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Submission

20 January 2017

The Hon. Jackie Trad MP
Deputy Premier
Minister for Infrastructure, Local Government and Planning and Minister for Trade and Investment
c/- State Interest Feedback
Planning Group
Department of Infrastructure, Local Government and Planning
PO Box 15009
CITY EAST QLD 4002

Via email: planningpolicy@dilgp.qld.gov.au

Dear Deputy Premier

Re: Review of the Planning Regulation, State Planning Policy and State Development Assessment Provisions

The Queensland Farmers' Federation (QFF) is the united voice of intensive agriculture in Queensland. It is a federation that represents the interests of 15 of Queensland's peak rural industry organisations, which in turn collectively represent more than 13,000 primary producers across the state. QFF engages in a broad range of economic, social, environmental and regional issues of strategic importance to the productivity, sustainability and growth of the agricultural sector. QFF's mission is to secure a strong and sustainable future for Queensland primary producers by representing the common interests of our member organisations:

- CANEGROWERS
- Cotton Australia
- Growcom
- Nursery & Garden Industry Queensland
- Queensland Chicken Growers Association
- Queensland Dairyfarmers' Organisation
- Burdekin River Irrigation Area Committee
- Central Downs Irrigators Limited
- Bundaberg Regional Irrigators Group
- Flower Association of Queensland Inc.
- Pioneer Valley Water Board
- Pork Queensland Inc.
- Queensland Chicken Meat Council
- Queensland United Egg Producers
- Australian Organic.

QFF welcomes the opportunity to participate in the state government's review of the Planning Regulation, State Planning Policy and State Development Assessment Provisions, to ensure the state's interests in plan making and development assessment are clearly, accurately and appropriately expressed.

Summary

QFF formally requests that the State Government immediately embarks on the development of a 'Large-Scale Solar State Code and Planning Guideline' to address an emerging number of issues associated with these new developments. Additionally, that planning for all large-scale photovoltaic facilities is impact assessable, rather than code assessable. Local Councils do not have the expertise or resources to assess these developments or ensure compliance with planning conditions should project proponents fail to comply with their obligations.

Background

QFF has been made aware of a growing number of siting and development issues associated with large-scale solar photovoltaic (PV) facilities by both landowners and local councils. For example, the issues highlighted by the initial approval and subsequent call-in of the Clare Solar Farm in Burdekin Shire Council pursuant to s.425 of the *Sustainable Planning Act 2009* in October 2015.

Solar facilities/farms are currently assessed by local government under planning schemes, and do not trigger an assessment under the *Regional Planning Interests Act 2014*, even if they are in an area of regional interest such as a Priority Agricultural Area (PAA) or a Strategic Cropping Area (SCA), because they are not resource or regulated activities. The impact of solar facilities on the productivity of the underlying agricultural land is not well understood. However, the long-term nature of solar facility infrastructure (typically 30 years or more) means the land is converted to a non-agricultural use for the life of the project.

Notable recent examples of approved solar farms on important agricultural land include:

- 340 hectare (ha) solar farm at Clare in the Burdekin, impacting 340 ha of ALC Class A land and Strategic Cropping Land (SCL), in an Important Agricultural Area (IAA) and within the Burdekin Haughton Water Supply Scheme. The Queensland Government has invested significantly in this scheme to support and expand agriculture in the region.
- 5,375 ha solar farm at Bulli Creek near Millmerran, which will impact 3,771 ha of ALC Class A land in an IAA, and 3,655 ha of land shown on the SCL trigger map.
- 180 ha solar farm near Childers, which will impact 124 ha of ALC Class A land and SCL.

