



Application form for the issue of an Electricity Generation Licence

by the Essential Services Commission of SA
under the Electricity Act 1996

August 2017

Enquiries concerning this application form should be addressed to:

Essential Services Commission
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Licence requirements and conditions

It is essential that licence applicants read the Essential Services Commission's (**Commission**) Advisory Bulletin No 4 – "*Licensing Arrangements for the Electricity and Gas Supply Industries*" before they fill out this form. This Bulletin is available on the Commission website www.escosa.sa.gov.au under electricity/licensing.

Generation operations which require a licence

Section 15(2)(a) of the *Electricity Act 1996* (**Act**)¹ is explicit in that it requires a person that carries on the operation of the generation of electricity to hold a licence. This requirement applies to all generators with the exception of a generator that can rely on:

- (1) one of the statutory exemptions specified in the Electricity (General) Regulations 1997 (**Regulations**) outlined below;
- (2) an individual exemption issued by the Commission (with the approval of the Minister) pursuant to section 80(1) of the Act; or
- (3) an exemption made by Governor under a regulation pursuant to section 98(2)(e) of the Act.

Pursuant to Regulations 6(1) and (2), the following generators are exempt from the requirement to hold a generation licence:

- ▶ a generator whose generating plant has a rated nameplate output of 100kVA or less;
- ▶ a generator that does not supply electricity for reward to or by means of a transmission or distribution network;
- ▶ a generator that generates electricity for the sole consumption of that generator or a designated body (such bodies must be designated by the Minister²); or
- ▶ a generator that generates electricity for a person at a premises occupied or used by the person as a tenant or licensee (whether directly or indirectly) of the generator (or a designated body) where that person is not charged for the supply of electricity except by a licensed retailer/generator or as an unspecified part of rent or charges for the occupation or use of the premises.

It is important for generators (or proposed generators) to carefully consider whether they can rely on a statutory exemption from the requirement to be licensed. If the reliance on a statutory exemption is queried by the Commission, the onus to provide evidence that a particular exemption can be relied upon is on the relevant generator.

In addition, in the event that the operations of a generator change so that it can no longer rely on one of the three exemptions specified above, it will need to apply to the Commission for a generation licence immediately in order to continue those operations.

Mandatory licence conditions

Sections 21(1) and 22 of the Act requires the Commission to place certain mandatory conditions in generation licences. The Commission strongly recommends that applicants review these mandatory conditions. Applicants must be familiar with the relevant conditions and confident that they can comply with the conditions.

¹ Available at <https://www.legislation.sa.gov.au/LZ/C/A/ELECTRICITY%20ACT%201996.aspx>

² To date, the Minister for Energy and Resources has not designated any bodies for the purposes of Regulations 6(1).

Additional technical licence conditions

Additional technical licence conditions apply to all new electricity generators seeking to connect to the South Australian power system. Applicants for a generation licence should familiarise themselves with the Commission's Inquiry into the licensing arrangements for generators in South Australia final report, available on the Commissions website.³

Model licence conditions reflecting the Inquiry findings and conclusions have been developed and are available in Appendix 1. The model conditions will be applicable to all new applications, having regard to advice from the Australian Energy Market Operator (AEMO) on the specific circumstances of individual applications received.

Depending on the specific characteristics of a given generation project, the model conditions may be varied to the degree necessary to ensure that South Australian consumers' long-term interests with respect to the price, quality and reliability of electricity services are protected.

Annual licence fees

Holding a licence incurs annual licence fees. The licence fees determined by the Minister for Resources and Energy are administered by the Commission. At annual intervals, the Commission, on behalf of the Minister, will send to each licensee, depending on the category within the sector, an invoice for the licence fee. Licence fees are to be paid on receipt of an invoice via one of the payment options set out in the invoice.

The initial licence will not be issued until the first annual licence fee (or approved licence fee instalment) has been paid.

³ Refer: <http://www.escosa.sa.gov.au/projects-and-publications/projects/inquiries/inquiry-into-licensing-arrangements-under-the-electricity-act-1996-for-inverter-connected-generators/inquiry-into-licensing-arrangements-under-the-electricity-act-1996-for-inverter-connected-generators>

Consultation and Confidentiality

The Commission will consult with relevant government, industry and consumer groups in the conduct of its licensing functions through a public consultation process. Consequently, applications and/or supporting information will be made available on the Commission's website and in hard copy from the Commission's office for this purpose.

If applicants believe that they are providing confidential information when completing this form they should write "this information is confidential" after any such information. It is the applicant's responsibility to ensure this is clearly highlighted on the form. Applicants should also provide a 'non-confidential' version of the form capable of publication on the Commission's website.

The Commission will use information supplied in applications and in support of applications in accordance with the requirements of Part 5 of the Essential Services Commission Act 2002. Applicants claiming confidentiality are encouraged to familiarise themselves with Part 5. Applicants should note that the Commission may disclose confidential information in some circumstances.

