

**SRDP** FARM  
ADVISORY  
SERVICE



The European Agricultural Fund  
for Rural Development  
Europe investing in rural areas



Scottish Government  
Riaghaltas na h-Alba  
gov.scot

# Renewables & Energy Efficiency



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# COSTS/ASSETS



## Energy Costs

- Electricity
- Red Diesel
- White Diesel
- Petrol
- Kerosene
- Imbedded Energy
  - Fertiliser
  - Feed

## Energy Assets

- Wind
- Water
- Crops
- Crop residues
- Slurry/FYM
- Land
- Underground

# Energy auditing

## 1. Quantify existing energy usage

- Keep records
- Bills can be difficult to interpret and may be estimated

## 2. Identify usage with specific operations

- Install additional meters on individual buildings/equipment
- Record tractor and vehicle fuel usage against tasks



# Energy auditing



## 3. Benchmark

- Relate energy usage to production or to stock numbers or hectares.
- Electricity consumption in dairying ranges from 200 to 400 kWh/cow/year
- Average fuel consumption for ploughing to 200mm is around 15 l/ha
- A typical farrowing house will use 8 kWh per pig produced, the most efficient installations use only 4kWh

# Energy auditing



## 3. Identify potential savings

- Upgrading of buildings
- Modification/replacement of equipment
- Alteration of management practices
- Establish costs and payback periods for various options.
- Implement zero and low cost options immediately.
- Plan ahead for other viable options where investment of time and money are required.

## 4. Information compiled will inform decisions on investment in renewables

# Farm scale renewables to date



- Scotland's farmers have been at the vanguard of the country's move to de-carbonise the energy sector.
- Almost all on-shore technologies require at least some land for their deployment
- Diversification of businesses
- Additional income stream unrelated to crop and livestock prices
- Many challenges along the way
- Now an integral part of many farming businesses



# Renewables – the story so far

- We have had a period of high incentive payments
  - Feasibility of schemes have been judged more on the amount of FITs, ROCs, RHI that they will generate
  - Less on the value of the energy they produce
  - Distortion in the market



# Renewables going forward

- Incentive payments are now much lower and may drop to zero in the near to medium term
  - The value of the energy produced can be better appreciated and realised
  - Any increase in oil prices will improve viability of renewables
- Large scale renewables will have to compete with other large scale technologies
- Feasibility of small scale renewables will be judged on the amount of local demand they can supply



Maximise the value of energy produced

# 50 kW PV example

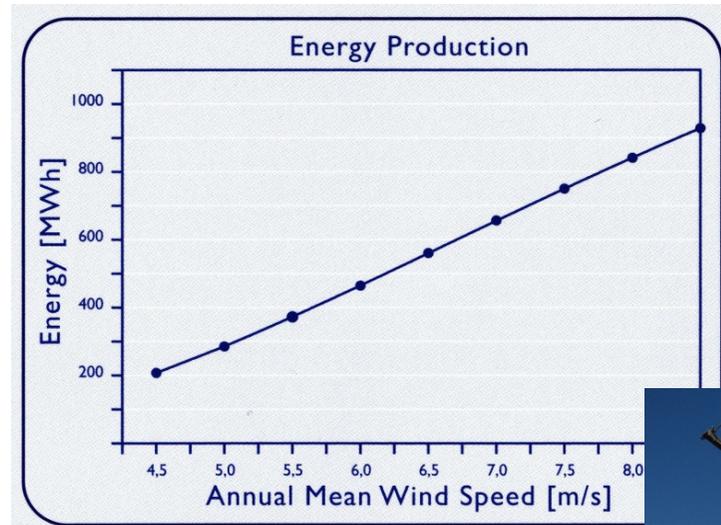


	FIT rates for Nov 2015 installation				Proposed FIT rates for Jan 2017 installation			
	25% on site usage		100% on site usage		25% on site usage		100% on site usage	
	£	% of total income	£	% of total income	£	% of total income	£	% of total income
<b>Generation tariff</b>	4802	65	4802	53	1474	36	1474	26
<b>Export tariff</b>	1546	21	0	0	1546	38	0	0
<b>Electricity savings</b>	1062	14	4250	47	1062	26	4250	74
<b>Total annual income</b>	7410	100	9052	100	4082	100	5724	100



