequences.

While Lyon supports the AEMC's attempt to introduce reforms, we consider the AEMC should redirect its focus slightly based on the availability of a wider range of tools than may have anticipated in the development of its proposal.

In relation the current proposed reforms, the premise for these reforms appears in simple terms to be to:

1. maintain downward pressure on wholesale electricity prices;
2. reduce the risk for investment in renewable generation;
3. assist developers of solar and wind projects to manage their risk to attract capital, based on an assumption that they do not have other ways to deal with certain revenue risks; and
4. increase efficiency in investment decisions regarding trade-offs between transmission and generation.

In response to the above, Lyon notes in no particular order that:

1. The investment decision between generation and transmission needs to provide for optimised outcomes via incentivising generation to locate where their bundled or unbundled services are most highly valued through the creation of markets for the services rather than by providing a market to price the risk of not locating where the generator can provide the greatest value to the NEM;
2. The wholesale electricity price is one component that influences the price to consumers of electricity and it should not be artificially lowered via cross subsidies from other sectors of the industry as is currently the case;
3. Renewable electricity generators have a far greater ability to manage their risk exposure now than they did even 12 months ago – the issue is whether they choose to apply the options available. Regardless, risk should always be managed by the entity best able to do so. If risk is transferred, it should be done in most economically efficient manner. Implementing a mechanism to allow generators to buy risk cover (i.e. the proposed financial transmission rights), should be done only where there are markets that can demonstrate that the opportunity cost of the alternatives is higher;
4. Renewable generators (developers and owners) should be incentivised to manage their risk exposure to the full extent they are able within markets for bundled and unbundled services within the NEM;
5. Introducing an insurance product before incentivising available technology to be used to deliver services that the market needs removes the incentive to deliver the services or ensure that your project is innovative. That's a barrier to entry, which closes off revenue for and thus implementation of more innovative solutions. To dull the innovation imperative is to impose a barrier to having to innovate.
6. The escalating cost of congestion and adverse MLF changes is an effective and valuable market signal. The fact that investment in standalone renewables will reduce in response is the market in action, not a bad thing.
7. If the revenue risks to standalone solar and wind and the resulting investment outcomes currently observable in the market were not manageable, then it would be appropriate to fall back on a financial instrument. But these risks are manageable, if developers choose to integrate BESS.
8. Capital markets will support projects that demonstrate they can effectively manage their risk or that the risk is appropriately priced. Capital markets place considerable discipline on owners of generation to manage risk if they want to access finance. The AEMC should seek to take full advantage of the role capital markets can play in driving correct investment decisions while at the same time reducing barriers to efficient signals in the market (e.g. lack of liquidity in the PPA market and alternatives to it);
9. Neither government nor consumers should subsidise poor risk management practices via the market design or changes to it. To do so will entrench inefficiency, higher cost to consumers and reduce Australia's international competitiveness; and
10. The Regulatory Investment Test (RIT) needs to be replaced with markets for services which force the cost service provision to face the pressure of competitive markets. The RIT is a major barrier to entry, a dampener on innovation and it needs to be narrowed considerably.

Reform built on a false premise will undermine economic efficiency

The AEMC's proposed COGATI access model appears to be based on the assumption that the existing risks of congestion and adverse loss factor changes are currently not manageable for new generation. This is not correct.

This assumption that the new clean generation coming into the market cannot manage the risks of congestion and adverse loss factor changes is not correct. To manage or not manage this risk is a choice made by the developers or owners of new clean generation.

It is open to developers of solar and wind generation coming into the market to make their projects stable and flexible, and thus able to address the risks of congestion and adverse loss factor changes, by integrating BESS into the design, construction and operation of their clean generation. Generation plant of this nature can manage its dispatch to avoid congestion and the correlation penalty component of adverse marginal loss factor (MLF) changes, be configured to act as a load, and deliver stable power such that the plant does not need to be forced offline to avoid voltage disturbances.

The COGATI Review does not appear to take the functionality and risk management aspects of new technological development (e.g. renewable generation integrated with BESS and operated by a single power plant controller behind a single connection point, as opposed to co-located and separately operated), and the potential for other innovations and future technological options, into account.

It will be difficult to achieve an optimised investment decision between generation and transmission if the NEM reforms do not contemplate technological development.