Further information

Applicants should note that the Commission may ask applicants who have submitted an application form to provide further information to the Commission, or to clarify the information that they have already provided if required.

Please note that, in the event that an application lacks sufficient detail and the Commission is required to request additional information from an applicant, delays in the assessment of the application may occur.

Licence Application Form

1 The Applicant

Applicants must answer all questions in this section.

1.1 Identity of Applicant

State the full name of the applicant. The applicant is the person who will be undertaking the electricity generation operations that will be the subject of the licence. Joint applicants should each complete an application form, and submit their application forms at the same time, with a covering letter explaining that a joint application is being made.

Name: Mannum Solar Farm Pty Ltd
.....
.....

1.2 Legal Identity of Applicant

Provide information about the applicant, (i.e. whether the applicant is a natural person, private limited company or partnership, etc). If the applicant is a body corporate, please also state the jurisdiction in which the applicant is registered, and the applicant's ABN/ACN.

Mannum Solar Farm Pty Ltd
.....
ABN 90 620 610 371
.....
Main business location: SA 5238
.....
.....

1.3 Address and Contact Details of Applicant

Business Address: Level 44, 525 Collins Street Melbourne
.....
.....
State: VIC Post Code: 3000
Postal Address (if different to Business Address):
.....
.....
State: Post Code:
Telephone: 0423778125 Facsimile: N/A
E-mail: frank.boland@tetriseenergy.com
.....

1.4 Contact Person on behalf of Applicant

The full name, title and contact details of a person to whom the Commission can direct enquiries and correspondence about the application.

Full Name: Frank Boland
.....
Title: Director
.....
Business Address: Level 44, 525 Collins Street Melbourne
.....

.....
State: VIC Post Code: 3000
.....

Postal Address (if different to Business Address):
.....

State: Post Code:
Telephone: 0423778125 Facsimile:
E-mail: frank.boland@tetriseenergy.com
.....

1.5 Contact Person for Licence Fees

The full name and/or title of the person to whom the Commission can direct enquiries and correspondence about licence fees.

Full Name: Frank Boland
.....

Title: Director
.....

Business Address: Level 44, 525 Collins Street Melbourne
.....

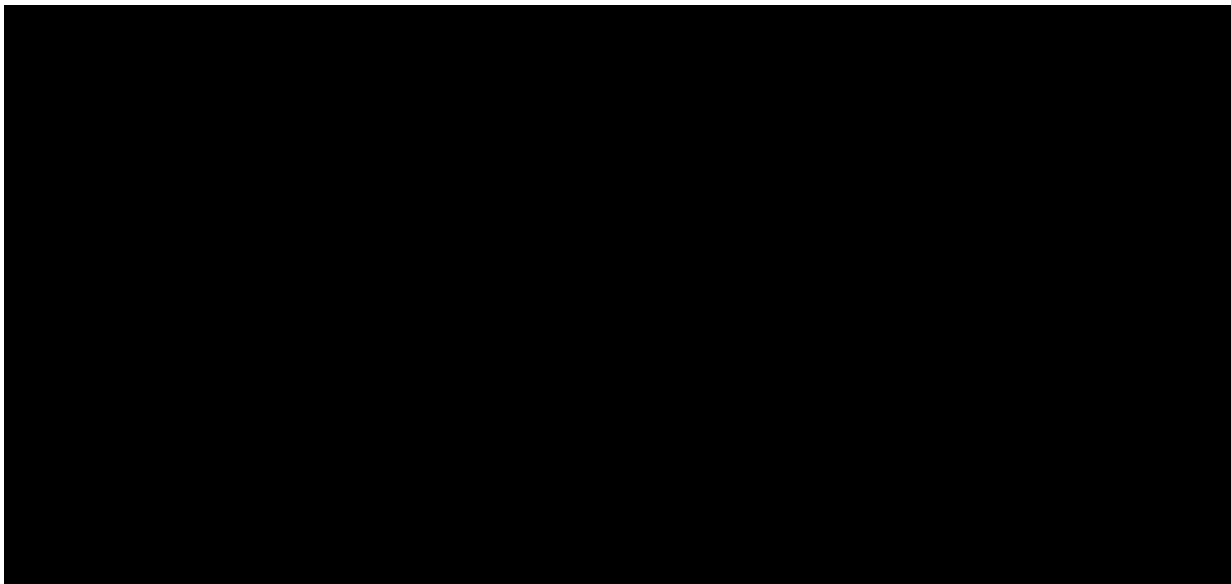
State: VIC Post Code: 3000
.....

Postal Address (if different to Business Address):
.....

State: Post Code:
Telephone: 0423778125 Facsimile:
E-mail: frank.boland@tetriseenergy.com
.....

1.6 Diagram of Corporate or other Structure

Please attach with this application form details of the corporate or other structure, including details of any related companies within the meaning of the Corporations Act 2001; and a diagram of the organisational chart, including composition of the board, management and other key personnel responsible for the key functions of the business.