# What projects can still be viable

- High yielding sites
  - Maximise return on capital investment
- Low cost
  - Simple installation
  - Low grid connection cost
- On- site usage
  - Offset cost of conventional energy



# Wind example

	50 kW wind turbine		
<b>Average wind speed</b>	5.5	7	8.5
<b>Yield</b>	120568	186238	237800
<b>20% On site usage</b>			
<b>Generation tariff (£)</b>	9959	15383	19642
<b>Export tariff (£)</b>	4440	6858	8757
<b>Savings (£)</b>	2411	3725	4756
<b>Total annual benefit (£)</b>	<b>16810</b>	<b>25966</b>	<b>33155</b>
<b>100% On site usage</b>			
<b>Generation tariff (£)</b>	9959	15383	19642
<b>Export tariff (£)</b>	0	0	0
<b>Savings (£)</b>	12057	18624	23780
<b>Total annual benefit (£)</b>	<b>22016</b>	<b>34007</b>	<b>43422</b>
<b>Installed cost</b>	<b>£180k to £300k</b>		
Jan 2017 tariff rates			



# Micro-hydro, Kames Fish Farm



- High rainfall area = high yielding site
- Relatively low construction and connection cost
- Local demand from fish farm
- Low carbon footprint a marketing opportunity

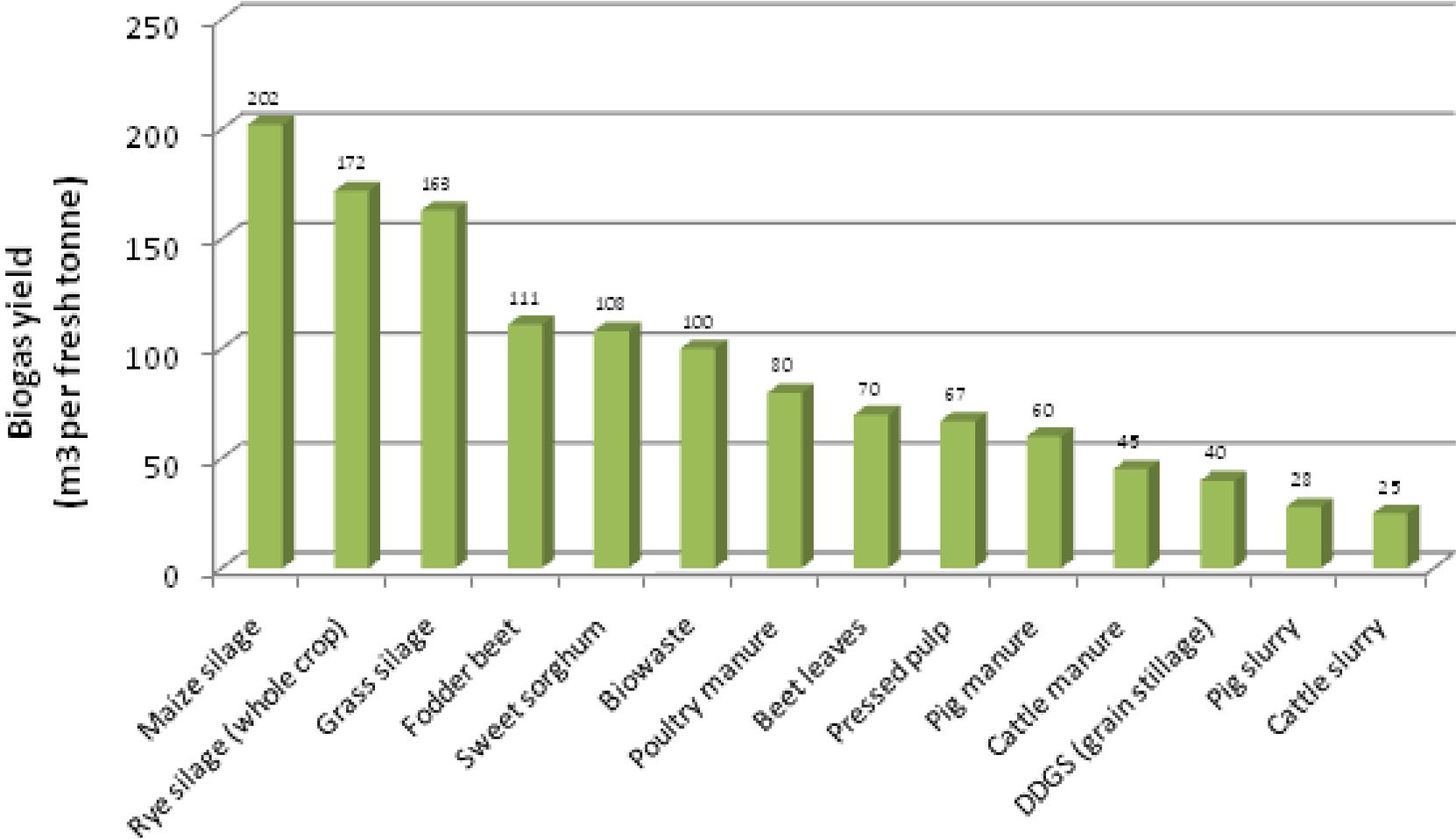


# Anaerobic Digestion

- Crop based feedstock can still provide reasonable return where;