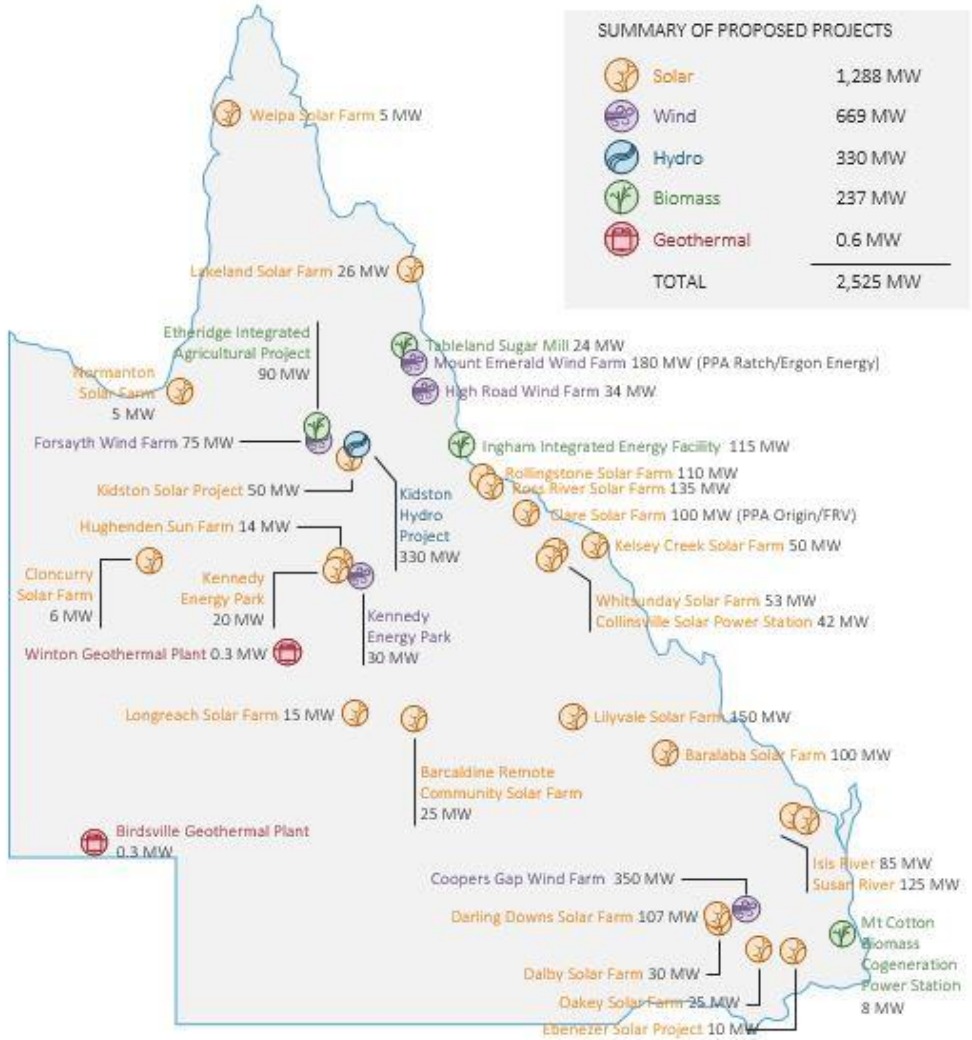
There will be a growing number of new large-scale PV facilities constructed across Queensland over the next 20 years. In September 2016, the Australian Renewable Energy Agency (ARENA) announced funding for 12 large scale projects, six of which are in Queensland and have a combined capacity of 300MW (table 1). The solar industry is currently expecting to have all 12 plants completed by the end of 2017, with an aggressive timetable required to lock in financing (given the uncertainty around ARENA), off take arrangements, connection agreements and the required approvals.

Table 1: Approved ARENA funded projects, September 2016

Applicant	Project name	Size (MW AC)	ARENA funding	Total project cost	Nearest town
Origin Energy	Darling Downs Solar Farm	110.0	$20 million	$216.7 million	Dalby, QLD
Whitsunday Solar Farm	Whitsunday Solar Farm	58.1	$9.5 million	$122.4 million	Collinsville, QLD
Neoen Australia	Parkes Solar Farm	50.6	$7.5 million	$107.9 million	Parkes, NSW
Genex Power	Kidston Solar Farm	50.0	$8.9 million	$126.2 million	Kidston, QLD
Manildra Solar Farm	Manildra Solar Farm	42.5	$10.9 million	$109.3 million	Manildra, NSW
RATCH Australia Corporation	Collinsville Solar Power Station	42.0	$9.5 million	$95.9 million	Collinsville, QLD
Neoen Australia	Griffith Solar Farm	25.0	$5.0 million	$54.6 million	Griffith, NSW
Canadian Solar (Australia)	Oakey Solar Farm	25.0	$2.2 million	$47.5 million	Oakey, QLD
Neoen Australia	Dubbo Solar Farm	24.2	$5.5 million	$55.6 million	Dubbo, NSW
APT Pipeline (APA Group)	Emu Downs Solar Farm	20.0	$5.5 million	$47.2 million	Cervantes, WA
Goldwind Australia	White Rock Solar Farm	20.0	$6.0 million	$44.5 million	Glen Innes, NSW
Canadian Solar (Australia)	Longreach Solar Farm	15.0	$1.3 million	$28.7 million	Longreach, QLD
TOTAL		482.0	$91.7 million	$1,056.4 million	

On top of the ARENA projects, a further 900MW plus of large-scale solar has been identified for Queensland (figure 1).

Figure 1: Summary of Proposed Renewable Energy Projects for Queensland



(http://www.qldrepanel.com.au/engagement-hub/forum_topics/queensland-has-a-current-project-pipeline-of-around-2500-mw-of-committed-and-proposed-large-scale-renewable-generation-plant-primarily-in-regional-areas-how-can-queensland-capture-maximum-ongoing-benefits-from-these-projects)

Many of existing and proposed development cover significant land areas ranging from 600 ha up to a proposed development of 1,200 ha. QFF considers PV facilities over 20 ha to be large-scale. QFF bases this 'large-scale' threshold on the potential land impacts (e.g. impacts to agricultural land and neighbouring landowners) not the energy generation capacity, noting the assumptions that:

- 1 MW solar PV power plant should require about 1 ha plus room for support services. Therefore, 1 MW of solar PV power plant will be about 1.6 ha in total area[1];
- the PV technology also impacts land requirements with solar tracking technology – 1 MW of thin film solar plant will require about 30 per cent more area than a similar power plant with crystalline solar modules; and
- approximately 1 m2 of land produces 200 W of electricity, depending on the location, efficiency and other environmental conditions[2] [3].

