Energy Checklist and Guide:

On-farm energy efficiency and clean energy transition



A: Checklist

- 1. Know where you use energy
- 2. Reduce energy use/ increase efficiency
- 3. Look for/understand possible alternatives
- 4. Check savings & funding



B: Guide

#1 Know where you use energy

Every farm has a different energy mix, so identify where you use the most energy and focus your efforts there to most effectively reduce energy costs and emissions and improve energy security on your farm.

In general, 80% of the energy used in agriculture is from diesel fuel, but for some enterprises, electricity will be the major energy cost, e.g., electricity is usually the main source of energy on dairy farms.

A quick review of your energy bills will show you which energy type you use the most and is your greatest energy cost.

This is likely where the greatest potential for reductions lie.

NSW DPI, in conjunction with Tocal College, has developed and Energy Efficiency Audit unit for farm use which can be done as a stand-alone course or as part of the Diploma of Agriculture www.tocal.nsw. edu.au/courses/industry-qualifications/ ahc50116-diploma-of-agriculture.

Completing this unit is an effective way to learn how to quantify energy use and identify where saving can be made. It gives an indication of the costs and saving made possible by, e.g., installing more efficient lighting systems, upgrading electrical control systems, converting from diesel to more efficient electric equipment, or installing variable speed drives on electric equipment.



#2 Reduce energy use/ increase efficiency

Well proven ways to save on both diesel and electricity costs are outlined in the following sections. While some of these require new investment, many efficiency improvements can be implemented at little or no cost as they involve changing how you use existing machinery rather than replacing it.

Proven savers:

- Match motor/engine size with use (don't oversize)
- Modernise motor/engine-with newer, higher efficiency ones
- Regular maintenance to keep efficiency high
- Substitute power (e.g., use solar pumps or electric vehicles if suited)
- Check efficiency of pumps (worn impellers/poor design etc, will waste energy)
- Install variable speed controllers if the load changes markedly, e.g., vacuum pumps or centre pivots on hilly country.

Tractors

Tractor fuel use can be reduced with good set up (correct ballast, tyre pressure, wheel slip etc.) and careful driving.

While newer tractors may automate much of this, most tractors will still rely on the operator to check set up and use the 'gear up and throttle back' principle, which allows the engine to produce the needed power at lower engine speed (revs).

NSW DPI has produced factsheets to help you ensure your tractor is operating efficiently, which can be as simple as checking that tyre pressures are correct!

Titles include:

- Tractor energy efficiency
- Adaptive driving
- Estimating tractor power needs
- Monitoring wheel slip for fuel efficiency
- Purchasing a fuel-efficient tractor
- Tractor ballasting
- Tractor tyre selection
- Tyre pressure and fuel efficiency.

These factsheets are available on the NSW DPI Energy Knowledge Hub at www.dpi. nsw.gov.au/dpi/climate/energy/energyknowledge-hub/nsw-dpi-factsheets.

When buying a tractor, ensure the power requirement matches the tractor horsepower to save diesel over the life of the machine.

Note that the power requirement (drawbar/PTO) for your equipment will vary with soil, speed, depth, width etc.

Typically, the required engine power per meter width of tillage implement will be around 20-35 kW, depending on the soil properties, cutting depth and speed of operations. In a light sandy soil, less power is required than for a heavier soil type.

Faster speeds and greater depth of operations will need more power so will be at the higher end of this estimate.



Tractor calculators and Nebraska test data can also be useful in guiding discussions and decisions with dealers when buying a new tractor and matching it to your needs.

Nebraska test data can be found at tractortestlab.unl.edu/test-page-nttl.

In the future, when reducing carbon emissions will be a priority, consider transitioning to renewable and synthetic fuel options.

While currently more expensive, these can be a practical low carbon alternative to fossil diesel.

Pumping

With rising energy costs, understanding the efficiency of your irrigation system is more important than ever.

Where pumping represents a major energy user, run your system through the NSW DPI/Agriculture Victoria Irrigation Assessment Tool¹, which can be found at extensionaus.com.au/irrigatingag/ energy-assessment-tool-for-centre-pivotand-travelling-irrigation-systems/

The Irrigation Energy Assessment Tool can provide guidance on what savings are possible with changes to your system and how your system compares with other similar industry systems. It helps answer these questions:

- Is my system wonderful or wasteful?
- Am I efficient or using more power than I need?

¹ This work has been produced jointly by Agriculture Victoria, Irrigation Australia and the NSW Primary Industries Climate Change Research Strategy funded by the NSW Climate Change Fund.

Electricity

Electricity can be used to power many agricultural activities, e.g., pumping water, heating, cooling and ventilation. Ways to reduce your electricity costs and use include:

- Vary the time of operations to access lower electricity prices (off peak / controlled load/time of use).