  - Maximum benefit is obtained from electricity and heat or from grid injection
  - Installation and grid costs are relatively low
- However;
  - Payment of FITS/RHI to be limited for gas produced from crop for new installations from spring 2017 following changes to the RHI & FIT regulations
  - FIT Deployment caps greatly exceeded and projects queued for registration (currently 12 month queue)



# Biogas yields



# Slurry/FYM only AD

- May become more viable where;
  - Packaged plants become available at lower cost
  - Existing slurry storage can be used
  - Grid connection cost is minimal
  - Electricity is used to offset purchased power
  - Heat is used to offset purchased oil
  - Oil price goes back up
  - Enhanced incentives for this type of project?



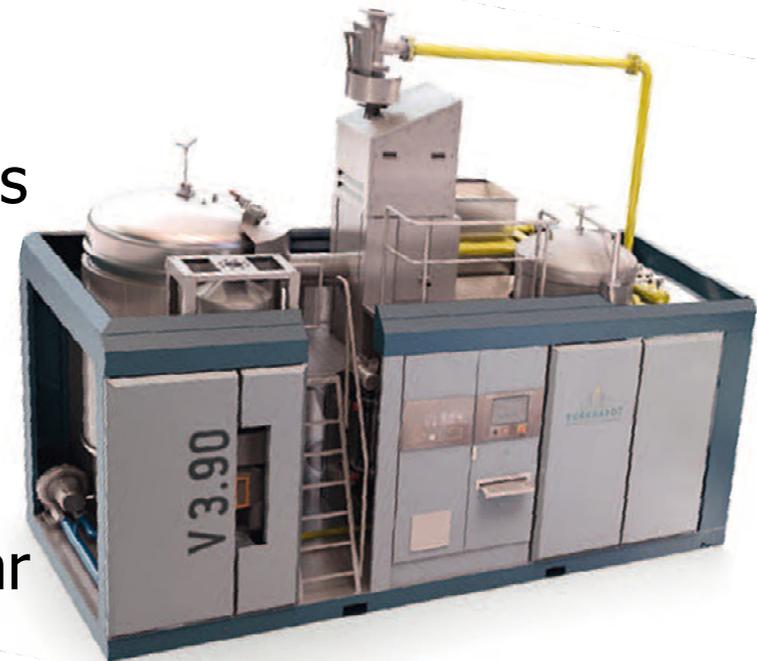
# Biomass

- Medium scale biomass heating installations are still a viable option but further RHI reductions likely.
- Efficient well designed systems critical.
- Changes coming in from this spring will remove the tariff bands and introduce tiering for all scales of installation.