3 Suitability of applicant to hold a licence

Applicants must answer all questions in this section.

3.1 Standard of honesty and integrity shown by Applicant

In deciding whether the applicant is a suitable person to hold a licence, the Commission may:

- ▶ consider the applicant's previous commercial and other dealings, and
- ▶ the standard of honesty and integrity shown in those dealings.

Please provide information that will assist the Commission in its consideration of this matter. If the applicant:

- ▶ has been found guilty of any criminal offence,
- ▶ has been successfully prosecuted under any Territory, State or Commonwealth legislation (such as the Australian Securities and Investments Commission Act 2001 or the Competition and Consumer Act 2010) or
- ▶ has been the subject of disciplinary action,
- ▶ has been the subject of any past or present administrative or legal actions in relation to an authorisation, authority, or licence in any industry,

details of such matters must be disclosed. Failure to disclose such information or misrepresent any matter relevant to such information may result in the cancellation of a licence.

The Commission may use the service of an external expert to assist with the assessment of the applicant's standard of honesty and integrity.

Mannum Solar Farm Pty Ltd (Mannum Solar) is registered under the Corporations Act 2001. It is the SPV (Special Purpose Vehicle) dedicated to the Construction, Operation and Maintenance for the Mannum Solar Farm project.

Tetris Energy Pty Ltd is the shareholder of Mannum Solar, together with its affiliated company, Tetris Capital Pty Ltd, Mannum Solar has expertise in all types of infrastructure including wind, solar and battery storage. This spans for both the construction and operation of these projects.

All employees and directors are expected to act lawfully, with integrity and professionalism in all activities, internally and externally.

Tetris Energy Pty Ltd, Tetris Capital Pty Ltd and Mannum Solar have not committed any offences against, or been prosecuted under any Territory, State or Commonwealth legislation in Australia.

3.2 Standard of honesty and integrity shown by Officers and major shareholders of Applicant

Applicants should address responses to this question in the same manner as 3.1 above except here it relates to officers and major shareholders of the applicant.

Please also supply details of any policies and procedures addressing the probity and competence of officers and other key management staff.

Tetris Energy trades as a subsidiary of Tetris Capital (Tetris), which commenced trading in early 2017, and hence the company has a limited financial / operating history. Tetris Capital is an Australian Financial Services Licence holder (AFSL no. 499919), and as such is required to comply with a range of stringent policies and procedures –including the requirement to hold adequate liquidity. These policies are strictly enforced by ASIC.

The Directors listed in Section 3.4 hereunder have not engaged in any prior misconduct or experienced refusal or suspension from licensing or professional membership. Neither Tetris Energy or Mannum Solar has breached any statutory obligations, committed any criminal or civil offence or been successfully prosecuted under any applicable legislation in its operating jurisdiction. None of the Officers listed have engaged in any prior misconduct or experienced refusal or suspension from licensing or professional membership.

None of the Tetris Energy Directors have been disqualified from managing corporations under the Corporations Act 2001 . None of the Officers listed have an actual or potential conflict of interest likely to affect their ability to carry out their role.

3.3 Names and addresses of the Officers of Applicant

State the names and addresses of the officers of the applicant. "Officers" of the applicant include the applicant's directors and secretary, and other persons who make or participate in making decisions that affect a substantial part of the business of the applicant.

Full Name: Francis Boland
Date of Birth: [REDACTED] Office Held: Director
Address: [REDACTED]
State: NSW Post Code: [REDACTED]

Full Name: Stephen McDonough
Date of Birth: [REDACTED] Office Held: Director
Address: [REDACTED]
Parkville
State: VIC Post Code: [REDACTED]

Full Name: Ryan Slocombe
Date of Birth: [REDACTED] Office Held: Director
Address: [REDACTED]
State: VIC Post Code: [REDACTED]

(attach additional pages if necessary)

3.4 Names and addresses of major shareholders of Applicant

State the full names and addresses of the major shareholders of the applicant

See above details in section 3.3

3.5 Details of the group members

This is information about entities controlled by the applicant, or by the ultimate parent entity of the applicant (if applicable).

N/A

.....
.....
.....

3.6 Additional information

Please answer the following questions.

- ▶ Is the applicant a resident of, or does it have permanent establishment in, Australia? Where the answer to this question is no, please provide further detail.

Yes

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.....
.....
.....

- ▶ Is the applicant under external administration (as defined in the Corporations Act 2001) or under a similar form of administration under any laws applicable to it in any jurisdiction? Where the answer to this question is yes, please provide further detail.

No

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- ▶ Is the applicant immune from suit in respect of the obligations under the Electricity Act 1996? Where the answer to this question is yes, please provide further detail.

No

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- ▶ Is the applicant capable of being sued in its own name in a court of Australia? Where the answer to this question is no, please provide further detail.

Yes

.....

.....

.....

.....

