Flow on Benefits of Microgrids in Agriculture

Andrew Chamberlin

20 September 2023

The flow on benefits of **microgrids for agriculture**

QUEENSLAND FARMERS' FEDERATION

CONSTRUCTIVE ENERGY

REAQUA SOLAR PUMPING

COTTON AUSTRALIA

Our Members

Canegrowers
Cotton Australia
Queensland Fruit & Vegetable Growers
Nursery & Garden Industry Queensland
eastAUSmilk
Australian Cane Farmers Association
Queensland United Egg Producers
Turf Queensland
Queensland Chicken Meat Council
Pork Queensland
Bundaberg Regional Irrigators Group
Burdekin River Irrigation Area
Central Downs Irrigators Ltd
Fairburn Irrigation Network
Mallawa Irrigation
Pioneer Valley Water Co-operative Ltd
Theodore Water Pty Ltd
Eton Irrigation
Queensland Oyster Growers Association
Lockyer Water Users Forum

QFF QUEENSLAND FARMERS' FEDERATION

About QFF

The Queensland Farmers' Federation (QFF) is the united voice of agriculture in Queensland.

- Member-based organisation representing the interests of peak agriculture industry organisations (state and national).
- Collectively, we represent 13,000 primary producers.
- We work with the government of the day on behalf of the agriculture sector, farmers and the community to build a strong future Queensland agriculture.
- We develop policy and advocate on behalf of our industries.

Who we represent

- Cotton
- Horticulture
- Nursery and garden
- Dairy
- Cane
- Poultry
- Pork
- Intensive animal industries
- Irrigators

The QFF team are a group of highly skilled and committed professionals with technical expertise across the priority areas of our members.

We deliver:

- cutting-edge projects to support innovative, sustainable practices on-farm
- science-based and future focused in our policy development

QFF QUEENSLAND FARMERS' FEDERATION

Our Policy and Projects Work

Water

Energy

Biosecurity

Agriculture productivity

Animal welfare

Waste management, resource recovery

Land use planning, regional development and co-existence

Environmental sustainability and natural resource management

Workforce planning, including education and training and workplace health and safety

Farm business planning, including risk management and resilience building

Project Team

Constructive Energy

- **Ashley Bland**
- **Tom Griffiths**

Reaqua & Farm Renewables Consulting

- **Karin Stark**

Cotton Australia

- **Jennifer Brown**

QFF

- **Madison Sturges**
- **Andrew Chamberlin**

Why Microgrids On Farm?

Agriculture and Energy

Energy productivity in Ag: irrigation, processing, cooling/heating, treatment systems, packing sheds, etc.

Efficiency gives way to asset optimization and energy sharing (between meters and consumers)

Reliability and business resilience

Lack of ‘fit for purpose’ utility products and services, energy independence

Commodity market pressures to decarbonise

Why Microgrids On Farm?

Regional Grids

- Aging infrastructure in regions
- Expensive network cost/consumer, transmission efficiency challenges
- Grid reliability and resilience challenges
- C&I/Ag consumer grid defection presents equity issues for remaining grid connected regional consumers
- Local benefit and other coexistence challenges from utility scale RE in regions