The assumption that appears to underpin the proposed COGATI access model is predicated on the false paradigm that undermined the Energy Security Board's Post 2025 Market Design Issues Paper, which framed the challenge of responding to the opportunities and risks of "future diverse [supply and demand side] sources" as changing the market framework to the meet the needs of those sources. This is akin to designing a market for a technology and its characteristics rather that to achieve optimum economic efficiency and least cost supply to consumers.

The false paradigm is that solar and wind generation is necessarily:

- intermittent or weather-driven and therefore only ever unstable and non-firm; and
- require massive co-investment in network stabilisation, transmission augmentation and "firming" of that unstable and non-firm energy.

The paradigm as presented above is not correct because there are alternatives.

Lyon's renewable energy project design philosophy is based on the premise that the physical properties of the electricity grid will limit the number of megawatts of variable renewable energy that can be connected to the grid without creating grid instability and causing greater than optimal grid augmentation and unnecessary "firming".

Lyon embarked on development of its flexible renewable projects six years ago because we could see than that these limitations would necessitate a combination of, firstly, changes to the technology creating the instability and, secondly, changes to regulatory frameworks (technical and economic).

In anticipation of this, Lyon has been working closely with some of the world's leading utilities, leading equipment manufacturers and academics to bring together advanced battery storage functionality, grid forming inverters, integrated power plant control systems, voltage management strategies, and integrated operational and trading strategies.

With full integration of the renewable generator and an advanced battery storage system which has specifically designed architecture and algorithms and located behind the meter operated by a single power plant controller and connecting to the grid via a single connection point, wind and solar generation can be stable and flexible. It can be dispatchable. It can provide grid services at the connection point.

This technology allows for a broader suite of options to be considered in the optimisation of generation and transmission, and broader market design, and therefore:

- allows maximum use of markets to keep downward pressure on the wholesale energy costs;
- removes potential cross subsidies from transmission to generation;
- places less reliance on the regulated sector of the industry to provide economically efficient pricing;
- does not require transmission trading rights to manage network congestion or MLFs;

- delivers managed, flexible energy at the connection point, that assists in stabilising the grid via voltage and frequency support; and
- can defer network augmentation.

It is a concern that key aspects of the NEM framework would be based on the proposition that the framework must now be designed around variable renewables.

Barriers to entry and innovation

As the economics of generation technology have changes since the NEM was introduced (e.g. a technology with the wide range of service offerings that advanced battery storage can offer was not envisaged at the time of the NEM original design) unintended barriers to entry and disincentives for innovation have become increasingly evident in the current market design and rules.

The current policy, regulatory and institutional framework creates barriers to more innovative use of advance technologies. For example, the current market framework inhibits full capture of the value that battery energy storage systems (BESS) can deliver, especially when integrated with generation. Currently, there are not adequate price signals via competitive markets for network stability services that BESS can provide. .

An important feature of these reforms must be that they ensure that barriers to entry are removed, unintended barriers to entry are not created by default and incentives are created to encourage innovation. These are some of the fundamental tenants of the microeconomic reforms introduced in the 1990 and were intended to apply to the NEM.

Lyon considers that, by omitting to deliver revenue for valuable services, the proposed access model does present barriers to entry and will diminish the extent to which innovation and technological change can benefit the industry, consumers and the economy as a whole.

Markets for unbundled services

The AEMC has proposed some additional market mechanisms in its report but does not go far enough in Lyon's view. Lyon also considers that, as outlined in the report, some of these reforms have the potential to create the wrong incentives. We do recognise that the detail of the market design that is yet to be enunciated may address some of these issues.

While Australia has an energy only market, it also has other markets at various stages of maturity (e.g. markets for FCAS, interregional settlement surplus) and other reforms such as 5 minute settlement which will create particular incentives.

To maximise the value consumers see from innovation and new technology such as advanced battery storage requires that these reforms include use of competitive markets to drive outcomes where possible. This can be achieved by establishing markets or allowing markets to develop for services that can be unbundled from a primary bundled service.

Markets for unbundled services should recognise that the value of renewable energy that is dispatchable and is able to offer a range of network stabilising services is higher than the value of basic intermittent energy. In other words, basic intermittent energy offers a single or very limited number of services bundled within its offering. Where technology can offer more services that are aligned with the needs of the NEM, there should be an ability to capture value from those services.