(attach additional pages if necessary)

3.7 Financial resources available to the Applicant

Provide information about the financial resources available to the applicant. If the applicant is a company, please also enclose:

- ▶ copies of all audited profit and loss statements and balance sheets for the last three financial years (including all notes), and
- ▶ director’s declaration that the financial statements comply with accounting standards, give a true and fair view, have been made in accordance with the Corporations Act and that there are reasonable grounds to believe the company/entity will be able to pay its debts as and when they fall due; and
- ▶ the director’s report and the audit opinion.

If the applicant is a subsidiary company, please also provide:

- ▶ copies of all audited profit and loss statements and balance sheets of the applicant’s parent company for up to the last three financial years.

The applicant should also submit copies of:

- ▶ its business plans including at least strategic direction and objectives, identified opportunities in the market place and forecast results; and
- ▶ evidence of capital and liquidity support in place, including any bank or cross guarantees, to support the business and evidence of negotiations with the network service provider concerning credit support arrangements.

Tetris is a private company owned by its senior staff and has no debt. The founding team have over 55 years’ combined experience in financial structuring and advisory, development, and origination – delivering over \$10bn of infrastructure and energy projects.

Tetris Energy trades as a subsidiary of Tetris Capital (Tetris), which commenced trading in early 2017, and hence the company has a limited financial / operating history. Tetris Capital is an Australian Financial Services Licence holder (AFSL no. 499919), and as such is required to comply with a range of stringent policies and procedures –including the requirement to hold adequate liquidity. These policies are strictly enforced by ASIC.

The Applicant is a new Special Purpose Vehicle specifically established to construct, own and operate the Mannum Solar Farm. As such it does not have a 3-year financial track record. Tetris Energy will arrange the funding for the project.

Mannum Solar has entered into Power Purchase Agreements for both the electricity and the LGCs for the full output of the project. These offtake agreements give the project revenue certainty.

3.8 Additional Details of Structure of Applicant

If the applicant is part of a group of related companies, and/or party to a partnership, joint venture or alliance agreement with another company, please provide:

- ▶ contractual arrangements (e.g. alliance contracts, associate contracts, establishment contracts) that define relationships within the group – including shared resources, guarantees, revenue flows, obligations and or responsibilities.

Mannum Solar is wholly owned by Tetris Energy Pty Ltd who will be responsible for arranging the financing for the project.

Supporting the project are offtake contracts for both the Electricity and also LGCs. Revenues from these contracts will flow back to Mannum Solar to cover operational costs and a return to the initial investment. In addition to Construction, Operations and Maintenance will be managed by Canadian Solar.

3.9 Human resources available to the Applicant

Provide information about the human resources available to the applicant. This includes:

- ▶ the experience and qualifications of those employees outlined in the organisational chart (see point 1.6); and
- ▶ if the applicant will employ contractor/s to assist with the licensed operations, the name of that contractor/s, details about the experience of the contractor/s in such operations and details of the processes in place to ensure the contractor/s complies with the regulatory obligations imposed by the licence.

Tetris Capital has a team of experienced professionals with experience in generator design, construction and operation. Tetris structures all contracts so that the obligations of the licence are made aware to all the subcontractors.

Frank has led the development of multiple renewable energy projects and has been responsible for managing all stages of the development cycle of wind, solar and storage assets - from origination through to financing. He has over 10 years of experience in renewable energy in Australia and in the US. Frank holds a Bachelor of Commerce, Bachelor of Science and an MBA from Macquarie Business School.

Stephen has led highly successful PPP/Infrastructure origination/asset management and has 20 years of experience across Australia in PPP's and Infrastructure. Stephen's experience stretches across all aspects of being a principal investor and developer of infrastructure, including early stage project development, consortium formation, government relations, design management, stakeholder engagement, commercial negotiation, and financing. Stephen has a Bachelor of Information Technology, Bachelor of Business, CPA, Graduate Diploma of Applied Finance and Investment, MBA and Company Directors Course (AICD).

Ryan brings a diverse background across all aspects of infrastructure, project and structured finance. Starting his working career as a consulting engineer, Ryan has subsequently held roles covering financing, asset management, and M&A across energy and natural resources, power and utilities, infrastructure and PPPs. Ryan has an Honours Degree in Engineering, a Bachelor's of Commerce Degree, and is a Member of the AICD, and volunteers as a Justice of the Peace in his local community.

All of the construction works will be delivered by a highly competent EPC contractor. Canadian Solar is will manage the EPC process. Canadian Solar Inc. is a publicly traded company (NASDAQ: CSIQ) that manufactures solar PV modules and provides turn-key solar energy solutions.

3.10 Technical resources available to the Applicant

Applicants for a generation licence are asked to provide details about the availability of technical resources to be used in carrying out the operations for which a licence is sought. The information should include details about the technically qualified staff available to the applicant and (if relevant) details of experience gained in similar operations.