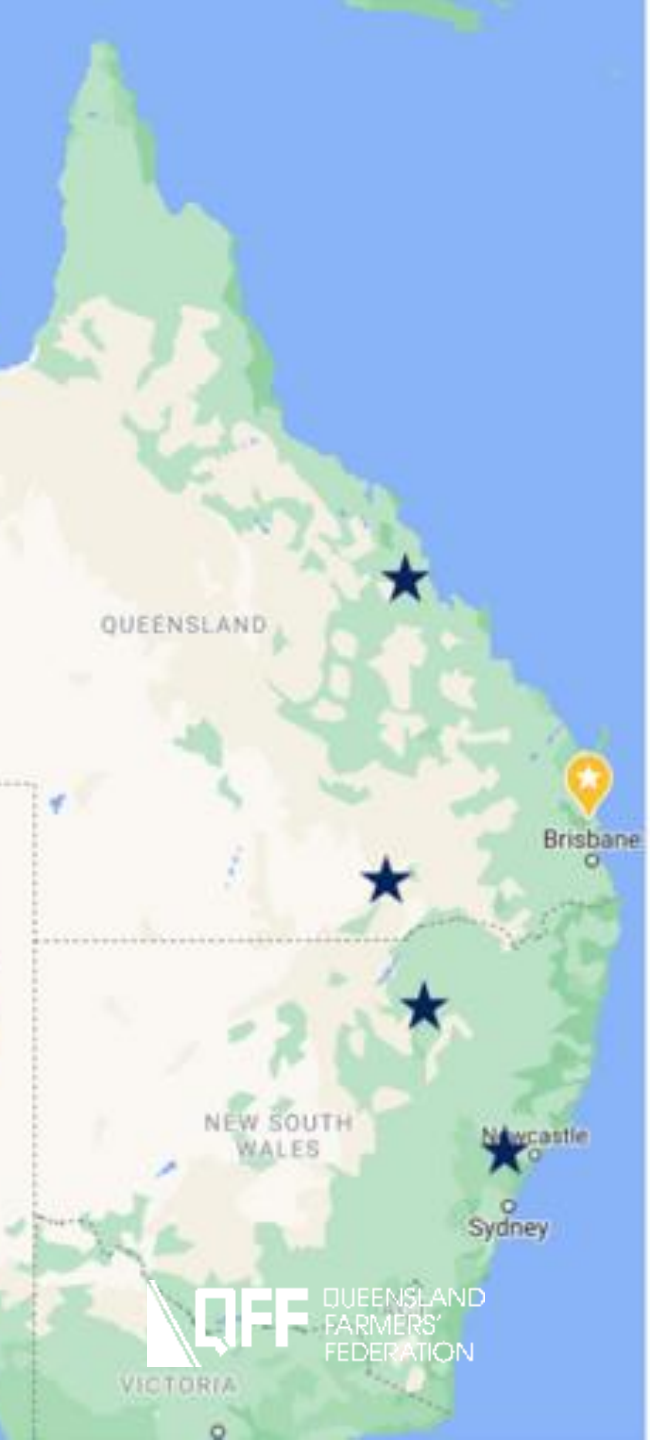
A balance between regional consumer benefit and network service affordability is critical

Defining Microgrids

A microgrid is a physical energy grid generating and distributing electricity within its geographic footprint.

It can:

- Blend DERs to form a self-contained system
- Use renewable and non-renewable sources
- Connect to and disconnect from the central grid, on demand
- Enable energy sharing and trading with local and national energy markets
- Help modernise central grids locally, with enabling regulation and technology



Evaluating Ag Microgrid Archetypes

Choosing the Case Studies

The feasibility study identified 4 archetypes that represented *commonly occurring grid and potential microgrid orientations*.

Case studies were selected across varying geographies, commodities, and consumption profiles.

The selection criteria ensured archetypes were robustly tested.

Location	Archetype	Commodity
Pokolbin, NSW	Single Enterprise	Winery
St George, QLD	Edge of Grid	Cotton
Mackay, QLD	Large Microgrid	Sugar Cane
Wee Waa, NSW	Anchor-Host/Hybrid	Mixed Horticulture

Criteria	Description
Practical	Is a microgrid or similar physically possible?
Replicable	Is the farm profile commonly occurring?
Impact	What is the potential value of the investment?
Partnership	Is there opportunity to share benefit off farm?

Value Drivers

The feasibility study expressed viability as an energy price cheaper than existing energy costs.

These income levers were considered.

Income Levers	Accessibility
Self-consumption	Currently accessible
Export/Feed in Tariffs	Varying accessibility
Ancillary/Wholesale Markets	Limited accessibility
Upgrade Deferral Payments	Very limited/no accessibility
Local Energy Markets/PPAs	Very limited/no accessibility

Simple project finance outputs didn't always capture the full value of a microgrid to the farmer.

Stacking the below value drivers considerably altered the perception of viability and risk appetite.

Value Driver	Pokolbin	Wee Waa	Mackay	St George
Affordability	✓	✓	✓	✓
Resilience	✓	✓	✓	✓
Independence				✓
Decarbonisation	✓	✓	✓	✓
Local Sharing	✓	✓	✓	✓

QFF QUEENSLAND FARMERS' FEDERATION

Feasibility Results

	POKOLBIN	ST GEORGE	MACKAY	WEE WAA
TYPE	Grid Connected Microgrid	Grid Connected Microgrid	Virtual Microgrid	Grid Connected Microgrid
CORE SYSTEM COMPONENTS	220kW solar PV 269kWh battery Monitoring + controls	500kW solar PV 1.01MWh battery Monitoring + controls	650kW solar PV 2.128MWh battery Monitoring + controls	800kW solar PV 1.68MWh battery Monitoring + controls
CAPITAL COST	$432,040 Batt $179,040 ($600/kWh) PV $1.15/W	$1,234,500 Batt $559,500 ($500/kWh) PV $1.35/W	$2,154,750 Batt $1,212,250 ($500/kWh) PV $1.45/W	$2,012,500 Batt $932,500 ($500/kWh) PV $1.35/W
12 & 25 YEAR NPV	-$90,049 & **$51,143**	**$338,093** & **$1,813,116**	-$19,100 & **$1,466,122**	-$283,500 & **$1,882,642**