# Biomass CHP

- Was viable where there is an on-site demand for heat and power
- 1.8 ROC/MWh for electricity produced
  - Ending March 2017
  - No proposal to include Biomass CHP within the FIT
  - CfD – see next slide
- RHI for heat used
  - Proposal to tier from next year



# Contracts for Difference (CfD)



- The government is planning a CfD round in April 2017 for projects that will come on line in 2021/22 and 2022/23.
- “Pot 2” of this round has a budget of £290M for each of the two years and is for less established technologies which includes AD and biomass CHP
- Draft “administrative strike price” for AD is set at £140/MWh for 2020/22 and £135/MWh for 2022/23
- This equates to 14.0 p/kWh and 13.5 p/kWh (remember this is the only payment there is no export or energy sale on top of this)
- If there is enough money in the pot to cover all applications successful projects will get the “administrative strike price”
- If not applicants will have to bid a lower strike price for their project. Contracts will be awarded depending on capacity, commissioning date and the bid price.
- Further detail will be available when the bid is launched.

# Storage

- Storage technology expensive although costs are falling
- On-site storage of intermittent generation for export to grid via constrained connection.
  - Unlikely to add up due to increased costs and poorer efficiency than unconstrained site **unless a premium can be obtained for time of supply.**
- On-site storage of intermittent generation for on-site usage.
  - More likely to become viable as storage equipment price drops.