If the solar PV projects identified in table 1 and figure 1 are realised, then the required land area could be in excess of 2,500 ha, depending on technology selection. Given the scale and complexity of large-scale PV facilities and the potential impacts on both the site and neighbouring land uses, the planning assessment cannot simply be code assessable. Relying on local councils to undertake these complex assessments, particularly regional councils that do not have the available skills or resources, is not responsible or appropriate.

QFF supports increasing the amount of energy generated from renewable and low carbon technologies to secure energy supply, reduce greenhouse gas emissions to slow down climate change and stimulate investment in new jobs and businesses. Many agricultural businesses have adopted solar amongst other renewable energy technologies as part of their energy demand management strategy and to combat rising electricity prices. There are also significant opportunities for the co-location of renewable energy systems across Queensland's agricultural sector. Planning has an important role in the delivery of new renewable and low carbon energy infrastructure.

Large-Scale Solar State Code and Planning Guideline

QFF acknowledges the work undertaken by the Department of Infrastructure, Local Government and Planning (DILGP) in the development the 'Wind State Code'. This code identifies critical planning considerations associated with wind-based renewable energy developments and the certainty that it provides to both project proponents and the local communities hosting this infrastructure. QFF considers that large-scale PV facilities pose similar challenges and warrant the development of a similar code.

The development of a 'Large-Scale Photovoltaic Facility State Code' will require an amendment to the State Development Assessment Provisions (SDAP) so that it applies to a material change of use for a new or expanding solar PV facility. QFF notes that precedent for such an amendment has been set by the 'Wind State Code', and that the potential off-site environmental and social impacts or land disturbance from a wind farm is considerably less than that from a large-scale solar facility.

QFF strongly advocates that a 'Solar Code' is required to protect individuals, businesses, communities and the environment from adverse impacts as a result of the construction, operation and decommissioning of large-scale PV developments. Large-scale PV facilities should be appropriately located, sited, designed, constructed, operated and decommissioned at their end-of-life (EoL) to ensure:

[1] See http://www.solarmango.com/scp/area-required-for-solar-pv-power-plants/. Accessed 10 January 2017.
[2] Lewis NS. Powering the planet. California Institute of Technology. Available at: ⟨http://www.nsl.caltech.edu/_media/energy:energy6.pdf⟩; 2010.
[3] Jacobson MZ, Delucchi MA. Providing all global energy with wind, water, and solar power, Part I: technologies, energy resources, quantities and areas of infrastructure, and materials. *Energy Policy* 2011;39:1154–69.

- risks to human health, wellbeing and quality of life are minimised by ensuring acceptable levels of amenity and associated emissions at sensitive land uses;
- development avoids, or minimises and mitigates, adverse impacts on the natural environment (fauna and flora) and associated ecological processes;
- development which avoids negative or long-term impacts on state interests such as the maintenance of sufficient areas of Good Quality Agricultural Land (GQAL)[4] and the potential impacts from the reduction of GQAL that may impact the viability of agricultural industries, agricultural processors and/or water supply schemes;
- development does not unreasonably impact on the character, scenic amenity and landscape values of the locality;
- the safe and efficient operation of local transport networks and road infrastructure;
- the safety, operational integrity and efficiency of air services and aircraft operations including crop spraying activities;
- provision of a sound methodology to address a range of documented impacts from large-scale PV farms;
- includes a model for fair and reasonable compensation for adjacent landowners and businesses where impacts result from the development;
- minimum standards for community consultation including minimum timeframes and a mechanism for appeal by directly impacted stakeholders;
- communities are protected from the associated decommissioning and remediation costs from EoL facilities (which could be up to 30 years from commission);
- minimum standards associated with the construction, maintenance (including weed spraying) and decommissioning at the end of their operational life, and to a reasonable extent, the site should be returned to its former state.

The 'Solar Code' must also provide additional supporting information and actions to assist applicants in demonstrating compliance with the performance outcomes or acceptable results of the code, as in the case of the existing 'Wind State Code'. It must also include the detailed methodology for some technical assessments that may be required. QFF considers the following areas must be considered (as a minimum) within the planning regime:

1. Location

Impact on agricultural land and agri-processing developments

Any loss of agricultural land (IAA; Class A and Class B agricultural land; PAA; SCL) for these developments should be avoided; including the direct loss of agricultural land, and land lost through the secondary impacts from the development on adjacent land. For example, the 'PV heat island effect' – discussed further into this submission.