The Mexican electricity market, for example, uses mechanisms to differentiate between electricity that is basic or single/limited service, and electricity that provides a great number of services bundled into its offering.

If markets for service are designed correctly, they will provide the incentives for electricity generation that is able to provide network support services to locate and be rewarded for their location. A NEM that encourages product differentiation and an ability to create value from differentiation is fundamental to

facilitating optimised investment decisions for generation and transmission investment and achievement of the National Electricity Objective.

The implementation of these markets should be aligned to the AEMO system requirements such that the market mechanism provides for the value of unbundled services that can be offered now or in the future by technology. This would assist in removing a number of barriers to entry that currently distort locational signals prior to other changes being made.

By taking the above approach:

- in the first instance, markets can determine more effectively the pricing signals for location based on maximising innovation and technological change;
- risk transfers between industry sectors will be reduced;
- the cross subsidy from networks to intermittent generation will be reduced;
- barriers to developing new technology and innovation are reduced;
- proposed changes for transmission access rights could co-exist, but be less relied up, reducing transaction costs and distortions; and
- cost transfers to consumers would be reduced.

Specific Comments

1. Dynamic regional pricing

Lyon's projects would be well positioned to capitalise on the introduction of dynamic regional pricing, so our comments go to the economic efficiency of the proposal rather than self-interest.

We consider that the proposal is rooted in the premise that the NEM needs to be designed to suit the needs and accommodate the limitations of particular forms of generation. It will therefore provide sub-optimal location signals, worsen inefficient risk transfers and bring higher transaction costs than are necessary.

The proposed approach to dynamic regional pricing primarily transfers risk within the NEM on the basis that a particular form of technology should face a lower risk profile to ensure investment. This should only be considered as a preferred option when there is no better option.

Lyon considers that dynamic regional pricing should be a secondary consideration to the implementation of markets that create the correct incentives for location of generation. Generation that can provide value adding services should be rewarded by markets for their services by locating in areas that can most value these services.

2. Financial transmission rights

> *'These arrangements should improve **investment certainty** for generators and storage and may **reduce their cost of capital** in the longer term. This is because generators and storage with financial transmission rights face less risk that other participants may change or undermine their expected revenue from their business case by locating nearby and causing congestion or adverse loss effects in the local transmission system.'*

Lyon raises the following points in relation to the basis for the introduction of financial transmission rights (FTR).

1. Lyon does not support the introduction of FTR unless FTR is subordinate to the introduction of other markets that encourage the provision of required services.

   On its own, FTR will introduce a major barrier to entry for innovation and technological advancement that may assist in optimising generation and transmission decisions.

   Again, it appears that FTR is a proposal that is rooted in the premise that the NEM needs to be designed to suit, or work around the limitations of, particular forms of generation.

   In this instance, FTR will provide financial risk management options to projects that locate where they please, not where they are needed.

The fundamental basis for these reforms should be to incentivise generation to locate where the services it can provide are most valuable. FTRs will only be economically efficient where the opportunity cost to the NEM, not the generator, is lower than or equal to the best other alternative.

With the developments in technology that are occurring and will continue to occur, if the correct incentives are put in place FTR is unlikely to be needed.

2. Capital markets should play a strong role in determining the merits of investment in generation.

   Capital markets are very efficient at pricing the risk profile of a generator seeking capital. The AEMC should be seeking to harness this important role of capital markets through the introduction of markets for services that generators/batteries can compete in, not dampen it through the introduction of a market for risk pricing because some generator/battery providers seek to locate where there is increased risk.

   A clear role for capital markets is to apply pressure to generators and battery owners to manage their risk by making correct business decisions including how they design, build, operate and locate the plant. Subsidies from governments and poor policy have created huge inefficiencies in the first phase of solar and wind coming into the market because they have distorted the way that capital providers have considered the allocation of capital to generators. This is occurring again with battery storage.

Questions regarding this submission should be directed to Luke Brown, General Manager Commercial via lbrown@lyonasia.com.au or +61 (0) 403 805 310.