QFF QUEENSLAND FARMERS' FEDERATION

Sensitivity Analysis

	POKOLBIN	ST GEORGE	MACKAY	WEE WAA
TYPE	Grid Connected Microgrid	Grid Connected Microgrid	Virtual Microgrid	Grid Connected Microgrid
% OF BASE CASE CAPEX	80%	75%	-	85%
12 & 25 YEAR NPV	**$12,375** & **$166,983**	**$22,222** & **$1,555,285**	Payback in 8-9 years, modest surplus	**$108,252** & **$1,612,942**

QFF QUEENSLAND FARMERS' FEDERATION

Comparing ‘Lowest Cost’ Interventions

Microgrid benefits may be marginal as a capital-intensive intervention.

Other interventions include:

- Efficiency interventions
- Resolving substation underutilisation with ag productivity tariffs
- Offering net metering retail products

The value of the intervention depends on the farmer’s value drivers for energy productivity.

Solution	Affordability	Reliability	Asset Utilisation	Decarbonise	Back-up Energy	Local Grid Benefit
Meter consolidation	No	No	Maybe	No	No	No
Virtual net metering	Yes	No	Maybe	No	No	No
DER installations	Yes	Yes	Yes	Yes	Yes	No
Local VPP	Yes	Yes	Yes	Maybe	Yes	Yes
Local Energy Market	Yes	Yes	Yes	Yes	Yes	Yes
Microgrid	Yes	Yes	Yes	Yes	Yes	Yes

Challenges to De-risking Microgrids

Technical

- Regional connectivity and smart tech
- Smart meter install costs
- Local access to skills for maintenance
- Variable market maturity
- Brownfield solutions are expensive/tricky, resolve virtually
- Systems serving >80% of energy are too expensive, solve behind the meter with modularity

Regulatory/Market

- Connection process disadvantages small-mid scale projects
- Regulatory innovation is slow
- Energy market uncertainty creates financial risk to microgrid models
- Market pricing mechanisms penalise or exclude CERs
- Regional REZs lack inclusion of CERs
- Monopolised networks impair power of choice and democratisation of energy
- Utilities lack fit for purpose/innovative products and services
- Energy data regulation need improvement

QFF QUEENSLAND FARMERS' FEDERATION

Opportunities for De-risking Microgrids

Agricultural

- Edge of Grid: obvious and easy
- Single Enterprise: system size or land availability dependent, agrivoltaics or VPP/collective system alternatives
- Large Microgrid: possible ag clusters include
  - Single commodity regions
  - Co-located supply chains
  - Co-located complementary commodities
- Anchor/Hybrid: local community energy anchor/off taker partnership
- On farm hydrogen/fertiliser production
- Local grid resilience services

Regulatory/Markets

- Regulatory sandbox to speed up innovation
- Support for pilot demonstrations and trials
- Revise of use of network and cost reflective pricing structures e.g. LUOs, etc.
- Standards and processes that support dynamic grid participation for non-utility entities
- Enable equitable and democratised energy access for regional consumers
- Transition the NEM to the 'internet of energy'

Networks

- Investment deferrals by integrating CERs for local grid support, eg:
  - Emergency supply
  - Voltage/frequency support
  - Restart and fast dispatch
- Regional grid modernisation enabled by CER tech integration
- Use of network efficiencies via local use of CERs in regions
- Reduce defection in regions with CER integration or energy productivity products and services

QFF QUEENSLAND FARMERS' FEDERATION

Renewable Energy Landholder Toolkit

Queensland Farmers' Federation working in partnership with the Queensland Government

Image credit: AGL

Renewable Energy Landholder Toolkit

Includes:

- a checklist with relevant information for the landholder
- a guideline with suggested actions
- considerations for dealing with project proponents
- case studies
- Resources from consultation phase: workshops/webinars and blogs

Renewable Energy Landholder Toolkit

Help Queensland landholders to understand:

- The value of their site to renewable energy proponents
- Relevant legislation
- Different stages of project development
- How to prepare for the negotiations and development
- What information and advice is available to help.

QFF
QUEENSLAND
FARMERS'
FEDERATION

Queensland
Government

Queensland Farmers' Federation
working in partnership with the
Department of Energy and Public Works

Energy Innovation Work at QFF

Current Projects

- Apply for ARENA's RAMPP funding for ag microgrid pilots
- Localised Energy in the Regions: Market research on emerging market for CERs in regional QLD
- Digital Agriculture
- Energy efficiency and carbon audits for members

Thank you!

Get in touch!
Email: andrew@qff.org.au
Phone: 0412 242 316

www.qff.org.au

Follow us @QldFarmers