Large-scale PV developments should only be approved on agricultural land if there are no alternative suitable locations on non-agricultural land and there is a clear over-riding need for the development in the proposed location.

The loss of agricultural land or resulting loss of productivity or commodity adaptation as a result of impacts from large-scale PV facilities, can also impact the viability of agri-processing facilities (e.g. animal processors, cotton gins and sugar mills), the efficient utilisation of assets, and ultimately the agricultural profitability of a region. Such facilities can also impact ongoing investment decisions and investment certainty; and investment security where land prices may be reassessed.

[4] GOAL includes PAA, SCA, SCL, IAA and ALC Class A & B agricultural land. QFF considers that the current structure of agricultural land classifications needs to be addressed to reduce confusion and realise better planning outcomes.

Infrastructure to service PV facilities, such as the transmission lines, may need to cross land held by different owners. This can present a challenge to the existing land owners from mandatory easements amongst other issues. Location selection and the design of the facility must minimise these associated impacts.

Environmental impacts

Environmental impacts include, but are not limited to, ecological and biodiversity impacts. An assessment will need to include a 'desk top study' for existing ecological records, biodiversity maps and an evaluation of the likely impacts of a large-scale PV facility on ecological features, specify mitigation to avoid/minimise these impacts and list any further surveys required.

A Biodiversity Planning Assessment (BPA) identifies the terrestrial ecological values in a region, or bioregion, according to their conservation significance. BPAs are used by governments, members of the community and landholders to make planning decisions about appropriate land use.

Vegetation management will be required including the identification of native vegetation and the requirements that apply to the proposed area through a 'regulated vegetation management map'.

The clearing of native vegetation in Queensland is regulated by the *Vegetation Management Act 1999*, the *Sustainable Planning Act 2009* and the State Policy for Vegetation Management. Whether a permit will be needed or not depends on the type of vegetation; the land tenure of the land (e.g. freehold or Indigenous land); the location, extent and purpose of the proposed clearing; and who is proposing to do the clearing (e.g. state government body, landholder).

The Regional Ecosystem Description Database lists the biodiversity status (BD status) and the vegetation management class (VM class) of each regional ecosystem. The BD status is based on an assessment of the condition of remnant vegetation in addition to the criteria used to determine the class under the *Vegetation Management Act* 1999 (the Act). The VM class is listed in the Vegetation Management Regulation under the Act.

The BD status is used for a range of planning and management applications including the Biodiversity Planning Assessments and to determine environmentally sensitive areas that are used for regulation of the mining industry through provisions in the *Environmental Protection Act* 1994.

2. Development

A sustainable construction plan

The development of a large-scale solar installation is likely to require the excavation of soil associated with construction compounds, access roads, cable trenching etc. Where such soil stripping occurs on agricultural land, topsoil and subsoil should be stripped, stored and replaced separately in order to minimise soil damage and to provide optimal conditions for site restoration. Any planning application should contain a methodology for soil stripping, storage and replacement that must be adhered to during site development.

Large-scale PV developments will require the delivery and storage of construction materials, plant, machinery and office/welfare accommodation. It is therefore likely that a temporary construction compound will be required. Such compounds should be carefully located in order to minimise environmental or amenity impact; or any impacts to adjacent landowners, and any planning application should contain details of their size and location.

Access roads and paths or access to services

Access roads and paths must: minimise disturbance to the agricultural land and vegetation; be temporary, capable of removal and 'reversible'; and minimise their landscape/visual impact and their impact on the rural environment.

Where access on neighbouring land is required, this must only occur subject to landowner agreement.

Site contours/gradient

If any site levelling works are proposed to facilitate the development of a solar panel array, the extent of these levelling works should be discussed at the pre-application stage and detailed within any planning application. Site levelling must not impact natural drainage or water flow to neighbouring properties or increase the risk of flooding, sediment flow and waterlogging.

3. Operation

Ground maintenance

Compared to many other power generating technologies, solar PV facilities have minimal maintenance and service requirements. However, a continuous operation and maintenance program is essential to optimize energy generation and maximize the lifetime and viability of the entire plant and its individual components. Operation and maintenance issues may include, but not be limited to, engineering features, grid connection, contractor selection, impacts from extreme weather events, data acquisition, security, environment monitoring, health and safety, and ongoing stakeholder engagement.

Vegetation will grow under the solar panels and this will require management; particularly to avoid the panels becoming obscured/impacted by vegetation, the site becoming overgrown with noxious weeds and assist with the eventual restoration of the site, in many cases to agriculture. There are various techniques for managing the vegetation, including mowing, slashing, spraying or mulching.

A 'Solar Code' must include conditions for preventing and minimising chemical spray drift impacts, from crop destruction/damage, health issues and nuisance (e.g. odour), through to negative impacts on the environment including soil health and pollution of water courses. Minimum standards must include records on the use of vegetation control practices on-site, including a management plan to be consulted with neighbouring property, and also the associated weather conditions during control measures. Chemical spraying should be avoided wherever possible.