Yours sincerely,

David Green
Chairman

ATTACHMENT A: ABOUT LYON

The Lyon Group is an independently owned group of companies founded in 2003 which focuses on solar battery power station development, ownership and operation.

Lyon's founders have arranged debt and equity financing for more than $10 billion worth of energy and infrastructure projects. They each have more than 20 years of renewables and energy market experience spanning Japan, other parts of Asia, Australia and Europe.

Lyon is recognised as one of the world's leading independent developers of integrated renewable generation and utility-scale battery storage.

Lyon developed the world's first grid connected integrated large-scale solar PV and battery storage project, Lakeland Solar and Storage Project, in Queensland. We are now leading the roll-out of the region's largest pipeline of utility-scale integrated solar battery power stations.

Lyon's energy development companies pursue a project design philosophy based on the premise that all new electricity generation must meet power system requirements of a modern and stable electricity grid, and be capable of providing commercial returns to investors.

Partners with whom we have ongoing joint development agreements include JERA, the operator of a power generation fleet in Japan and offshore totalling more than one and half times the capacity of the National Electricity Market (NEM). JERA is also the world's largest buyer of gas.

International utilities have chosen to work with and invest alongside Lyon because our design philosophy leads to flexible, dispatchable renewable power stations. Our projects deliver dispatchable clean power and valuable grid services, which contrasts with traditional standalone renewable projects.

With full integration of solar PV and four hour duration battery storage, Lyon is at the global forefront of moving renewable energy projects from their current state (i.e. supplying unpredictable and unstable energy to the grid) to an advanced and usable form of energy that provides predictable, dispatchable, firm and on-call energy.

Lyon's developments are the only fully integrated grid connected solar battery power station developments currently available and are an important step forward for the industry.

The nature of Lyon's projects addresses many of the key opportunities and challenges that substantial and rapid change are creating for market participants and policy makers/market bodies. For example:

- Growing curtailment of new generation, due to factors including but not limited to thermal constraints and local voltage and frequency destabilisation, driven by construction of clusters of solar and wind in zones remote from matching grid capacity or load;
- Low and even negative pricing during peak solar and wind production (in markets without competition, this translates as a pattern of new supply variously exceeding and falling short of demand);
- The growing incidence of the wholesale electricity price being set at high levels by gas peakers, reflecting their fuel price and availability risk;
- Greater demand for ancillary services at the same time as lower supply of them, reflecting the nature of predominant generation substitution;
- Adverse loss factor changes, reflecting the same factors as growing curtailment; and
- The perversity of replacing old generation that has a level of flexibility well short of future system and investor requirements with new generators that are even less flexible.

https://www.lyonasia.com.au/about/

ATTACHMENT B: REVENUE RISK MITIGATION

Flexibility to adjust to changing market conditions is a highly valuable attribute as the scale and pace of change increases.

As has been widely reported, the electricity industry in Australia has faced a changing regulatory environment in response to the high penetration rates of traditional renewables (i.e. wind and solar) in the NEM. These types of projects create difficulties for the grid in managing the unstable power they dispatch. Traditional renewables also create revenue risks. They are liable to being forced offline due to voltage instability, and they can't respond to constraints and adverse loss factor changes.

These realities underpin the design philosophy for the Lyon Projects. Projects designed and developed according to this philosophy are suitable for the current and future NEM operating environment and do not present the investment risks associated with traditional renewables.

Further, the Lyon Projects are designed to generate revenues from the risks that traditional renewables can do nothing about (e.g. the provision of MLF options, offering the BESS as a load sink).

The risks faced by electricity generation projects in the NEM have increased in recent times. This is having a material impact on the quantum of revenue and revenue risk profile. Connection risk, MLF risk, constraint risk; and price separation and concentration risk are particularly significant.

Because they cannot respond, the financial viability of many traditional renewables has been threatened, with some projects no longer viable and the profitability of some operating traditional renewables plant in doubt.

The Lyon Projects were specifically designed with an objective of managing these risks, and can change their operating modes rapidly to do so.

Connection risk management

Connection risk and constraint risk are closely related issues. Connection risk relates to whether a project meets the requirements of the Australian Energy Market Operator (*AEMO*) and the local network company for connection to the grid. Constraint risk relates to whether a project is able to dispatch its energy to the grid following approval being granted to connect to the NEM.