Where applicants are relying on a third party to provide staff and resources to meet the technical requirements of the generation licence, please provide:

- ▶ a list of all functions and activities being proposed to outsource;
- ▶ details of any formal agreement/s to provide services, including confirmation that the third party possess relevant technical competencies to conduct the proposed activities;
- ▶ a summary of the third party's technical capacity to meet relevant obligations, including relevant accreditations; and

- ▶ a summary of the third party's experience and knowledge in the relevant area.

Mannum Solar will set up a project management team which is backed up by external consultants and contractors to oversee the construction of the solar farm and the ongoing operation and maintenance activities. Complementing the Tetris team to ensure our obligations are met will be:
The Energy Project – Network and grid expertise
FNB Consulting – Planning and environment
Canadian Solar – PV modules
SMA – Inverters

Tetris has selected Canadian Solar as the company that will manage the EPC and operations of the plant. Canadian Solar's total project pipeline is now 20.4 GW, including an increase in the late-stage project pipeline to 2.4 GW. Including two manufacturing facilities in Ontario, Canadian Solar employs nearly 9,000 workers worldwide. This translates to more than 16 GW of panel shipments, or approximately 70 million PV modules, in the past 15 years.

SMA is a leading global specialist for photovoltaic system technology and the leading inverter supplier in Australia. SMA has 20 offices globally with over 3,000 employees. In 2017 sales were about 900 million euros.

Tetris has used The Energy Project as our network consultant to advise on the technical and regulatory requirements to ensure compliance of the facility.

3.11 Quality of Electricity Produced/Connection Agreement

The Commission may not issue a generation licence unless it is satisfied that the generating plant (or proposed generating plant) will generate electricity of the appropriate quality for the relevant transmission or distribution network. The Commission will be satisfied that the electricity is of an appropriate quality if the applicant has entered into a connection agreement which meets the Commission's technical requirements with the licensed operator of the relevant transmission or distribution network. Applicants are therefore required to submit a copy of such a connection agreement.

The Proponent has entered into a Connection Agreement with SAPN. Please find a copy of this attached to this licence application.
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3.12 Risk Management

Provide confirmation and reasonable evidence that the applicant's management has identified the risks associated with electricity operations and has established, utilises and relies upon risk management systems and processes which are adequate, accurate and current to address those risks. A copy of the applicant's risk management strategy should be submitted.

Tetris Energy has selected contractors and consultants that are extremely experienced to identify and properly manage all project risks.

Mannum Solar, through its parent entity Tetris Energy, utilises corporate risk management processes as an integral part of the normal operation of its business. Tetris's risk management framework are attached to this application.

3.13 Development Act Approval

Please advise if the applicant has or is applying for approval under the Development Act 1993 (SA). If so, provide details, including the date on which approval was or will be granted.

Mannum Solar received the Development Plan Consent for the Mannum Solar Farm (Development No. 711/486/17) on 20/04/2018 from Mid-Murray Council. The conditions in the Development Plan Consent be fulfilled prior to construction. Design certification will be obtained which will allow Building Rules Consent will be granted from Mid-Murray Council one month before construction is to begin. Following this approval, Mannum Solar will have full Development Approval and will be able to proceed to construction. The Decision Notification Form and conditions have been attached.

3.14 Registration with AEMO

Please advise if the applicant will apply to register with AEMO. If so, provide details. Applicants for a wind generation licence should note that registration as a semi-scheduled market participant is required for all new generators and all expansions to existing wind generation plant.

The Applicant is not required to register with AEMO as the facility is below 5 MW. However, it will be registering as a Small Generation Aggregator to enable Mannum to sell energy directly into the National Electricity Market and via our retailer.

3.15 Licences held by the Applicant in other Australian jurisdictions.

If the applicant holds, or has previously held, electricity and/or gas licences in other Australian jurisdictions please provide details. If a licence previously held has been suspended or cancelled, please provide details.

N/A
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3.16 Previous unsuccessful licence applications in other Australian jurisdictions

Please state whether the applicant has applied for an electricity or gas licence in another Australian jurisdiction and not been issued with a licence, and provide details if relevant.

N/A
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3.17 Licences held by Associates of the Applicant

If an associate of the applicant (within the meaning of the Corporations Act) holds an electricity or gas licence in South Australia or in other Australian jurisdictions, please provide details.

N/A
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3.18 Compliance Plans

Applicants are required to submit a copy of their Compliance Plan which demonstrates how the compliance systems the applicant has (or will have) in place will ensure compliance with all of the applicable regulatory obligations imposed by the relevant licence.

Mannum Solar will provide Annual Compliance Reports to ESCOSA and a Safety, Reliability, Maintenance and Technical Management Plan to the OTR to ensure compliance with all the regulatory obligations imposed by the generation licence.

Mannum Solar will also establish a compliance framework with Canadian Solar to correctly allocate responsibilities for obligations. This will be enforced under the Operations and Maintenance contract.