- How much could I improve or save?
- Is it worth making changes?
- For stationary diesel motors explore electric, including solar electric, alternatives.
- Solar pumps are becoming more versatile and can pump high volumes at high head with no operating costs if they are run when the sun is shining.
- They can replace many older systems or be integrated into existing systems.
- Further information can be found in the NSW Farmers Solar Pumping Guide at www.energy. nsw.gov.au/sites/default/files/2022-09/ NSW_Farmers_May2015_Solar-poweredirrigation-pumping.pdf and from supplier and retailer websites, e.g., Grundfos and Lorentz.



• Check you are on the best tariff available in your area and that suits your needs. You can compare retailers at www.energymadeeasy.gov.au/. You may be able to renegotiate a better tariff with your existing retailer simply by giving them a call.

• Generate your own power using on-site

renewable energy technologies e.g. solar PV, wind, biogas, pumped hydro.

- Shift loads to match your renewable energy production whenever possible, i.e., use the power you produce rather than more costly grid electricity.
- The NSW Climate and Energy Action website provides easy-toaccess information about how to save money and reduce your climate and energy impact using, e.g., LED lighting, variable speed drives/load controllers: www.energy.nsw.gov.au.
- Learn about different appliances and equipment and how you can reduce their energy use at www.energy.nsw. gov.au/business-and-industry/coursesand-guides/technology-guides
- There are also valuable courses available to help you focus your efforts to save energy: www.energy.nsw.gov. au/business-and-industry/coursesand-guides/find-energy-course
- Australian Government energy information for agricultural industries: www.energy.gov.au/business/ industry-sector-guides/agriculture

#3 Look for/understand possible alternatives

Information on energy efficiency and clean energy opportunities exist in many places. Farms will have different opportunities depending on their operations and scale.

Some sources of information are listed below.

Energy Smart Farming

NSW DPI, Tocal College and Agriculture Victoria have joined forces to create the Energy Smart Farming community of practice which provides information about energy efficient and renewable energy technologies to improve farm productivity and resilience. https://extensionaus. com.au/energysmartfarming/home



NSW DPI Energy Knowledge Hub

Further energy resources and ongoing research is available on the NSW DPI Energy Knowledge Hub: www.dpi.nsw. gov.au/dpi/climate/about-dpi-climate/ publications/energy-knowledge-hub

Insights from NSW DPI energy projects

The NSW DPI Energy Efficiency Solutions project has run on-farm energy pilots over the last several years, gaining insights into energy related issues in agriculture www. dpi.nsw.gov.au/dpi/climate/energy/cleanenergy/on-farm-energy-pilot-projects.

Some of the learnings include:

- Solar PV is usually good value, especially if you can use the energy when it is being produced.
- Irrigation systems can almost always be improved! It is important to know if yours is OK or inefficient and costly, hence the need to use the calculator extensionaus.com.au/irrigatingag/ energy-assessment-tool-for-centrepivot-and-travelling-irrigation-systems/
- A lot of effort has been put into improving the efficiency of electric systems, and there are well established

technologies such as variable speed controllers/drives, LED lighting and substitution with solar. However, diesel is the major energy source used in agriculture and it is not always possible to electrify diesel-powered plant and equipment, particularly heavy vehicles and heavy mobile machinery.

 New technologies and electrification can start to make changes, but agriculture will continue to rely on diesel for some time. It is important to understand the possibilities that low carbon fuels such as renewable and synthetic diesel can offer which may allow existing machinery to operate acceptably in a low carbon future.

Exploring Beyond Diesel Webinar Series

Around 80% of the energy used in agriculture is coming from diesel.

We have limited local production and storage of diesel, meaning fuel security can at times be an issue.

Diesel also impacts agriculture's carbon footprint.

The DPI's Exploring Beyond Diesel series looks at emerging diesel alternatives.

Links to each presentation and further information on the webinar series are available on the NSW DPI website www. dpi.nsw.gov.au/dpi/climate/energy/ farm-energy-forums-and-training



#4 Saving/Funding check

Many changes to improve energy efficiency can achieve immediate savings and their cost can be recovered quickly.

However, the cost of large investments may be take longer to recoup, so make sure you are investing wisely.

Some benefits of an investment may be difficult to quantify, e.g., more reliable energy supply, but it is important to also consider these factors when making an investment decision.

Assistance schemes that may reduce the cost of upgrades continually come and go and it is worth checking to see if any funding is currently on offer.

Current NSW Government offers can be found at www.energy.nsw.gov.au/business-andindustry/programs-grants-and-schemes

An example is the Motors, Pumps and Fans incentive found at www.energy. nsw.gov.au/business-and-industry/ programs-grants-and-schemes/businessequipment/motors-pumps-fans

Australian Government offers can be found at www.energy.gov.au/ business/grants-and-funding



Before investing in new assets to improve energy efficiency or to generate renewable energy on-farm check the likely savings and payback period/return on investment.