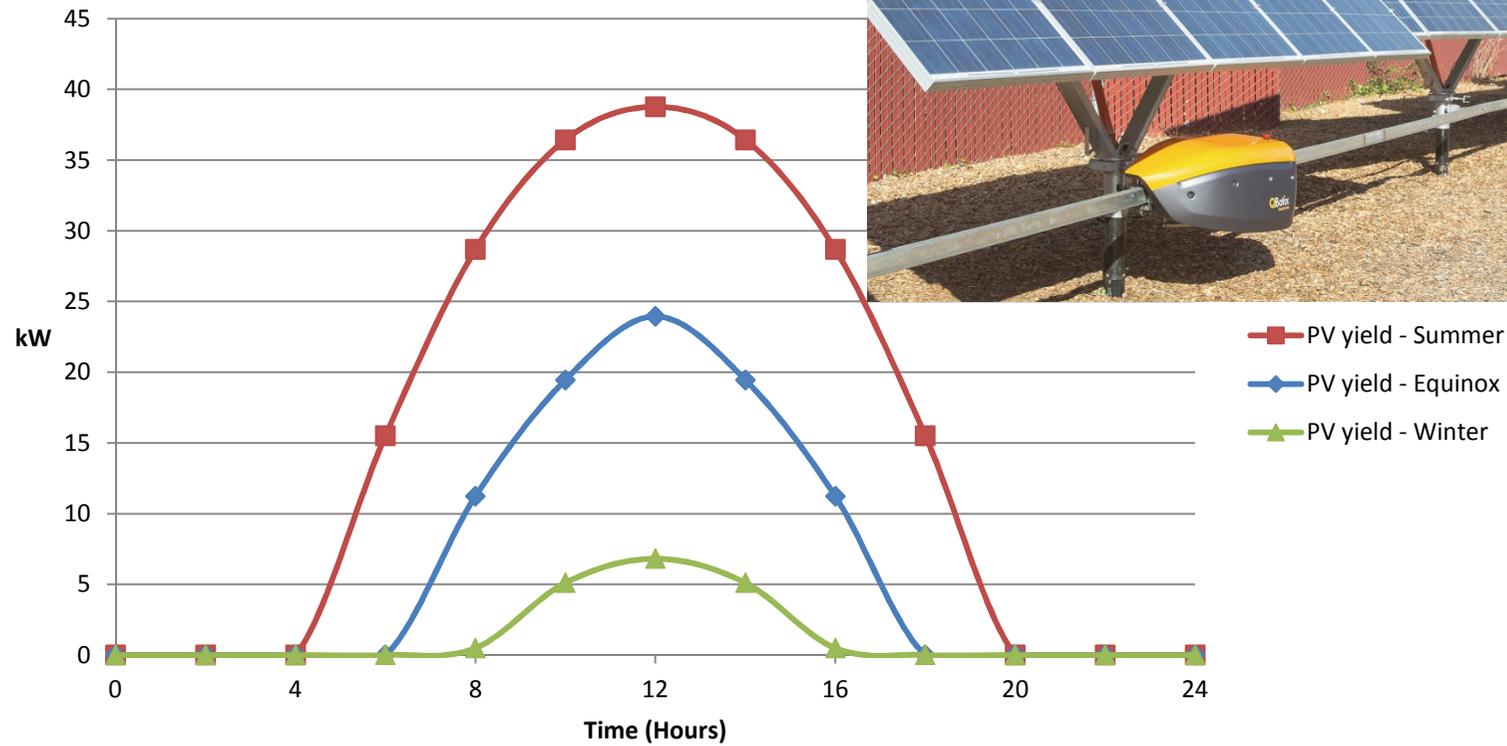
## 40 kWh Battery

When fully charged will supply:  
10 kW for 4 hours or  
5 kW for 8 hours

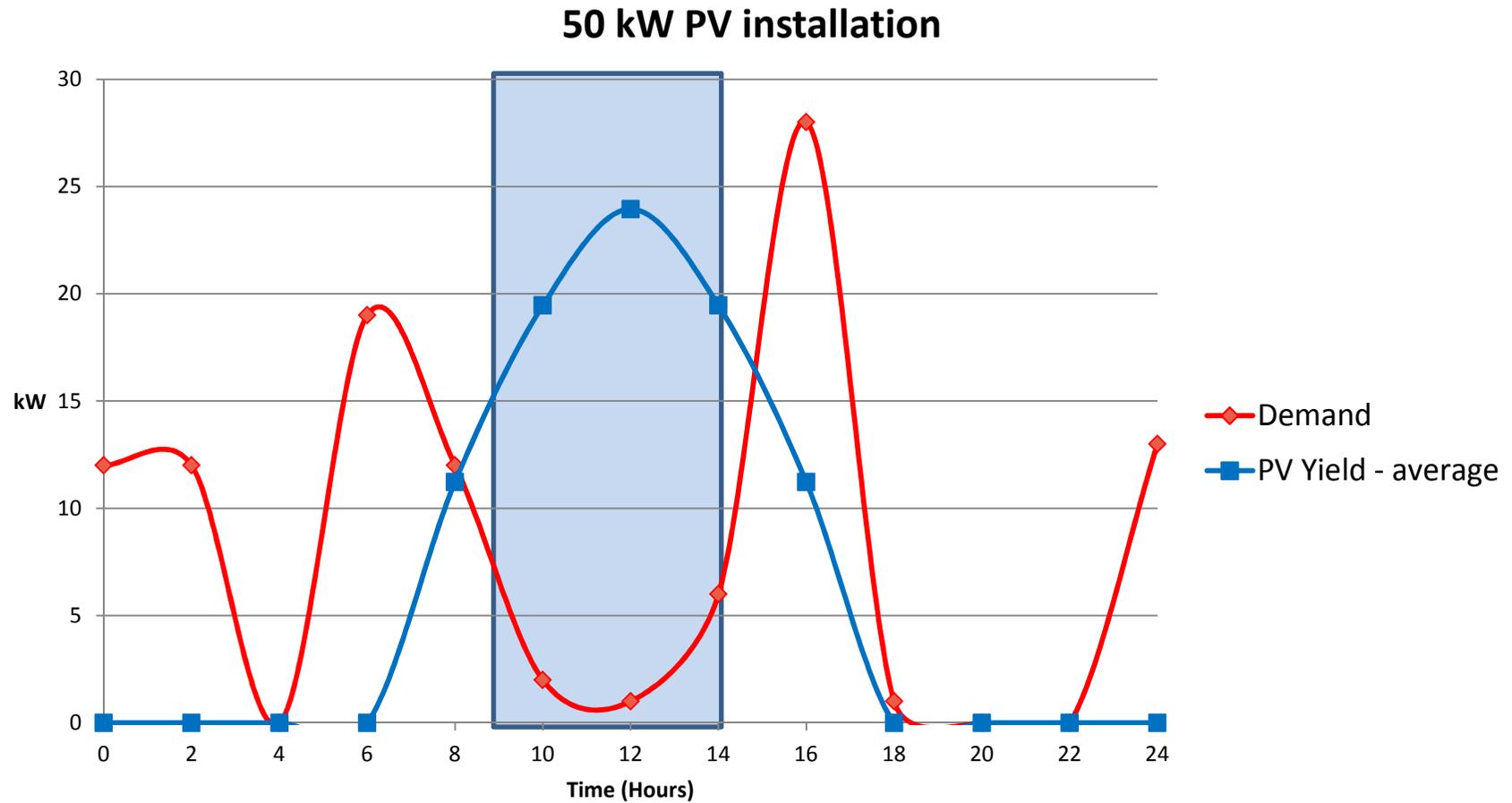
# Storage with PV



### 50 kW PV installation



# Yield/demand profiles



# Solar PV with storage



## Annual Average

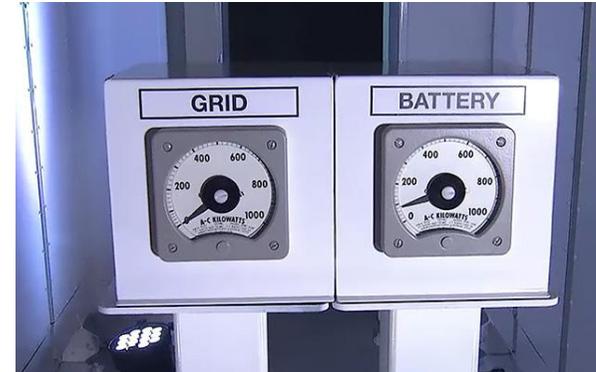
- Average daily production from 50 kWp PV array 112 kWh
- Direct usage 37 kWh
- Export or available to store 75 kWh

## May Average

- Average daily production from 50 kWp PV array 188 kWh
- Direct usage 25 kWh
- Export or available to store 163 kWh
  
- Current cost of storage for 100 kWh £30,000
- Saving on an average day £5.31
- Annual saving (needs to be confirmed with on site data) £1940

# Battery storage

- Could be viable if;
- Energy price goes up
- Storage costs go down
- Energy profile at site maximises benefit of storage
- Used to avoid high peak time charges
- Emergency back up
- Short term demand response required



# Hydrogen production

- Hydrogen production by electrolysis
  - Can be stored on site or fed into the gas grid as storage for later conversion back to electricity or to provide carbon neutral gas
  - Can be used as a transport fuel in cars, buses, ferries and tractors?
    - Fuel cells can turn hydrogen back to electricity
    - or internal combustion engines running on hydrogen can be used



Picture courtesy of New Holland

# Green Hydrogen

- Green H<sub>2</sub> market is currently limited but there is scope to develop
- Hydrogen production needs to be planned along with hydrogen uses
- Most promising initial market
  - Transport fuel (Taxed)
  - Large public and private sector organisations with Carbon reduction commitment (CRC)