4 Factors specified in the Essential Services Commission Act 2002

In considering a licence application, the Commission must have as its primary objective protection of the long term interests of consumers with respect to the price, quality and reliability of electricity supply, and must also have regard to the need to:

- (a) promote competitive and fair market conduct;
- (b) prevent misuse of monopoly or market power;
- (c) facilitate entry into relevant markets;
- (d) promote economic efficiency;
- (e) ensure consumers benefit from competition and efficiency;
- (f) facilitate maintenance of the financial viability of regulated industries and the incentive for long term investment;
- (g) promote consistency in regulation with other jurisdictions.

If the applicant believes that information about their application would assist the Commission in its consideration of these factors, the applicant should provide such information below.

- a) A new solar farm will add to the competitiveness in the SA generation market.
.....
- b) The offtake arrangements are with two new entrant retailers into the SA market, this will create further value and options for customers.
.....
- c) This is the first project for Tetris Energy and Canadian Solar in the SA market. Mannum Solar also improves the regional diversity of generators.
.....
- d) The location of the Mannum Solar Farm in proximity of major loads which reduces network losses and promotes efficiency.
.....
- e). Consumers will be the direct beneficiary of new low cost renewable energy. Having a new entrant generator and retailers will encourage further competition and efficiency.
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.....
.....

5 Application fees

Applicants for a licence must pay to the Commission an application fee fixed by the Minister for Energy from time to time. This fee is presently set at \$1,000 per licence. Please enclose this fee with the application. An application cannot be considered until this fee has been received and cannot be refunded.

6 Declaration

All information in this application for the issue of a licence to authorise electricity generation operations in the electricity supply industry in South Australia must be verified by a Statutory Declaration of the applicant, in accordance with the provisions of the *Oaths Act 1936* (SA)⁴, stating that the information contained in the application is true and correct to the best of the applicant's knowledge, information and belief.

Where the applicant is a body corporate, evidence of the relevant authority of the declarant to sign on behalf of the body corporate must also be provided to the Commission.⁵

Statutory Declaration

I **Stephen McDonough**

of **Mannum Solar Farm Pty Ltd**

do solemnly and sincerely declare that the information contained in this Application for the issue of a licence to authorise electricity generation operations in the electricity supply industry in South Australia is true and correct to the best of my knowledge information and belief.

And I make this solemn declaration conscientiously believing the same to be true, and by virtue of the provisions of the *Oaths Act 1936*.

Date **22/10/18**

Signature 

(Where the applicant is a body corporate, the declaration must be made by a person authorised by body corporate to sign on its behalf)

Declared at: **Melbourne** this **22nd** day of **Oct 2018**

Before me: 

(Signature of Justice of the Peace or other person authorised under the *Oaths Act 1936*)

RYAN SLOCOMBE JP
C/O HONORARY JUSTICE OFFICE
18/121 EXHIBITION STREET
MELBOURNE 3001
JUSTICE OF THE PEACE FOR VICTORIA
REG. NO 13045

⁴ or equivalent legislation in other Australian jurisdictions.

⁵ The Commission will accept a copy of a Board minute (or circulating resolution) giving approval for the declarant to sign on behalf of the applicant as evidence of the relevant authority.

Attachment 1

2017 model licence conditions for new generators

Interpretation of this schedule

1. Interpretation

1.1. Terms used in this schedule and also in the National Electricity Rules (NER) have the same meaning in this schedule as they have in those rules (unless otherwise specified or unless the context otherwise requires).

1.2. For the purposes of this schedule, the term:

Commission - means the Essential Services Commission, established under the Essential Services Commission Act 2002.

continuous uninterrupted operation means that, for voltage disturbances within the continuous operating range (that is, connection point voltage fluctuating within 90 percent and 110 percent of normal voltage), active power must be maintained (unless there has been a change in the intermittent power source) and reactive power must be managed to meet voltage control requirements.

Disturbance ride through capability

2. Disturbance ride through capability – general requirements

2.1. The non-synchronous generating system must meet the following requirements:

- (a) The low voltage ride-through activation threshold (LVRT), as measured at the low voltage (LV) terminals of the generating units and dynamic reactive support plant (as applicable), must not be less than 85 percent of nominal voltage.
- (b) The generating system must maintain continuous uninterrupted operation for voltage disturbances as specified in clauses 3, 7 and 8.
- (c) Where LVRT and high voltage ride-through (HVRT) requirements in the NER are specified in respect of the generating system's connection point, the withstand capability of individual generating units is to be determined at the LV side of the generating unit's transformer. All individual generating units must remain connected for connection point voltages within the LVRT/HVRT withstand requirements, irrespective of the generating system's transformer tap position.

3. Disturbance ride-through (reactive current injection)

3.1. The generating system must supply additional capacitive reactive current (reactive current injection) of up to 4 percent of the maximum continuous current of the generating system (in the absence of a disturbance) for each 1 percent reduction of connection point voltage below 90 percent of normal voltage, as shown in Table 1. This requirement applies at the LV terminals of the generating units and dynamic reactive support plant (as applicable) for

power system disturbances resulting in a voltage reduction of up to 100 percent of normal voltage at the connection point.