Mulching large areas is likely to present technical challenges and may add to the landscape/visual impact of a development proposal. In other jurisdictions (e.g. the U.K.) few ground maintenance management techniques are regarded as sustainable. The ability to continue an agricultural use on the site or rehabilitate the site in the long-term to agricultural use must be factored in. For example, if grazing is utilised as part of the land management strategy, appropriate fencing and animal welfare plans must be applied.

Water and drainage

Significant PV facilities, must be accompanied by a 'Flood Risk Assessment', which includes the impact of drainage from the panels, other impermeable areas/infrastructure and access tracks. Where access tracks need to be provided, permeable tracks should be used. Localised tools such as swales and infiltration trenches, should be used to control any run-off (including sediment flow) where required.

Facilities and their associated infrastructure should not impact on existing drainage systems and watercourses or change flows to adjacent properties. QFF notes that many of the proposed facilities are within significant catchments ranging from coastal waters (flowing to the reef) to the Murray Darling Basin.

Buffer zones

A buffer strip of larger than five (5) metres between hedges and solar panels is desirable to promote ecological and biodiversity opportunities if it can be achieved. Existing hedges and established vegetation, including mature trees, should be retained wherever possible and may assist to limit negative impacts including visual to the heat island effect. Buffer zones will also have to take into account fire breaks.

Visual amenity

The landscape/visual impact of a solar PV facility is likely to be one of the most significant impacts of such development. Any large-scale PV development will need to have regard in both its design layout and future maintenance plans for the retention of growth of vegetation on boundaries, including the opportunity for individual trees within the boundaries to grow on to maturity.

Visual impacts may include glint and glare. Glint may be produced as a direct reflection of the sun in the surface of the solar PV panel. It may be the source of the visual issues regarding viewer distraction. Glare is a continuous source of brightness, relative to diffused lighting. This is not a direct reflection of the sun, but a reflection of the bright sky around the sun. Glare is significantly less intense than glint.

While solar PV panels are designed to absorb, not reflect, irradiation, the sensitivities associated with glint and glare, and the landscape/visual impact, including the potential impact on aircraft safety (e.g. regional airports and aerial crop sprayers), should be considered. For example, before construction of utility scale PV power plants near airports or within known flight corridors in the United States, the Federal Aviation Administration (FAA) requires that the glare from the proposed plant not be a hazard to navigable airspace[5] [6].

For significantly sized facilities, it may be necessary to seek a glint and glare assessment as part of a planning application. This may be particularly important if 'tracking' panels are proposed as these may cause differential diurnal and/or seasonal impacts. The combined reflective potential for solar PV panels, frames and supports should be included in any assessment.

Health concerns

PV arrays and the associated electrical infrastructure emits electric magnetic fields (EMF), usually at extra low frequency (ELF) when generating and transmitting electricity. Magnetic fields which are only generated when a device is operating, are not easily shielded and will pass through most objects resulting in higher potential exposure. Magnetic fields are higher at the inverters and transformers of the panels themselves and, as such, site design must minimise potential risks to sensitive receptors.

PV cells (particularly on dwellings) have also been linked to electromagnetic hypersensitivity (EHS). The medical literature defines EHS as 'an idiopathic environmental intolerance attributed to electromagnetic fields'. The World Health Organization's (WHO) fact sheet on EHS states that "*while some individuals report mild symptoms and react by avoiding the fields as best they can, others are so severely affected that they cease work and change their entire lifestyle*"[7].

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[5] Ho, C. K. and Sims, C. A., 2013. Solar Glare Hazard Analysis Tool (SGHAT) User's Manual v. 2.0, SAND2013-7063P, Sandia National Laboratories, Albuquerque, NM.

[6] Rogers, J.A., C.K. Ho, A. Mead, A. Millan, M. Beben, and G. Drechler, 2015. Evaluation of Glare as a Hazard for General Aviation Pilots on Final Approach, Federal Aviation Administration, DOT/FAA/AM-15/12, Office of Aerospace Medicine, Washington, DC 20591, 2015, www.faa.gov/data_research/research/med_humanfacs/oamtechreports/2010s/2015/.

[7] World Health Organization. Extremely low frequency fields. Environmental Health Criteria, Vol. 238. Geneva, World Health Organization, 2007.

Estimations of the prevalence of EHS within the community vary and there is no determination for the Australian population. The UK-based EM Radiation Research Trust state that it is currently estimated that between 2.5 and 8 per cent of the population could have this condition[8]. Research has previously indicated that up to 50 per cent of the Australian population will be electrically sensitive in the near future[9].