- Vertical integration of the supply chain is required
- Production of fertilizer from green H<sub>2</sub> has potential to hugely reduce carbon inputs to agriculture



# Local demands



Opportunities exist to maximise the value of energy produced by supplying heat or power to third parties local to farm businesses e.g.

- Water treatment and sewerage works
- Public buildings
- Hotels
- Commercial properties
- Food processing businesses

Savings for the third party and increased income for the generator.

Integration with existing supplies needs careful consideration and close cooperation but mutual benefits are possible.

# Efficiency and demand management



- Opportunities to increase the value of renewable generation by better integration with farm businesses exist
- Improving the efficiency of equipment and operations can allow a higher proportion of on-site demand to be met from renewables or leave more energy for export.
- Manage heating, cooling and processing operations to utilise wind or solar energy when it is available.
- Some operations can be easily automated to maximise the use of renewables, manual intervention will be required for others.



# Electric vehicles are coming!



Jaguar I-PACE  
0 – 60 mph in 4 seconds  
310 miles range



Rapid charge point  
80% charge in 30 mins

# Conclusion



- *Be aware of your energy costs*
- *Be aware of your renewable assets*
- *Use energy as efficiently as possible*
- *Add value to renewable generation where possible*
- *Be aware of developments in the energy industry including new business models*
- *Think long term*

# Want more information?



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# Thank You