- 3.2. The generating system must supply additional inductive reactive current (reactive current absorption) of up to 6 percent of the maximum continuous current of the generating system (in the absence of a disturbance) for each 1 percent increase in connection point voltage above 110 percent of the normal voltage, as shown in Table 1. This requirement applies at the LV terminals of the generating units and dynamic reactive support plant (as applicable).
- 3.3. The reactive current injection must be maintained until the connection point voltage returns to within the range of 90 percent to 110 percent of normal voltage.

Table 1: Reactive current injection requirements

Reactive current response	Current injection gain (%)	Current absorption gain (%)	Minimum amount of contribution as percentage of rated current	Speed of contribution	
				Rise time (millisecond)	Settling time (millisecond)
Synchronous	4	6	250	30	N/A
Non-synchronous	4	6	100	30	60

- 3.4. The amount of reactive current injection required may be calculated using phase-to-phase, phase-to-ground, or sequence components of voltage. For the last method, the ratio of negative-sequence to positive-sequence current injection must be X.⁶
- 3.5. The generating system must comply with the following response characteristics for reactive current injection:
 - (a) A rise time no greater than 30 milliseconds and a settling time no greater than 60 milliseconds applies to reactive current injection requirements.⁷
 - (b) The reactive current injection requirements described above apply for all pre-disturbance reactive power control modes (voltage control, power factor control and reactive power control).⁸
 - (c) The reactive current response must be adequately damped as defined in the NER.
 - (d) Upon occurrence of a fault, reactive power consumption must not exceed 5 percent of maximum continuous rated current of the generating system and must be limited to the rise time duration set out in Table 1.
 - (e) The post-fault reactive power contribution of the generating system must be sufficient to ensure that the connection point voltage is within the following ranges for continuous uninterrupted operation:
 - (i) voltages over 110 percent for the durations permitted under NER clause S5.1a.4;

⁶ The exact ratio of negative-sequence to positive-sequence current injection will be specified by the Commission at the time the licence is issued.

⁷ The settling time requirement does not apply to synchronous generators.

⁸ This requirement does not apply to synchronous generators.

- (ii) 90 percent to 110 percent of normal voltage continuously;
- (iii) 80 percent to 90 percent of normal voltage for a period of at least 10 seconds; and
- (iv) 70 percent to 80 percent of normal voltage for a period of at least 2 seconds.

4. Disturbance ride through (active power injection requirements)

- 4.1. The generating system must be capable of restoring active power to at least 95 percent of the level existing just prior to a fault within X milliseconds after disconnection of the faulted element.⁹
- 4.2. Upon occurrence of a fault, a generating system's transient active power consumption must not exceed one power frequency cycle and must not exceed 5 percent of the maximum continuous rated current of the generating system.

5. Multiple low voltage disturbance ride-through

- 5.1. The generating system, including, but not limited to, each of its generating units and dynamic reactive power support plant, must be capable of withstanding both of the following within a five minute interval:
 - (a) Any combination of voltage disturbances causing the voltage at the respective low voltage (LV) terminals of the equipment to drop below 85 percent of the nominal voltage for a total duration of 1,500 milliseconds regardless of disturbance type, duration, and residual voltage at the generating unit's terminals. The total number of voltage disturbances for which successful ride-through is required is limited to 15. Each fault can be a solid fault resulting in 100 percent voltage drop at the connection point with duration not exceeding the longest time expected to be taken for the breaker fail protection system to clear the fault, as set out in Table S5.1a.2 of the NER.
 - (b) A single worst-case long-duration shallow voltage disturbance, causing the voltage at the connection point to drop to 70- 80 percent of the normal voltage for a total duration of 2,000 milliseconds.
- 5.2. Subject to compliance with the requirements in clause 5.1, the generating system, including, but not limited to, each of its generating units and dynamic reactive power support plant, is not required to withstand any additional voltage variation exceeding ± 10 percent of nominal voltage experienced at the respective LV terminals within 30 minutes from the commencement of the first variation.¹⁰

6. Disturbance ride-through (high voltage disturbance ride-through)

- 6.1. The generating system must have a level of over-voltage withstand capability consistent with the levels shown in Table 2.¹¹

⁹ The exact active power recovery time will be specified by the Commission at the time the licence is issued and will be between 100 and 500 milliseconds.

¹⁰ For synchronous generators, consideration will be given to the physical limitations of the plant. This may require a variation to this condition, to be determined by Commission at the time of issuing of the licence.

¹¹ Unless otherwise specified by the Commission at the time the licence is issued.

- 6.2. The generating system must maintain continuous uninterrupted operation for temporary over voltage durations as specified in Table 2.