With regards to the weakness of the evidence for a link between exposure to ELF magnetic fields and childhood leukaemia, the WHO provide the following advice[10]:

- Government and industry should monitor science and promote research programmes to further reduce the uncertainty of the scientific evidence on the health effects of ELF field exposure. Through the ELF risk assessment process, gaps in knowledge have been identified and these form the basis of a new research agenda.
- Member States are encouraged to establish effective and open communication programmes with all stakeholders to enable informed decision-making. These may include improving coordination and consultation among industry, local government, and citizens in the planning process for ELF EMF-emitting facilities.
- When constructing new facilities and designing new equipment, including appliances, low-cost ways of reducing exposures may be explored. Appropriate exposure reduction measures will vary from one country to another.

According to the *Disability Discrimination Act 1992 (Cth)*, the definition of a disability includes the malfunction of a part of the person's body, as well as a disorder that affects a person's thought processes, perception of reality, emotions or judgment or that results in disturbed behaviour. It also includes a disability that presently exists, previously existed or may exist in the future. The Act specifically outlines that to avoid doubt, a disability that is otherwise covered by this definition includes behaviour that is a symptom or manifestation of the disability.

EHS clearly fits this definition. EHS can cause both a malfunction of people's bodies (for instance, skin rashes, nausea, heart palpitations), as well as affecting sufferers' cognitive processes.

QFF notes the 2013 Administrative Appeals Tribunal case, (David McDonald v Comcare)[11], where the decision was made to award Dr McDonald compensation in accordance with the *Safety, Rehabilitation and Compensation Act 1988*, in respect of an injury incurred due to exposure to low-level electromagnetic fields. The claim, for aggravation of EHS syndrome, was satisfied by Dr McDonald having suffered either an aggravation of sensitivities to EMFs; or, an aggravation of his symptoms by reason of his honest belief that he suffered from the condition of EMF sensitivity and that his exposure at his workplace worsened his sensitivity. This precedent may have implications for farm residents and farm workers. QFF is currently following up this line of enquiry with WorkCover Queensland to determine the risks posed to workers in the agricultural sector.

There is a growing body of scientific research seeking to determine if there is an association between PV installations (at both domestic and large-scale commercial scale) and the incidence of cancer including childhood leukaemia. Many of these studies exploring a range of negative medical outcomes are

[8] EM Radiation Research Trust 2015, Electromagnetic Hypersensitivity, Online, Available: http://www.radiationresearch.org/campaigns/electromagnetic-hypersensitivity. Accessed 12 January 2017.
[9] Hallberg, O. & Oberfeld, G. 2006, 'Will we all become electrosensitive', letter to the editor, Electromagnetic Biology and Medicine 25 (3), 2006. pp. 189-91
[10] World Health Organisation – Electromagnetic Fields and Public Health. http://www.who.int/peh-emf/publications/facts/fs322/en/. Accessed 12 January 2017.
[11] See Administrative_Appeals_Tribunal_of_Australia_Dr_Alexander_McDonald_and_Comcare_28_02_2013

inconsistent, furthering community concern between PV installations and cancer rates. The WHO has designated ELF-EMF as a possible carcinogen[12].

Further studies concerning electromagnetic radiation must be considered as part of the science-based evidence to determine the location of large-scale PV arrays where they are in proximity to sensitive receptors. There is growing evidence that high frequency voltage transients can produce negative biological effects, for example:

- Cancer – American Journal of Industrial Medicine, 51(8): 579-586, 2008.
- Diabetes – Bioelectromagnetics, 25(3): 160-166, 2001; Proceedings from the International Conference of Childhood Leukaemia, London, September 6-10, 2004; Electromagnetic Biology & Medicine, 25: 259-268, 2006; Electromagnetic Biology & Medicine, 27: 135-146, 2008.
- Neurotransmitter levels – Electromagnetic Biology & Medicine (online), Informa Healthcare, January 18, 2013.
- Multiple Sclerosis – Proceedings from the International Conference of Childhood Leukaemia, London, September 6-10, 2004; Electromagnetic Biology & Medicine, 25: 259-268, 2006.
- Headaches – Proceedings from the International Conference of Childhood Leukaemia, London, September 610, 2004.
- Childhood Leukaemia – Medical Hypothesis, 56(3): 290-295, 2001.
- Amyotrophic Lateral Sclerosis (ALS) – Medical Hypothesis, 74(6): 1086-1087, 2010.
- Symptoms of Electromagnetic Hypersensitivity (EHS) – Proceedings from World Health Organization Workshop on Electrical Hypersensitivity, Prague, Czech Republic, October 25-26, 2004; Science of the Total Environment, November 1, 2011.

Noise

Environmental nuisances may also impact health. For example, ground-mounted PV array inverters and transformers make a humming noise when the array is generating electricity. Any sound from the inverters should be inaudible at 15-30 metres from the boundary of the arrays. Options to minimise noise impacts to adjacent land should be explored. This could include conducting preconstruction sound studies to determine background levels, elevating transformers and undertaking appropriate noise mitigation measures including screening and the use of buffer zones. Acoustic quality levels for sensitive receptors are contained within the *Environmental Protection (Noise) Policy 2008*.