The connection risk of traditional renewables is increasing. This is because of a number of factors, including:

- Traditional renewables are having difficulty meeting the appropriately strict new connection standards introduced by AEMO, such as the required fault ride through ratio for inverter based generation;
- the energy dispatched by traditional renewables is intermittent and can destabilise the network; and
- existing network constraints and the requirements for expensive network upgrades.

With a view to mitigating the new tighter connection standards progressively introduced by AEMO over the past 18 months, Lyon has worked closely with the world's leading inverter manufacturers, AEMO and the local network companies, to develop 'grid forming' inverters (traditional inverters are grid following) that can be incorporated into the Lyon Projects.

This is a fundamental technical breakthrough which will enable the Lyon Projects to connect to the NEM at the weakest points in the grid without the need for expensive network upgrades or the use of old technology, such as synchronous condensers.

Constraint risk management

The Lyon Projects are largely insulated from constraint risk and have been specifically designed to capitalise on the way in which constraint risk affects other generation projects.

Constraints in electricity networks arise when the network is being operated at or near its design limit (thermal, voltage stability or transient stability).

Lyon recognised several years ago that the NEM would become increasingly constrained as more traditional renewables connected to the NEM. This would present an increasing risk to the revenues of traditional renewables, which is now evident in the market.

It is important to note that constraints in electricity networks are a result of various factors relating to network design limits and their breach. These include:

- voltage variation;
- transient instability;
- frequency deviation; and
- heating, causing outcomes such as line droop or transformer malfunction.

AEMO's constraint formula requires that each individual plant's characteristics and its equipment are taken into account when considering whether a project should be forced to cease or reduce its dispatch.[1]

Lyon's approach has been to develop integrated renewable and BESS projects that manage the quality of the power dispatched and make a direct positive contribution to network strength and therefore contribute to minimising the causes of constraints. A generator with integrated BESS also has the flexibility to shift dispatch away from constrained periods.

The use of the BESS as a load sink relieves pressure on constraints and increases project revenues by selling storage capacity to other projects that may be constrained.

MLF risk management

MLF risk is the risk that there is a significant adverse change in the grid losses allocated to a particular project. The Lyon Projects are largely insulated and protected from dramatic MLF reductions for a number of reasons, including:

- the time-shifting capabilities of the BESS, providing an arbitrage or load-shifting ability, which in turn serves to offset the 'transport capacity' element factored into MLF calculations;
- an inherently low correlation with nearby solar and wind generators and therefore the MLFs affecting those projects; and
- the Lyon Projects can also be registered as significant loads, which benefits their MLFs.

AEMO's 2019-20 MLF figures demonstrated that BESS can **increase** regional MLFs. In 2019-20, following the commissioning of the ESCRI/ Dalrymple BESS as a load, the regional MLF increased approximately 2%.

Revenue optimisation

Flexibility to meet changing market conditions is a valuable attribute and even more so when the market is in transition. In the current NEM transition there is change driven by, among other things:

- aging older technology coming to end of its life and being replaced by different technology;
- policy to address carbon emissions influencing market incumbents differently to new entrants;
- demands placed on the electricity grid due to the connection of new generation with different power output characteristics; and
- the high capital cost of the transition from a carbon based electricity system to renewables.

These changes have consequences for the way in which capital providers consider their investment in the sector and particular projects.

The NEM is a dynamic market with a wholesale energy market and active contracts market. With the market in transition, investment decisions need to consider current and future risks to revenues and the likelihood that the investment will become stranded or sub-economic.

In recognition of this, Lyon's development strategy is to develop projects that offer the flexibility to optimise their access to revenues.

The multiple operating modes and flexibility of the Lyon Projects provides access to multiple revenue streams and provides the ability to respond to changing market conditions in less than 300 milliseconds. This provides a wide range of options for combinations of operations of the Lyon Projects to align with a current or future

[1] AEMO 2015, Constraint Implementation Guidelines for the National Electricity Market.

market conditions to optimise revenues for the Lyon Projects.

Traditional Renewables and other generators do not have the ability to optimise their operations with desired revenue outcomes as the market changes. Their lack of flexibility presents risks to their revenues and reduces their ability to maximise revenues.