Table 2: Required over voltage withstand capability

Temporary overvoltage (% of normal voltage)	110–115	>115–120	>120–125	>125–130	>130–140
Duration(s)	1,200	20	2	0.2	0.02

7. Disturbance ride-through (partial load rejection)

- 7.1. The non-synchronous generating system must be capable of continuous uninterrupted operation during and following a power system load reduction of 30 percent from its pre-disturbance level or equivalent impact from separation of part of the power system in less than 10 seconds, provided that the loading level remains above minimum load.

8. Disturbance ride-through (frequency disturbance ride-through)

- 8.1. The generating system must be capable of continuous uninterrupted operation for any combination of the following rates of change of frequency:
- (a) ± 4 Hz/s for 250 milliseconds
 - (b) ± 3 Hz/s for 1 second, until such time as power system frequency breaches the extreme frequency excursion tolerance limits. ¹²

9. Disturbance ride-through (voltage phase angle shift)

- 9.1. The generating system must not include any vector shift or similar relay/protective function acting upon voltage phase angle which might operate for phase angle changes less than 20 degrees.

Voltage control capability

10. Voltage control capability

- 10.1. The generating system must be capable of being controlled by a fast-acting, continuously variable, voltage control system which must be able to receive a local and remote voltage set point.
- 10.2. The generating system must be capable of operating at either a set reactive power level or a set power factor, which must be able to be set locally or remotely at any time.
- 10.3. The voltage, power factor and reactive power control mode of the generating system must be capable of:
- (a) being overridden by the disturbance ride through requirements specified in clauses **Error! Reference source not found.** to 9 (inclusive) during power system voltage disturbances, and

¹² For synchronous generators, consideration will be given to the physical limitations of the plant. This may require a variation to this condition, to be determined by the Commission at the time of issuing of the licence.

- (b) automatically reverting to power factor or reactive power mode when the disturbance has ceased.

System strength

11. System strength

- 11.1. Individual components of plant within a generating system, which includes but is not limited to generating units and dynamic reactive power plant, must be capable of operating down to the following levels at the high voltage terminals in relation to each component:
 - (a) minimum short circuit ratio of 1.5, and
 - (b) minimum positive sequence X/R ratio of 2.

Active power control capability

12. Active power control capability

- 12.1. The generating system must be capable of automatically providing a proportional increase or decrease in active power output, in response to falling and rising power system frequency respectively.
- 12.2. To comply with clause 12.1:
 - (a) An active power response to changing power system frequency must be provided with no delay, beyond that required for stable operation, or inherent in the plant controls, once frequency leaves the deadband.
 - (b) The steady state droop setting of the active power response must be adjustable in the range 2 percent to 10 percent.
 - (c) The frequency deadband for the active power response must be adjustable in the range from 0 to +/- 1.0 Hz.
- 12.3. The generating system must be capable of sustaining a response to abnormal frequency conditions for at least 10 minutes, subject only to energy resource availability for intermittent generating systems.
- 12.4. The generating system must be capable of applying different deadband and droop settings in response to rising and falling frequency and for different levels of frequency change.

13. Active power control capability (AGC capability)

- 13.1. The generating system must have active power control capabilities that allow it to participate in existing national electricity market arrangements requiring automatic generation control (AGC).
- 13.2. At a minimum, the AGC must have the capability to:
 - (a) receive and respond to a remotely determined active power control setpoint, updated at a rate of every four seconds, transmitted to the generating system, and

- (b) provide the following information to AEMO, upon a request from AEMO under NER clauses S5.2.6.1 or 3.8.2:
 - (i) actual active power output;
 - (ii) maximum raise limit;
 - (iii) minimum lower limit;
 - (iv) maximum raise ramp rate; and
 - (v) maximum lower ramp rate.

14. Active power control capability (rate of change of active power)

- 14.1. The generating system must be capable of limiting the rate of change of active power, both upwards and downwards. A generating system is not required to comply with a limit on the rate of reduction of active power where the reduction in active power is caused by energy resource availability for intermittent generating systems.
- 14.2. The generating system must be capable of implementing different active power rate limits for operation in the normal operating frequency band and for contingency events.
- 14.3. The generating system must be capable of setting a ramp rate limit with accuracy of within 10 percent.

15. Active power control capability

- 15.1. The generating system must have the capability to provide real-time information about its active power control settings to AEMO, including mode of operation, deadband and droop parameters and any other active power control setting that may change during real-time operation.

System restoration

16. System restoration

- 16.1. Where sufficient minimum fault level is available from online synchronous machines, the generating system must have the following capability in the event of a black system:
 - (a) the generating system must be capable of operation with auxiliary loads only for X minutes¹³ while system load is being restored, and
 - (b) the generating system, including, but not limited to, each of its generating units and dynamic reactive power support plant (as applicable) must have the capability to provide steady-state and dynamic reactive power when operating with auxiliary loads only for X minutes while system load is being restored.¹⁴

¹³ The exact duration will be specified by the Commission at the time the licence is issued.

¹⁴ The exact duration will be specified by the Commission at the time the licence is issued.



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