Climatic impacts to adjacent land and stakeholders

There is a growing body of empirical research and genuine concern surrounding large-scale PV facilities and their 'heat island' (PVHI) effect. The PVHI effect warms surrounding areas, thereby potentially influencing biodiversity and wildlife habitat, ecosystem functions and human health; and even agricultural land values of properties directly adjacent to these facilities.

One study[13] determined that temperatures around a solar PV plant were regularly 3–4°C warmer. This study went on to state:

"As with the Urban Heat Island (UHI) effect, large PV power plants induce a landscape change that reduces albedo so that the modified landscape is darker and, therefore, less reflective. Lowering the terrestrial albedo from ~20 per cent in natural deserts to ~5 per cent over PV panels alters the energy balance of absorption, storage, and release of short- and long-wave radiation".

[12] The use of the label 'possible carcinogen' indicates that there is not enough evidence to designate low frequency EMF as a human carcinogen at this time.

[13] Barron-Gafford, G. A. et al. (2016). The Photovoltaic Heat Island Effect: Larger solar power plants increase local temperatures. Sci. Rep. 6, 35070; doi: 10.1038/srep35070.

"PV panels are thin and have little heat capacity per unit area but PV modules emit thermal radiation both up and down, and this is particularly significant during the day when PV modules are often over 20°C warmer than ambient temperatures, (iii) vegetation is usually removed from PV power plants, reducing the amount of cooling due to transpiration, (iv) electric power removes energy from PV power plants, and (v) PV panels reflect and absorb upwelling longwave radiation, and thus can prevent the soil from cooling as much as it might under a dark sky at night".

A potential change in critical climatic conditions (e.g. the associated temperature rise) may impact adjacent land owners, effecting existing crop development and input requirements (such as water and nutrient demands), ripening and harvesting patterns or require a long-term change of the commodity to reflect the new climatic conditions. QFF is also aware of anecdotal evidence of banks reconsidering agricultural land values (and associated loans/refinancing) for properties adjacent to proposed large-scale PV facilities.

4. Rehabilitation

Site restoration

As with any other resource development in Queensland, a final restoration plan must be provided during the planning application phase.

Where development on agricultural land cannot be avoided, PV installations must be designed and constructed to be 'reversible', allowing the site to be easily restored to a more intensive agricultural use. Intrusive development, such as trenching and foundations, should therefore be minimised and the use of mass concrete should be avoided. Where possible, large-scale PV arrays should be installed using 'pile' driven or screw foundations or pre-moulded concrete blocks (shoes), and capable of easy removal. The use of shoes may also be required for land subject to native title or areas with biodiversity values. Where 'pile' driven foundations are proposed, impacts during construction on nearby sensitive receptors should be considered.

Community consultation

Consistent with impact assessable development, community involvement should be considered as an integral part of the development process. All stakeholders should be engaged by the developer, at the pre-design, conceptual stage. For regional Queensland areas, this must be undertaken at a local exhibition/presentation level, where community views can be sought and recorded. A second exhibition/presentation should be arranged, by the developer, some weeks prior to submission of the planning application. This second consultation should allow sufficient time to seek community views/opinions, and take them into consideration, prior to the submission of any final planning application. Any planning application should detail the stakeholder consultation undertaken.

Consideration of financial assurance

Financial assurance (FA) is a type of financial security provided to the Queensland Government by the holder of an environmental authority (EA). FAs are intended to provide a guarantee that the costs of site remediation, site closure and post-closure liabilities are not borne by the state or community in the event of the occupiers or operators of a facility abandoning the site, becoming insolvent, or incurring clean-up costs beyond their financial capacity. FAs may currently be applied to a number of activities which disturb land or may result in chemical releases and significant contamination of land.

Depending on the construction methods and land-use/remediation plans for a large-scale PV facility, at the EoL of that facility there may be substantial costs associated with remediation, including the removal of concrete foundations, the replacement or remediation of top soil, through to the recycling or disposal of panels which contain hazardous materials and therefore incur higher associated costs.

It is unlikely that the costs of remediation at EoL have been factored in to the upfront infrastructure and investment costs associated with the facility, nor included in the unit price of the power generated. As such, there will be little incentive to remediate the site back to previous land-use or comply with any planning conditions pertaining to site restoration. This may include a failure to remove the infrastructure on-site (ranging from the framing to the PV panels which contain hazardous materials including, but not limited, to lithium, silicon, arsenic, lead and cadmium) which, in time, may be broken or start to leak, leading to significant environmental harm and community risk.

QFF notes that the financial stress across the solar industry continues to be high due to a range of factors including: over-supply; removal of the carbon tax and diminishing feed-in-tariffs and carbon prices; market saturation of the domestic market in some geographical locations; and potential policy restricting new installations. In the U.S., during 2012 for example, there were approximately 40 large solar-related companies forced into restructuring, operational shutdown, or fire-sale liquidation. Some of these companies supplied and traded in Australia.

QFF notes that solar project proponents involved in the development of large-scale facilities have been placed into administration over the past few years. In January 2017, two further companies involved in the delivery of commercial PV projects in Australia were placed into liquidation (see ASIC Insolvency Notices). There is also a growing community awareness and concern around phoenix organisations and shell companies operating in this sector (at both domestic and commercial level). There have already been cases where some local governments (in New South Wales) have been unable to enforce planning conditions applied to PV developments, either because the company went into liquidation or the project proponent has simply refused to comply.

Given the life-cycle of these technologies/facilities and the turnover of companies operating in this industry, the state government must consider a strategy to protect local councils and rate payers from the costs associated with the remediation of these facilities at EoL. The current regulatory framework, FA and 'chain of responsibility', is limited to developments with an EA. Large-scale PV facilities do not require an EA and therefore cannot be subject to a FA under current regulation.

One solution may be to create a new Environmentally Relevant Activity (ERA) for PV facilities >20 ha within the *Environment Protection Regulation 2008*. QFF considers that this approach is appropriate given s.19 of the *Environmental Protection Act 1994*, where an ERA may be prescribed:

(1) A regulation may prescribe an activity as an environmentally relevant activity if the Governor in Council is satisfied-
    (a) A contaminant will or may be released into the environment when the activity is carries out; and
    (b) The release of the contaminant will or may cause environmental harm.

This would permit the Department of Environmental Heritage and Protection to then manage the off-site environmental impacts through the conditions of an EA, including but not limited to, EoL guarantees such as a FAs. This would also align the licencing and FAs for new energy generating capacity with existing resource and energy developments.

Impacts from product stewardship and rising disposal costs

The development of a product stewardship scheme for PV systems and large storage batteries were listed separately by the Federal Government for consideration under the *Product Stewardship Act 2011* in June 2016–17. Listing provides a signal to the market of the Federal Government's interest in evaluating the rationale and feasibility of some form of stewardship for PV systems and/or energy storage batteries under the Act for the next financial year.

There has been significant growth in the installation of solar systems in Australia since 2010 and as of June 2016, there are over 1.57 million solar PV installations. This number will rise as large-scale facilities reach investment decision driven by ambitious state targets, such as the 50 per cent target for

renewable energy in Queensland. The EoL of the PV system components ranges between 10–30 years, suggesting Australian states and territories will have a significant volume of EoL equipment requiring processing or disposal between 2020–2030. The supply company and/or installer may not still be in business after 30 years. There will also be increasing volumes of both PV systems and the now associated storage batteries.

QFF acknowledges that some work has been undertaken to develop a responsible stewardship approach to support a new industry manage PV systems and/or batteries across the whole life cycle, but it is still undeveloped. Influencing the design and manufacturing of new technology is challenging, and because of the manufacturing structure of the solar industry, Australia must consider harmonising its policies with international approaches.

The Australian solar industry is highly fragmented and still maturing. Integrating responsible management at EoL for high-value resource recovery is an important way of strengthening the emergent markets for renewable energy systems. Presently however, the majority of PV systems and components are imported, making product stewardship difficult to implement with high volumes of orphan goods. Product stewardship would also not retrospectively apply to existing facilities and some previous product stewardships schemes have taken up to 10 years to fully develop and implement. There is a growing number of inverters and batteries requiring EoL treatment which is expensive and the costs associated with this will rise significantly into the future given the hazardous nature of their components, likely future disposal bans and rising disposal and treatment costs.

All large-scale project proponents must provide evidence that they have considered future decommissioning and restoration costs associated with the facility, particularly for those sites covering considerable areas of land disturbance and infrastructure removal (such as in the case of the proposed 600-1200 ha facilities). Where the Administering Authority is not satisfied that this has occurred then provision must be made for a FA to ensure that site clean-up costs are not borne by the community.

Cumulative impacts

The relevant Administering Authority (planning) should maintain a record of all planning applications received in respect of proposals for large-scale PV installations and a record of all planning decisions. The issue of cumulative impacts (environmental, social and economic) associated with large-scale PV facilities in a regional area must be considered in the planning application process.

Whilst (electricity) network constraints exist in many areas, and may ultimately limit the capacity and size of the PV facility, this cannot be assumed. The planning process must take into account the cumulative impacts of multiple large-scale facilities or the cumulative impact from a single, substantial facility.

5. Assessments

The ‘Solar Code’ must also include approved methodologies for the required assessments. For example, within the ‘Wind State Code’, the Appendices provide additional technical guidance and material for the preparation of technical assessments. Appendices could include:

- Guidance on the information which should be provided within a Landscape and Visual Impact Assessment
- Ecological Assessment Methodology
- Noise Impact Assessment Methodology
- Electromagnetic Field Health Impact Assessment Methodology
- Glare and Glint Assessment Methodology
- Heat Island Impact to Local Climate and Adjacent Land Methodology.

If you require further clarification or have questions about this submission, please contact Dr Georgina Davis on (07) 3837 4720 or email georgina@qff.org.au.

Yours sincerely

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